Magnetic Resonance Imaging

BR104-ED-X

Normal Breast Implants. What We Must Know to Avoid Misinterpretations

All Day Location: BR Community, Learning Center

Awards
Certificate of Merit

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TEACHING POINTS

Nowadays there are many different types of breast implants and some of them with particular landmarks that could lead to misinterpretations by unexperienced radiologists.We selected 10 types of implants from different manufacturers commonly used in plastic surgery.The purpose of this exhibit is: To demonstrate the most common types of breast implants, especially some specific landmarks and main anatomical features that could lead to misinterpretations; To demonstrate in detail the microscopic anatomical characteristics of breast implants shell; To correlate the findings of both in vitro and in vivo through different imaging modalities: mammography, ultrasound and MRI.

TABLE OF CONTENTS/OUTLINE

Anatomical characteristics of breast silicone implants in detail through in vitro handling.Microscopic characteristics of different implants shell.Imaging findings: mammography, ultrasound and MRI.Comparison of in vivo and in vitro findings using different imaging methods, outlining specific landmarks.The major teaching points are:To demonstrate the normal aspects of breast implants not only through in vitro handling including microscopic approach, but also through different imaging modalities;To outline some specific implants landmarks in different imaging modalities that could be misinterpreted by unexperienced radiologists;

BR105-ED-X

Blind Spots on Breast MRI: Review of Commonly Missed Findings. A Primer for Residents and Fellows

All Day Location: BR Community, Learning Center

Participants
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TEACHING POINTS

1. Common areas of missed pathology on breast MRI includes the lungs, heart, liver and thoracic spine2. Having a routine search pattern which includes reviewing common "blind spots" will decrease the likelihood of missing significant non-breast pathology3. Review of prior imaging will increase the ability to diagnose benign findings without recommending additional imaging and will also decrease the likelihood of missing significant non-breast pathology

TABLE OF CONTENTS/OUTLINE

A review of the normal anatomy on breast MRI is followed by a presentation of cases of incidental and significant pathology seen outside the breast parenchyma.Cases are presented in a quiz format to emphasize common 'blind' spots. Correlation with other imaging modalities will be provided in select cases.Abnormalities presented include:Lung: nodule, infiltrateCardiac: cardiomegaly, pericardial cystLiver: simple cyst, hemangiomaBones: hemangiomaSoft tissue: axillary schwanommaOther: gastric tumor, splenic cyst

BR118-ED-X

Eyes Wide Open - Extramammary Findings on Breast MRI

All Day Location: BR Community, Learning Center

Awards
Certificate of Merit
Identified for RadioGraphics

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TEACHING POINTS

To review incidental findings encountered on breast MRI, discuss their significance in different patient demographics, appropriate differential and management considerations. To emphasize that a history of breast or other malignancy warrants careful evaluation of incidental findings on breast MRI, which may impact staging and treatment. Findings in the liver, lung, bone, nodes, deserve particular attention to exclude breast cancer metastasis. Acute cardiopulmonary, or non breast neoplastic findings, are clinically relevant and may require further evaluation. A systematic approach aids diagnosis. Correlation with patient history and prior imaging is essential.

TABLE OF CONTENTS/OUTLINE

1) Recognize incidental breast MR findings are most likely to be clinically relevant in those with a history of breast or other malignancy, prompting further workup. 2) Understand the frequency and distribution of incidental findings on breast MRI, most commonly in the liver, lung, mediastinum, bone, and less commonly in the spleen, gallbladder, kidney, thyroid, vascular structures and soft tissues. 3) Construct a systematic diagnostic approach by understanding normal imaging appearance of anatomic structures on standard breast MRI sequences. 4) Case based presentation of diagnostic pearls, clinical correlation, and management of incidental findings on breast MR.

BR120-ED-X

Do Not Look at the Breast Only: Extramammary Incidental Findings on Breast MRI

All Day Location: BR Community, Learning Center

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TEACHING POINTS

Understand the definition and prevalence of extramamary findings on MRI breast Identify extramamary findings Review the most common incidental findings Provide algorithms to evaluate and recommended managmente of the findings

TABLE OF CONTENTS/OUTLINE

Several cases will be presented in a quiz format. Some of the lesions were missed on initial lecture of the case, in part due because the main attencion was focused on the breast findings. Cases will be review, differential diagnosis and recomended managemente will be provide. The list of cases includes: Liver lesions Chest wall lesions Lung lesions Other lesions

BR121-ED-X

Male Breast MRI: When Is It Helpful? Our Experience over the Last 10 Years as a Pictorial Review

All Day Location: BR Community, Learning Center

Participants
Kyungmin Shin, MD, Houston, TX (*Presenter*) Nothing to Disclose
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TEACHING POINTS

Understand the role of breast MRI in men Review of male breast MRI with pictorial examples using BI-RADS 5th edition descriptors Understand and be able to identify when breast MRI may be indicated and appropriate in male patients in addition to mammography and ultrasound Understand and learn how to overcome the challenges of male breast MRI

TABLE OF CONTENTS/OUTLINE

Brief introduction for indications and role of breast MRI in men Examples of different indications for male breast MRI performed at our institution Pictorial examples of male breast MRI for differing indications and review of why it may be helpful in certain situations in addition to mammography and ultrasound Pitfalls and differences regarding male breast MRI compared to female breast MRI Summary

BR128-ED-X

Are You Dense, Too? An Approach for Difficult MR Mammography to Differentiate Cancerous Tissues from Surrounding Dense Breast

All Day Location: BR Community, Learning Center

FDA Discussions may include off-label uses.

Participants
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TEACHING POINTS

Ultra-high b value DWI and Ultra-early phase contrast dynamic imaging are useful to differentiate cancerous tissue from normal but dense breast tissue. The combined interpretation of T2WI, DWI, dynamic contrast imaging and high-resolution thin slice imaging can depict the correct expanse of cancers in dense breasts.

TABLE OF CONTENTS/OUTLINE

Table contents/outline Population and clinical characteristics of dense breast females Problems of breast cancer diagnosis in dense breast females Ultra-high b-value DWI and Ultra-early phase dynamic contrast imaging: The introduction of new imaging modalities for differentiating cancers from normal breast tissues Combined image interpretation employing FS-T2WI, DWI, dynamic contrast imaging and thin slice high-resolution imaging Radiological-pathological correlation of resected breasts

BR150-ED-X

Avoiding Confustion Using Breast Diffusion MRI

All Day Location: BR Community, Learning Center

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TEACHING POINTS

To show the current usefulness and future potential of diffusion-weighted imaging (DWI) in breast imaging. Adding DWI to conventional dynamic contrast-enhanced sequences improves the specificity of breast MRI. New functional imaging techniques like DWI enable us to study physiologic processes in tumors and obtain information to complement conventional techniques.

TABLE OF CONTENTS/OUTLINE

DWI allows us to observe a series of molecular processes before morphological changes become visible on conventional techniques.Well-established indications for DWI in daily clinical practice: DWI parameters can serve as surrogate biomarkers for early prediction and for monitoring the response to primary chemotherapy. DWI is also useful for differentiating benign from malignant lesions: malignant lesions have significantly lower apparent diffusion coefficients (ADC) than benign lesions. DWI can help differentiate posttreatment changes from tumor recurrence.Potential applications of DWI:Current research aims to correlate DWI parameters with tumor grade and molecular profiles. DWI may enable screening of high-risk patients without intravenous contrast agents. DWI may help detect axillary lymph node involvement in patients with breast cancer. Diffusion tensor imaging will allow breast fiber tractography.

BR161-ED-X

No Cancer Left Behind: A Case-Based Review of the Utility of Pre-operative Breast MRI

All Day Location: BR Community, Learning Center

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TEACHING POINTS

1. While there is some disagreement among breast radiologists and surgeons over the usefulness of pre-operative MRI in patients undergoing surgery for breast cancer, there are a number of ways that such imaging can impact patient care.2. Pre-operative MRI in breast cancer patients can locate additional occult malignancy (multifocal, multi centric, and/or contralateral disease) and better delineate the true size/extent of disease.3. In addition, MRI can identify hidden cancers in blind spots of other modalities, which, if left behind, would have resulted in under treatment and unexpected early recurrences.

TABLE OF CONTENTS/OUTLINE

Detail the controversy over the utility of pre-operative breast MRI in the surgical management of breast cancer.Review relevant literature.Image-rich, case-based review to highlight the utility of MRI, as it can alter surgical planning for a variety of reasons.Cases include (but are not limited to):-Breast MRI of invasive lobular carcinoma demonstrating multicentric disease resulting in mastectomy-Mammo and sono demonstrating a primary mass found to have a few subcentimeter nodules in one quadrant on MRI consistent with multifocal disease.-Mammo demonstrating a cluster of micro calcifications consistent with DCIS, found to have multicentric invasive ductal carcinoma on MRI.

BR162-ED-X

The Role of Breast MRI in the Diagnosis and Managment of Papillary Lesions of the Breast

All Day Location: BR Community, Learning Center

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TEACHING POINTS

To review MRI features of the different papillary lesions of the breastThe role of breast MRI for planning the surgeryVacuum biopsy MRI-guided for histological diagnosis and it's role for the treatment of solitary papillomas in selected cases

TABLE OF CONTENTS/OUTLINE

Breast papillary lesions include a wide range of pathologies that have different morphological, radiological and pathological features. They can be divided in solitary or central papillomas, multiple or peripheral papillomas, juvenile papillomatosis, atypical ductal hyperplasia or DCIS inside a papilloma, micropapillary DCIS, and papillary carcinoma. Overlapping features makes difficult the differentiation of benign and malignant papillary lesions by imaging. Breast MRI has shown better accuracy than mammography and ultrasound for the diagnosis. To increase the diagnostic specificity is important to know their MRI features: morphology, enhancement, DWI. Breast MRI is an usefull tool to evaluate the extent of disease, essential for planning surgery. Besides in those lesions that are not seen with conventional techniques, vacuum biopsy MR-guided is the only way to get the histological diagnosis. In selected patients with bloody nipple discharge and the presence of solitary papilloma, vacuum biposy MRI-guided constitutes an alternative to surgery for the treatment.

BR165-ED-X

Thinking Outside of the Breast: Secondary Findings on Diffusion Weighted MR Imaging

All Day Location: BR Community, Learning Center

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TEACHING POINTS

1. Review the role of diffusion weighted breast MRI and highlight it's utility in clinical practice2. Demonstrate that pathology can be seen in regions outside of the breast including the chest (lungs, heart), upper abdomen and lower neck on breast MRI. 3. Familiarize the general radiologist with incidental findings seen on breast MRI. This includes a special emphasis on secondary findings seen on diffusion weighted imaging along with multimodality correlation4. Illustrate the importance of evaluating all sequences and images on breast MRI for secondary findings.

TABLE OF CONTENTS/OUTLINE

1. Discuss the physics and principles of diffusion weighted imaging on breast MRI2. Discuss the utility of diffusion weighted imaging for MR evaluation of the breast 3. Demonstrate the use of breast MRI in evaluation of secondary findings.4. Highlight the importance of T1/T2 weighted images, post-contrast sequences and diffusion weighted images in displaying ancillary findings on breast MRI5. Show sample cases with pointers to help identify important findings outside of the breast on MRI along with multimodality correlation including CT, nuclear medicine, ultrasound and radiographic studies.

BR167-ED-X

Reading Between the Lines: Magnetic Resonance Evaluation for Breast Implant Rupture

All Day Location: BR Community, Learning Center

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TEACHING POINTS

Review the typical magnetic resonance sequences obtained to evaluate implants Describe the most common MRI features signifying implant rupture Highlight imaging findings that may mimic rupture on breast MRI

TABLE OF CONTENTS/OUTLINE

· Magnetic Resonance Imaging for Implant Interrogation: Review silicone-selective sequences Expander implant incompatibility Non-contrast evaluation and breast cancer detection limitations· Implant Characteristics: Implant Type: saline, silicone, dual-lumen, expander-type Implant Location: prepectoral, retropectoral Contour Abnormalities: radial fold, bulge, herniation· Saline Implants: Injection Ports Saline Rupture· Silicone Implants: Intracapsular Rupture: linguine sign, keyhole sign, subcapsular line sign Extracapsular Rupture: extracapsular silicone, silicone granulomas, silicone-laden lymphadenopathy Cohesive Implant Rupture· Peri-Implant Effusions: Benign Effusions Malignant Effusions· MRI biopsy considerations in patients with breast implants

BR176-ED-X

How to Differentiate Large Enhancing Breast Masses in MRI

All Day Location: BR Community, Learning Center

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TEACHING POINTS

A large breast mass can be frightening. A big size is one of the most common presenting features of breast carcinoma. However, the clinical features are frequently nonspecific. Imaging performed before biopsy is helpful in characterizing the nature of the mass. Magnetic resonance imaging (MRI) has been increasingly used for accurate diagnosis of breast cancers, particularly in cases in which mammography and breast ultrasound are inconclusive or yield discrepancies. MRI enable complete visualization of the tumor even in the region close to the chest wall, as well as clear delineation from healthy glandular tissue and may help to define the appropriate management. Large enhancing masses can present a confounding overlap between benign and malignant lesions. The knowledge of usual and unusual MRI presentations of large tumors, using conventional and advanced techniques, allows a more accurate differential diagnosis.

TABLE OF CONTENTS/OUTLINE

Large enhancing masses (preview) Hamartoma Fibroadenoma Phyllodes tumor Pseudoangiomatous stromal hyperplasia (PASH) Invasive ductal carcinoma Angiosarcoma Clinical features Breast MRI Benign and malignant findings with predictive positive and negative values Appearances in conventional and advanced MRI Differential diagnosis Pathology findings Appropriate management

BR188-ED-X

MRI of Benign Breast Lesions: Key Imaging Findings for Making Correct Diagnosis

All Day Location: BR Community, Learning Center

Awards
Certificate of Merit

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TEACHING POINTS

The Breast Imaging Reporting and Data System (BI-RADS) lexicon is now used worldwide for assessing breast lesion on dynamic MRI, and demonstrates good correlation with the likelihood of malignancy. However, MRI features even using the BI-RADS still overlap between benign and malignant lesions, and the specificity of MRI remains to be only moderate. One of the causes of this low specificity may be lack of considerations about specific findings of common benign breast lesions. The aims of this exhibit are: To review the MRI findings of common benign breast lesions To learn about the malignant lesions that mimic benign lesions To learn the key MRI findings for making correct diagnosis of benign lesions

TABLE OF CONTENTS/OUTLINE

1. MRI findings of common benign breast lesions and pathological background Typical benign finding: high SI on T2WI Edema: fibroadenoma, benign phyllodes tumor Dilated duct or microcysts: intraductal papilloma, mastopathy Specific findings Fluid: simple, complicated cyst Fat: hamartoma, galactocele Abscess: subareolar abscess, granulomatous mastitis Fibrosis: diabetic mastitis 2. Malignant mimickers in each benign lesion on MRI3. Key points for correct diagnosis of common benign lesions MRI findings that are specific or findings that require caution

BR196-ED-X

Young Women at High-Risk for Breast Cancer: Imaging characteristics (Magnetic Resonance, Mammography and Ultrasound)

All Day Location: BR Community, Learning Center

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TEACHING POINTS

Patients under 40 years of age comprise about 5% of the overall breast cancer population. These patients are generally considered to have at the time of diagnosis: more aggressive, advanced, large tumors, more positive lymph nodes, negative steroid hormone receptors and resultant poorer overall out-comes. It's not clear whether the poorer outcomes are a function of ineffective screening, pathologically "different" or more aggressive tumors a combination of two, or other unrelated factors. Also the young patient tends to be treated more "aggressively" surgically. Breast cancer in young group presents like higher histology grade, positive axillary nodes, hormone receptor negativity, and higher p 53 and Ki-67 expression.The aim of this study is to emphasize breast cancer characteristic features of magnetic resonance imaging, ultrasound and mammography in young women that have a challenging diagnosis.

TABLE OF CONTENTS/OUTLINE

1-Pathophysiology2-Clinical findings3-Diagnistic imaging correlation: Magnetic Resonance, ultrasonography and mammography4-Pathology findings

BR202-ED-X

Where To Go From Here?: Interactive Radiologic - Pathologic Case Review and Step-by-Step Management of Breast MRs Given BI-RADs 3, 4, or 5

All Day Location: BR Community, Learning Center

Awards
Certificate of Merit

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TEACHING POINTS

MRI use in the evaluation of breast disease has increased. Specifically, breast MRI extends beyond high-risk screening and is effective for dense breasts, implants, multifocal breast cancer, and patients with malignancy who may have occult, contralateral breast disease. MRI is sensitive at detecting malignancy, but may also detect benign enhancing lesions. Image-guided biopsy can distinguish benign vs. malignant, and avoid needless surgery. For probably benign lesions, short-interval follow-up MRI is reasonable. Experience with the range of malignant and benign appearances allows radiologists to decide which lesions require biopsy and which can be safely followed. Understanding the radiologic-pathologic correlations is key for integrating post-biopsy radiologic management and surgical interventions.

TABLE OF CONTENTS/OUTLINE

We use a case-based approach to present the history, MRIs of BI-RAD lesions 3, 4, or 5, and pathology. Users have diagnostic scenarios and questions for: A. Breast-MRI detected mass and non-mass evaluated with MRI guided biopsiesB. Breast-MRI detected abnormality evaluated with US guided biopsyC. Short term follow up for BI-RADS 3 lesions detected on breast MRI, and following benign concordant MRI guided biopsyD. False positive breast-MRI detected lesions that resolved on follow up imaging at time of attempted biopsy

BR203-ED-X

MR Only Detected Breast Masses Pictorial Review of Radiologic and Pathologic Findings: The Spectrum of BI-RADS 4 and 5 Lesions

All Day Location: BR Community, Learning Center

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TEACHING POINTS

In the United States, approximately 1.6 million breast biopsies are performed each year. Of these, a significant number, 70-90%, are image-guided percutaneous procedures. Although US-guided remains the preferred method due to concerns such as cost, safety, and comfort, certain patients may not be best served by this method. In patients with MRI-detected abnormalities that remain occult on mammography and sonography, MRI guided biopsy is necessary and warranted. The radiologist performing the procedure is chiefly responsible for close follow up of the tissue diagnosis as well as assessment of the imaging-pathology correlation for concordance/discordance considerations.

TABLE OF CONTENTS/OUTLINE

1.Overview of magnetic resonance (MR) imaging of the breast, MRI biopsy role, and utility as an adjunct to traditional modalities2.Brief review of breast MR standardized vocabulary, imaging lexicon3.Evaluate the morphologic criteria, enhancement patterns, and kinetic characteristics of MR detected BI-RADS 4 and 5 breast masses and malignancy potential4.Present the radiologic-pathologic findings of benign and malignant MR-detected masses: pseudoangiomatous stromal hyperplasia, apocrine metaplasia, flat epithelial atypia, ADH, radial scar, DCIS, and invasive carcinomas. 5.Discuss concordance, case management, and necessary imaging follow up, when appropriate

BR209-ED-X

Comparative Effectiveness of Ultrasound and MR Imaging of Non-Calcified Ductal Carcinoma in Situ

All Day Location: BR Community, Learning Center

Awards
Certificate of Merit

Participants
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TEACHING POINTS

Ductal carcinoma in situ (DCIS) is a heterogeneous disease comprising a spectrum of noninvasive malignant tumors of the breast. Typical mammographic finding of DCIS is micro-calcifications. However, approximately 6-23% of DCIS cases manifest as non-calcified lesions. Diagnosis of non-calcified DCIS by mammography is challenging. Thus, high resolution US and breast MRI can be useful.The purpose of this educations exhibit is:1. To illustrate the imaging features of non-calcified ductal carcinoma in situ (DCIS) on ultrasonography and breast MRI.2. To determine the role the imaging studies in the diagnosis and treatment decision of non-calcified DCIS.

TABLE OF CONTENTS/OUTLINE

1. Clinical manifestation and significance of non-calcified DCIS.2. Ultrasonographic features of non-calcified DCIS. 1) Mass, 2) "Pseudomicrocystic" appearance3. Morphologic and kinetic characteristics of non-calcified DCIS at dynamic breast MRI4. Case review5. Role of imaging and Discussion

BR210-ED-X

Pearls and Pitfalls in the MR Evaluation of Complete Response of Breast Cancer after Neoadjuvant Chemotherapy: Radiologic-pathologic Discordance

All Day Location: BR Community, Learning Center

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TEACHING POINTS

Assessment of residual breast cancer after neoadjuvant chemotherapy is important in optimal surgical planning. DCE-MR is considered to be the best modality to predict of the extent of residual tumor. However, several factors may influence the diagnostic accuracy of MR and cause false positive or negative results. Thus, it is important to have an improved knowledge about the imaging findings and factors that may cause the discordance between radiologic and pathologic complete response to decrease the inaccurate evaluation.

TABLE OF CONTENTS/OUTLINE

1. Brief review of neoadjuvant chemotherapy of breast cancer and the role of DCE-MR in evaluating tumor response.2. Discordance between radiologic and pathologic CR(1) False negative:i. Presenting initially as nonmass enhancement- Hormone receptor positive-HER2 negative tumor- Pathologic correlation:ii. Lack of enhancement in breast cancer after chemotherapy- Decreased microvascularity after neoadjuvant chemotherapy- Pathologic correlationiii. Inflammatory breast cancer- Pathologic correlation(2) False positivei. Enhancement of fibrotic parenchymal change after chemotherapy- Enhancement pattern and kinetic curve analysis:- Pathologic correlationii. Intraductal lesioniii. Pseudo-enhancement due to artifact

BR212-ED-X

First Trial of Computer-aided Analysis of Unenhanced Breast MR Images: Does Structure Analysis of Mammary Gland Help to Find the Breast Cancer?

All Day Location: BR Community, Learning Center

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TEACHING POINTS

Recently, breast MR examination is introduced for high-risk group. The kinetic curve by dynamic scan is usually used in order to identify malignant tumor. Here, structure of mammary glands is also modified when there is the tumor in the breast; we can obtain the novel diagnostic information if we can accurately analyze the structure of mammary glands. The purpose of this exhibition is to show how much we can obtain the useful information from automated analysis of mammary structure in breast MR images. The major teaching points of this exhibit are:1. We can analyze the structure of mammary gland in three-dimensionally. 2. Mammary structure tells us the abnormality of the breast.3. Unenhanced MR images is useful for the detection of breast cancer.

TABLE OF CONTENTS/OUTLINE

1.The advantage of the use of unenhanced breast MR images.2.Explanation of the structure analysis of mammary gland -Extraction of mammary gland ;Orientation analysis of mammary gland ;Estimation of abnormality3.Live demonstration of proposed system using tablet computer

VI023-EB-X

Magnetic Resonance Angiography of the Lower Extremity Arterial Vasculature

All Day Location: VI Community, Learning Center

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Bobby T. Kalb, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Hina Arif Tiwari, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Iva Petkovska, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Ferenc Czeyda-Pommersheim, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Surya Chundru, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Gregory J. Woodhead, MD, PhD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Diego R. Martin, MD, PhD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Magnetic Resonance Angiography (MRA) represents a powerful imaging technique to detail information related to the vessel wall, vessel lumen, and surrounding non-vascular soft tissue. This technique is performed without damaging ionizing radiation and the risk of contrast induced nephrotoxicity. This exhibit aims to educate the viewer on the various techniques available for MRA imaging of the lower extremity and the ability of these techniques to assess atherosclerotic disease and to accurately diagnose cystic adventitial disease, popliteal artery entrapment syndrome, and vasculitis.

TABLE OF CONTENTS/OUTLINE

-Summary of angiographic techniques using digital subtraction and computed tomography.-Description of MRA techniques. This discussion will focus upon bright blood techniques using 3D, gadolinium-enhanced, GRE imaging coupled with a bolus chase algorithm. Analysis using source images, multiplanar reconstructions, and 3D reconstruction using a MIP algorithm will also be detailed. Lastly, non-contrast techniques incorporating balanced steady state free precession algorithms will also be outlined.-MRA imaging features of atherosclerosis.-MRA diagnosis of cystic adventitial disease.-MRA description of popliteal artery entrapment syndrome.-MRA anatomic evaluation for fibular graft procurement.-MRA imaging features of vasculitis.

VI116-ED-X

Clinical Utility of Non-Contrast-Enhanced Magnetic Resonance Angiography at 1.5T

All Day Location: VI Community, Learning Center

Participants
Takafumi Naka, Kawasaki-Shi, Japan (*Presenter*) Nothing to Disclose

TEACHING POINTS

- To introduce the role of non-contrast-enhanced(NCE)-MRA. - To explain the basic principles of each NCE-MRA methods. - To explain the features and how to choose optimal methods.1) Comparing NCE-MRA and contrast-enhanced-MRA 2) The principle of NCE-MRA methods 2-1 Time-of-Flight 2-2 Phase Contrast 2-3 Fast Spin Echo 2-4 Balanced Steady-State Free Precession

TABLE OF CONTENTS/OUTLINE

Since the FDA issued warnings linking gadolinium-based contrast agents used in MRI and nephrogenic systemic fibrosis(NSF), CE-MRA is no longer considered safe for patients with impaired renal function. TOF is based on the phenomenon of flow-related enhancement of spins entering into an imaging slice. As a result of being unsaturated, these spins give more signal that surrounding stationary spins. However, slow flow or flow from a vessel parallel to the scan-plane, may become de-saturated just like stationary tissue. TOF is most commonly used in the head. In the PC pulse sequence, bipolar gradients are used to encode the velocity of the spins. Stationary spins undergo no net change in phase after the two gradients are applied. Moving spins will experience a different magnitude of the second gradient compared to the first. This results in a net phase shift. PC is most commonly used in the body.

VI163-ED-X

MRI Pulse Wave Velocity Measurement for Vascular Age/aortic Stiffness Assessment: Intra-, Interobserver and Inter-center Variability in a Multicenter Trial Setting

All Day Location: VI Community, Learning Center

Participants
Maja Hrabak Paar, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose
Achim Kircher, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Saeed Y. Al Sayari, MBBS, MBA, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Sebastien Kopp, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Francesco Santini, PhD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Jens Bremerich, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Tobias Heye, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Aortic pulse wave velocity (PWV) is an established marker of aortic stiffness. In this study we assessed intraobserver, interobserver and inter-center variability of PWV measurement using magnetic resonance imaging (MRI) in order to gauge the precision of the implemented method in a multicenter trial setting.

METHOD AND MATERIALS

This is an IRB approved, HIPAA compliant prospective study. A subset of 45 (15 patients per site) adult patients (31 male, age 58±12 yrs.) with newly diagnosed essential arterial hypertension were randomly included from a multicenter trial (3 sites, 140 patients total) on antihypertensive treatment. All patients underwent cardiovascular 3T MRI with a standardized imaging protocol. Axial phase-contrast scans (100 frames/RR-interval) were repeated three times per examination to assess transit time (Δt) between the ascending and descending aorta. The distance between ascending and descending aorta (Δx) was measured on prospectively ECG-gated parasagittal 2D GRE images of the aortic arch. Δt and Δx were measured using semi-automatic analysis software (Syngo.via Siemens Healthcare, Erlangen, Germany) three times per scan by five different readers, resulting in 2025 Δt and 675 Δx data points. PWV was calculated as Δx/Δt. Intraobserver, interobserver and inter-center variability was calculated as coefficient of variation (COV).

RESULTS

Median intraobserver COV equaled 0 for Δt; ranged from 0.4-1.2% (interquartile range 0.2-1.8%) for Δx, and 0.4-1.2% (0.2-2.0%) for PVW. Interobserver COV was 0 (0-0.3%) for Δt; 1.5% (1.2-1.8%) for Δx, and 1.5% (1.2-2.0%) for PWV.There was no significant inter-center difference in scan-rescan COV ($p>0.05$): 12.5% for Δt and 14.9% for PWV in center 1, 10.7% for Δt and 11.8% for PWV in center 2, and 12.1% for Δt and 12.8% for PWV in center 3.

CONCLUSION

MRI PWV measurement for assessment of aortic stiffness as a surrogate marker for vascular age is a method with low intra- and interobserver variability. Using a standardized protocol, low inter-center variability can be achieved in a multicenter trial setting.

CLINICAL RELEVANCE/APPLICATION

Establishing the measurement variability in multicenter trials is important to ensure that study results are representing biological changes and not predominantly the overall measurement error.

FIGURE (OPTIONAL)

http://abstract.rsna.org/uploads/2015/15012582/15012582_5tgb.jpg

SPPH02

AAPM/RSNA Tutorial on Equipment Selection: MRI

Saturday, Nov. 28 2:15PM - 4:15PM Location: E351

MR PH

AMA PRA Category 1 Credits ™: 2.00
ARRT Category A+ Credits: 2.00

Participants
Thaddeus A. Wilson, PhD, Memphis, TN (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Provide an overview of MRI/Ultrasound technology, recent advances and trends for the future. 2) Make the session attractive to both the clinician, clinician educator, medical physicist and other associated radiological fields. 3) First session hour will be spent reviewing the concepts of the modality. 4) Second session hour will be spent discussing artifacts of the modality.

Sub-Events

SPPH02A Update in MRI

Participants
Edward F. Jackson, PhD, Madison, WI, (efjackson@wisc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Active Handout:Edward F. Jackson

http://abstract.rsna.org/uploads/2015/15001984/SPPH02A1.pdf

SPPH02B Primer and Clinical Significance of Artifacts in MRI

Participants
Timothy J. Carroll, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SSA03

Cardiac (Anatomy and Function)

Sunday, Nov. 29 10:45AM - 12:15PM Location: S504AB

CA CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Gregory W. Gladish, MD, Houston, TX (*Moderator*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR, Cleveland, OH (*Moderator*) Institutional Research Grant, Koninklijke Philips NV

Sub-Events

SSA03-01 Utility of Ungated Free-breathing Through-time Radial GRAPPA in Pediatric Cardiac MRI- Preliminary Results

Sunday, Nov. 29 10:45AM - 10:55AM Location: S504AB

Participants
Prabhakar Rajiah, MD, FRCR, Cleveland, OH (*Abstract Co-Author*) Institutional Research Grant, Koninklijke Philips NV
Deepa Prasad, MBBS, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Lydia Everhart, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Vikas Gulani, MD, PhD, Ann Arbor, MI (*Abstract Co-Author*) Research support, Siemens AG
Nicole Seiberlich, PhD, Cleveland, OH (*Abstract Co-Author*) Research Grant, Siemens AG
Ravi Ashwath, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Robert C. Gilkeson, MD, Cleveland, OH (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC Research support, Koninklijke Philips NV Research support, Siemens AG

PURPOSE

Cardiac MRI (CMR) sequences require ECG gating and multiple breath holds, which may be difficult in children and often require general anesthesia. We sought to compare the image quality and quantitative ventricular parameters with ungated free breathing through-time radial GRAPPA to gold-standard breath-hold cine sequences.

METHOD AND MATERIALS

The study included 9 patients, 7 on 1.5 T and 2 on 3 T scanners. Both gold-standard breathheld SSFP scans with ECG gating and free breathing ungated highly under sampled radial bSSFP scans were acquired. Radial data was reconstructed using through-time radial GRAPPA. ESV, EDV, EF and mass were assessed for both scans and compared using two-sided t-tests. Images were evaluated by two independent cardiac imagers for several features including endocardial border detection, blood pool, myocardium, mitral and tricuspid valve, global and regional cardiac wall motion abnormalities on a 5 point scale (1- worst, 5- best). Artifacts were graded on a 5 point scale (1- no artifacts, 5- extensive artifacts).

RESULTS

There was excellent correlation of quantitative measurements between the two MRI techniques (EF R=0.89, EDV R=0.99, ESV R=0.93, mass R=0.98). The differences in EF, EDV, ESV and mass between gold-standard and real-time methods were not statistically significant. For the Bland-Altman plot, the mean difference of the measurements between the gold-standard and real-time methods was -0.35% (1.57% and -2.27%) and 95% limits of agreement contained 100% of the difference scores. On qualitative assessment, mitral valve was seen well (p=0.01) in SSFP but all the other features were comparable in both sequences. The mean artifact score was significantly lower in the real- time images (1.1 vs 2.8, $p < 0.005$). The mean scan time was also shorter with real time real time method (4.1 mins vs 6.5 mins, $p < 0.001$)

CONCLUSION

Real-time functional CMR with through-time radial GRAPPA performed without ECG-gating under free-breathing can be considered as an alternative to gold-standard breath hold cine imaging for the evaluation of quantitative and qualitative parameters in pediatric patients with comparable results, fewer artifacts and shorter scan times.

CLINICAL RELEVANCE/APPLICATION

This novel sequence is useful in cardiac MRI of children, who often are not compliant with breath holding instructions and may thus obviate the need for general anesthesia in these children.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Prabhakar Rajiah, MD, FRCR - 2014 Honored Educator

SSA03-02 Accuracy, Precision, and Inter-Observer Variability of Left Ventricular Mass Quantification with 4D Flow MRI

Sunday, Nov. 29 10:55AM - 11:05AM Location: S504AB

Awards

Trainee Research Prize - Fellow

Participants
Kate Hanneman, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Aya Kino, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Joseph Y. Cheng, PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Marcus T. Alley, PhD, Stanford, CA (*Abstract Co-Author*) Research Funding, General Electric Company; Research Consultant, Arterys;
Shreyas S. Vasanawala, MD, PhD, Palo Alto, CA (*Abstract Co-Author*) Research collaboration, General Electric Company; Consultant, Arterys; Research Grant, Bayer AG;

PURPOSE

4D flow MRI has been shown to comprehensively evaluate flow, ventricular function, and anatomy in congenital heart disease. Here, we aim to compare the accuracy, precision, and inter-observer variation of left ventricular (LV) mass quantification by 4D flow MRI versus the gold standard cardiac-gated cine steady-state free precession (SSFP).

METHOD AND MATERIALS

With IRB approval, informed consent, and HIPAA compliance, 22 consecutive patients with suspected or known congenital heart disease (10 males, 6.4±4.8 years) referred for 3T ferumoxytol-enhanced cardiac MRI were prospectively recruited. Complete ventricular coverage was obtained with both axial 4D flow and standard two-dimensional short-axis multi-slice SSFP sequences. Two blinded cardiovascular imagers independently segmented the images for LV myocardium on end systolic (ES) and end diastolic (ED) images, thus yielding four blinded measurements of LV mass by each imager in each subject. Linear regression, ANOVA, Bland-Altman analysis, and intra-class correlation (ICC) were used to assess the hypothesis that the accuracy, precision and inter-observer variability of LV mass measurements are not significantly difference between 4D flow and cine SSFP acquisitions.

RESULTS

Significant positive correlations were found for LV mass between 4D flow and SSFP at ED (32.8±14.2g vs. 33.3±14.4g, r=0.989, p<0.001) and ES (33.2±14.4g vs. 31.8±13.6g, r=0.988, p<0.001). Mean bias between ED and ES LV mass measurements as a percentage of the mean were -2.1±10.3% for 4D flow and 4.2±4.7% for SSFP, respectively. There was no significant difference between 4D flow and SSFP with respect to mean square difference of ED-ES LV mass (F=2.05, p=0.159). High levels of inter-observer agreement were achieved for LV mass with 4D flow (ED ICC 0.948 (95%CI 0.880, 0.978); ES ICC 0.936 (95%CI 0.851, 0.973)) and SSFP (ED ICC 0.960 (95%CI 0.906, 0.983); ES ICC 0.953 (95%CI 0.890, 0.980)), with overlapping confidence intervals.

CONCLUSION

Ferumoxytol-enhanced 4D flow MRI determines LV mass with comparable precision, accuracy and inter-observer agreement relative to cine SSFP.

CLINICAL RELEVANCE/APPLICATION

4D flow imaging allows for accurate and reliable assessment of LV mass, potentially reducing costs and increasing patient comfort due to shortened data acquisition times.

SSA03-03 Deformable Registration Based Analysis of Cine MR for Quantification of Regional Myocardial Function: Comparison to MR Feature Tracking and Speckle-Tracking Echocardiography

Sunday, Nov. 29 11:05AM - 11:15AM Location: S504AB

Participants
Mariana M. Lamacie, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Dinesh Thavendiranathan, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Marie-Pierre Jolly, Princeton, NJ (*Abstract Co-Author*) Employee, Siemens AG
Andreas Greiser, PhD, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG
Elsie Nguyen, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Richard Ward, MSc, MRCP, Toronto, ON (*Abstract Co-Author*) Grant, Novartis AG Grant, Apotex, Inc
Bernd J. Wintersperger, MD, Toronto, ON (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Research support, Siemens AG

PURPOSE

The aim of this study is to assess deformable registration algorithms using cine SSFP data for analysis of myocardial strain in comparison to cine SSFP feature tracking (FT) and speckle-tracking echocardiography (STE)

METHOD AND MATERIALS

In this prospective study, 28 patients with thalassemia major and 10 healthy volunteers underwent cardiac MRI at 1.5T (Avanto fit, Siemens, Germany). LV peak systolic global longitudinal (GLS) based on 3 long axis SSFP cine images was measured using MR feature tracking (2D Cardiac Performance Analysis MR, Tomtec, Germany) and a prototype automatic contouring tool with integrated inverse deformable registration analysis (DRA) (TrufiStrain, Siemens CT, Princeton, US) based on material coordinates assessment (Lagrangian strain). Repeated analysis was performed for both MR approaches to assess for measurement variability. 2D speckle-tracking echocardiography (STE) (EchoPAC, GE, UK) was performed within 2h of the MR examination.

RESULTS

STE based longitudinal strain analysis was feasible in 89% of subjects while both MR approaches successfully analyzed all data sets (100%). GLS measured by FT (-23.2±3.9%; P<0.0001) and DRA (-16.0±1.7%; P<0.0001) was significantly different from STE (-19.9±1.6%). While GLS data based on FT analysis did not significantly correlate to STE (r=0.09; P=0.61) DRA derived GLS showed significant correlation (r=0.34; P=0.049). DRA demonstrated significantly lower intra-observer variability in comparison to FT analysis (COV (%): 1.63 vs. 6.22, F=14.43, p<0.001) with also low inter-observer variability (COV 3.179%). Assessment of ICC also demonstrates superiority in repeated measurements (intra-observer agreement) for DRA (0.9903; 95% CI: 0.9815 to 0.9950) as compared to FT analysis 0.9659 (95% CI: 0.8479 to 0.9874).

CONCLUSION

Deformable registration based analysis of cine SSFP data is a novel semi-automated method that allows assessment of longitudinal deformation with superior reproducibility in comparison to MR feature tracking approach. Although DRA derived GLS values differed from those obtained by STE and FT MR methods, the values were still within the published normal values.

CLINICAL RELEVANCE/APPLICATION

Strain analysis is an important measure of regional ventricular function and subclinical myocardial dysfunction. Automated, accurate and reproducible assessment of strain using standard Cine SSFP data can promote routine use in clinical practice.

SSA03-04 Feature Tracking Cardiac MRI Reveals Abnormalities in Ventricular Function in Patients with Bicuspid Aortic Valve and Normal Ejection Fraction

Sunday, Nov. 29 11:15AM - 11:25AM Location: S504AB

Participants
Nicholas S. Burris, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Karen G. Ordovas, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Michael D. Hope, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Prior echocardiographic studies of congenital bicuspid aortic valve (BAV) have found evidence of subclinical systolic and diastolic dysfunction. Patients with BAV commonly undergo cardiac magnetic resonance imaging (CMR) for evaluation of valvular function and aortic dimensions. Feature tracking CMR (FT-CMR) is a technique that allows for assessment of myocardial strain using standard 2D cine sequences. The purpose of this study was to investigate differences in myocardial strain between BAV patients with preserved ejection fraction and healthy controls using FT-CMR.

METHOD AND MATERIALS

Patients with isolated BAV and normal ejection fraction (EF), who had previously undergone CMR (n=36), were compared to an age- and sex-matched sample of healthy control subjects (n=10). FT-CMR strain analysis software (Circle Cardiovascular Imaging, Inc.) was used to measure LV mass, EF and 2D ventricular strain parameters. Comparison of means was performed with student's t-test assuming unequal variance.

RESULTS

Average age was 30.4 ± 10.7 for the BAV group and 29.4 ± 8.7 for healthy controls (p=0.8). Gender distribution was similar between groups (BAV: 47% F, Control: 50% F). The majority of BAV patients had mild or no valve dysfunction by echocardiography (stenosis: 64%, insufficiency: 72%). There was a trend towards higher global peak circumferential and radial strain in BAV patients compared to controls [(-19.8 ± 1.8 vs. -18.8 ± 1.2%, p=0.07) and (40.3± 6.4% vs. 36.8 ± 4.3, p=0.08) respectively], but these differences did not reach statistical significance. Compared to controls, myocardial mass index was higher in BAV patients (61.3 ± 13.5 vs. 46.1 ± 8.7 g/m2, p<0.001). Peak diastolic circumferential and radial strain rates were lower in BAV patients compared to controls [(0.83 ± 0.21 vs. 1.1 ± .21 s^-1, p=0.01) and (-2.0 ± 0.66 vs. -2.8 ± 0.50 s^-1, p=0.02) respectively]. Longitudinal strain and strain rate were not different between groups.

CONCLUSION

Feature-tracking CMR can identify abnormalities of left ventricular strain in a clinical cohort of BAV patients with normal EF. Differences in diastolic strain rate between BAV and control groups may indicate evidence of early diastolic dysfunction.

CLINICAL RELEVANCE/APPLICATION

Feature tracking cardiac MRI strain analysis may aid in identifying early diastolic dysfunction in congenital BAV patients undergoing cardiac MR evaluation.

SSA03-05 Is CMR Reproducible Enough for the Follow-up of RVEF? Comparison with Gated Blood Pool SPECT in Various Subgroups of Heart Disease

Sunday, Nov. 29 11:25AM - 11:35AM Location: S504AB

Participants
Laurent Dercle, MD, Villejuif, France (*Presenter*) Nothing to Disclose
Thomas Giraudmaillet, MD, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
Fatima-Zohra Mokrane, MD, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
Charline Zadro, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
Marie Agnes Marachet, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
Herve P. Rousseau, MD, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The estimation of right ventricular ejection fraction (RVEF) is crucial in order to establish the diagnosis, the risk stratification, the prognosis, and the response to treatment in a wide range of heart disease. Cardiac Magnetic Resonance Imaging (CMR) is the reference-standard for the evaluation of RV volumes but the manual delineation of endocardial border leads to a significant operator-dependency. This report investigates if new MRI techniques are reproducible enough to be considered as the reference-standard for the follow-up of RVEF (in 12 subgroups of heart disease), in comparison with the most reproducible technique: gated blood pool single photon emission computed tomography (GBPS).

METHOD AND MATERIALS

94 CMR and 99 GBPS were measured by two physicians. GBPS was performed using 2 automatic algorithms: BP-SPECT and QBS and a semi-automatic algorithm: TOMPOOL. Relative Inter-Observer Variability (IOV) was defined as the absolute difference between the two calculated measurements normalized to their average and expressed as a percentage.

RESULTS

The overall IOV (%) was greater using semi-automatic GBPS procedure (TOMPOOL: 16±20%) than CMR (12±14%) or automatic

GBPS algorithm (QBS: 8±12%, BP-SPECT: 6±6%). The IOV of CMR challenged GBPS in 2 subgroups of heart disease treated arrhythmia (6±5%) and hyperdynamic cardiomyopathy / cirrhosis (4±3%). Overall, the factors that most influenced the IOV were right valve regurgitation (20±18%; n=27), dilated cardiomyopathy (20±20%; n=24), RVEF<45% (20±18%; n=32), end-systolic diameter of the left ventricle>41mm (17±19%; n=30) and left valve regurgitation (17±20%; n=27).

CONCLUSION

The most reproducible procedure is automatic GBPS. Changes occurring during the follow-up should be interpreted cautiously on CMR (IOV: 12%) or semi-automatic GBPS (IOV: 16%). The parameters responsible for increased IOV on CMR are: valve regurgitation, altered ejection fraction and enlargement of the left ventricle. The reproducibility of CMR challenged GBPS in treated arrhythmia and hyperdynamic heart disease.

CLINICAL RELEVANCE/APPLICATION

The estimation of RVEF is crucial in a wide range of heart disease. A reproducible technique is necessary for an optimal follow-up of RV dysfunction.

SSA03-06 Left Ventricular Function Can Be Adequately Assessed Using Compressed Sensing Cine Imaging with High Spatial and Temporal Resolution

Sunday, Nov. 29 11:35AM - 11:45AM Location: S504AB

Participants
Juliane Schelhorn, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Felix Nensa, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Haemi P. Schemuth, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan Maderwald, PhD, MSc, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Marcel Gratz, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Kai Nassenstein, Essen, Germany (*Presenter*) Nothing to Disclose
Michael Zenge, PhD, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG
Harald H. Quick, PhD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas W. Schlosser, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Cardiac magnetic resonance cine imaging currently bases on time consuming cine SSFP sequences with limited spatial and temporal resolution. Here we assessed whether two compressed sensing cine sequences with high spatial or high temporal resolution can reliably quantify left ventricular volumes and mass.

RESULTS

Small differences were observed between standard SSFP and sparse 1 for end-diastolic volume (EDV, median difference 4ml, p=0.044), stroke volume (SV, mean difference, 7±10ml, p=0.013), ejection fraction (EF, 1%, p=0.029), and myocardial mass (-8±7g, p<0.001), but no significant difference was found for end-systolic volume (ESV, p=0.135). No significant differences were observed between standard SSFP and sparse 2 regarding EDV (-1±5ml, p= 0.528), ESV (-3±5ml, p=0.058), SV (2±5ml, p=0.139), and EF (1±3%, p=0.105), except for myocardial mass (-6±8g, p=0.017). Intraclass correlation coefficients comparing standard SSFP with both sparse sequences were at least 0.95. Bland-Altman analysis and Passing-Bablock regression showed good agreement between all sequences. Intraobserver agreement was good to excellent (kappa: 0.76-0.90).

CONCLUSION

Compressed sensing cine sequences with improved spatial or temporal resolution enable reliable assessment of LV volumes and mass.

CLINICAL RELEVANCE/APPLICATION

Compressed sensing cine imaging allows an adequate assessment of the left ventricular function and an improved spatial and temporal resolution.

SSA03-07 CMR-derived TAPSE Is a Useful Marker for Detection of RV Function Changes in Patients with Chronic Thromboembolic Pulmonary Hypertension

Sunday, Nov. 29 11:45AM - 11:55AM Location: S504AB

Participants
Xiaojuan Guo, PhD, Beijing, China (*Presenter*) Nothing to Disclose
Min Liu, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhanhong Ma, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Tao Jiang, Bei Jing, China (*Abstract Co-Author*) Nothing to Disclose
Shuang Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Tianjing Zhang, Beijing, China (*Abstract Co-Author*) Employee, Siemens AG

PURPOSE

The aim of this study is to determine whether CMR-derived right ventricular fractional shortening (RVFS), tricuspid annular plane systolic excursion with a reference point within the right ventricular apex (TAPSEin) and with one outside the ventricle (TAPSEout) : (1) can predict pulmonary hypertension ,(2)correlates with pulmonary vascular resistance index (PVR) and main pulmonary artery flow in patients with CTEPH.

METHOD AND MATERIALS

37 patients (age, 50.1 ± 11.7 years; male,22) with chronic thromboembolic pulmonary hypertension (CTEPH) and 15 healthy subjects (age,47.4 ± 13.6 years; male, 9) underwent CMR imaging at 3T. The four-chamber Cine images were acquired to get the distance between the cutting edge of the tricuspid annulus with the RV free wall and the RV apex or a reference point outside the RV apex in end-diastole (end-diastolic length (EDL)in or EDLout) and end-systole (end systolic length (ESL)in or ESLout). All patients underwent right heart catheterization to get PVR.The parameters between different group were compared by an

independent t- test. The ROC curve analysis was used to evaluate the diagnosis value of TAPSE derived by CMRI. TAPSE obtained by CMRI were correlated with PVR and MPA mean velocity by Spearman or Pearson correlation analysis.

RESULTS

TAPSEout (t=5.69, p<0.001), TAPSEin (t=5.83, p<0.001) and RVFS (t=6.05, p<0.001) revealed a significant difference between patients with CTEPH and the healthy group .ROC curve analysis showed that TAPSEout had a high predictive value for CTEPH (Auc=0.92 for TAPSEout, 0.89 for TAPSEin ,0.88 for RVFS, p<0.01). The diagnostic threshold for TAPSEout was15.7mm for CTEPH patients.In patients with CTEPH, PVR showed a significant but weak correlation with TAPSEout (r=-0.31, p=0.04) and no correlation with TAPSEin (r=- 0.09, p=0.61) and RVFS (r=-0.08, p=0.64). There was a moderate correlation between MPA mean velocity and TAPSEout (r=-0.54, p<0.03) and no correlation with TAPSEin (r=-0.13, p=0.62) and RVFS (r=0.-0.06, p=0.83).

CONCLUSION

CMR-derived TAPSEout is a useful marker to predict CTEPH. TAPSEout shows a good correlation with PVR and MPA mean velocity in CTEPH patients. TAPSEout might be a potential indicator for detection of RV function changes.

CLINICAL RELEVANCE/APPLICATION

CMR -determined TAPSE measurement is a quick screening method to identify patients with potential RV dysfunction and to select patients in whom a more detailed analysis would be used.

SSA03-08 Body Mass Index-Based Reduction of Radiation Exposure in Coronary CT Angiography Using a 3rd Generation Dual-Source CT Scanner

Sunday, Nov. 29 11:55AM - 12:05PM Location: S504AB

Participants
Stefanie Mangold, MD, Charleston, SC (*Presenter*) Nothing to Disclose
Carlo N. De Cecco, MD,PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Julian L. Wichmann, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Maxwell Stroebel, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Christian Canstein, Charleston, SC (*Abstract Co-Author*) Employee, Siemens AG
U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Bracco Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; ; ;
Giuseppe Muscogiuri, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Akos Varga-Szemes, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively investigate the potential of further dose reduction at coronary computed tomography angiography (CCTA) based on body mass index (BMI) using a 3rd generation dual-source CT (DSCT) scanner and automated tube voltage selection.

METHOD AND MATERIALS

We evaluated 231 patients who underwent CCTA with a 3rd-generation DSCT. Prospectively ECG-triggered adaptive sequential acquisition at 70, 80, 90, 100 and 120kV (pulsing window 30-90%, full dose at 70% of the cardiac cycle) was performed with automated attenuation-based selection of tube current and voltage and advanced modeled iterative reconstruction. Patients were divided in three classes: 1, 70-80kV (n=44); 2, 90-100kV (n=59) and 3, 120kV (n=118). BMI and effective dose (ED) was recorded. Vascular attenuation in proximal and distal coronary arteries was measured. Contrast-to-noise ratio (CNR) was calculated. To subjectively evaluate vessel enhancement and image noise five-point scales were used.

RESULTS

Image quality was diagnostic in 98.7% of the examinations. BMI between the groups was significantly different with 24.2kg/m2 in group 1, 27.5kg/m2 in group 2 and 34.3kg/m2 in group 3 (p=.0006 and p<.0001, respectively). Proximal and distal CNR was significantly lower in group 1 compared to group 2 (14.5vs16.8 and 11.4vs14.0,p=.049 and .007) and in group 3 compared to group 2 (13.6 and 10.9;p=.002 and .0001). However, no significant differences between the groups were shown by subjective image quality analysis (p>.05). Intragroup comparison in group 1 and 2 revealed no significant differences regarding the BMI and objective image quality parameters between 70 and 80kV (mean BMI: 24.0±3.0vs25.1±3.4kg/m2,p=.370; mean proximal CNR: 15.0vs14.1,p=.492) and between 90 and 100kV (mean BMI: 27.7±4.6vs27.2±4.3kg/m2,p=.717; mean proximal CNR: 16.1vs17.5,p=.429). However, ED was significantly lower for 70kV in comparison to 80kV (1.7±1.4vs2.7±1.5mSv,p=.001) as well as for 90kV compared to 100kV (5.0±3.4vs6.5±3.3mSv,p=.011). Mean ED at 120kV was 11.2±4.4mSv.

CONCLUSION

For CCTA with 3rd generation DSCT automated tube voltage selection is effective in reducing the ED according to patient size.

CLINICAL RELEVANCE/APPLICATION

Automated tube voltage selection can be used to achieve significant reduction of radiation dose in CCTA in patients with a wide range of body types.

SSA03-09 The Impact of Dipper Status in Hypertension on Cardiac Structure, Global Function and Regional Myocardial Strain: Insights from Cardiac Magnetic Resonance (CMR)

Sunday, Nov. 29 12:05PM - 12:15PM Location: S504AB

Participants
Jonathan C. Rodrigues, MRCP,FRCR, Bristol, United Kingdom (*Presenter*) Nothing to Disclose
Antonio M. Amadu, MD, Sassari, Italy (*Abstract Co-Author*) Nothing to Disclose
Amardeep Ghosh Dastidar, MBChB,MRCP, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Stephen M. Lyen, FRCR, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Amy Burchell, MBBCh,MRCP, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

Laura Ratcliffe, MBBS,MRCP, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Emma Hart, BSC,PhD, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Mark Hamilton, MRCP, FRCR, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Chiara Bucciarelli Ducci, MD, PhD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Julian Paton, BSC,PhD, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Angus Nightingale, MBBCHIR,MD, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Nathan Manghat, FRCR, MD, Plymouth, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The loss of normal nocturnal dip in blood pressure in hypertension has adverse prognostic implications. We investigated the impact of dipper status on cardiac structure and function using cardiac magnetic resonance (CMR).

METHOD AND MATERIALS

24 hour ambulatory blood pressure monitoring (ABPM) and comprehensive CMR including late gadolinium enhancement (LGE) for myocardial scar assessment (1.5T Avanto, Siemens) were performed in 72 hypertensive patients referred from our tertiary hypertension clinic. Dipper status (n=33) was defined as >10% drop and non-dipper (n=39) as 0-10% drop in nocturnal systolic BP (SBP) versus diurnal SBP. Left ventricular mass (LVM) and volumes indexed to body surface area. Regional myocardial strain was estimated from the global mid LV from a 3D model generated from 4-chamber, 2-chamber and short axis cines (cvi42, Circle Cardiovascular Solutions Inc.). Fishers exact or unpaired student T tests were used as appropriate.

RESULTS

The results are show in Table 1. Non-dippers were significantly older than dippers (54±14 vs 46±15 years $p<0.05$). There was no difference in overall SBP and DBP between dippers and non-dippers but the latter had significantly higher nocturnal SBP (152±23 vs 129±13 mmHg $p<0.0001$) and DBP (82±14 vs 76±12 mmHg $p<0.05$). There were non-significant trends towards higher indexed LVM (90±25 vs 84±18g/m2) and prevalence of subendocardial LGE suggesting previous subclinical myocardial infarction (11% vs 3%) in non-dippers compared to dippers. Time to peak longitudinal strain was significantly higher in non-dippers compared to dippers (346±68 vs 316±54ms $p<0.05$) despite no significant difference in BP. A similar trend was observed for time to peak radial strain (332±68 vs 306±68ms $p=0.07$).

CONCLUSION

Significantly higher nocturnal SBP and DBP occur in non-dippers versus dippers. Trends towards increased indexed LVM, prevalence of subendocardial MI and prolonged time to peak strain. The latter suggests increased peripheral vascular resistance in non-dippers. These findings may help explain the adverse cardiovascular risk conferred by non-dipper status.

CLINICAL RELEVANCE/APPLICATION

CMR provides insights into different structural and function differences in non-dippers versus dippers and has potential to aid risk stratification in patients with hypertension.

SSA06

Gastrointestinal (Pancreas Solid Masses)

Sunday, Nov. 29 10:45AM - 12:15PM Location: E353A

GI CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Michael A. Blake, MBBCh, Boston, MA (*Moderator*) Editor with royalties, Springer Science+Business Media Deutschland GmbH
Desiree E. Morgan, MD, Birmingham, AL (*Moderator*) Research support, General Electric Company

Sub-Events

SSA06-01 Diagnostic Performance of 18F-FDG PET/MRI for the Preoperative Assessment of Resectability and Staging of Pancreatic Cancer: Comparison with 18F-FDG PET/CT Plus Contrast-enhanced MDCT - A Prospective Preliminary Study

Sunday, Nov. 29 10:45AM - 10:55AM Location: E353A

Participants
Ijin Joo, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jeong Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Grant, Guerbet SA; Support, Siemens AG; Support, Koninklijke Philips NV ; Grant, Bayer AG; Consultant, Bayer AG; Grant, General Electric Company; Support General Electric Company; Grant, STARmed Co, Ltd; Grant, RF Medical Co, Ltd; Grant, Toshiba Corporation; Grant, Dong-Seo Medical Industrial Col, Ltd
Dong Ho Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Sun Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic performance of 18F-FDG PET/MRI in the assessment of local resectability, N staging, and M staging in patients with pancreatic cancer compared with 18F-FDG PET/CT plus contrast-enhanced MDCT.

METHOD AND MATERIALS

In this prospective study, a total of 37 patients with 39 pancreatic cancers were enrolled and underwent 18F-FDG PET/MRI, 18F-FDG PET/CT, and contrast-enhanced MDCT within 2 weeks of each other. Mean and maximum standardized uptake values (SUVs) in PET/MRI and PET/CT of pancreatic cancers were measured. Two independent radiologists retrospectively reviewed two imaging sets (set 1: PET/MRI, set 2: PET/CT plus MDCT) to evaluate tumor conspicuity and local resectability using a 5-point scale, and to determine preoperative N staging (N- or N+) and M staging (M0 or M1). Diagnostic performances two imaging sets were compared using paired t-test, ROC analysis, and McNemar test.

RESULTS

Both mean and maximum SUVs of the pancreatic cancer showed strong correlations between PET/MRI and PET/CT (r=0.89 and 0.90, Ps<0.0001). Tumor conspicuity was slightly higher in PET/MRI set than PET/CT plus MDCT set (3.64 vs. 3.36, and 3.49 vs. 3.23 in reviewers 1 and 2, respectively; Ps>0.05). Diagnostic performance of PET/MRI in assessing local resectability was equivalent to PET/CT plus MDCT (Az values of 0.857 vs. 0.725, and 0.875 vs. 0.754 in reviewers 1 and 2, respectively; Ps>0.05). There were no statistically significant difference in the diagnostic accuracies for N- and M-staging between two imaging sets (N-staging: 52.6% vs. 42.1%, and 57.9% vs. 42.1%; M-staging: 75.0% vs. 79.2%, and 79.2% vs. 83.3%, in reviewers 1 and 2, respectively; Ps>0.05).

CONCLUSION

In this preliminary study in patients with pancreatic cancer, diagnostic performance of 18F-FDG PET/MRI is comparable to that of 18F-FDG PET/CT plus contrast-enhanced MDCT in the preoperative assessment of local resectability, N-staging, and M-staging .

CLINICAL RELEVANCE/APPLICATION

In the preoperative assessment of resectability and staging of pancreatic cancer, 18F-FDG PET/MRI, as an one-step whole-body imaging tool, may serve as a alternative to PET/CT plus MDCT.

SSA06-02 Prospective Histopathological Correlation of IVIM Derived Quantitative MR Parameters in Pancreatic Adenocarcinoma

Sunday, Nov. 29 10:55AM - 11:05AM Location: E353A

Participants
Elizabeth M. Hecht, MD, New York, NY (*Presenter*) Nothing to Disclose
Michael Z. Liu, MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sachin Jambawalikar, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Helen R. Remotti, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Stuart W. Weisberg, MD,PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Martin R. Prince, MD, PhD, New York, NY (*Abstract Co-Author*) Patent agreement, General Electric Company; Patent agreement, Hitachi, Ltd; Patent agreement, Siemens AG; Patent agreement, Toshiba Corporation; Patent agreement, Koninklijke Philips NV; Patent agreement, Nemoto Kyorindo Co, Ltd; Patent agreement, Bayer AG; Patent agreement, Lantheus Medical Imaging, Inc; Patent agreement, Bracco Group; Patent agreement, Medtronic, Inc; Patent agreement, Topspins, Inc; Stockholder, Topspins, Inc
Donald Garmon, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Yanghee Woo, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Michael D. Kluger, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

John Chabot, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess agreement between IVIM derived parameters and histopathology in participants with suspected pancreatic ductal adenocarcinoma (PDA) undergoing surgical resection.

METHOD AND MATERIALS

18 patients (9M:9F, mean 68y) were prospectively enrolled in this IRB approved, HIPAA compliant study with informed consent. All underwent respiratory-triggered axial EPI DWI with 11b values from 0 to 800 within 1 month of surgery (mean, 6d). Two experienced radiologists (>10y each) independently drew 2 ROIs over tumor and surrounding non-tumoral tissue when present and individual results were averaged. Mono (ADC0-800, ADCtotal) and bi-exponential (true diffusion (D), "pseudo"- diffusion (D*) and perfusion fraction (f) fitting were derived using open source MITK software (MITK.org). DWI metrics were compared with quantitative histopathology including % fibrosis, tumor cell density, and mean vascular density (MVD). Statistical analysis included intra-class correlation, Pearson correction and student t-test.

RESULTS

16 patients had PDA (Grade 2 (n=7), 2-3 (n=4), 3 (n=5),1 cholangiocarcinoma and 1 metastatic renal cell carcinoma (mRCC). Non-tumoral pancreas tissue was available in 14/18 patients specimens. Mean reader ROI size for tumor and non-tumor tissue was not significantly different (p>0.05). Reader agreement was moderate-high (0.68-0.98) for ADC, f and D. Histopathology revealed that MVD was significantly lower in tumor as compared to non tumor (p=0.002) and % fibrosis was significantly higher in tumor (p=0.004). D, f and ADC0-800 were not significantly different between tumor and non-tumor tissue for either reader. There was moderate but significant correlation between D and % fibrosis in tumor tissue (excluding mRCC) for each reader (Reader 1, r=-0.48, p=0.04; Reader 2, r=-0.59, p=0.01. Including non-tumor and tumor tissues significance was maintained (Reader 1, r=-0.43, p=0.02; Reader 2, r=-0.47, p=0.007). D was lower for grades 3-4 vs. grades 1-2 fibrosis (1.11 µm2/ms vs. 1.45 µm2/ms, p=0.05). MVD did not significantly correlate with f or fD*. Cell density/tumor grade did not correlate with IVIM metrics.

CONCLUSION

D negatively correlates with % fibrosis in tumor and non-tumoral pancreatic tissue and may serve as a biomarker of treatment response.

CLINICAL RELEVANCE/APPLICATION

Development of imaging biomarkers that can monitor desmoplasia in pancreatic adenocarcinoma would be clinically useful.

SSA06-03 Pancreatic Neuroendocrine Neoplasms: Correlation of MR Imaging Appearance with Biological Behavior

Sunday, Nov. 29 11:05AM - 11:15AM Location: E353A

Participants
Mingliang Wang, MD, Shanghai, China (*Presenter*) Nothing to Disclose
Mengsu Zeng, MD, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Shengxiang Rao, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe MR imaging features of pancreatic neuroendocrine neoplasms (pNENs) and to identify MR imaging features in predicting biological behavior.

METHOD AND MATERIALS

MR imaging data from 35 patients (14 men and 21 women; age range 27-69 years) with pathologically proven pNENs was retrospectively reviewed. Of the pNENs, 14/35 (40.0 %) were G1, 19/35 (54.3 %) were G2 and 2/35 (5.7 %) were G3. Image analysis included tumor location, tumor diameter, signal intensity on precontrast images, enhancement pattern, pancreatic duct dilatation, vascular encasement, extrapancreatic spread, and presence of metastases.

RESULTS

2/35 (5.7 %) of lesions appeared as a cyst with thick wall. In other 33 cases, the median maximum diameter of pNENs was 2.67 cm (range 0.60-5.20 cm). 75.8 % of lesions appeared hyperintense on T2-weighted imaging. 36.4 % of lesions appeared inhomogeneity on T2-weighted imaging. On post-contrast images, 69.7% of lesions appeared early contrast enhancement on Arterial Phase images and continuous contrast-enhancement with its degrees higher than the pancreas on Delay Phase images Significant differences in gender, tumor diameter, signal intensity on precontrast images, and invasiveness were found between G1 group and G2 group (P <0.05). The lesions in G2 group had larger size than that in G1 group. The tumor size had good diagnostic performance, with area under ROC curve (AUC) of 0.944. When a cutoff value for tumor size was set as 1.95 cm, diagnostic sensitivity was 88.9% and specificity was 92.3% in differentiating G1 group from G2 group.

CONCLUSION

MR imaging features such as tumor diameter, signal intensity on precontrast images, and invasiveness may preoperatively suggest the biological behaviour of pNENs, assisting decisions about treatment. Lesions with a larger diameter, irregular margins, absence of a cleavage plane,inhomogeneity and invasiveness were significantly associated with malignant pNENs.

CLINICAL RELEVANCE/APPLICATION

MR imaging can display malignant signs of pancreatic neuroendocrine neoplasms, predict biological behavior of the neoplasms and help assisting decisions about treatment.

SSA06-04 Enhancement Pattern of Pancreatic Neuroendocrine Tumors on Dynamic Enhanced CT: A Comparison between Tumors with Different Degree of Fibrosis Component

Sunday, Nov. 29 11:15AM - 11:25AM Location: E353A

Participants
Cherry Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jae Ho Byun, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung-Mo Hong, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Soo Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyoung Jung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Moon-Gyu Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the enhancement pattern and other CT findings between pancreatic neuroendocrine tumor (NET) with different degree of fibrosis component.

METHOD AND MATERIALS

We retrospectively reviewed the CT images of 45 patients (17 males and 28 females) with surgically confirmed NET containing fibrotic component > 30% of the whole tumor (Group A). They were matched for age, gender, and tumor grade at a ratio of 1:1 to 45 NET patients with fibrotic component < 30% (Group B). Hounsfield unit (HU) of tumors in the precontrast (PC), arterial (AP), and portal (PP) phases, HU ratio (tumor to normal parenchyma) in each phase, HU enhancement pattern (progressive enhancement or wash-out pattern), and visible enhancement pattern change from AP to PP (peripheral to full, peripheral to peripheral, full to peripheral, or full to full) were compared between Group A and B. Other CT findings, including heterogeneity of enhancement, calcification, margin, perilesional infiltration, pancreatic duct dilation, direct invasion, lymph node and distant metastasis, were also compared between the two groups.

RESULTS

Group A showed progressive enhancement pattern and Group B showed wash-out pattern ($P<0.05$). HU of tumors and HU ratio in PC were higher in group A than in group B (42.5±7.5 vs. 38.6±8.2; 1.02±0.28 vs. 0.88±0.23; $P\leq.024$), whereas those in AP were lower in group A than in group B (146.2±8.2 vs. 183.1±49.7; 1.4±0.52 vs. 1.61±0.38; $P\leq.003$). Peripheral to full or peripheral enhancement change was more frequent in group A, while full to full enhancement change was more frequent in Group B ($P<.05$). Other CT findings were not significantly different between the two groups ($P>.05$).

CONCLUSION

On dynamic enhanced CT, NET with rich fibrotic component tended to show progressive enhancement pattern and peripheral to peripheral or full enhancement change, while NET with poor fibrotic component tended to show wash-out pattern and full to full enhancement change.

CLINICAL RELEVANCE/APPLICATION

CT enhancement pattern has been suggested as a prognostic indicator of pancreatic NET. However, its degree of fibrotic component could be one of causes for its various enhancement patterns.

SSA06-05 Using Iodine Quantification from DECT Images to Differentiate Pancreatic Neuroendocrine Tumors from Splenules

Sunday, Nov. 29 11:25AM - 11:35AM Location: E353A

Participants
Andrea Prochowski Iamurri, MD, Boston, MA (*Presenter*) Nothing to Disclose
Manuel Patino, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Diana Murcia, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Canellas, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Farhad Mehrkhani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Yasir Andrabi, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Avinash R. Kambadakone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Dushyant V. Sahani, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Consultant, Allena Pharmaceuticals, Inc

PURPOSE

Differentiating intrapancreatic splenule from other solid pancreatic masses and pancreatic neuroendocrine tumors (pNET) can be challenging on a single phase CT exam. We investigated the role of iodine quantification from DECT for characterizing splenules (SPL).

METHOD AND MATERIALS

In this retrospective study, 45 patients (16 with pNET and 29 with SPL) underwent to portal phase DECT (750HD GE) and material decomposed iodine images (MD-I) were used to quantify mean iodine concentrations (MIC) for pNET, SPL, spleen and aorta. Normalized iodine concentration (NIC) were calculated for pNET, SPL and spleen. MIC of pNET and of SPL were compared with spleen MIC. On the SECT images, mean HU (MHU) values were calculated for pNET, SPL and spleen. MHU and NIC values of lesions and spleen and their ratio were compared using a t-test. Lesion appearance was evaluated on MD-I with a scale from 1 to 3 (1 homogenous, 2 mild heterogeneity, 3 heterogeneous).

RESULTS

NIC values were: pNET 0.73±0.2, SPL 0.66±0.1 and spleen 0.66±0.1. The MIC ratio between pNET and spleen was 1.14±0.3, and for SPL/spleen 1.01±0.1 ($p=0.047$). The MHU ratios between pNET and spleen was 0.92±0.2 and for SPL/spleen 0.86±0.1 ($p=0.174$). SPL also demonstrated a homogenous appearance (29) vs the heterogeneous appearance of pNET (16, 4= mild heterogeneity, 12=obvious heterogeneous).

CONCLUSION

On the MD-I images from DECT, SPL's are homogenous and follow the iodine concentration of spleen whereas pNET are often heterogenous and show higher NIC values than spleen.

CLINICAL RELEVANCE/APPLICATION

Inaccurate diagnosis of intrapancreatic SPL and pNET on portal phase CT often leads to unnecessary interventions and surgeries and occasionally delay in much needed surgery in the cases of pNET. Reliable diagnosis of splenule on portal-venous phase DECT is feasible by subjective assessment and iodine quantification.

Honored Educators

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Dushyant V. Sahani, MD - 2012 Honored Educator
Dushyant V. Sahani, MD - 2015 Honored Educator

SSA06-06 Low Contrast Enhancement of Primary Pancreatic Ductal Adenocarcinoma is Associated with Early Development of Metastases Following Resection

Sunday, Nov. 29 11:35AM - 11:45AM Location: E353A

Participants
Aisha True-Yasaki, San Francisco, CA (*Presenter*) Nothing to Disclose
Eric Collisson, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;
Michael A. Ohliger, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Judy Yee, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, EchoPixel, Inc
Ronald J. Zagoria, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Zhen J. Wang, MD, Hillsborough, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Previous studies suggest that enhancement patterns of pancreatic ductal adenocarcinoma (PDAC) reflect tumor angiogenesis and fibrosis, both of which are implicated in PDAC prognosis. The purpose of this study is to determine whether the degree of enhancement of resectable PDAC at pancreatic phase CT can predict subsequent early development of metastases.

METHOD AND MATERIALS

We retrospectively identified 38 patients with resectable PDAC who underwent multiphase pancreatic protocol CT prior to surgery (no neoadjuvant therapy), and who had >= 12 month follow up at our institution. Tumor enhancement was determined by measuring CT attenuation change (Δ Hounsfield unit (HU)) between the pancreatic phase and unenhanced images. Tumor grade, size, and AJCC stage at pathology were recorded. Follow up imaging studies were reviewed to determine any subsequent development of metastatic disease and its timing in these patients. Uni- and multi-variate analyses were used to determine predictors of the development of metastases within 12 month of surgery.

RESULTS

Fourteen of the 38 patients had developed metastases (liver, lung, peritoneum) by 12 months. The mean tumor enhancement in patients who had developed metastases by 12 months was significantly lower than that of patients who did not (32.1±13.7HU vs. 55.9±18.9HU, p=0.0002). A threshold of 40HU identified patients with metastases by 12 months with 79% sensitivity and 92% specificity. Both tumor grades and size at pathology were significantly higher in patients with metastases by 12 months than those without (both p values < 0.05). There was a trend of higher tumor stages in patients with metastases by 12 months (p=0.06). 32/38 patients underwent gemcitabine based adjuvant therapy post resection. The proportion of patients receiving adjuvant therapy was not significantly different between the two groups. Multivariate analysis showed that tumor enhancement < 40HU and tumor grade were independent predictors of development of metastases by 12 months (both p values <0.05).

CONCLUSION

Low contrast enhancement (<40HU) of primary PDAC is associated with development of metastases by 12 months following resection.

CLINICAL RELEVANCE/APPLICATION

Enhancement pattern of primary PDAC at CT may be a useful prognostic marker.

SSA06-07 Assessment of Iodine Uptake by Pancreatic Cancer Following Chemotherapy Using Dual Energy CT

Sunday, Nov. 29 11:45AM - 11:55AM Location: E353A

Participants
Satomi Kawamoto, MD, Baltimore, MD (*Presenter*) Research Grant, Siemens AG; ;
Matthew K. Fuld, PhD, Iowa City, IA (*Abstract Co-Author*) Researcher, Siemens AG
Gale Christensen, Baltimore, MD (*Abstract Co-Author*) Grant, Becton, Dickinson and Company
Daniel Laheru, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Elliot K. Fishman, MD, Owings Mills, MD (*Abstract Co-Author*) Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

PURPOSE

To evaluate quantitative change of iodine uptake by pancreatic cancer using dual source dual energy CT before and after

chemotherapy

METHOD AND MATERIALS

Twenty patients (13 males, 7 females, average age 67.8±11.8 years) with newly diagnosed pancreatic adenocarcinoma were scanned with dual source dual energy CT before and after (average interval: 71.9±42.8 days) chemotherapy. Dual phase CT protocol included arterial phase timed by bolus tracking, followed by a 60 second venous phase scanned with dual energy CT at 100 kV and 140 kV with tin filtration with reference dose of 250 and 193 mAs, respectively. Tumor segmentation was performed on a workstation using automated segmentation followed by manual editing. Iodine uptake by the tumor was obtained as an iodine concentration (mg/ml) and normalized by iodine uptake within the abdominal aorta ('normalized tumor iodine uptake'). Tumor iodine uptake was compared to change in tumor volume and tumor markers.

RESULTS

At baseline, average iodine uptake by tumor was 1.26±0.37mg/ml in arterial phase and 1.79±0.50mg/ml in venous phase, and average normalized tumor iodine uptake was 0.10±0.05 in arterial phase and 0.38±0.09 in venous phase. After chemotherapy, average normalized tumor iodine uptake was significantly decreased compared to the baseline in both arterial phase (0.08±0.04 [p=0.016]) and venous phase (0.31±0.09 [p=0.0007]). The tumor was decreased in volume in 17 patients (average volume change: 71±15%), and increased in 3 patients (average volume change: 154±22%). Average normalized iodine uptake in tumors that reduced volme greater than 20% after chemotherapy (n=9) was 72% and 77% of the baseline in arterial and venous phase respectively, lower than that of the other tumors (n=11) (88% of the baseline in both phase), but there was no statistically significantly difference. Average normalized tumor iodine uptake in patients with decreased tumor markers (n=8) were 74% and 80% of the baseline in arterial and venous phase, and in patients with increased tumor markers (n=3) were 116% and 96% of the baseline in arterial and venous phase, but the number of subjects were too small for statistical analysis.

CONCLUSION

Iodine uptake by pancreatic adenocarcinoma evaluated using dual energy CT may decrease after chemotherapy.

CLINICAL RELEVANCE/APPLICATION

Iodine uptake by pancreatic adenocarcinoma evaluated by dual energy CT may be potentially useful for assessment of treatment response.

Honored Educators

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Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator

SSA06-08 Agreement of Results of CT-perfusion Measurements in Pancreatic Carcinoma: Comparison of Three Different Kinetic Calculation Models

Sunday, Nov. 29 11:55AM - 12:05PM Location: E353A

Participants
Gerd Grozinger, MD, Tubingen, Germany (*Presenter*) Nothing to Disclose
Sven Schneeweis, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Marius Horger, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the interchangeability of perfusion parameters between three calculation methods for the post-processing of perfusion-CT images in pancreatic carcinoma.

METHOD AND MATERIALS

Perfusion-CT images was performed in 48 (32 male; mean age: 69±9 years) patients with adenocarcinoma of the pancreas. Images were post-processed using a software package based on the maximum-slope approach (blood flow-BF and blood volume-BV) and Patlak analysis (BV and k-trans), as well as a software package with deconvolution-based analysis (BF, BV and k-trans). Volume-of-interest (VOI) analysis of the tumor average perfusion was performed. Perfusion parameters were compared using the Wilcoxon matched-pairs test and Bland-Altman plots. Following CT-examinational protocol: 80kV, 100/120mAs, 64x0.6mm collimation, 26 consecutive scans, IV injection of 50 mL contrast at a flow rate of 5 mL/s, was used.

RESULTS

48 VOIs of tumors were analyzed. Moderate to good correlations were demonstrated between the various perfusion values ($r = 0.42-0.90$, $P < .001$). The Wilcoxon test revealed a significant difference between the methods ($P < .001$), with the BF and BV values obtained using the maximum-slope approach and Patlak analysis being lower than those obtained using deconvolution-based analysis. For analysis of k-trans deconvolution revealed significantly lower values ($P<0.001$). The Bland-Altman plots for BF and BV values revealed a proportionality trend with outliers, which were strongly associated with the magnitudes of the parameters. Analysis of the k-trans values did not show any systematic bias. Comparison of the three different BV-calculations revealed an equal distribution.

CONCLUSION

There were significant differences in the perfusion parameters obtained using the three software packages, and therefore these parameters are not directly interchangeable. However, the magnitude of pairs of parametric values is in constant relation to each other enabling the use of any of these methods.

CLINICAL RELEVANCE/APPLICATION

Perfusion-based tumor characterization could emerge as a more sensitive treatment monitoring and therefore cognizance of perfusion parameter values obtained with existing software packages is mandatory.

SSA06-09 Role of Sarcopenia and Visceral Obesity, Assessed Using Preoperative CT-scan, as Predictors of Short-term Outcome Following Pancreaticoduodenectomy in Pancreatic Cancer Patients

Sunday, Nov. 29 12:05PM - 12:15PM Location: E353A

Participants
Anna Damascelli, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Giulia Cristel, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Giulia Carrara, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Nicolo Pecorelli, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recent reports showed that body composition parameters, assessed using computed tomography (CT) images, may improve preoperative risk stratification in oncologic Patients. The aim of this study is to evaluate how sarcopenia (depleted muscle mass) and visceral obesity impact on postoperative outcome in pancreatic cancer patients treated with pancreaticoduodenectomy (PD) in a high volume Institution, focusing on mortality and pancreatic fistula (PF) occurrence.

METHOD AND MATERIALS

Between 2010 and 2014, 284 consecutive patients underwent PD for pancreatic cancer; among them 202 patients underwent preoperative staging CT-scan imaging at our Institution within 30-days before PD, and were included in this study. Total abdominal muscle area (TAMA), visceral fat area (VFA) and subcutaneous fat area (SFA) were assessed using Slice-O-Matic 5.0 software (Tomovision, Montreal, Canada); TAMA and VFA were evaluated on two contiguous slices at the third lumbar vertebra, and then averaged, using Hounsfield unit threshold of -29 to +150 for skeletal muscle, -150 to -50 for visceral adipose tissue and -190 to -30 for subcutenous and intermuscular fat. Perioperative variables and postoperative outcomes were prospectively collected. Multivariate analysis was performed to identify independent predictors of 60-day mortality, and PF graded according to International Study Group of Pancreatic Fistula criteria. Sarcopenia was defined using predetermined sex-specific cut-off values (52.4 cm2/m2 for men and 38.5 cm2/m2 for women).

RESULTS

132 (65.4%) patients were classified as sarcopenic. Postoperative mortality occurred in 12 patients (5.9%), major complications in 40 (19.8%) and pancreatic fistula in 48 patients (23.8%). At multivariate analysis, VFA/TAMA and ASA score = 3 were the strongest predictors of mortality ($p<0.001$). Among patients who developed major complications, survivors had significantly lower VFA/TAMA ratio than non-survivors ($p=0.017$). VFA was an independent predictor of PF ($p<0.001$).

CONCLUSION

Preoperative analytic morphometric assessment, using CT images, is a useful tool for the prediction of mortality and pancreatic fistula occurrence, following PD for cancer.

CLINICAL RELEVANCE/APPLICATION

Preoperative CT assessment of sarcopenia and visceral adiposity improve risk stratification in patients undergoing pancreaticoduodenectomy for cancer, predicting mortality and pancreatic fistula occurrence.

SSA07

Gastrointestinal (Rectal Cancer)

Sunday, Nov. 29 10:45AM - 12:15PM Location: E450A

GI BQ CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Marc J. Gollub, MD, New York, NY (*Moderator*) Nothing to Disclose
Kedar Jambhekar, MD, Little Rock, AR (*Moderator*) Nothing to Disclose

Sub-Events

SSA07-01 Correlations of Extramural Vascular Invasion on Preoperative MRI with Local Lymph Node Metastasis in Rectal Cancer

Sunday, Nov. 29 10:45AM - 10:55AM Location: E450A

Participants
Liheng Liu, MD, Beijing, China (*Presenter*) Nothing to Disclose
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Zhenghan Yang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhenchang Wang, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the possibility of predicting local lymph node metastasis by extramural vascular invasion (EMVI) on preoperative MRI in patients with rectal cancer.

METHOD AND MATERIALS

MR images and clinical pathologic data of 183 consecutive patients with rectal cancer (between Dec. 2011 and Dec. 2014) were reviewed. MRI-detected extramural vascular invasion (mr-EMVI), with clinical pathologic factors (including age, gender, T stage, differentiation, size and pathological EMVI), were analyzed by chi-square crosstabs test (or t test) and multivariate logistic regression to determine risk factors for lymph node metastasis.

RESULTS

A total of 183 rectal cancer patients who underwent radical surgery were included in our study. Of them, 78 (42.6%) patients had lymph node metastasis according to pathology at the time of surgery. Among those clinical pathologic factors, T stage (odds ratio, 1.848), pathological EMVI (odds ratio, 4.878) and MRI-detected EMVI (odds ratio, 3.884) were independent risk factors for LNM. The incidence of LNM in the patients with pathological EMVI and MRI-detected EMVI was 78.7% and 75.4% respectively. By using pathological EMVI as a gold standard, sensitivity, specificity and agreement rate of MRI-detected EMVI were 61.7%, 82.3% and 77.0%.

CONCLUSION

MRI-detected EMVI could be used as a predictor for lymph node metastasis in patients with rectal cancer.

CLINICAL RELEVANCE/APPLICATION

This paper has shown that the lymph node status at the time of surgery in rectal cancer is related to preoperative MRI-detected extramural vascular invasion. The results may be useful for patients' selection for preoperative neoadjuvant therapy.

SSA07-02 Reproducibility of Evaluation of Invasion Depth of Rectal Cancer into the Mesorectal Fat: Can We Reliably Discern T3ab from T3cd Tumours?

Sunday, Nov. 29 10:55AM - 11:05AM Location: E450A

Participants
Monique Maas, MD, Maastricht, Netherlands (*Presenter*) Nothing to Disclose
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Doenja M. Lambregts, MD, PhD, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Max Lahaye, MD, PhD, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
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Xubin Li, MD, PhD, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
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Miriam van Heeswijk, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Geerard L. Beets, MD, PhD, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Regina G. Beets-Tan, MD, PhD, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

One of the important aspects of rectal cancer staging is the measurement of the invasion depth of a tumour into the mesorectal fat in millimetres. This determines whether there is a T3ab (<5mm) or T3cd (>5mm), which changes treatment for patients (CRT yes/no). Measurement of this factor is arbitrary. Aim was to evaluate reproducibility of the measurement of invasion depth into the mesorectal fat by different readers.

METHOD AND MATERIALS

Sixty-one patients with a pathologically proven T3 tumour were selected. Two readers with different experience in reading rectal

Sixty-one patients with a pathologically proven T3 tumour were selected. Two readers with different experience in reading rectal cancer MRI (2 years and 5 years) measured the maximal depth of invasion of tumour into mesorectal fat in the axial plane perpendicular to the tumour axis. Clock position of the measurement was registered. ICC and Bland-Altman plots were used for analyses.

RESULTS

Intraclass correlation coefficient was 0.61. The Bland-Altman plot showed a mean difference between measurements of 2.45 (SD 3.53) mm with limits of agreement of -4.45 to 9.39. Differences between measurements ranged from -9 to 15 mm. In 36% of patients the clock position of the measurements of both readers were was not in the same quadrant.

CONCLUSION

Reproducibility of measurement of invasion depth of tumour into the mesorectal fat is low, both with regard to the depth and to the location of the deepest invasion. Therefore, the distinction between T3ab and T3cd tumours is unreliable and should not be used for treatment decisions.

CLINICAL RELEVANCE/APPLICATION

The distinction between T3ab and T3cd tumours is deemed relevant to identify patients with a high risk tumor and administer neoadjuvant chemoradiation. Since measurement of invasion depth is only moderately reproducible, the use of this factor for risk and treatment stratification is questionable.

SSA07-03 Interobserver Variability in Interpretation of High Resolution MRI of Primary Rectal Cancer

Sunday, Nov. 29 11:05AM - 11:15AM Location: E450A

Participants
Ajaykumar C. Morani, MD, Houston, TX (*Presenter*) Nothing to Disclose
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Raghunandan Vikram, MBBS, FRCR, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Y. N. You, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Melissa W. Taggart, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
George J. Chang, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Randy D. Ernst, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess interobserver variability in the interpretation of high resolution MRI scans for staging primary rectal cancer

METHOD AND MATERIALS

MRI of 22 randomly selected cases with known rectal cancer, were evaluated independently by 4 abdominal radiologists with approximately 2-4 years of experience in reading rectal MRI. Criteria evaluated included T stage and depth of tumor invasion separately assessed as measured in mm and < or > 5 mm, lymph node involvement and vascular invasion. The data was tabulated and interobserver agreement was calculated. For the small percentage of patients who went directly to surgery correlation with final pathology was performed.

RESULTS

There was wide range in interobserver agreement between 2 readers in different sets/combinations, ranging from 68-90% with overall complete agreement among all readers in only 68% of cases with respect to depth of tumor invasion which improved to 82%, if depth of tumor invasion was separated in <5 mm versus > 5 mm. 5 patients had undergone surgery immediately after MRI without preoperative chemoradiation. In these cases, individual reader accuracy for pT1/T2 versus T3 staging was 60-100% with overall mean accuracy of 80% among all readers. Agreement between 2 readers in different combinations, ranged from 68-81% with overall complete agreement among all readers in 54% of cases with respect to presence or absence of vascular invasion. Interobserver agreement was noted in 76-90% cases and complete agreement among all readers in 68% cases with respect to lymph node status.

CONCLUSION

High resolution MRI is now a widely accepted modality in the preoperative staging of primary rectal cancer. Inter-observer variability remains a significant limitation.

CLINICAL RELEVANCE/APPLICATION

High resolution MRI is now widely used for triaging patients directly to surgery or chemoradiation followed by surgery. However there is significant variation in the interpretation of key parameters. This should be recognized to avoid overtreatment or under-treatment of patients.

Honored Educators

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Raghunandan Vikram, MBBS, FRCR - 2012 Honored Educator

SSA07-04 Value of MRI in Prediction of Metachronous Distant Metastasis after Curative Surgery in Patients with Rectal Cancer versus Clinical and Pathologic Outcomes

Sunday, Nov. 29 11:15AM - 11:25AM Location: E450A

Participants
Huanhuan Liu, Shanghai, China (*Presenter*) Nothing to Disclose
Yanfen Cui, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

Caiyuan Zhang, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Dengbin Wang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the risk factors for distant metastasis in patients with rectal cancer with MRI, clinical and pathologic outcomes.

METHOD AND MATERIALS

291 patients with surgico-pathologically confirmed rectal adenocarcinoma, who had undergone preoperative MRI before any treatment, were retrospectively collected. Preoperative MRI features (tumor location and size, MRI-TN stage, status of circumferential resection margin (CRM), lymphovascular invasion (LVI)), clinical characteristics (age, gender, preoperative CEA value), operation information (operation method, tumor location) and pathologic outcomes(pTN stage,status of pCRM, pLVI, nerve invasion(pNI), number of regional metastatic lymph nodes(pMLNNs), ratio of pMLN (pLNR),tumor grade) as well as immunohistochemical results were analyzed. Univariate and multivariate logistic regression models were performed to predict the risks of distant metastasis. The Kaplan-Meier method was used to analyze the disease-free survival (DFS) rate and 3-year overall survival (OS) rate.

RESULTS

Among 291 patients, 69 patients (23.7%) were confirmed to have distant metastasis.In univariate analysis, MRI-T stage (P=0.005), MRI-N stage (P<0.001), CEA value (P=0.007), pT stage (P<0.001), pN stage (P<0.001), pMLNNs (P<0.001), pLNR (P<0.001), tumor deposits (P=0.014), pLVI (P=0.005), pNI (P=0.003) correlated significantly with metachronous distant metastasis. In multivariate analysis, only preoperative CEA values (P=0.038, Exp(B)=2.102), pLNR(P<0.001, Exp(B)=23.780) and pT stage(P=0.005, Exp(B)=3.677) were independent risk factors for distant metastasis. The mean DFS period for both groups was significantly different (57.22±0.62 vs 18.88±1.98 months, P<0.001). The 3-year OS rate for patients with distant metastasis was 35.0% compared with 97.1% for those without distant metastasis (P<0.001).

CONCLUSION

Preoperative MRI provided limited value in prediction of metachronous distant metastasis in patients with rectal cancer as independent risk factor. Compared with MRI features, preoperative CEA values, pLNR and pT stage were independent risk factors. Patients with the risk factors should be closely followed up for monitoring the metachronous metastasis status in order to take measures for the hope of a good survival outcome.

CLINICAL RELEVANCE/APPLICATION

Compared with MRI features,CEA values,pLNR and pT stage were independent risk factors to predict metachronous distant metastasis in patients with rectal cancer.

SSA07-05 MRI Detected Tumor Response for Intermediate Stage Rectal Cancer(RC) Treated with Chemotherapy Predicts Disease Free Survival and Recurrence: A Collaborative Group Experience

Sunday, Nov. 29 11:25AM - 11:35AM Location: E450A

Participants
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Eva Ballesteros JR, MD, Sabadell, Spain (*Abstract Co-Author*) Nothing to Disclose
Jesus Santos Cores Santos Cores, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose
Gina Brown, MD, MBBS, Sutton, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

'Intermediate risk' RC patients may benefit from neoadjuvant chemotherapy as staging MRI shows markers for distant disease but clear potential resection margins making local recurrence unlikely. This exhibit assesses MRI and pathological staging following neoadjuvant chemotherapy for intermediate risk RC in a prospectively enrolled multicenter phase II trial.

METHOD AND MATERIALS

The trial evaluated safety and efficacy of neoadjuvant Capecitabine, Oxliplatin and Bevacizumab(CAPOX-B). Forty-six patients were enrolled between 2009-11.Eligibility included baseline magnetic resonance(MR) showing a T3 tumour with mesorectal fascia (MRF) potentially clear.Baseline Nodal and Extra-mural venous invasion(EMVI) status was also recorded.Response was assessed by post-treatment MR and pathological T, N and EMVI status as well as Tumor regression grade(TRG).Additionally MR tumor length change,mrEMVI reversion and pathological T downstaging were recorded.Three-year disease free survival and recurrence were calculated using Kaplan-Meier.Cox proportional regression determined relationships between outcomes and all recorded imaging and pathology variables divided into good and poor responders.Three separate Cox-regression analyses were also performed for: baseline imaging, post-treatment imaging and pathology variables.

RESULTS

Median follow-up was 36 months, fourteen patients experienced relapse. 3-year DFS was 69%.On Cox multivariate analysis including all factors mrEMVI(p=0.028) and T-downstaging(p=0.032) were independent prognostic factors for DFS. mrEMVI(p=0.040), T-downstaging(p=0.013) and ypN(p=0.041) were significant independent factors for recurrence.Significant univariate factors for DFS were: Baseline mrEMVI status(p=0.0001),mrEMVI reversion(p=0.003),post-treatment MR Tstaging(ymrT) (p=0.007),mrTRG(p=0.011),pathological nodal status(p=0.02) and Tdownstaging(p=0.0009).Significant univariate factors for recurrence were: mrEMVI(p=0.007),ymrT(p=0.008),mrTRG(p=0.019),Tdownstaging(p=<0.0001),ypN(p=0.002) and ypT(p=0.022).

CONCLUSION

Baseline MRI-EMVI is an independent prognostic factor for survival and recurrence in intermediate risk rectal cancer treated with neoadjuvant chemotherapy.

CLINICAL RELEVANCE/APPLICATION

Future randomised trials should evaluate primary chemotherapy verses standard treatment in patients with T3,MRF clear and mrEMVI positive disease.Moreover mrEMVI positive may be recommended as a stratification factor.

SSA07-06 Follow-up with MRI of Rectal Cancer Treated by TEM: Recurrence Detection and Inter-observer Reproducibility

Sunday, Nov. 29 11:35AM - 11:45AM Location: E450A

Participants
Monique Maas, MD, Maastricht, Netherlands (*Presenter*) Nothing to Disclose
Britt Hupkens, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Milou Martens, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jeroen Leijtens, Roermond, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Willem M. Deserno, MD,PhD, Almelo, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Camille van Berlo, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Geerard L. Beets, MD, PhD, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Regina G. Beets-Tan, MD, PhD, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Small rectal cancers can be treated with transanal endoscopic microsurgery(TEM). Postoperative changes make follow-up with MRI challenging. Aim was to evaluate post-TEM-MRI at different time points for recurrence detection and assess interobserver-reproducibility.

METHOD AND MATERIALS

38 patients underwent TEM (8 after CRT). 122 MRIs were performed with a mean of 3 MRIs per patient. Seven patients had a recurrence. MRI was performed every 3-4 months during follow-up and consisted of T2W-MRI±DWI. MRIs were evaluated by readers with different experience by confidence level (CL) scoring for recurrence, reproducibility was evaluated with weighted kappa statistics.

RESULTS

For all MRIs AUC for recurrence detection was 0.79and0.73 for T2W-MRI and 0.69and0.76 for DWI. During follow-up AUC increased from 0.55-0.57 at the first MRI to 0.67-0.73 at subsequent MRIs for T2W-MRI. Interobserver-reproducibility was increased during FU for T2W-MRI from kappa 0.09 to 0.77. For DWI reproducibility was fair-good (kappa 0.49-0.61) which increased slightly during FU. Reproducibility also increased during FU from kappa 0.36 to 0.84. At the first MRI after TEM higher CL scores were given at DWI than at T2W-MRI, this difference disappeared as of the second MRI during FU. Number of equivocal scores decreased during FU. Iso-intensity in bowel wall and/or mesorectal fat were predictive for recurrence.

CONCLUSION

The first post-TEM MRI is difficult to assess. After the first MRI accuracy for recurrence detection increases dramatically, due to comparison with earlier studies. There is a learning curve during FU per patient leading to more certainty in readers. Reproducibility is fair-moderate, but increases during FU. Iso-intensity in bowel wall and/or mesorectal fat were predictive for recurrence.

CLINICAL RELEVANCE/APPLICATION

After TEM follow-up is crucial to detect recurrences. MRI is a feasible and reliable modality to perform follow-up after TEM to both detect luminal and nodal recurrences.

SSA07-07 Imaging Genomics of Colorectal Cancer: Patterns of Metastatic Disease at Time of Presentation Based on Mutational Status

Sunday, Nov. 29 11:45AM - 11:55AM Location: E450A

Participants
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James H. Thrall, MD, Boston, MA (*Abstract Co-Author*) Board Member, Mobile Aspects, Inc; Board Member, WorldCare International Inc; Consultant, WorldCare International Inc; Shareholder, Antares Pharma, Inc; Shareholder, iBio, Inc ; Shareholder, Peregrine Pharmaceuticals, Inc
Debra A. Gervais, MD, Chestnut Hill, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To identify the most frequent genetic traits associated with metastatic colorectal tumors at time of presentation and whether there is a correlation between the genotypes and the metastatic disease patterns.

METHOD AND MATERIALS

Retrospective review of 713 subjects with cross-sectional imaging at time of diagnosis with no previous treatment. All tumor samples were tested for Single Nucleotide Polymorphisms (SNP). Mutations can be present individually or coexisting. Z tests were

used to assess differences.

RESULTS

Three-hundred-ninety-seven males and 316 females. Metastatic disease in 547/713 (76), 385/487(79) mutants (M) and 162/226(72) wild types (WT) (p=0.02). Incidence of metastatic disease per genotype as follows: NRAS 31/35(89%), KRAS 213/244 (87%), APC 47/55(85%), TP53 142/170(84%), PIK3C 59/81 (73%), BRAF 56/79(71%) and WT (72%)162/226. Metastasis to the liver, lymphnodes (LN), peritoneum and lung were observed with all genotypes. Liver:LN proportion of involvement was seen as follows: KRAS 62:28 (p<0.001), BRAF 55:62, NRAS 71:58, TP53 63:59, PIK3C 69:49, APC 64:47 and WT 51:49. Metastatic site involvement exclusive to certain genotypes was observed: duodenum/kidneys/uterus/cervix/vagina: KRAS+TP53, Brain:TP53, Appendix: KRAS, Retroperitoneum:PIK3C/WT and Bladder/Pancreas/Prostate/Mediastinum: WT. All genotypes except for BRAF demonstrated bone metastasis.

CONCLUSION

Our study suggests there is an association between mutational status and patterns of metastatic disease in Colorectal Cancer. Metastatic disease to the bladder, pancreas, prostate and mediastinum in CRC suggests wild type tumors. A lower involvement of LN suggests the presence of KRAS mutation.

CLINICAL RELEVANCE/APPLICATION

Genetic profiling should guide the search for specific metastatic patterns allowing special consideration for unusual sites of involvement of metastatic disease to suggest the presence of a specific mutation.

Honored Educators

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Debra A. Gervais, MD - 2012 Honored Educator

SSA07-08 The Application of 3.0T MR Intravoxel Incoherent Motion Imaging and Diffusion Weighed Imaging in Preoperative Diagnosis of Lymph Node Metastatic of Rectal Carcinoma

Sunday, Nov. 29 11:55AM - 12:05PM Location: E450A

Participants
Lin Qiu, Guangzhou, China (*Presenter*) Nothing to Disclose
Xiang-Ran Cai, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Sirun Liu, MSc, Guang-Zhou, China (*Abstract Co-Author*) Nothing to Disclose
Meng Chen, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
You-Zhen Feng, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhong-Ping Zhang, MMedSc, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the clinical value of Intravoxel Incoherent Motion imaging (IVIM) sequence in the diagnosis of lymph node metastatic of rectal carcinoma.

METHOD AND MATERIALS

87 lymph nodes from sixty-two rectal carcinoma patients with IVIM sequence (b=0,25,50,75,100,150,200,400,600,800,1000,1200,1500 and 2000 s/mm2) at 3.0T MR scanner and pathology data were collected. The parameter of IVIM(standard ADC, D, D* and f values)and the DWI signal strength value with b=1000 s/mm2 (S1000)in non-metastatic lymph nodes and metastatic lymph nodes were measured and calculated. Pathology findings and MR sequence were compared. The difference of metastatic lymph nodes and non-metastatic lymph nodes were compared by paired-samples t test.

RESULTS

There were 25 metastatic lymph nodes was found in 62 patients. The standard-ADC=(0.795 ±0.23)×10-3 s/mm2,D= (0.649 ±0.11) ×10-3 s/mm2,D*= (4.79±2.38)×10-3 s/mm2 ,f=(0.27±0.09) % and =348.25±26.74 in the metastatic lymph nodes ;the standard-ADC=(0.995 ±0.34)×10-3 s/mm2,D= (0.787 ±0.19) ×10-3 s/mm2,D*= (4.86±5.40)×10-3 s/mm2 ,f=(0.33±0.33) % and S1000 =211.75±35.66 in non-metastatic lymph nodes. The difference of standard-ADC value(t=31.92,p<0.01), D(t=17.63,p=0.02) and S1000 (t=18.92,p<0.01) were statistically significant in the metastatic lymph nodes and non-metastatic lymph nodes;the standard-ADC value, D value and S1000 value of metastatic lymph nodes were higher than non-metastatic lymph nodes.

CONCLUSION

IVIM sequence can reveal standard ADC, D, D* , f and signal strength values ,they are helpful for diagnose metastatic lymph node.

CLINICAL RELEVANCE/APPLICATION

IVIM sequence is helpful for diagnose metastatic lymph node.

SSA07-09 CT Texture Analysis in Patients with Locally Advanced Rectal Cancer Treated with Neoadjuvant Chemoradiotherapy: A Potential Imaging Biomarker for Treatment Response and Prognosis

Sunday, Nov. 29 12:05PM - 12:15PM Location: E450A

Participants
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Kyoung Ho Lee, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yoon Jin Lee, MD, Seongnam-si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji Hoon Park, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Bracco Group

PURPOSE

To evaluate the association of texture of locally advanced rectal cancer in computed tomography (CT) with neoadjuvant concurrent chemoradiotherapy treatment (CRT) response and 3-year disease-free survival (DFS).

METHOD AND MATERIALS

Institutional review board approved this retrospective study and waived the requirement of informed patient consent. 95 consecutive patients who had neoadjuvant CRT followed by surgery for locally advanced rectal cancer have been included. Texture features were assessed with pretreatment CT scans by using independently developed software. Entropy, uniformity, kurtosis, skewness, and standard deviation were obtained from the largest axial image of the tumor (its boundary being manually drawn), without filtration and with Laplacian of Gaussian spatial filter of various filter values for fine (1.0), medium (1.5 and 2.0), and coarse (2.5) textures. Dworak pathologic grading was used for treatment response. Mean value of each texture parameter was compared between treatment responder (grade 3 and 4) and non-responder (grades 1 and 2) groups via independent t-test. Kaplan-Meier analysis was used to find the relationship between CT texture and 3-year DFS. Receiver operating characteristic curve was performed to determine the optimal threshold values. Using Cox proportional hazards model, independence of texture parameters from patient's stage and age was assessed.

RESULTS

Treatment responder group (n = 32) showed fine-texture features (lower entropy, higher uniformity, and lower standard deviation) with statistical significance in no filtration, and fine (1.0) and medium (1.5) filter values. Without filtration, Kaplan-Meier survival plots for entropy, uniformity, and standard deviation were significantly different (P = .03, P = .016, and P = .033) and fine-texture features (≤ 6.7 for entropy, > 0.0100 for uniformity, and ≤ 28.06 for standard deviation) were associated with higher 3-year DFS. Entropy, uniformity, and standard deviation were independent factors from the cancer stage and age in 3-year DFS (P = .033, P =.011, and P = .04).

CONCLUSION

Fine-texture features are associated with better neoadjuvant CRT response and higher 3-year DFS in patients with locally advanced rectal cancer.

CLINICAL RELEVANCE/APPLICATION

Our study implies the possibility of texture analysis as an imaging biomarker for the treatment response of neoadjuvant CRT and 3-year DFS in locally advanced rectal cancer.

SSA08

ISP: Gastrointestinal (HCC)

Sunday, Nov. 29 10:45AM - 12:15PM Location: E450B

CT GI MR OI BQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Shahid M. Hussain, MD, PhD, Omaha, NE (*Moderator*) Nothing to Disclose
Mustafa R. Bashir, MD, Cary, NC (*Moderator*) Research support, Siemens AG; Research support, Bayer AG; Research support, Guerbet SA; Research support, General Electric Company; Consultant, Bristol-Myers Squibb Company

Sub-Events

SSA08-01 Gastrointestinal Keynote Speaker: Update on HCC Screening with Imaging

Sunday, Nov. 29 10:45AM - 10:55AM Location: E450B

Participants
Shahid M. Hussain, MD, PhD, Omaha, NE (*Presenter*) Nothing to Disclose

SSA08-02 Performances of Imaging for the Diagnosis of Small HCC Following the Recommendations of the European and American Association for the Study of the Liver

Sunday, Nov. 29 10:55AM - 11:05AM Location: E450B

Participants
Christophe Aube, MD, PhD, Angers, France (*Presenter*) Speaker, Bayer AG Support, General Electric Company
Valerie Vilgrain, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Julie Lonjon, Montpellier, France (*Abstract Co-Author*) Nothing to Disclose
Olivier Seror, Bondy, France (*Abstract Co-Author*) Consultant, Angiodynamics, Inc; Consultant, Olympus Corporation; Consultant, Bayer AG
Ivan Bricault, PhD, Grenoble, France (*Abstract Co-Author*) Medical Advisory Board, IMACTIS
Agnes Rode, MD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Christophe Cassinotto, MD, Pessac, France (*Abstract Co-Author*) Nothing to Disclose
Frederic Oberti, MD, PhD, Angers, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate, in a large population of patients with chronic liver disease, the performances of the different imaging techniques (contrast enhanced ultrasound (CEUS), CT scanner and MRI) alone and in combinations for the characterisation of hepatic nodules smaller than 3cm. This study was supported by a national institutional grant (PHRC 2008)

METHOD AND MATERIALS

From April 2010 to April 2013, 442 patients with a chronic liver disease have been prospectively included in 16 centres. They had 1 to 3 nodules 10 to 30 mm explored by CEUS, CT scanner and a MRI within a month. The examination was regarded as positive if the nodule displayed the typical landmark of HCC as defined by the European and American Association for the Study of the Liver (EASL and AASLD) recommendations. A composite gold standard was constructed with histology, imaging and follow up. We determined sensitivity and specificity for a given exam alone and for various combinations of exams as single tests. Results were given regarding the size of the nodules: 10-20mm and 20-30 mm.

RESULTS

382/442 patients with 551 nodules have been finally kept for the statistical analysis. They were 315 (82.46%) males; the mean age was 62.06 +/- 9.73 years. The causes of the chronic liver disease were mainly alcohol (58.12%), C virus (31.41%) and metabolic syndrome (19.11%). The mean size of the nodules was 18.15 +/- 5.74mm.For the 10 - 20mm nodules (n=347) sensibility for the diagnosis of HCC was 70.2% for MR, 67.6% for CT scanner and 39.9% for the CEUS; and the specificity was respectively 83.1%, 76.6% and 93.5%. For the 20 - 30mm nodules (n=204) sensibility for the diagnosis of HCC was 70.5% for MR, 67.5% for CT scanner and 52.4% for the CEUS; and the specificity was respectively 97.3%, 97.3% and 100%.For the 10 - 20mm nodules the sensibility and specificity were respectively 54.8% and 100% for the association of CT + MR; 27.7% and 100% for CT + CEUS; and 28.7% and 99.4% for MR and CEUS

CONCLUSION

This study validates the use of sequencial application of CT and MRI as recommended in the recent update of EASL and AASLD guidelines, in case of small HCC and in a large population. It shows the potential interest of CEUS for its high specificity.This study is part of the CHIC group.

CLINICAL RELEVANCE/APPLICATION

Recent updates of EASL and AASLD recommendations for the non invasive diagnosis of HCC are validated for the small HCC in a large population.

SSA08-03 Non-invasive Diagnostic Criteria of Hepatocellular Carcinoma: Comparison of Diagnostic Accuracy of Updated LI-RADS with Clinical Practice Guidelines of OPTN-UNOS, AASLD, NCCN, EASL-EORTC, and KLCSG-NCC

Sunday, Nov. 29 11:05AM - 11:15AM Location: E450B

Participants
Burcu Akpinar, MD, Aurora, CO (*Presenter*) Nothing to Disclose
Samuel Chang, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Kaplan, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively compare the diagnostic accuracy of different noninvasive diagnostic criteria of hepatocellular carcinoma (HCC) by LI-RADS, OPTN-UNOS, AASLD, NCCN, EASL-EORTC, KLCSG-NCC

METHOD AND MATERIALS

We reviewed the medical records of 2,210 patients who had undergone biopsy, resection, or explantation of liver from January 2011 to November 2013 in our institution. Ninety three patients (M:F=69:24; mean age: 54.8, range 30-77) with chronic hepatitis B and/or cirrhosis for any etiology who had focal hepatic lesions ≥ 5 mm reported on dynamic contrast enhanced CT or MR were included. The focal hepatic lesions treated prior to imaging were excluded. A total of 144 lesions were finally included in our study with 73 lesions ≥ 2 cm, 55 lesions between 1-2 cm, and 16 lesions < 1 cm. The focal hepatic lesions were retrospectively evaluated on CT or MR by use of different noninvasive diagnostic criteria of HCC including LI-RADS (2014), OPTN-UNOS, AASLD, NCCN, EASL-EORTC, and KLCSG-NCC. Using the pathology reports as a gold standard, sensitivity, specificity, and accuracy of the diagnostic criteria were analyzed.

RESULTS

The sensitivity was highest and equal with AASLD, NCCN, EASL-EORTC and KLCSG-NCC criteria (84.4%), followed by LI-RADS (77.9%) and OPTN-UNOS criteria (75.3%). The specificity was highest with OPTN-UNOS criteria (92.5%), followed by LI-RADS (90.0%), AASLD, NCCN, EASL-EORTC and KLCSG-NCC (82.1%). The accuracies were 83.3%, equal for all noninvasive diagnostic criteria.

CONCLUSION

AASLD, NCCN, EASL-EORTC and KLCSG-NCC had the highest sensitivity whereas OPTN-UNOS had the highest specificity among all six guidelines. LI-RADS could not provide higher specificity than OPTN-UNOS criteria or high sensitivity than AASLD or EASL criteria.

CLINICAL RELEVANCE/APPLICATION

Though LI-RADS 2014 is widely used by radiologists, it provides lower specificity than OPTN-UNOS criteria as well as lower sensitivity than AASLD or EASL criteria for noninvasive diagnosis of HCC.

SSA08-04 Prognostic Stratification of Patients with Hepatocellular Carcinoma Undergoing Curative Resection: Comparison of Preoperative MRI Staging and Postoperative American Joint Committee on Cancer Staging Systems

Sunday, Nov. 29 11:15AM - 11:25AM Location: E450B

Participants
Chae Jung Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chansik An, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yeun Yoon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong Eun Chung, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin-Young Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myeong-Jin Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To devise a preoperative staging system for hepatocellular carcinoma (HCC) undergoing resection using magnetic resonance imaging (MRI) findings, and to compare its prognostic ability with that of the American Joint Committee on Cancer (AJCC) staging.

METHOD AND MATERIALS

A total of 175 consecutive patients with HCC who underwent curative hepatic resection after preoperative MRI between January 2000 and December 2007 were analyzed. We devised an MRI staging system based on the number of nodules, a size criterion of 2 cm, gross vascular invasion, and two MRI features (rim enhancement and peritumoral parenchymal enhancement in the arterial phase) which were reported to be associated with worse prognosis after curative resection of HCC. In the devised MRI staging, instead of microvascular invasion which is used by the AJCC staging system, a size criterion of 2 cm was used to differentiate tumor stages 1 and 2. Each tumor stage was further divided into two substages; if both of the MRI features were absent, a patient was staged as T1a, 2a, or 3a, but staged as T1b, 2b, or 3b if any of these were present. Disease-free survival of both staging systems was analyzed using the Kaplan-Meier method with log-rank testing.

RESULTS

Both MRI and AJCC staging systems were excellent for predicting disease-free survival across different tumor stages 1, 2 and 3. Of 175 patients, 29 (16.6%), 6 (3.4%), 77 (44%), 51(29%), 6 (3.5%), and 6 (3.5%) were staged as T1a, T1b, T2a, T2b, T3a, and T3b by the preoperative MRI staging system, respectively. Disease-free survival was significantly different between T1 and T2a (median, 1925 days vs. 1668 days; P=0.048), between T2a and T2b (median, 1668 days vs. 799 days; P=0.0021), and between T2b and T3 (median survival, 799 days vs. 141 days; P=0.0015). However, no significant difference was found in disease-free survival between T1a and T1b, and between T3a and T3b.

CONCLUSION

Preoperative MRI staging system may be comparable to the postoperative AJCC staging system in predicting prognosis following

curative resection of HCC. Furthermore, tumor stage 2 of the MRI staging system may be further divided into T2a and T2b.

CLINICAL RELEVANCE/APPLICATION

These advantages (preoperative staging and further stratification of T2 into T2a/b) can make the devised MRI staging useful in deciding on treatment plans of patients with HCC.

SSA08-05 Utilising the Full Potential of MRI in the Diagnosis of HCC - Time for a Game Changer?

Sunday, Nov. 29 11:25AM - 11:35AM Location: E450B

Participants
Kelvin Cortis, MD, FRCR, Msida, Malta (*Presenter*) Nothing to Disclose
Rosa Liotta, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Miraglia, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Settimo Caruso, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Fabio Tuzzolino, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose
Angelo Luca, MD, Palermo, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The current cornerstone of HCC diagnosis is the wash-in/wash-out enhancement pattern. It is known that HCC might exhibit other MRI findings. Our aim was to retrospectively review the MRIs of histologically proven HCCs on liver explants, and to identify the best combination of sequences useful in HCC diagnosis.

METHOD AND MATERIALS

97 consecutive patients who underwent liver transplantation between 2004 and 2012 and Gd-BOPTA-MRI within 3 months of surgery were enrolled. A hepatobiliary histopathologist and two radiologists blinded to the radiological/histopathological findings performed a nodule by nodule analysis. The signal intensity of all nodules was assessed on the following axial sequences: T1 in/opposed phase, 3D fat suppressed (FS) T1 (pre-contrast, arterial, portal, equilibrium, and hepatobiliary phases), T2, T2 FS, and diffusion (B=800). Arterial enhancement was graded as none, mild, moderate, or intense.A multiple logistic regression analysis was performed following pathological/radiological correlation, and the Odds Ratio (OR) was calculated for every parameter analysed and adjusted for nodule size.

RESULTS

Imaging was performed 41.7±25.4 days pre-transplantation. 291 lesions were identified on histopathology, of which 193 were HCCs, 68 regenerative nodules, 8 low-grade dysplastic nodules (DN), 19 high-grade DNs, 2 cholangiocarcinomas, and 1 necrotic nodule. 48 HCCs (24.9%) were not detectable on imaging (24.9%), leaving a total of 145 HCCs (≤ 10 mm n=25;11-19 mm n=58;≥ 20 mm n=62).As expected, intense (OR 10.9, p<0.000) or moderate (OR 2.2, p=0.003) arterial enhancement and hypointensity on the portal venous (OR 14.3, p<0.000) or equilibrium (OR 15.9, p<0.000) phases were found to predict HCC.In addition, nodules showing hypointensity on the hepatobiliary phase and T2 hyperintensity were also highly likely to represent HCC. In the former, an OR of 10.2 was observed (p<0.000). The OR was 14.3 in non-FS T2 weighted sequences, and 10.2 in FS T2 weighted sequences (p<0.000).

CONCLUSION

In patients with a high risk of HCC, nodules lacking the typical hemodynamic findings are most likely HCC if they exhibit T2 hyperintensity and/or hypointensity on the hepatobiliary phase with an OR of 14.3 and 10.2, respectively (p<0.000).

CLINICAL RELEVANCE/APPLICATION

MRIs targeted at diagnosing HCC should include T2 weighted sequences with and without FS and Gd-BOPTA/Gd-EOB-enhanced hepatobiliary phases alongside standard sequences.

SSA08-06 A Tumor Suppression Factor HNF4α (Hepatocyte Nuclear Factor) Expression Correlates with Gadoxetic Acid Enhanced MRI Fndings in Hepatocellular Carcinoma

Sunday, Nov. 29 11:35AM - 11:45AM Location: E450B

Participants
Azusa Kitao, Kanazawa, Japan (*Presenter*) Nothing to Disclose
Osamu Matsui, MD, Kanazawa, Japan (*Abstract Co-Author*) Research Consultant, Kowa Company, Ltd Research Consultant, Otsuka Holdings Co, Ltd Research Consultant, Eisai Co, Ltd Speakers Bureau, Bayer AG Speakers Bureau, Eisai Co, Ltd
Norihide Yoneda, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuto Kozaka, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Kobayashi, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshifumi Gabata, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Kotaro Yoshida, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Dai Inoue, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Minami, MD, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Wataru Koda, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Junichiro Sanada, Kanazawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Hepatocyte nuclear factor (HNF) 4A is one of transcription factors with tumor suppression effect, and besides, regulates expression of many molecules including organic anion transporting polypeptide (OATP) 1B3 (uptake transporter of gadoxetic acid) in hepatocellular carcinoma (HCC) (Yamashita T, Hepatology 2014). The purpose of this study is to clarify the correlation between HNF4A expression, pathological findings and imaging findings on gadoxetic acid enhanced MRI.

METHOD AND MATERIALS

The subjects are 138 surgically resected HCCs. We semiquantitatively evaluated the immunohistochemical HNF4A and OATP1B3 expression of HCC into four grades: grade 0: no expression, grade 1: weak expression, grade 2: moderate expression and grade 3:

intensive expression. We compared HNF4A grade of HCCs with OATP1B3 grade, enhancement ratio on the hepatobiliary phase of gadoxetic acid enhanced MRI and histological tumor differentiation grade (well, moderately and poorly differentiated HCC).

RESULTS

HNF4A grade in HCC showed a significant positive correlation with OATP1B3 grade (P=0.003, r=0.46). There was also a significant positive correlation between HNF4A grade and enhancement ratio on the hepatobiliary phase of gadoxetic acid enhanced MRI (P<0.0001, r=0.49). Especially, intensive HNF4A expression was observed in atypical HCC showing high enhancement ratio and increased OATP1B3 expression. HNF4A grade was decreased according to the decline of differentiation grade of HCC (P=0.0007, r=0.29).

CONCLUSION

The expression of HNF4A in HCC correlated with both of OATP1B3 expression and enhancement ratio on the hepatobiliary phase of gadoxetic acid enhanced MRI. In addition, HNF4A expression was decreased during multistep hepatocarcinogenesis. Gadoxetic acid enhanced MRI is useful to evaluate the expression of HNF4A in HCC.

CLINICAL RELEVANCE/APPLICATION

Gadoxetic acid enhanced MRI has a potential to reflect the expression of many genes and molecules regulated by HNF4A as imaging biomarkers (radiogenomics), which will be important for future personalized medicine.

SSA08-07 Presence of Hypovascular and Hypointense Nodules on Preoperative Gadoxetic Acid-enhanced MR Imaging: An Important Risk Factor for Recurrence after Liver Resection for Hypervascular Hepatocellular Carcinoma

Sunday, Nov. 29 11:45AM - 11:55AM Location: E450B

Participants
Katsuhiro Sano, MD, PhD, Chuo, Japan (*Presenter*) Nothing to Disclose
Tomoaki Ichikawa, MD, PhD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Shimizu, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Utaroh Motosugi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Morisaka, MD, Kofu, Japan (*Abstract Co-Author*) Nothing to Disclose
Shintaro Ichikawa, MD, Chuo-Shi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Onishi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Masanori Matsuda, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hideki Fujii, MD, Tamaho, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The hepatocyte phase (HP) of gadoxetic acid-enhanced magnetic resonance imaging (EOB-MRI) can reveal numerous hypovascular and hypointense nodules with malignant potential, which may progress to conventional hypervascular hepatocellular carcinoma (HCC). We retrospectively evaluated the prognostic factors for patients with hypervascular HCC after liver resection, including the presence of hypovascular hypointense nodules on HP of EOB-MRI (hypo-nodule).

METHOD AND MATERIALS

In total, 114 consecutive patients who had undergone surgical resection and were pathologically diagnosed with moderately differentiated HCC were included. For the analysis of risk factors for recurrence and a poor survival rate after liver resection, univariate and multivariate Cox regression analyses were performed for the following factors: age, tumor size, tumor number, vascular invasion, TNM stage, albumin level, prothrombin ratio, Child-Pugh class, alpha-fetoprotein level, protein induced by vitamin K absence/antagonist-II (PIVKA-II), liver cirrhosis, past history of HCC, and presence of hypo-nodules on HP of preoperative EOB-MRI. We compared the 5-year recurrence-free and overall survival rates between patients with and without hypo-nodules on HP of EOB-MRI.

RESULTS

Univariate and multivariate analyses revealed the presence of hypo-nodules as the only significant risk factor for recurrence after liver resection (risk ratio, 2.1 and 2.1; p-value, 0.014 and 0.020) and albumin level as the only significant risk factor for a poor survival rate (risk ratio, 10.3 and 6.1; p-value, <0.001 and 0.019).The 5-year recurrence-free rate was significantly lower for patients with hypo-nodules (13.1%) than for those without (48.8%; p = 0.008); similar results were observed for the 5-year survival rate (66.1% vs. 83.4%), although the difference was not significant (p = 0.222).

CONCLUSION

The presence of hypo-nodules on HP of preoperative EOB-MRI is an important risk factor for recurrence after liver resection for hypervascular HCC.

CLINICAL RELEVANCE/APPLICATION

The presence of hypovascular and hypointense nodules on hepatocyte phase of preoperative gadoxetic acid-enhanced MR imaging is an important risk factor for recurrence after liver resection for hypervascular hepatocellular carcinoma.

SSA08-08 Hepatocellular Carcinoma without Gadoxetic Acid Uptake on Preoperative MR Imaging: An Important Prognostic Risk Factor after Liver Resection

Sunday, Nov. 29 11:55AM - 12:05PM Location: E450B

Participants
Tatsuya Shimizu, MD, Yamanashi, Japan (*Presenter*) Nothing to Disclose
Katsuhiro Sano, MD, PhD, Chuo, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoaki Ichikawa, MD, PhD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Utaroh Motosugi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Morisaka, MD, Kofu, Japan (*Abstract Co-Author*) Nothing to Disclose
Shintaro Ichikawa, MD, Chuo-Shi, Japan (*Abstract Co-Author*) Nothing to Disclose

Hiroshi Onishi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Masanori Matsuda, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hideki Fujii, MD, Tamaho, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Hepatocellular carcinomas (HCCs) commonly demonstrate hypointensity compared with the surrounding liver parenchyma on the hepatocyte phase (HP) of gadoxetic acid-enhanced MR imaging (EOB-MRI). However, some hypervascular HCCs with gadoxetic acid (EOB) uptake demonstrate iso- or hyperintensity on HP. Such lesions are known to be biologically less aggressive. A previous study showed a lower recurrence rate for hyperintense HCC than for hypointense HCC.In this study, we retrospectively evaluated the overall survival rate for patients with hyperintense and hypointense HCC on EOB-MRI.

METHOD AND MATERIALS

In total, 114 consecutive patients with moderately differentiated HCC that was surgically resected from January 2008 to December 2013 were included in this study. According to their signal intensity on HP of EOB-MRI, the 114 patients were classified as EOB uptake (+) HCC (n = 23) and EOB uptake (-) HCC (n = 91). Risk factors for recurrence and a poor survival rate after liver resection were analyzed by univariate and multivariate Cox regression analyses of the following factors: age, tumor size, tumor number, vascular invasion, TNM stage, albumin level, prothrombin ratio, Child-Pugh class, alpha-fetoprotein level, protein induced by vitamin K absence/antagonist-II (PIVKA-II), liver cirrhosis, past history of HCC, and EOB uptake on HP of preoperative EOB-MRI. Then, we calculated the overall survival and recurrence-free rates for both groups using Kaplan-Meier survival curves. The log-rank and Wilcoxon tests were used to analyze significant differences.

RESULTS

The absence of EOB uptake was found to be a significant risk factor for a poor survival rate after liver resection (risk ratio, 5.4; $p < 0.05$). The EOB uptake (+) group showed a higher overall survival rate compared with the EOB uptake (-) group (5-year survival rate, 100% and 73.3%; $p < 0.05$). However, the recurrence-free rate was not significantly different ($p = 0.70$).

CONCLUSION

The absence of EOB uptake was a significant risk factor for a poor survival rate after liver resection. The overall survival rate was higher for patients with EOB uptake than for those without.

CLINICAL RELEVANCE/APPLICATION

In patients with moderately-differentiated hepatocellular carcinoma, the absence of gadoxetic acid uptake is a significant risk factor for a poor survival rate after liver resection. The overall survival rate is higher for patients with gadoxetic acid uptake than for those without.

SSA08-09 Dual Energy Spectral CT Imaging for the Evaluation of Small Hepatocellular Carcinoma Microvascular Invasion

Sunday, Nov. 29 12:05PM - 12:15PM Location: E450B

Participants
Yang Chuangbo, MMed, Xianyang City, China (*Presenter*) Nothing to Disclose
Chenglong Ren, Shanxi, China (*Abstract Co-Author*) Nothing to Disclose
Xirong Zhang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Haifeng Duan, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Lei Yuxin, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Ma Chunling, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Taiping He, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Tian Xin, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate small hepatocellular carcinoma microvascular invasion using dual energy spectral CT imaging.

METHOD AND MATERIALS

This study was approved by our ethics committee. We retrospectively analyzed the images of 50 patients with 56 small hepatocellular carcinoma who underwent preoperative contrast enhanced dual-phase spectral CT scans before surgical resection. Tumors were divided into two groups based on the pathological findings for analysis: with (n=37) and without (n=19) microvascular invasion. Iodine concentration (IC) for tumors was measured in arterial phase (AP) and venous phase (VP) on the iodine-based material decomposition images to calculate IC reduction rate (ICrr) between AP and VP. IC values were further normalized to that of aorta to obtain normalized IC (NIC). Tumor CT attenuation number was measured on the monochromatic image sets to generate spectral HU curve and to calculate a slope (k) for the curve: (CT(40keV)-CT(90keV))/50. Values of the 2 pathological groups were compared and ROC study was performed to assess the differential diagnosis performance.

RESULTS

The IC, NIC, ICrr and slope (k) values in AP for tumors with microvascular invasion(Fig 2A-2C) were significantly higher than those without microvascular invasion(Fig 1A-1C) (2.40±0.80mg/ml vs. 1.68±0.47mg/ml for IC; 0.22±0.06 vs. 0.16±0.05 for NIC; 0.27±0.16 vs. 0.01±0.25 for ICrr; and 3.28±1.08 vs. 2.27±0.63 for slope, all $p<0.05$)(Table 1). Using the normalized iodine concentration value of 0.18 in AP as a threshold, one could obtain an area-under-curve of 0.82 for ROC study with sensitivity of 82.4% and specificity of 70.0% for differentiating small hepatocellular carcinoma with and without microvascular invasion. These values were significantly higher than the sensitivity of 64.7% and specificity of 69.2% with conventional CT numbers at 70keV(Table 2).

CONCLUSION

Using quantitative parameters obtained in spectral CT in the arterial phase provides new method with high accuracy to evaluate small hepatocellular carcinoma microvascular invasion.

CLINICAL RELEVANCE/APPLICATION

Quantitative iodine concentration measurement in spectral CT may be used to provide a new method to evaluate small

hepatocellular carcinoma microvascular invasion.

SSA09

Genitourinary (New Technologies for Imaging the Genitourinary Tract)

Sunday, Nov. 29 10:45AM - 12:15PM Location: E351

GU BQ MR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Julia R. Fielding, MD, Chapel Hill, NC (*Moderator*) Nothing to Disclose
Erick M. Remer, MD, Cleveland, OH (*Moderator*) Nothing to Disclose

Sub-Events

SSA09-01 Simultaneous Conventional Dynamic MR Urography and High Temporal Resolution Perfusion MRI of Bladder Tumors Using a Novel Free-Breathing Golden-Angle Radial Compressed-Sensing Sequence

Sunday, Nov. 29 10:45AM - 10:55AM Location: E351

Participants
Nainesh Parikh, MD, New York, NY (*Presenter*) Nothing to Disclose
Justin M. Ream, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Hoi Cheung Zhang, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Kai Tobias Block, PhD, New York, NY (*Abstract Co-Author*) Royalties, Siemens AG;
Hersh Chandarana, MD, New York, NY (*Abstract Co-Author*) Equipment support, Siemens AG; Software support, Siemens AG; Consultant, Bayer, AG;
Andrew B. Rosenkrantz, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the feasibility of simultaneous conventional dynamic MR urography (MRU) and high temporal resolution perfusion MRI of bladder tumors using a novel free-breathing golden-angle radial acquisition scheme with compressed sensing reconstruction

METHOD AND MATERIALS

22 patients with bladder lesions underwent MRU using the GRASP (Golden-angle RAdial Sparse Parallel) technique. Following contrast injection, GRASP was performed of the abdomen and pelvis during free breathing (voxel size 1.4x1.4x3.0 mm, 1,000 radial spokes, acquisition time 3:44 min). Two dynamic data-sets were retrospectively reconstructed from this single acquisition by combining a distinct number of spokes into each dynamic frame: 110 spokes per frame to provide a resolution of approximately 30 seconds, serving as conventional MRU for clinical interpretation, and 8 spokes per frame to provide 2 second resolution images for quantitative perfusion. Using the 2 second resolution images, ROIs were placed within the bladder lesion and normal bladder wall for all patients, an arterial input function was generated from the femoral artery, and the GKM perfusion model was applied.

RESULTS

Follow-up cystoscopy and biopsy demonstrated 16 bladder tumors (13 stage≥T2, 3 stage≤T1) and 6 benign lesions. All lesions were well visualized using the conventional 25 second clinical dynamic images. Based on the 2 second resolution images, Ktrans was significantly higher in bladder tumors (0.38±0.24) than in either normal bladder wall (0.12±8, $p<0.001$) or in benign bladder lesions (0.15±0.04, $p=0.033$). The ratio between Ktrans of the lesion and of normal bladder wall in each patient was nearly double in tumors than in benign lesions (4.3±3.4 vs. 2.2±1.6), and Ktrans was nearly double in stage≥T2 tumors than in stage≤T1 tumors (0.44±0.24 vs. 0.24±0.24), although these did not approach significance ($p=0.180$-0.209), likely related to small sample size.

CONCLUSION

GRASP DCE-MRI provides simultaneous conventional dynamic MRU and high temporal resolution perfusion MRI of bladder tumors. Quantitative evaluation of bladder lesions based on the 2 second temporal resolution reconstructions showed associations with pathologic findings in our preliminary cohort.

CLINICAL RELEVANCE/APPLICATION

The novel GRASP sequence allows quantitative perfusion evaluation of bladder lesions within the context of a clinical MRU examination using a single contrast injection and without additional scan time.

SSA09-02 Magnetic Resonance Fingerprinting in Diagnosis of Prostate Cancer: Initial Experience

Sunday, Nov. 29 10:55AM - 11:05AM Location: E351

Participants
Shivani Pahwa, MD, Clevelnad, OH (*Presenter*) Nothing to Disclose
Chaitra A. Badve, MD, MBBS, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Yun Jiang, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Alice Yu, BS, MS, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Mark D. Schluchter, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Mark A. Griswold, PhD, Cleveland, OH (*Abstract Co-Author*) Research support, Siemens AG Royalties, Siemens AG Royalties, General Electric Company Royalties, Bruker Corporation Contract, Siemens AG
Lee E. Ponsky, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Vikas Gulani, MD, PhD, Ann Arbor, MI (*Abstract Co-Author*) Research support, Siemens AG

PURPOSE

To describe initial experience in detecting prostate cancer (PCa) using quantitative MRI parameters – T1 and T2 relaxation times

To describe initial experience in detecting prostate cancer (PCa) using quantitative MRI parameters - T1 and T2 relaxation times derived from magnetic resonance fingerprinting (MRF-FISP), in combination with conventional ADC maps.

METHOD AND MATERIALS

63 patients with clinical suspicion of prostate cancer were imaged on 3T Siemens Skyra /Verio scanners. MRF has been shown to measure T1 and T2 relaxation times with high accuracy and precision2. In addition tothe standard multiparametric MRI exam, MRF-FISP was acquired (slice thickness: 6 mm, in-plane resolution:1×1 mm2,FOV:400 mm, TR:11-13 ms, flip angle:5-75 deg, duration:50s per slice).b-valuesfor DWI were0, 500, 1000 s/mm2.T1, T2 maps were generated from MRF-FISP dataand regions of interest (ROI)were drawn on T1, T2 and ADC maps in areas suspicious for cancer identified based on PIRADS score, and normal peripheral zone (NPZ). Matched pairs t-tests were used to compare T1, T2, ADC values in biopsy provenPCa and NPZ. Logistic regression model was applied to these parameters in differentiating PCa from NPZ. Receiver operating characteristic (ROC) analysis was performed for the parameters singly and in combination and area under the curve (AUC) was calculated

RESULTS

29 patients were diagnosed with cancer on transrectal biopsy. T1, T2, ADC values were significantly lower in cancer compared to NPZ ($p<0.0001$). Mean T1, T2, ADC for prostate cancer were 1413±60ms, 66±3ms, 745±54 x 10-6mm2/s, respectively. For NPZ, these values were 2058±77ms, 165±8ms, 1736±37 x 10-6mm2/s.The AUC for T1, T2, ADC values in separating PCa from NPZ was 0.978, 0.982, 0.801, respectively. The combination of T2 and ADC produced the most complete separation between cancer and normal tissues, resulting in AUC of 0.995.

CONCLUSION

MRF-FISP is a novel relaxometry sequence that allows quantitative examination of prostate in a clinical setting. The T1 and T2 relaxation times so obtained, in combination with ADC values show promising results in detecting prostate cancer.

CLINICAL RELEVANCE/APPLICATION

Quantitative MR parameters can help identify prostate cancer non-invasively. This could have broad applications in diagnosis, guiding biopsy, and following treatment

SSA09-03 Contrast-enhanced Ultrasound for Renal Mass Characterization: Comparison of Low MI Time-intensity Curves and Destruction Reperfusion Techniques

Sunday, Nov. 29 11:05AM - 11:15AM Location: E351

Participants
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Kevin O. Herman, MD, Raleigh, NC (*Abstract Co-Author*) Nothing to Disclose
W K. Rathmell, Chapel Hill, NC (*Abstract Co-Author*) Research support, GlaxoSmithKline plc
Lee Mullin, PhD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate contrast enhanced US (CEUS) for renal mass characterization in chronic renal insufficiency (CRI), comparing nondestructive (low MI) and destruction-reperfusion techniques.

METHOD AND MATERIALS

Prospective study comparing 48 subjects: 24 with normal function and renal masses scheduled for excision; 24 with CRI and indeterminate renal lesions on non-contrast US/CT.CEUS was performed on an Acuson Sequoia with CPS software. Perflutren (Definity) 1.3ml was administered IV. Lesions were imaged at a low MI of 0.2. A 3 minute videoclip was recorded. Time Intensity curves (TICs) of the lesion and adjacent parenchyma were generated. After 30 minutes, a 2nd dose of Definity was given and a Destruction Reperfusion (DR) sequence performed on the same lesion. DR was performed under an IND exemption from the FDA. Bubble destruction was performed at an MI of 0.9. Reperfusion images were obtained using Motion Stabilized Persistence software (Siemens). A color-coded parametric map quantifying arrival time was generated in which Green=faster arrival, Red=slower, Black=no contrast. (Arrow=Bosniak IV mass).Reference standard was pathology, contrast CT/MR or absence of change on follow up imaging for benign lesions. Two blinded readers reviewed the low MI images and classified the lesions using Bosniak criteria.

RESULTS

Lesion size ranged from 1.7-7.6cm (mean 3.5cm). Histopathology of resected masses showed no cavitation or cellular injury from high MI of DR. DR arrival times correlated with low MI TIC parameters. Sensitivity for distinguishing Bosniak I/II/IIF from III and higher was: Reader 1-96%, Reader 2-100%. Specificity was 78% and 63%. Specificity is lower because CEUS detects smaller amounts of contrast than CT/MR, leading to 'overstaging' with standard Bosniak. Reduced time to peak and arrival time ($p<0.05$) was seen in the parenchyma of CRI subjects compared to parenchyma of those with normal renal function.

CONCLUSION

CEUS can characterize renal lesions, but Bosniak criteria must be modified because US is more sensitive to slight enhancement. DR does not cause tissue injury, correlates with low MI findings, and takes less time. The parenchyma in CRI showed reduced/ delayed contrast uptake, suggesting CEUS may also be useful for renal functional imaging.

CLINICAL RELEVANCE/APPLICATION

CEUS can evaluate indeterminate renal lesions and renal function in CRI, a population where CT and MR contrast are contraindicated.

SSA09-04 ARFI Evaluation of Small (<4 cm) Renal Masses. A Preliminary Study

Sunday, Nov. 29 11:15AM - 11:25AM Location: E351

Participants
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Chiara Dalla Serra, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Pozzi Mucelli, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate if ARFI can be a reliable technique in distinguish ccRCCS from other solid and fluid-containing small renal masses.

METHOD AND MATERIALS

31 small (<4 cm) renal masses (27 were solid - 17/27 ccRCCs, 3/27 papillary RCCs, 2/27 chromophobe RCCs, 4 oncocytomas and 1 angiomyolipoma - and 4 were cysts) were prospectively evaluated using US and ARFI. Each lesion was assigned an ARFI value obtained from the average of 12 measurements.All the solid masses underwent resection; all the cystic lesions were Bosniak 2, so were evaluated with follow up.The difference existing between the two groups was evaluated by means of Student's t test.A cut off value was determined to distinguish between ccRCCs and other lesions and sensibility, specificity, PPV, NPV and accuracy were determined.

RESULTS

ccRCCs are characterized by an higher ARFI value and - when compared with all the other lesions - the difference existing between the two groups was statistically significant ($p<0.001$). Considering a cut off value of 1.95 m/sec sensibility, specificity, PPV, NPV and accuracy were respectively 94.1%, 78.6%, 84.2%, 91.7% and 87.1%.

CONCLUSION

ccRCC is characterized by an higher ARFI value which can be used to distinguish it from other solid and fluid containing masses.

CLINICAL RELEVANCE/APPLICATION

ARFI can be an useful tool in the evaluation of small renal masses, helping distinguish cc RCCs from other lesions.

SSA09-05 Fusion Imaging of (Contrast-enhanced) Ultrasound with CT or MRI for Kidney Lesions

Sunday, Nov. 29 11:25AM - 11:35AM Location: E351

Participants
Thomas Auer, Innsbruck, Austria (*Abstract Co-Author*) Nothing to Disclose
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Daniel Junker, Innsbruck, Austria (*Abstract Co-Author*) Nothing to Disclose
Isabel M. Heidegger, Innsbruck, Austria (*Abstract Co-Author*) Nothing to Disclose
Werner R. Jaschke, MD, PhD, Innsbruck, Austria (*Abstract Co-Author*) Nothing to Disclose
Friedrich H. Aigner, MD, Innsbruck, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of the study was to evaluate the feasibility of fusion imaging (FI) of (contrast-enhanced) ultrasound (CEUS) with CT/MRI in localization of sonographically challenging kidney lesions and usefulness for assessment of indeterminate kidney lesions

METHOD AND MATERIALS

From March 2013 to January 2014, 30 consecutive patients were included in this retrospective studyAll patients presented with previously in CT/MRI detected indeterminate kidney lesions that were either not detectable or hard to distinguish in conventional gray-scale ultrasoundIn these patients additional FI was performed by fusion of ultrasound with CT/MRI datasets. In 26 (86.7%) of these patients FI and CEUS was simultaneously conducted

RESULTS

FI could be performed in all of the 30 patientsFI-indication: In 18 of 30 patients (60%) FI was performed because a lesion of interest could not clearly be allocated due to multiple and directly adjacent similar lesions within one kidney. In 12 of 30 patients (40%) the kidney lesions were solitary or at least isolated but could not be detected with gray-scale US alone.CEUS-indication: Insufficient CT protocol (without NECT) and a not-water-isodens lesion (>20 HU) in 8 (30.8%) patients borderline CE in CT (10HU-20HU) in 11 (42.3%) patients non-conclusive CT/MRI studies in 5 (19.2%) patients CEUS for follow-up in 2 (7.7%) patients.Combined FI-CEUS: FI-CEUS could clearly differentiate between a surgical and non-surgical finding in 24 (80%) of 30 patients In 2 (6.7%) of 30 patients with conducted FI-CEUS lesions remained indeterminateFinal dignosis: Histology revealed a surgical lesion in 6 (20%) patients, while in 18 (60%) patients a non-surgical lesion such as BII/BIIF cysts, abscess formations, cicatricial tissue and a pseudotumor could be found. FI-CEUS didn't determine a final diagnosis in 2 patients (6.7%) In one elderly patient (3.3%) FI was conducted without CEUS because only size control of was demanded In 3 (10%) patients kidney lesions were not confidently detected with FI due to general US limitations

CONCLUSION

Our data suggest that FI of the kidney is a feasible examination regarding the localization and further assessment of indeterminate kidney lesions.

CLINICAL RELEVANCE/APPLICATION

The combination of FI with a synchronous CEUS examination can clarify indeterminate renal CT or MRI findings, reduce radiation exposure and is cost effective.

SSA09-06 Optimal Energy for Kidney Parenchymal Visualization in Monoenergetic Images Generated from Dual Energy CT

Sunday, Nov. 29 11:35AM - 11:45AM Location: E351

Participants
Jason DiPoce, MD, Jerusalem, Israel (*Presenter*) Nothing to Disclose
Zimam Romman, Haifa, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jacob Sosna, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, ActiViews Ltd Research Grant, Koninklijke Philips NV

PURPOSE

To evaluate image quality of kidney parenchyma in a spectrum of CT monoenergy levels and to select the optimal Monoenergy levels for visualization.

METHOD AND MATERIALS

IRB approval was obtained. 30-corticomedullary phase, IV contrast-enhanced CT abdomen scans (18 males, 12 females, mean age of 50 years) were evaluated. In each scan, kidney parenchyma (60 regions) was assessed. The scans were obtained from a 64-slice spectral detector CT prototype (Philips Healthcare, Cleveland, OH, USA) at 120 kVp with an average of 150 mAs. For each scan, simultaneous conventional polyenergetic and monoenergetic image datasets at 50, 60, 70, 100, and 140 keV were reconstructed. Two experienced radiologists analyzed subjectively in consensus visualization of the kidney parenchyma and selected the optimal visualization dataset based on the conspicuity of the cortex and medulla and compared to the conventional images. Objective kidney signal-to-noise ratio (SNR) in the optimal monoenergy images was measured and compared to data from the conventional CT images.

RESULTS

Optimal image quality for kidney visualization was subjectively selected with 60 - 70 keV monoenergy images and was judged to be better than the conventional dataset. The kidney SNR values in optimal monoenergy were highly significantly different ($p<0.01$) from conventional CT images. Average SNR was 10.9 and 16.3 in the conventional and optimal monoenergy respectively.

CONCLUSION

Optimal visualization of the kidney parenchyma on dual energy CT images is achieved with monoenergy image reconstruction at 60 - 70 keV based on both subjective and objective assessments and seems to improve image quality compared to conventional images.

CLINICAL RELEVANCE/APPLICATION

Optimal image quality in monoenergy images may be supplemental to conventional polyenergetic images and potentially increase the diagnostic yield.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jason DiPoce, MD - 2013 Honored Educator
Jacob Sosna, MD - 2012 Honored Educator

SSA09-07 The Use of New Tissue Strain Analytics Measurement in Testicular Lesions

Sunday, Nov. 29 11:45AM - 11:55AM Location: E351

Participants
Dirk-Andre Clevert, MD, Munich, Germany (*Presenter*) Speaker, Siemens AG; Speaker, Koninklijke Philips NV; Speaker, Bracco Group;
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Julian Marcon, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Melvin D'Anastasi, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Alexander Karl, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Virtual touch tissue imaging quantification (VTIQ) is a newly developed technique for the sonographic quantification of tissue elasticity. It has been used in the assessment of breast lesions. The purpose of this study was to determine the diagnostic performance of VTIQ in unclear testicular lesions.

METHOD AND MATERIALS

Twenty patients with known testicular pathology underwent conventional B-mode sonography with additional VTIQ of the testicular lesions using a Siemens Acuson S2000™ and S3000™ (Siemens Medical Solutions, Mountain View, CA, USA) system. Tissue mechanical properties were interpreted and compared in the VTIQ examination. The pathologic diagnosis was established after surgery or in the follow up examination in highly suspicious of benign lesions.

RESULTS

Over 36 months, 22 focal testicular lesions (median lesion size, 18 mm; range, 4-36 mm in 20 patients (median age, 43 years; range, 22-81 years) were examined. Lesions were hyperechoic (n = 1), hypoechoic (n = 14), isoechoic (n = 1), mixed echogenicity (n = 3) or anechoic (n = 3). Histological examination showed one benign lesion (6.25 %) with a mean size of 7 mm and 15 malignant lesions (93.75 %) with a mean size of 20 mm. The value of the shear wave velocity in normal testis tissue showed a mean shear wave velocity of 1.17 m/s. No value of the shear wave velocity could the measured in cystic lesions. The rest of the benign lesions showed a mean shear wave velocity of 2.37 m/s. The value of the shear wave velocity in germ cell tumours showed a mean shear wave velocity of 1.94 m/s and for seminoma it showed a mean shear wave velocity of 2.42 m/s.

CONCLUSION

VTIQ is a reliable new method for measuring qualitative and quantitative stiffness of testis lesions and tissue. The qualitative shear-

wave elastography features were highly reproducible and showed good diagnostic performance in unclear testicular lesions. The VTIQ technique is a useful in assessing small testicular nodules and pseudo lesions.

CLINICAL RELEVANCE/APPLICATION

VTIQ is a reliable user independent new method for measuring qualitative and quantitative stiffness of different testis lesions and tissue. The VTIQ technique allows to distinguished different testis lesions and pseudo lesions.

SSA09-08 One-stop-shot MRI for Infertility Evaluation: Comparison with US and CT-HSG

Sunday, Nov. 29 11:55AM - 12:05PM Location: E351

Participants
Javier Vallejos, MD, MBA, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Jimena B. Carpio, MD, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose
Ezequiel Salas, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
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Mariano Baronio, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Patricia M. Carrascosa, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Research Consultant, General Electric Company
Lorena I. Sarati, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Demonstrate the utility of MRI-HSG in the diagnosis of infertility, can through this method show uterine, tubal, ovarian and pelvic causes.

METHOD AND MATERIALS

14 patients between 31 and 41 year-old diagnosed with infertility were studied. We performed a transvaginal ultrasound, virtual CT-HSG and MRI- HSG at the same day. MRI protocol include high-resolution T2 sequences, fat-suppressed T1, diffusion weighted imaging and contrast dynamic sequence (3D time-resolved imaging of contrast kinetics [TRICKS]). A contrast dilution of saline, iodine and gadolinium was instilled. Antral follicle counts, endometrial cavity findings, uterine wall pathology, tubal patency, and pelvic cavity findings were assessed with modalities.

RESULTS

In all cases it was observed more ovarian follicles on MRI-HSG than in US. In 65% of patients, Fallopian tubes were visualized completely with MRI-HSG, whereas in the remaining 35% only look at its distal portion. In all cases was demonstrated tubal patency with free peritoneal spillage. In 45% of patients, MRI-HSG showed endoluminal lesions, likes polyps and miomas, that were corroborated with CT-HSG. In 14% of patients, MRI-HSG detected endometrial implants in pelvic cavity that could not be corroborated by the other methods.

CONCLUSION

MRI-HSG allows a comprehensive evaluation for infertility diagnosis, with visualization and quantification of antral follicles, endometrial cavity, uterine wall and fallopian tubes as well as pelvic cavity findings such as endometrial implants.

CLINICAL RELEVANCE/APPLICATION

MRI techniques could be combined with HSG procedure in order to enables a one-step-shot imaging for evaluation of female infertility with the advantages of causing less pain and avoidance of exposure to ionizing radiation.

SSA09-09 4D Ultrasound Cistoscopy with Fly through in the Evaluation of Urinary Bladder Tumors Preliminary Experience

Sunday, Nov. 29 12:05PM - 12:15PM Location: E351

Participants
Vito Cantisani, MD, Roma, Italy (*Abstract Co-Author*) Speaker, Toshiba Corporation; Speaker, Bracco Group; Speaker, Samsung Electronics Co, Ltd;
Nicola Di Leo, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Valerio Forte, MD, Rome, Italy (*Presenter*) Nothing to Disclose
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Ferdinando D'Ambrosio, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the feasibility and diagnostic efficacy 4D Ultrasound cystoscopy with Fly through as compared with trasditional cystoscopy in evaluating Urinary Bladder tumors.

METHOD AND MATERIALS

30 consecutive patients with previous detected urinary bladder lesions at cystoscopy were prospectively evaluated with 2D baseline US, and 4D Ultrasound with fly through (US virtual navigation system) by an expert radiologist blinded to cystoscopy results. The two imaging modalities were compared with cystoscopy and surgical results (N=8 patients) in order to assess the sensitivity and specificity in tumor detection and characterization. The diagnostic performance of 2D features and 4D ultrasound were estimated and compared using ROC curve analysis.

RESULTS

24/33 and 31/33 urinary bladder lesions were detected by 2 D US and 4 D Ultrasound respectively. The latter was also able to

identify two additional lesions not previously detected at traditional cystoscopy. The US features of the lesions were consistent with the one provided at cystoscopy with not significant differences in term of characterization.Conclusion: Our preliminary results shows that 4 D ultrasound cystoscopy with fly through is more accurate than baseline 2D ultrasound to detect and characterize urinary bladder lesions with results comparable with traditional cystoscopy.

CONCLUSION

Our preliminary results shows that 4 D ultrasound cystoscopy with fly through is more accurate than baseline 2D ultrasound to detect and characterize urinary bladder lesions with results comparable with traditional cystoscopy.

CLINICAL RELEVANCE/APPLICATION

New ultrasound software such as 4 D ultrasound cystoscopy with fly through may help us to follow-up patients treated conservatively for urinary bladder lesions.

SSA10

Genitourinary (Adrenal and Renal Imaging)

Sunday, Nov. 29 10:45AM - 12:15PM Location: E353B

CT GU MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Steven C. Eberhardt, MD, Albuquerque, NM (*Moderator*) Nothing to Disclose
Claudia P. Huertas, MD, Medellin, Colombia (*Moderator*) Nothing to Disclose
Seung Hyup Kim, MD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose

Sub-Events

SSA10-01 The Role of Peak Enhancement Values in Differentiating Pheochromocytomas from Adrenal Adenomas on CT

Sunday, Nov. 29 10:45AM - 10:55AM Location: E353B

Participants
Mohammed F. Mohammed, MBBS, Vancouver, BC (*Presenter*) Nothing to Disclose
David Ferguson, MBBCh, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Alison C. Harris, MBChB, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
William C. Yee, MD,FRCPC, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to establish the role of the peak enhancement Hounsfield Unit (HU) value of focal adrenal lesions in differentiating potential pheochromocytomas from adrenal adenomas.

METHOD AND MATERIALS

The peak enhancement HU values of histologically confirmed pheochromocytomas (n = 24) were retrospectively compared with those of histologically confirmed adrenal adenomas (n = 28) on the 60-second contrast enhanced venous phase and compared utilizing a chi-square test. The studies were performed over a period of 5 years (2009-2014) on multi-detector CT scanners (MDCT). HU values were also measured on unenhanced (n = 34) and 15-minute delayed contrast enhanced (n = 27) phases. Measurements were obtained by drawing a representative region of interest over the target lesion. Peak enhancement values were recorded and absolute washout, relative washout and absolute enhancement (60-second enhanced minus unenhanced) were also calculated when available. Mass size was also recorded. The Student t test was used for comparing absolute enhancement and mass size.

RESULTS

83.3% (n = 20) of pheochromocytomas demonstrated a peak enhancement value of 85 HU or greater, compared to 10.7% (n = 3) of adrenal adenomas ($p < 0.001$, PPV = 86.96%, NPV = 86.2%). Absolute enhancement of pheochromocytomas was also higher than that of adrenal adenomas (mean = 66.2 HU [range, 51-95 HU] vs. 48.1 HU [range, 18-74]; $p < 0.005$). Of the pheochromocytomas imaged with a triphasic protocol (n = 9), 77.8% (n = 7) met absolute and relative washout criteria for the diagnosis of a lipid-poor adenoma (>= 60% and >=40% respectively). Pheochromocytomas were significantly larger than adrenal adenomas (mean diameter, 4.5 cm [range, 1-8.3 cm] vs. 1 cm [range, 0.8-6.2 cm]; $p < 0.0001$).

CONCLUSION

Peak enhancement values of 85 HU or greater in an adrenal lesion on the 60-second post contrast phase strongly suggest a diagnosis of pheochromocytoma rather than adrenal adenoma, regardless of whether or not the lesion demonstrates absolute or relative washout characteristics compatible with a lipid poor adenoma.

CLINICAL RELEVANCE/APPLICATION

Peak enhancement values on the 60-second post contrast phase should be routinely assessed in the workup of an adrenal lesion to avoid missing a pheochromocytoma.

SSA10-02 Proton-Density Fat Fraction: A Viable Tool for Differentiating Adenomas from Nonadenomas in Adrenal Glands, Compared with In-phase and Out-of-phase MR Imaging

Sunday, Nov. 29 10:55AM - 11:05AM Location: E353B

Participants
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Zhen Li, MD, PhD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose
Yanchun Wang, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the application of proton-density fat-fraction (PDFF) measurements for accurately quantifying the fat-content of adrenal nodules, differentiating adenomas from nonadenomas, and compare with in-phase (IP) and out-of-phase (OP) MR imaging.

METHOD AND MATERIALS

This study was compliant with HIPAA and approved by the Institutional Review Board, with the waivers of informed consent. The consecutive research was performed between Aug 2013 to Aug 2014, 37 patients with 40 adrenal nodules (21 histopathologically proven adenomas, 13 proved pheochromocytomas and 6 clinically proven metastases) who underwent MRI scanning with T1 independent volumetric multi-echo gradient-echo imaging with T2*correction (IDEAL-IQ), following with an axial 3D dual-echo Dixon sequence (LAVA-FLEX) which performed IP and OP images. All MRI examinations were performed on a 3.0-T MR scanner. PDFF, SI index (SII), SI adrenal-to-liver ratio (ALR) and SI adrenal-to-spleen ratio (ASR) were calculated. All statistical analyses were performed by using statistical software SPSS 17.0.

RESULTS

PDFF of adenomas (21.39±10.09%)was significantly higher than of nonadenomas (2.25±2.73)(p=0.000, <0.05).PDFF was an effective tool for distinguishing adenomas from nonadenomas with an area under the curve (AUC) of 0.982, higher than 3.20 predicted adenomas with a sensitivity of 100% and a specificity of 89.5%.While,the sensitivities and specificities for adenomas were 90.0% and 100%, both for SII, ALR and ASR on IP/OP images, with AUC of 0.942, 0.937, 0.932, respectively.

CONCLUSION

PDFF measurements provided a more accurate estimation for fat content in adrenal nodules than with IP/OP images, and it could be a precisely parameter for differentiating adenomas from nonadenomas.

CLINICAL RELEVANCE/APPLICATION

In conclusion, IDEAL-IQ could be a valuable diagnostic tool for discriminating adenomas from nonadenomas with a high sensitivity and a relatively high specificity, avoiding radiation exposure, contrast media side-effect and complicated data calculation. IDEAL-IQ would be a prospective, reliable, and widely used method for diagnosing adrenal gland nodules in clinical study.

SSA10-03 Adrenal Calcifications on CT Associated with Familial Cerebral Cavernous Malformation Type I: An Imaging Biomarker for a Hereditary Cerebrovascular Condition

Sunday, Nov. 29 11:05AM - 11:15AM Location: E353B

Participants
Corinne D. Strickland, MD, MS, Boston, MA (*Presenter*) Shareholder, Thayer Medical Corporation
Steven C. Eberhardt, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Leslie Morrison, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Li Luo, PhD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose
Blaine L. Hart, MD, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Cerebral Cavernous Malformation Type I (CCM1) is an autosomal dominant disorder characterized by multiple cavernous malformations in the brain that may cause seizures, cerebral hemorrhage, or focal neurologic deficits. Abdominal manifestations are unproven and poorly described. Individuals of Hispanic descent in the Southwestern US are disproportionately affected by this condition due to a founder mutation in the CCM1/KRIT1 gene. Our aim was to investigate whether adrenal calcifications on CT are associated with CCM1 in carriers of the common Hispanic mutation (CHM).

METHOD AND MATERIALS

In an IRB-approved, HIPAA-compliant study, abdomen CT scans of 23 CCM1 subjects (10 F, 13 M, mean 48 yrs, range 24-73 yrs) were retrospectively reviewed. All subjects had multiple CCM lesions on brain MRI; 11 had confirmed CHM genotype. As controls, abdomen CTs from 38 unaffected matched subjects (18 F, 20 M, mean 48 yrs, range 23-73 years) and 13 subjects with sporadic (non-familial) CCM (6 F, 7 M, mean 51 yrs, range 26-72 yrs) were reviewed. Size, location, number, laterality of calcifications, and adrenal morphology were recorded. Brain lesion count was recorded for CCM1 subjects. Statistical comparisons between groups were calculated using Fisher exact test and two-sample t test.

RESULTS

15 of 23 CCM1 subjects (65%) had small (≤ 5mm), focal calcifications (SFC) in one or both adrenals, compared with 0 in unaffected and sporadic CCM subjects (p<0.001). SFC were either left-sided or bilateral. Glands with SFC had normal adrenal morphology. The presence of SFC correlated positively with number of CCM brain lesions (p=0.048); bilateral SFC correlated positively with patient age (p=0.030).

CONCLUSION

SFC are found in a majority (65%) of adults with CHM-related CCM1 and may be a clinically silent disease manifestation. SFC in this population are predominantly left-sided, more often bilateral with increasing age, and more common in patients with greater number of brain lesions. These findings add to existing evidence that CCM1 is a multi-system disorder with effects beyond the central nervous system. CCM1 should be considered in the differential diagnosis for focal adrenal calcifications encountered incidentally on CT.

CLINICAL RELEVANCE/APPLICATION

Incidental adrenal calcifications on CT may detect unrecognized CCM1 and improve diagnostic confidence in equivocal cases. Recognition of this entity is important for management of neurologic manifestations and genetic counseling.

SSA10-04 Clinical Value of Dual-Energy Virtual Non-Contrast of Dual-Source CT for Adrenal Adenoma

Sunday, Nov. 29 11:15AM - 11:25AM Location: E353B

Participants
Yang Shitong, Zhengzhou, China (*Presenter*) Nothing to Disclose

PURPOSE

To explore the feasibility of using virtual non-contrast (VNC) images in diagnosis of adrenal adenoma in dual-energy scans, and evaluate the sensitivity, specificity, and accuracy of VNC images for the lipid-poor adenoma.

METHOD AND MATERIALS

The clinical manifestations and CT images for 30 patients with 31 lesions confirmed by pathological results from surgery were reviewed retrospectively. All of the patients were examined by a pre-contrast scan (true non contrast; TNC) and then arterial and venous phase enhanced scan. Then enhanced examinations were performed with dual-energy scan mode (SOMATOM Flash, Siemens Healthcare, Forchheim, Germany). The dedicated post processing application Liver VNC was used to get VNC images at the arterial and venous phase respectively.Mean CT values, signal-to-noise ratio, subjective image quality, and radiation dose were compared between routine TNC and VNC.The correlation between TNC and VNC images of the adrenal adenoma was evaluated. Sensitivity, specificity and accuracy of VNC images for the characterization of lipid-poor adenoma were calculated from chi-square tables of contingency.

RESULTS

No significant differences were seen for mean CT values in normal adrenal tissue,adrenal adenoma and the muscles of posterior spine between TNC and VNC images ($p>0.05$),except the abdominal aortic and spleen which the mean CT values in VNC images was higher than TNC image and the differences were statistically significant ($p<0.05$).SNR of all tissues in VNC images were higher than that in TNC image,and the differences were statistically significant ($p<0.05$) expect the abdominal aortic($p>0.05$).The subjective score of VNC images was lower than that of TNC image, but the difference was no statistically significant($p>0.05$).The radiation dose of VNC images was lower than that of TNC($p<0.05$).A positive correlation was found for CT values of adrenal adenoma between TNC and VNC images.Sensitivity,specificity,and accuracy from VNC images of arterial phase for the characterization of lipid-poor adenoma were 86.9%,100%,90.3% and from venous phase were 60.9%,87.5%,67.7%.

CONCLUSION

VNC images calculated from contrast-enhanced dual-energy CT have a potential to replace the TNC images to diagnose the adrenal adenoma and thus reduce the patient's radiation dose.

CLINICAL RELEVANCE/APPLICATION

Dual-energy VNC have a potential to replace the TNC images to diagnose the adrenal adenoma and thus reduce the patient's radiation dose.

SSA10-05 Characterization of Adrenal Lesions Using Rapid Kilovolt-Switching Dual Energy CT: Utility of Contrast-Enhanced Material Suppression Imaging

Sunday, Nov. 29 11:25AM - 11:35AM Location: E353B

Participants
Jason A. Pietryga, MD, Birmingham, AL (*Presenter*) Nothing to Disclose
Mark E. Lockhart, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Therese M. Weber, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
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Desiree E. Morgan, MD, Birmingham, AL (*Abstract Co-Author*) Research support, General Electric Company

PURPOSE

To characterize adrenal lesions as benign or malignant on contrast-enhanced dual energy CT using material suppression imaging (MSI) virtual unenhanced images and pseudo-unenhanced monoenergetic 140keV images.

METHOD AND MATERIALS

IRB-approved HIPAA-compliant study. A retrospective search identified consecutive adult outpatients who had undergone multiphasic dual energy CT(DECT) with an adrenal lesion (≥1cm) reported. Two patients weighing ≥300 lbs were excluded. A single board-certified radiologist reviewed the CTs and placed ROIs on the adrenal lesions on the noncontrast (NC) series and simultaneously placed matching ROIs on MSI virtual unenhanced and virtual monoenergetic 140 keV images. The lesions were characterized by accepted clinical standards. Spearman rank correlation was performed to evaluate for associations between the virtual unenhanced, pseudo-unenhanced HU and NC HU and t tests to evaluate means. Regression analysis was performed to identify threshold values to characterize adrenal lesions as benign vs malignant. Myelolipomas were excluded from the regression analysis.

RESULTS

104 patients (52M,52F, mean age 62, weight 188 lb) with a total of 140 adrenal lesions were identified. 56%(78/140) of the lesions were lipid-rich adenomas, 6%(9/140) lipid-poor adenomas, 20%(28/140) malignancies, 8%(11/140) myelolipomas and 10%(14/140) indeterminate. The mean HUs for adenomas were -6.5 (NC), 11.3 (MSI), 12.5 (140 keV); mean HUs for malignant lesions were 34.2 (NC), 39.1 (MSI) 38.7 (140 keV), all $p<0.0001$. There were very strong Spearman correlations between NC and MSI HU (.83), NC and 140keV HU (.81) and MSI and 140keV HU (98). Excluding 1 obvious necrotic RCC metastasis, a threshold of 20 HU on MSI and 16 HU on 140keV images correctly characterizes lesions as adenomas with a sensitivity of 68%(59/87) and 53%(46/87), respectively, both with specificity of 100%.

CONCLUSION

MSI virtual unenhanced and virtual 140keV monoenergetic contrast-enhanced DECT images can be used to characterize adrenal adenomas with a sensitivity of 72% and 59%, respectively, when using new HU threshold values of 20 and 16, respectively. Excluding an obvious necrotic RCC metastasis, both threshold values are 100% specific.

CLINICAL RELEVANCE/APPLICATION

In this largest DECT series of adrenal lesions, new HU criteria are presented that can characterize lesions on contrast-enhanced DECT, potentially obviating the need for further imaging for most patients.

SSA10-07 MASS Criteria as a Predictor of Survival in Sunitinib Treated Metastatic RCC - A Secondary Post-hoc Analysis of a Multi-institutional Prospective Phase III Trial

Sunday, Nov. 29 11:45AM - 11:55AM Location: E353B

Participants
Andrew D. Smith, MD, PhD, Jackson, MS (*Presenter*) Research Grant, Pfizer Inc; President, Radiostics LLC; President, Liver Nodularity LLC; President, Color Enhanced Detection LLC; Pending patent, Liver Nodularity LLC; Pending patent, Color Enhanced Detection LLC;
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Xu Zhang, PhD, Jackson, MS (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To validate MASS Criteria as a predictive imaging biomarker in metastatic RCC treated with anti-angiogenic therapy.

METHOD AND MATERIALS

As part of a published multi-institutional prospective phase III trial, 375 adult patients with metastatic clear cell RCC were treated with sunitinib. In this secondary post-hoc retrospective analysis, initial post-therapy CT images were evaluated by RECIST, Choi Criteria, and MASS Criteria in patients with DICOM format images. Comparison of PFS and OS among MSKCC risk and imaging response groups was evaluated using log-rank test. Inter-observer agreement between 3 readers was assessed in 21 randomly selected cases using intra-class correlation coefficient (ICC).

RESULTS

Median PFS and OS of the full cohort (N=270) were 1.1 and 2.6 years, respectively. PFS and OS of all MASS Criteria objective response categories were significantly different from one another ($p<0.0001$ for each). By comparison, PFS of MSKCC low (N=186) and intermediate (N=84) risk groups, PFS of RECIST PR (N=33) and SD (N=228) groups, and OS of Choi Criteria SD (N=36) and PD (N=13) groups were not significantly different ($p=0.225$, 0.810 and 0.311, respectively). Median PFS for patients with baseline MSKCC Criteria low (N=186) and intermediate (N=84) risk were 1.2 and 0.9 years, respectively. By comparison, median PFS for patients with MASS criteria FR (N=177), IR (N=84), and UR (N=9) were 1.4, 0.5, and 0.1 years, respectively. Inter-observer agreement among 3 readers interpreting 21 randomly selected cases using MASS Criteria was substantial (ICC=0.70).

CONCLUSION

In patients with metastatic RCC treated with sunitinib, MASS Criteria response on the initial post-therapy CT is predictive of PFS and OS.

CLINICAL RELEVANCE/APPLICATION

MASS Criteria is currently the only quantitative biomarker for predicting response to anti-angiogenic therapy in metastatic RCC that has been validated in a multi-institutional study and it may potentially be useful in guiding therapy, reducing drug toxicities and costs, and planning adaptive design clinical trials.

SSA10-08 Prediction of Survival in Patients with Metastatic Clear Cell Carcinoma Treated with Targeted Anti-angiogenic Agent Sunitinib via CT Texture Analysis

Sunday, Nov. 29 11:55AM - 12:05PM Location: E353B

Participants
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Farzad Khalvati, PhD,MSc, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Alexander Kiss, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Balaji Ganeshan, PhD, London, United Kingdom (*Abstract Co-Author*) Scientific Director, TexRAD Limited
Georg Bjarnason, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the role of CT Texture analysis in prediction of progression free and overall survival and assessment of response to treatment with Sunitinib in patients with metastatic clear renal cell carcinoma (RCC).

METHOD AND MATERIALS

Contrast enhanced CT texture parameters were assessed in 40 patients with metastatic clear RCC who were treated with Sunitinib. Appropriate measurable lesions were selected based on RECIST criteria before and about two months after treatment with Sunitinib. Texture and histogram analysis of the lesions were performed using TexRad software. Using a Cox regression model, correlation of texture parameters with measured time to progression and overall survival were assessed.

RESULTS

"Size normalized tumor Entropy" (NE) was found as an independent predictor of time to progression and overall survival and can add to Heng; a well-known prognostic model for metastatic RCC patients. Cox proportional hazards regression analysis (HR) showed that NE was an independent predictor of time to progression. (HR = 0.01 and 0.02; 95% confidence intervals (CI): 0.00 - 0.29 and 0.00 - 0.39; $p=0.01$ and $p=0.01$ for NE before and two months after treatment, respectively). NE was also shown to be an independent predictor of overall survival. (HR = 0.01 and 0.01; 95% CI: 0.00 - 0.31 and 0.001 - 0.22; $p=0.01$ and $p=0.003$ for NE before and two months after treatment, respectively).

CONCLUSION

Tumor heterogeneity is a well-known feature of malignancy reflecting areas of increased cellular density, hemorrhage and necrosis. CT texture analysis can quantify heterogeneity by using a range of parameters including size normalized Entropy (NE) as a measure of texture irregularity. Our study showed that NE is an independent predictor of the outcome of treatment with Sunitinib in patients with metastatic RCC and can be used for prediction of time to progression and overall survival in these patients. This can help identify non-responders from the outset with the potential to avoid unnecessary toxicity and to start alternative therapies earlier.

CLINICAL RELEVANCE/APPLICATION

The ability to identify poor responders early in the course of treatment or before starting the treatment can help patients be spared from toxicity usually associated with these treatments and could potentially receive alternative therapies earlier. Using the costly drugs of treatment only in patients who benefit from them will be a potential for cost-effectiveness improvement.

SSA10-09 Arterial Spin Labeling MR Imaging for Detecting Perfusion of Defect of Renal Cell Carcinoma Pseudo-capsule and Predicting Renal Capsule Invasion: Initial Experience

Sunday, Nov. 29 12:05PM - 12:15PM Location: E353B

Participants
Hanmei Zhang, Chengdu, China (*Presenter*) Nothing to Disclose
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Panli Zuo, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Niels Oesingmann, PhD, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG
Bin Song, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The defect of pseudo-capsule is tightly correlated with the invasiveness of tumors.This study aimed to prospectively evaluate the performance of combining morphological imaging and functional imaging for detecting the defects of pseudo-capsule in renal tumors,and to predict renal capsule invasion which were confirmed histopathologically.

METHOD AND MATERIALS

Twelve patients with suspicious renal tumors underwent T2-weighted imaging and contrast-free renal ASL imaging at a 3.0T MR scanner.Renal ASL was performed using a prototype flow-sensitive alternating inversion recovery trueFISP (FAIR-trueFISP) sequence with a TI of 1200 ms for perfusion images and without inversion for M0 images.A modified Look-Locker inversion-recovery (MOLLI) sequence was used for T1 mapping.Renal blood flow (RBF) was quantitatively measured on the perfusion images which were determined on a pixel by pixel basis.For T2-weighted images alone,the discontinuous hypo signal intensity rim was defined as the defect of tumors' pseudo-capsule,for combination of T2-weighted images and ASL,the hypo signals in T2-weighted images as well hyper signals in perfusion images was defined as the defect of tumors' pseudo-capsule.The diagnostic performance was assessed using diagnostic test's index.

RESULTS

Twelve renal lesions (11 clear cell RCCs and 1 chromophobe RCC) were evaluated in 12 patients.All ccRCCs showed defect of tumors' pseudo-capsule on T2-weighted images.Of the 11 ccRCCs cases,10 cases showed blood flow right on the defect area of tumors' pseudo-capsule on perfusion images and 1 case did not.All the defect areas of tumors' pseudo-capsule seen in the surgery operation had renal capsule invasion.For defecting of tumors' pseudo-capsule,i.e. predicting renal capsule invasion,sensitivity,specificity,positive predictive value and negative predictive value were 100%,33.3%,81.8%,100% for T2-weighted images alone and 100%,66.7%,90%,100% for combination of T2-weighted images and ASL images.

CONCLUSION

The combination of T2-weighted images and ASL images produced promising diagnostic accuracy for predicting renal capsule invasion,which could offer additional imaging information for clinical diagnosis of renal tumors.

CLINICAL RELEVANCE/APPLICATION

Noninvasively and prospectively evaluated the presence of the defect pseudo-capsule in renal tumors may help predict the invasiveness of tumor and influence clinical therapy strategy.

SSA12

Molecular Imaging (Neuroimaging)

Sunday, Nov. 29 10:45AM - 12:15PM Location: S504CD

NR MI MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Alexander Drzezga, MD, Cologne, Germany (*Moderator*) Research Grant, Eli Lilly and Company; Speakers Bureau, Siemens AG; Speakers Bureau, General Electric Company; Speakers Bureau, Piramal Enterprises Limited; Research Consultant, Eli Lilly and Company; Research Consultant, Piramal Enterprises Limited; ; ; ; ; ;
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Sub-Events

SSA12-01 Molecular Imaging Profiling of Treatment Effects in Experimental Multiple Sclerosis

Sunday, Nov. 29 10:45AM - 10:55AM Location: S504CD

Awards
Molecular Imaging Travel Award

Participants
Benjamin Pulli, MD, Boston, MA (*Presenter*) Nothing to Disclose
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Neng Dai, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Treatment effects of interferon beta (IFN) and glatiramer acetate (GA), two first-line agents used in multiple sclerosis (MS), are similar as evaluated by conventional MRI. We imaged these two drugs with MPO-Gd, an activatable molecular MR probe specific to myeloperoxidase (MPO), an enzyme secreted by pro-inflammatory myeloid cells, to better profile and study their effects on the innate immune response in vivo.

METHOD AND MATERIALS

Thirty-five female SJL mice were injected with proteolipid protein to induce experimental autoimmune encephalomyelitis, a mouse model of MS, and treated with IFN (1 µg/day), GA (150 µg/day), MPO inhibitor ABAH (0.8 mg/day), or saline. Mice underwent MRI at 4.7T with MPO-Gd at disease peak (day 12). Lesion volume, number, contrast-to-noise ratio (CNR), and total MPO-Gd enhancement were quantified on delayed images. Mechanistic in vitro experiments were performed.

RESULTS

CNR (MPO activity in vivo) was decreased with ABAH and IFN, but not with GA. Lesion volume, lesion number, and total MPO-Gd enhancement was decreased with all three agents (Fig., A-B). These findings suggest that IFN may have the imaging signature of an MPO inhibitor. However, direct enzymatic inhibition was only found with ABAH, and not with IFN or GA (C). When primary neutrophils were stimulated to secrete MPO, IFN decreased activity of the MPO enzyme, similar to ABAH (D), while GA did not have a similar effect (D). When neutrophils were incubated with IFN, increased superoxide anion production (as measured by dihydroethidium [DHE] fluorescence) was detected (E). Inhibition of superoxide anion production by apocynin resulted in the restoration of MPO activity from stimulated neutrophils (F). Spectrophotometry revealed that IFN-mediated superoxide anion production abolished absorbance of MPO at 430 nm, consistent with irreversible destruction of the iron-containing prosthetic group (G).

CONCLUSION

Molecular imaging profiling with MPO-Gd reveals differential treatment effects of the two first-line drugs used in the treatment of MS (H), and led to the discovery of a novel mechanism of action of IFN: IFN triggers superoxide anion production in myeloid cells to irreversibly inactivate MPO.

CLINICAL RELEVANCE/APPLICATION

Molecular imaging profiling with imaging agents that probe the immune response could open up a new avenue to study the effects of current and future novel therapeutic drugs for MS.

SSA12-02 Microtubule Stabilization Therapeutic Improves Cognition and Acutely Increases Axonal Transport on Manganese-enhanced MRI in Aged Mice with AD Pathology

Sunday, Nov. 29 10:55AM - 11:05AM Location: S504CD

Participants
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Greg Garwin, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
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Donna J. Cross, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Previously we reported increased axonal transport in young mice transgenic (Tg) for Alzheimer's disease (AD) after intranasal administration of a microtubule-stabilizing therapeutic, paclitaxel using MRI with manganese (MEMRI). In this study we administered paclitaxel to AGED 3xTg-AD mice with established pathology from 10-18 mos and hypothesized that cognition would improve and be associated with increased axonal transport.

METHOD AND MATERIALS

Mice, (3xTg-AD n=10, age=44wks) were treated by intranasal lavage with paclitaxel (TAX: 0.6 mg/kg) or 0.9% saline (SAL) in 5 µl per nostril at intervals of 2wks. MEMRI was obtained after first treatment to assess acute effect on transport. Scanning (14T Bruker MR: MDEFT, TR/TE: 5000ms/1.9ms, 0.140x0.140x0.25mm3) pre and immediately after treatment occurred at 100 min. and from 370-400 min after delivery of 5 µL of 1M MnCl2 intranasally. Images were coregistered stereotactically aligned and normalized to a mouse atlas. Tracer kinetic analysis based on dispersion model was used to estimate transport. At 56 wks after 5 treatments, mice were tested in radial water tread maze for memory deficits and compared to age-matched WT (n=5) and at 75 wks after 11 treatments, anxiety was assessed by elevated plus maze.

RESULTS

At 10 mos, 3xTg-AD have amyloid and neurofibrillary tangles. There was a significant acute effect of TAX on transport in the olfactory tract. Transport rates decreased slightly in SAL (-13%) in the 3wk interval between MEMRI scans however TAX increased (>100%) transport at 24hrs after administration (p=0.05). Cognition was tested in the water tread maze (memory) and elevated plus maze (anxiety). TAX had improved memory as compared to SAL and not significantly different from WT (Day 5, 36% dec, 143.8±43 vs 91.5±77s and Day 12, 22% dec, 138.3±52 vs 107.7±75s for SAL vs. TAX, $p<0.05$). 3xTg-AD mice exhibit anxiety. TAX spent more time exploring open arms than SAL (Open arm 84% inc, 129.1±80 vs 20.9±31s for TAX vs SAL, $p\leq0.05$). There were no differences in Mn2+ uptake indicating delivery thru activity-dependent Ca2+ channels was not affected by treatment.

CONCLUSION

MEMRI indicated that paclitaxel has an acute effect on axonal transport processes in AD mice. Paclitaxel also improved cognition and anxiety in AD mice when administered after pathology was well-established.

CLINICAL RELEVANCE/APPLICATION

Microtubule-stabilizing drugs present an exciting new therapeutic option for Alzheimer's disease.

SSA12-03 Whole-Brain, Volumetric MR Spectroscopic Profiles Identify Infiltrating Glioblastoma Margin for Fluorescence-Guided Surgery

Sunday, Nov. 29 11:05AM - 11:15AM Location: S504CD

Participants
James S. Cordova, BS, Atlanta, GA (*Presenter*) Nothing to Disclose
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Hyunsuk Shim, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Glioblastoma (GBM) resection based on T1W-contrast enhanced MRI (T1W-CE) results in high rates of local recurrence due to tumor infiltration beyond contrast enhancing margins. MR spectroscopic imaging (MRSI) maps are thought to identify tumor infiltration outside of T1W-CE regions more specifically than T2-FLAIR. Thus, coupling preoperative MRSI with real-time fluorescence-guided surgery (FGS) using 5-aminolevulinic acid (5-ALA) may allow the maximal removal of tumor beyond the enhancing margin.

METHOD AND MATERIALS

In a trial for new and recurrent GBM (n=20 patients), 3D whole-brain MRSI volumes, including choline (Cho), creatine (Cr), and N-acetylaspartate (NAA) maps, were acquired and used for surgical planning in patients receiving FGS. Biopsies were collected from regions with elevated Cho/NAA before bulk resection using 5-ALA fluorescence. Fluorescence of resected tissue was quantified ex vivo with a hand-held spectrometer, and metabolic data was sampled from MRSI volumes using an 8 mm^3 region-of-interest centered at the point of tissue extraction. Samples were stained for SOX2, a tumor-specific marker, and analyzed to quantify tumor infiltration using an automated histology image analysis tool. Semi-automated tumor segmentation was used to evaluate extent-of-tumor resection (EOR) (Cordova et al. 2014).

RESULTS

One-hundred percent of tissue samples from metabolically abnormal regions, even those devoid of T2 abnormality, contained SOX2 positive cells (range: 3 - 96% of cells). Cho/NAA, Cho/Cr, and Cho showed strong, statistically significant correlations with the proportion of SOX2-positive cells ($\rho = 0.70$, 0.66, and 0.60, respectively; $p < 0.05$). Ex vivo tissue fluorescence showed a weaker yet significant correlation with Cho/NAA and Cho ($\rho = 0.365$ and 0.404; $p<0.05$). Median EOR in MRSI/5-ALA cases was 97.5% whereas that in a concurrent study using FGS alone was 94.2%.

CONCLUSION

This is the first time that 5-ALA-induced fluorescence has been shown to correlate with MRSI-derived metabolic markers in brain tumors. The correlation of MRSI abnormality with histopathology and quantitative intraoperative fluorescence supports the use of MRSI for identifying regions of tumor infiltration outside of T1W-CE.

CLINICAL RELEVANCE/APPLICATION

As MRSI is independent of contrast diffusion, it defines tumor infiltration more precisely than T1W-CE; and when combined with FGS, results in more complete resections that may extend patient survival.

SSA12-04 Motexafin Gadolinium (MGd) - Enhanced MR and Optical Imaging of Rat Gliomas for Potential Intraoperative Determination of Tumor Margins

Sunday, Nov. 29 11:15AM - 11:25AM Location: S504CD

Participants
Longhua Qiu, Seattle, WA (*Presenter*) Nothing to Disclose
Feng Zhang, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To investigate the possibility of using motexafin gadolinium (MGd)-enhanced molecular MR imaging and optical imaging to identify the genuine margins of rat gliomas.To investigate the possibility of using motexafin gadolinium (MGd)-enhanced molecular MR imaging and optical imaging to identify the genuine margins of rat gliomas.

METHOD AND MATERIALS

Rat glioma model was created by inoculating C6 glioma cells in right caudate nucleuses of male Sprague-Dawley rats (160g ± 20g). Thirty six rats with tumors were randomized into six groups (n=6/group). Five groups were euthanized at different time points of 15, 30, 60, 120 and 240 minutes after intravenous administration of 6-mg/kg MGd respectively, while one group received saline as a control. After a craniotomy, ex vivo optical imaging was performed to identify the tumors featuring as MGd-emitting red fluorescence. Then, the whole brains were harvested for ex-vivo T1-weighted MRI (T1WI). Optical photon intensities and MRI signal-to-noise ratio (SNR) were quantified for plotting the times to photon/SNR curves. Tumor extent was demarcated on both optical and MR imaging. Subsequently, confocal microscopy of brain tissues was performed to confirm the intracellular uptake of MGd by tumor cells and correlate the tumor margins determined on both optical and MR images.

RESULTS

Fluorescent optical imaging could sensitively detect the deep-seated tumors with red fluorescence in rat brains and clearly outlined the tumor margins. T1WI showed the tumors heterogeneous enhancement. Both the photon intensity and the maximal enhancement on T1WI reached the peak at 15 minutes after MGd administration, with a continuing tumor visibility lasting for 2-4 hours. Confocal microscopy confirmed the exclusive accumulation of MGd in tumor cells which was well correlated with imaging findings.

CONCLUSION

Both MGd-enhanced optical imaging and molecular MR imaging can sensitively determine rat glioma tumor margin within the optimal time window of 15~30 minutes post-MGd administration, which pose the potential clinical application for aiding the complete removal of gliomas at a hybrid surgical setting with intraoperative optical and MR imaging capabilities.

CLINICAL RELEVANCE/APPLICATION

MGd-enhanced imaging poses a potential clinical application for aiding the complete removal of gliomas at a hybrid surgical setting with intraoperative optical and MR imaging capabilities.

SSA12-05 Generation of a Bispecific Antibody for Combined EGFR/CD105 Targeting of High-Grade Gliomas

Sunday, Nov. 29 11:25AM - 11:35AM Location: S504CD

Awards
Molecular Imaging Travel Award

Participants
Reinier Hernandez, MSc, Madison, WI (*Presenter*) Nothing to Disclose
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Hao Hong, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Stephen Graves, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Robert J. Nickles, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Weibo Cai, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Our aim was to design and generate a heterodimer [Bs-F(ab')2] using two mAb Fab fragments for dual-targeting of epidermal growth factor receptor (EGFR) and CD105. The synergistic targeting properties of Bs-F(ab')2 were investigated in vitro/in vivo.

METHOD AND MATERIALS

Bs-Fab'2 was synthesized by reacting two mAb fragments (Cetuximab Fab and TRC105 Fab) derivatized with the "Click' chemistry pair tetrazine/trans-cyclooctene. Bs-Fab'2 was purified by size exclusion chromatography, conjugated to NOTA, and labeled with 64Cu for positron emission tomography (PET). In vitro and in vivo dual-receptor binding studies were performed in a U87MG human

glioblastoma cancer model (EGFR/ CD105 +/+). Blocking, biodistribution, and ex vivo histological examination were performed to validate the in vivo data.

RESULTS

Purified Bs-F(ab')2 was confirmed by SDS-PAGE (~100 kDa, >90% pure), whereas the two Fab fragments were each at ~50 kDa. Flow cytometry showed an enhanced fluorescence signal for the heterodimer compared with either Fab. PET of U87MG tumor bearing mice with 64Cu-NOTA-Bs-F(ab')2 revealed a strikingly higher tumor uptake (32.0±6.9, 47.5±6.7, 46.0±3.3 and 44.1±9.4 %ID/g at 3, 15, 24, and 36 h postinjection, respectively; n=3) compared to those observed with 64Cu-NOTA-Cet-Fab and 64Cu-NOTA-TRC105-Fab (both <15%ID/g). Injection of a blocking dose (100mg/kg) of Cetuximab or TRC105 prior to the administration of the tracer resulted in a significantly reduced tumor uptake of 64Cu-NOTA-Bs-F(ab')2, which confirmed that Bs-F(ab')2 tumor-uptake was mediated by both EGFR and CD105 expression. Owing to the low tracer uptake in non-target organs (e.g. liver and kidney), we attained excellent tumor-to-normal tissue contrasts.

CONCLUSION

We report the first successful dual-targeting of EGFR and CD105, with a "click" heterodimer featuring two mAb Fab fragments, which led to synergistic enhancement of tumor uptake over either Fab alone. These results may improve future cancer diagnosis and therapeutic efficacy.

CLINICAL RELEVANCE/APPLICATION

Combined EGFR/CD105-targeting provides increased tumor-targeting efficacy and specificity, which may ultimately lead to better diagnostic sensitivity and increased tumor cytotoxicity.

SSA12-07 MRI Contrasts Induced by Direct Saturation: Demonstration in the Central Nerve System

Sunday, Nov. 29 11:45AM - 11:55AM Location: S504CD

Participants
Rongwen Tain, PhD, Chicago, IL (*Presenter*) Nothing to Disclose
Feliks Kogan, PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Xiaohong J. Zhou, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Kejia Cai, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A frequency selective saturation RF pulse across a broad frequency range produces a Z-spectrum. This Z-sprectrum receives contributions from components mainly including direct saturation (DS) of bulk water, magnetization transfer, chemical exchange saturation transfer, and Nuclear Overhauser Enhancement. When a weak saturation regime is applied, such as B1rms< 50 Hz and duration < 500 ms, the Z-spectrum is mainly attributed to the DS spectrum, characterized by a Lorentzian-shape. The DS magnitude at a given frequency offset has been used to measure iron content in brain. Additionally, the position of maximum DS has been exploited to map B0 field variations (ΔB0). In this study, we investigate additional contrasts revealed by analyzing DS spectrum.

METHOD AND MATERIALS

This study was performed under an approved IRB protocol. DS spectra within ±1 ppm were acquired from the brain and cervical spinal cord of healthy subjects at 3T scanner with a 32 channel head-coil and a 16 channel head and neck spine coil, respectively. The pulse sequence consists of a pre-saturation pulse (B1rms = 12.2 Hz for brain, 24.4 Hz for spinal cord, 200 ms) followed by a 2D single-shot SPGR readout. The DS data was fitted pixel by pixel with a Lorentzian function to produce B0 field, DS line-width, and DS magnitude maps. In addition, simulations with Bloch equations were performed to correlate with experimental data.

RESULTS

Beside the ΔB0 map, the Lorentzian fitting of data obtained from both brain and spinal cord was used to produce new maps based on the DS line-width and magnitude. In the brain and spinal cord respectively, the DS line-width of gray matter is slightly narrower than that of the white matter. As expected, CSF gave the narrowest line-widths. DS amplitude was reversed. Simulation further showed that DS line-width is positively proportional to 1/T2 and inversely proportional to 1/T1. DS magnitude was found to be proportional to proton density.

CONCLUSION

Two quantitative contrasts (DS line-width and magnitude) that reflect tissue relaxation rates and proton density have been demonstrated in the human CNS tissues.

CLINICAL RELEVANCE/APPLICATION

The discovered contrasts induced by DS MRI have the clinically potential for characterization of normal and pathological tissues.

SSA12-08 CD146-based Noninvasive ImmunoPET Imaging of High-grade Gliomas

Sunday, Nov. 29 11:55AM - 12:05PM Location: S504CD

Participants
Reinier Hernandez, MSc, Madison, WI (*Presenter*) Nothing to Disclose
Yunan Yang, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Stephen Graves, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Robert J. Nickles, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Weibo Cai, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The goal of this study is to establish CD146 as a novel target for in vivo immunoPET imaging of mice bearing orthotopic high-grade gliomas (HGG).

METHOD AND MATERIALS

An improved immunization approach was used to generate YY146, a murine anti-CD146 monoclonal antibody. RT-PCR, western blot, flow cytometry, and immunofluorescence staining studies were conducted to determine in vitro CD146 expression. Subcutaneous (s.c.) U87MG human glioblastoma (CD146+) and PC3 human prostate cancer (CD146-) tumors were induced in athymic nude mice. Additionally, orthotopic U87MG tumors were generated in nude mice and its progression monitored by T2-weighted MRI. YY146 was conjugated to p-SCN-Bn-NOTA and radiolabeled with 64Cu. Sequential PET scans, blocking, histological, and biodistribution studies were carried out to determine in vivo CD146 specificity of 64Cu-NOTA-YY146.

RESULTS

Flow cytometry demonstrated that chelator conjugation to YY146 did not compromise its CD146-binding affinity/specificity. 64Cu-NOTA-YY146 was obtained with high radiochemical purity (>95%) and specific activity, in yields surpassing 90%. MicroPET imaging studies revealed an elevated and persistent uptake of 64Cu-NOTA-YY146 in U87MG (CD146+) s.c. xenografts which peaked at 13.7±0.7 %ID/g, 48h post-injection (n=3). In contrast, significantly lower accumulation was observed in PC3 (CD146-) tumors (<5 %ID/g). Excellent tumor homing was observed from PET/CT imaging of orthotopic U87MG tumors, where 64Cu-NOTA-YY146 was able to infiltrate the brain and accumulate in tumorous tissue (21.5±3.5 %ID/g at 48h post-injection; n=5). The attained exquisite tumor-to-normal brain contrast allowed for the sensitive detection of small malignancies (~2 mm). Biodistribution, blocking experiments, as well as histological examination validated PET data, and confirmed the CD146 specificity of 64Cu-NOTA-YY146.

CONCLUSION

We successfully implemented noninvasive immunoPET imaging of in vivo CD146 expression in an orthotopic human glioblastoma cancer model. The high affinity and specificity of 64Cu-NOTA-YY146 envisages the potential of this novel mAb for targeted HGG diagnosis and therapy.

CLINICAL RELEVANCE/APPLICATION

Herein, we show for the first time that CD146 is a promising tumor-specific target for noninvasive in vivo imaging and targeted therapy of high-grade gliomas.

SSA12-09 The Expression of P2X7 Receptors in EPCs and Their Potential Role in the Targeting of EPCs to Brain Gliomas

Sunday, Nov. 29 12:05PM - 12:15PM Location: S504CD

Participants
Xiao Chen, Chongqing, China (*Presenter*) Nothing to Disclose
Weiguo Zhang, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose
Jingqin Fang, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the functional expression of P2X7 receptors in EPCs, role of P2X7 receptors in proliferation and homing to glioma of EPCs.

RESULTS

We confirmed, for the first time, the expression of P2X7 receptors in rat spleen-derived EPCs. Activation of P2X7 receptors in EPCs by BzATP promoted cells proliferation and migration, rather than apoptosis. Compared to the group without BBG treatment, less transplanted EPCs homed to gliomas in the group with BBG treatment, especially integrated into the vessels containing tumor-derived endothelial cells in gliomas. Moreover, western blot showed that CXCL1 expression was downregulated in gliomas with BBG treatment, which meant P2X7 receptors suppression inhibited the homing of EPCs to gliomas through down-regulation of CXCLl expression. Additionally, MTT assay and MRI revealed that P2X7 receptors exerted no significant promoting effect on C6 glioma cells proliferation, glioma growth and angiogenesis.

CONCLUSION

Taken together, our findings imply the possibility of promoting proliferation and targeting ability of transplanted EPCs to brain gliomas in vivo through P2X7 receptors, which may provide new perspectives on application of EPCs as a therapeutic and imaging probe to overcome antiangiogenic resistance for gliomas.

CLINICAL RELEVANCE/APPLICATION

Apply EPCs as a therapeutic and imaging probe to overcome antiangiogenic resistance for gliomas.

SSA13

Musculoskeletal (Interventional)

Sunday, Nov. 29 10:45AM - 12:15PM Location: E451B

MK CT IR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Michael G. Fox, MD, Charlottesville, VA (*Moderator*) Stockholder, Pfizer Inc;
Mary Kristen Jesse, MD, Denver, CO (*Moderator*) Nothing to Disclose

Sub-Events

SSA13-01 Fluoroscopic Guided Sacroiliac Joint Injections - Comparison of Intra-articular and Peri-articular Injections on Immediate and Short-term Pain Relief

Sunday, Nov. 29 10:45AM - 10:55AM Location: E451B

Participants
Nicholas C. Nacey, MD, Charlottesville, VA (*Presenter*) Nothing to Disclose
James Patrie, MS, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Michael G. Fox, MD, Charlottesville, VA (*Abstract Co-Author*) Stockholder, Pfizer Inc;

PURPOSE

To determine if intra-articular sacroiliac (SI) joint injections provide greater immediate and short-term pain relief compared to peri-articular SI joint injections.

METHOD AND MATERIALS

All fluoroscopic guided SI joint injections targeting the inferior 1 cm of the SI joint, performed over a 4-year period, were identified. All patients were injected with 2.5 mL of Bupivacaine and 20 mg (0.5 mL) of triamcinalone. Patients were excluded if another triamcinalone dose or a different steroid/anesthetic combination was used, or if either the pre-injection, immediate (5-10 minute) post-injection, or 1-week post-injection pain score was not recorded. Two MSK radiologists with 2 and 13 years post-fellowship experience independently retrospectively reviewed the fluoroscopic images to determine intra-articular or peri-articular placement. Univariate and multivariate statistical analysis was performed.

RESULTS

169 patients (114F:55M; mean age 60.9 years) met the inclusion criteria with 88 intra-articular and 81 periarticular injections. Pre, immediate and 1-week post-injection pain scores for the intra-articular and periarticular injections were 6.2/2.0/4.1 and 6.0/2.3/4.2, respectively. Immediate and 1-week post-injection pain reduction was statistically significant in both groups ($p<0.001$). After adjusting for age, gender, pre-pain level, time of year, and reason for exam there was no significant difference in the pre-injection to immediate post-injection change in pain between intra-articular and periarticular injections (mean change 0.35, $p=0.30$) or in the pre-injection to 1-week postinjection change in pain (mean change 0.03, $p=0.92$). Geometric mean fluoro time was 27 sec for intra-articular injections and 42 sec for periarticular injections ($p<0.001$).

CONCLUSION

Both intra-articular and periarticular SI joint injections provide statistically significant immediate and 1-week post-injection pain relief. However, there was no significant difference in the degree of pain relief provided by intra-articular and peri-articular injections.

CLINICAL RELEVANCE/APPLICATION

Since similar pain relief was provided with intra-articular and periarticular SI joint injections, fluoroscopy is an adequate method for performing most SI joint injections.

SSA13-02 Ten Years' Experience in Combined Intradiscal and Periradicular Injection of Medical Ozone and Periradicular Administration of Steroids and Anesthetic for the Treatment of Lumbar Disk Herniation: Effects on Disk Size and Lumbar Radiculopathy in 437 Patients

Sunday, Nov. 29 10:55AM - 11:05AM Location: E451B

Participants
Thomas Lehnert, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (*Presenter*) Nothing to Disclose
Julian L. Wichmann, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Josef Matthias Kerl, MD, Frankfurt, Germany (*Abstract Co-Author*) Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Ralf W. Bauer, MD, Frankfurt, Germany (*Abstract Co-Author*) Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Martin Beeres, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the therapeutic benefit and morphologic changes in herniated lumbar disk after CT-guided intradiscal and periradicular ozone-oxygen injection combined with a periradicular administration of steroids and anesthetic.

METHOD AND MATERIALS

437 patients with lumbar radiculopathy received an intradiscal (3 mL) and periradicular (7 mL) injection of an ozone-oxygen mixture (ratio 3:97), followed by a periradicular injection of corticosteroid (1 mL of Celestan®Depot) and anesthetic (2 mL of Carbostesin® 0.25%) in the same session. Under CT guidance, intradiscal and periradicular injection was administered by means of an extraspinal lateral approach, using a 22-gauge 17.8-cm spinal needle. 6 months after treatment, clinical outcome was assessed by applying the modified MacNab method. The effects on disk matrix and disk volume were evaluated by MRI.

RESULTS

Treatment was successful in 316 patients (72.3%). In the remaining 121 patients (27.7%), treatment was considered to have failed. Among the patients whose treatment was a success, outcome was excellent in 153 patients (48.4%) and good in 163 patients (51.6%). Among the patients whose treatment was a failure, this was poor in 87 patients (71.9%) and poor with recourse to surgery in 34 patients (28.1%). Initial disk volume was 8.06-29.15 cm^3 (mean, 18.29 cm^3). 6 months after treatment, in patients with excellent outcome disk volume reduction was 5.67-22.11% (mean, 12.11%), in patients with good outcome 2.61-16.11% (mean, 7.29%) and in patients with poor outcome 0.33-8.21% (mean, 2.46%).

CONCLUSION

Our study shows that the combined intradiscal and periradicular injection of medical ozone and periradicular injection of steroids affects both the mechanical and the inflammatory components of pain caused by disk herniation. For this reason, this is a therapy option for treating lumbar disk herniation that has failed to respond to conservative management, before recourse to surgery or when surgery is not possible.

CLINICAL RELEVANCE/APPLICATION

CT-guided combined intradiscal and periradicular injection of ozone-ozygen represents a therapeutic alternative for lumbar radiculopathy with promising results. The ease of execution and non-invasiveness of this therapy permit the successful outpatient treatment of lumbar sciatic pain.

SSA13-03 Computed Tomography (CT) Guided O2-O3 Discolysis: Critical Review of Indications According to Our Experience

Sunday, Nov. 29 11:05AM - 11:15AM Location: E451B

Participants
Marco Perri, MD, L'Aquila, Italy (*Presenter*) Nothing to Disclose
Marco Varrassi, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose
Claudia Marsecano, MD, Fiuggi, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandra Splendiani, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Masciocchi, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimo Gallucci, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study was to clarify the O2-O3 discolysis indications and outcomes depending on the type of disc disease.

METHOD AND MATERIALS

Medical Ethical Committee approval was obtained for prospective double-blind trial. A total of 517 patients gave informed consent and were randomly assigned to two groups. Control group of 159 men and 101 women with age range 25-89 years, underwent percutaneous steroid treatment while Study Group of 163 men and 94 women with age range 22-92 years underwent the same treatment with the addiction of oxygen-ozone discolysis. Procedures were performed under computed tomographic guidance. Visual Analog Scale Questionnaire was administered before treatment and at intervals, the last at 6-month follow-up. Results were compared with the X2 and t-test.

RESULTS

After 6 months, O2-O3 discolysis was successful in 106 Study Group patients (41.24% with extrusions) compared with 9 Control Group patients (3.5%) with the same disco vertebral pathology (P <.001). Moreover in 89 (34.6%) Study Group patients with protrusions success rate was statistically significant(P<.001) compared with 5 Control Group patients(1.9%) with the same pathology. Furthermore statistically significant difference (P<.001) was detected in the presence of Grade I, II, III of Degenerated Disc in 185 of Study Group patients (68.4%) compared with 4 Control Group patients (1.5%).

CONCLUSION

O2-O3 discolysis is more effective at 6 months than steroid and anesthetic injection near intraforaminal sites especially in cases of sciatica due to herniated or protruded disc and with a Grade of Disc Degeneration from mild to moderate range.

CLINICAL RELEVANCE/APPLICATION

Our approach leads to relief in sciatica symptoms and obtains the best results in case of extrusions, protrusions and in presence of discal degenerative aspects from mild to moderate grade.

SSA13-06 Magnetic Resonance Guided Focused Ultrasound Surgery (MRgFUS) for Totally Non-Invasive Treatment of Osteoid Osteoma: A Prospective Development Study

Sunday, Nov. 29 11:35AM - 11:45AM Location: E451B

Participants
Maurizio Del Monte, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Gaia Cartocci, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Napoli, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Valeria De Soccio, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Fabrizio Boni, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate mid-to long-term efficacy of MRgFUS in the treatment of symptomatic osteoid osteomas

METHOD AND MATERIALS

This prospective study involved 29 consecutive patients with clinical and imaging diagnosis of Osteoid Osteoma; all patients underwent MRgFUS ablation (ExAblate, InSightec; 3T MR).Lesions located in vertebral body were excluded; prior RFA or surgery was not considered an exclusion criteria.Patients received therapy using MRgFUS, delivered toward the nidus, identified on MRI and/or CT. Primary endpoints were adverse events (serious and otherwise) and pain relief assessed using Quality of Life questionnaires in patients with bone pain (FACT-BP), Visual Analog Pain Score (VAS) and daily intake of Non-steroidal drugs (NSAIDs). Patient's follow-up, including clinical and imaging examinations, was established at 1, 12 and 24 months.As secondary endpoint, imaging examinations (CT and dynamic CE-MRI, Gd-BOPTA, Bracco) were used to evaluate inflammatory status after treatment and bone remodeling.

RESULTS

29 patients (4 female; 25 male; mean age 23,4 yo) were recruited for totally non-invasive MRgFUS treatment. The treatment was well tolerated by all patients and no adverse events were recorded. A mean number of 5.6 sonications with mean energy of 894 ± 209 J was necessary to complete the treatment. Complete clinical response was found in 27/29 patients. There was a significant (p=0.001) improvement in quality of life, according to FACT-BMP (mean values: 33.7 at baseline and 54.7 at follow-up;). A statistically significant difference (p=0.001) was noted between pre-and post-treatment VAS scores (8.4vs0.6,respectively). Imaging evaluation with CE-MRI demonstrated edema and hyperemia decrease in lesions associated with complete response. At CT, bone remodeling was evident in all complete responders (27/29 patients, 93%); in 15/29 (51%), nidus fading was demonstrated and in 10/29 (34%) restitutio-ad-integrum of bone abnormality was depicted

CONCLUSION

MRgFUS can be safely and effectively adopted for the treatment of Osteoid Osteoma.This application is totally non-invasive, carried out in a single session and with pain relief attainable since the very following day after treatment. Our results also indicated a positive trend to bone restoration especially in younger patients

CLINICAL RELEVANCE/APPLICATION

MRgFUS allows single session, totally non-invasive treatment of osteoid osteoma

SSA13-07 Minimally Invasive Screw Fixation of Fractures in the Cervical and Thoracic Spine: CT-controlled Pre-surgical Guidewire Implantation in Clinical Routine

Sunday, Nov. 29 11:45AM - 11:55AM Location: E451B

Participants
Sebastian Fischer, MD, Frankfurt, Germany (*Presenter*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Maximilian Kresing, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Ingo Marzi, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan Zangos, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin G. Mack, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Katrin Eichler, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Purpose of our retrospective study is to evaluate the feasibility and accuracy of minimally invasive, transpedicular screw placement in cervicothoracic fractures with the help of CT-controlled guidewires.

METHOD AND MATERIALS

293 guidewires were inserted in 35 patients (42.9 ± 21.2 years) under CT fluoroscopy (286 thoracic, 7 cervical). There were 28 traumatic cases, 3 pathologic fractures, 3 fractures due to infectious infiltrations and 1 osteoporotic fracture. In 151 pedicles the screwing was directly performed and controlled in the CT-room. CT-images were reviewed regarding accuracy and cortical violations using the popular 2 mm increment deviation classification by Gertzbein and Robbins.

RESULTS

The guidewire implantation resulted in 28 cortical contacts. Minor affections of the pedicle wall by the inserted screws occurred in 39.1% (59 of 151), respectively 23.8% if taking unavoidable encroachments into account (30 of 59). The width of the pedicular isthmus correlated to the number of cortical guidewire-contacts (r=-0.449; p=0.077) and pedicle violations (all graded "A") by the inserted screws (r=-0.581; p=0.049).Total procedural duration was 138.6 ± 44.2 min, representing 14.5 ± 11.6 min for each pedicle, while showing a significant negative correlation against the vertebral level [r=-0.849; p=0.0002] and the occurrence of pedicle violations (r=-0.641; p=0.027).

CONCLUSION

The treatment of vertebral fractures with a guidewire-based insertion technique for pedicle screws results in a very high accuracy and a low complication rate if performed under CT-imaging.

CLINICAL RELEVANCE/APPLICATION

Guidewires help in precise placement of cervical and thoracic screws for vertebral osteosynthesis. Special attention should be taken in the mid-thoracic levels due to a smaller width of the pedicle isthmus.

SSA13-08 Feasibility of CT Guided Needle Biopsy in Harvesting Chondrocytes for Autologous Chondroctye Implantation: An Initial Experience on Human Cadavers

Sunday, Nov. 29 11:55AM - 12:05PM Location: E451B

Participants
Nima Hafezi Nejad, MD, MPH, Baltimore, MD (*Presenter*) Nothing to Disclose

Shadpour Demehri, MD, Baltimore, MD (*Abstract Co-Author*) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation
Bashir Zikria, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the timing, accuracy and technical feasibility of CT guided chondrocyte retrieval from superior medial and lateral non weight-bearing margins of the trochlea.

METHOD AND MATERIALS

As an initial experience, 10 human knee cadavers were selected as samples. Osteosite bone biopsy needle (G13761 - Murphy M1M - 11G/10cm) was used for the purpose of chondrocyte retrieval. Two operators, one musculoskeletal radiologist and one orthopedic surgeon performed the chondrocyte retrieval procedures. Each performed one sampling from the medial and one sampling from the lateral margins of trochlea. In the first planning phase, operators selected the proper target for chondrocyte retrieval, in the CT examination. Time (seconds), accuracy (mm distance from the target) and needle readjustment attempts were recorded during chondrocyte retrieval.

RESULTS

All samplings resulted in eventual tissue retrieval. Samplings from the lateral margin were performed faster (Operator 1: 74 ± 34 sec vs. 106 ± 36 sec; P value: 0.056 - Operator 2: 72 ± 30 sec vs. 111 ± 35 sec; P value: 0.014) and more accurate (Target error: Operator 1: 1.32 ± 1.01 mm vs. 3.23 ± 1.72 mm; P value: 0.007 - Operator 2: 1.17 ± 0.57 mm vs. 2.81 ± 1.36 mm; P value: 0.040) than samplings from the medial margin. There was no significant difference in the mean number of needle adjustment rates (ranging from 1.50 ± 0.71 to 1.10 ± 0.74 readjustment attempts); neither between the operators, nor between lateral and medial margins.

CONCLUSION

This preliminary results supports the hypothesis that CT guided needle biopsy may be a feasible and accurate method for chondrocyte retrieval from non weight-bearing margins of the trochlea. Sampling from the lateral margin may be relatively advantageous in terms of procedure time and accuracy.

CLINICAL RELEVANCE/APPLICATION

Feasibility of CT-guided chondrocyte retrieval for autologous chondrocyte implantation may obviate one arthroscopic surgery; and therefore, reduce the cost, morbidity and complication.

SSA13-09 US and MRI Follow-up after Treatment of Supraspinatus Tendon Tendinopathy: PRP vs Needling

Sunday, Nov. 29 12:05PM - 12:15PM Location: E451B

Participants
Alice La Marra, MD, L'Aquila, Italy (*Presenter*) Nothing to Disclose
Francesco Arrigoni, Coppito, Italy (*Abstract Co-Author*) Nothing to Disclose
Silvia Mariani, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose
Simone Quarchioni, Laquila, Italy (*Abstract Co-Author*) Nothing to Disclose
Luigi Zugaro, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonio Barile, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Masciocchi, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the efficacy of infiltrative treatment with PRP versus needling, in patients with tendinosis of the supraspinatus tendon at level of its crescent area.

METHOD AND MATERIALS

We enrolled 40 patients (aged 40-60), with tendinosis of the supraspinatus tendon at its crescent area , evaluated through ultrasound-US and MRI exams ; we excluded patients with partial lesions.Twenty patients were submitted to PRP treatment (group 1); 20 patients were submitted to needling treatment (group 2).All patients , 6 months after treatment (T1) underwent US examinations and 1 year after treatment (T2) underwent US and MRI examinations.We considered some fundamental parameters: morphology of the tendon, echogenicity or signal intensity of its structures, presence or not of bursitis, evolution in partial or full tear. All patients were evaluated through VAS (Visual Analogic Scale) for pain and Constant scale for functionality

RESULTS

In group 1, at T1 the ultrasound exams showed disappearance of bursitis and recovery of tendon echogenicity in 15/20 patients; 5 patients had no changes . At T2, in 17/20 patients MRI and US showed morphological recovery; we observed non-substantive modifications in 2 patients and a worsening in 1 patient.85 % of the patients showed improvement in VAS and 77% in Constant values already at T1; the mean values were 70% at T2.In group 2, at T1, US showed disappearance of bursitis and recovery of tendon echogenicity in 8/20 patients; , 12 patients showed no changes.At T2 in 6/20 patients , MRI and US showed morphological recovery; 8 patients had no significant variations; 4 patients had worsening of tendinosis; 2 patients showed partial tears of the tendon.65 % of the patients showed improvement in VAS and 62% in Constant values at T1; the mean values were only 33% at T2.

CONCLUSION

Compared to needling, the PRP infiltrative treatment of tendinosis of the supraspinatus tendon showed major possibilities of recovery, with a slower evolution of tendinosis or tendon's tear.

CLINICAL RELEVANCE/APPLICATION

Both PRP and needling are effective minimally invasive treatments suitable for large range of patients.PRP resulted to be more effective with a lower rate of progression of the tendinosis or tendon tear

SSA14

ISP: Musculoskeletal (Bone Tumor)

Sunday, Nov. 29 10:45AM - 12:15PM Location: E451A

MK MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Craig W. Walker, MD, Omaha, NE (*Moderator*) Nothing to Disclose
Corrie M. Yablon, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SSA14-01 Musculoskeletal Keynote Speaker: Bone Tumor

Sunday, Nov. 29 10:45AM - 11:05AM Location: E451A

Participants
Mark J. Kransdorf, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

SSA14-03 Distinguishing Untreated Osteoblastic Metastases from Enostoses Using CT Density Measurements

Sunday, Nov. 29 11:05AM - 11:15AM Location: E451A

Participants
Adam C. Ulano, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Miriam A. Bredella, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Patrick J. Burke, MBBCh, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Ivan Chebib, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Frank J. Simeone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ambrose J. Huang, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Martin Torriani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Connie Y. Chang, MD, Boston, MA (*Presenter*) Nothing to Disclose

PURPOSE

Differentiating osteoblastic metastases from benign enostoses on CT can be challenging. The purpose of our study was to determine if CT density thresholds of osteoblastic bone lesions can be used to distinguish untreated osteoblastic metastases from benign enostoses.

METHOD AND MATERIALS

Our study was IRB approved and complied with HIPAA guidelines. The study group comprised 62 patients (mean age 62± 20 y, 35 f, 27m) with sclerotic bone lesions found on CT. Etiology of sclerotic lesions was assessed by biopsy (n=17) or clinical and imaging follow-up (n=45). None of the patients had prior treatment for metastases. CT density of all lesions was measured by a MSK and an abdominal imaging fellow. If multiple lesions were present, the largest lesion was evaluated. The average and maximum densities in Hounsfield Units (HU) were measured. ROC analysis was performed to determine sensitivity and specificity, area under the ROC (AUC), and confidence intervals (CI), as well as cutoff values of CT densities to differentiate metastases from enostoses. Interreader reproducibility was assessed using intraclass correlation coefficient (ICC) with 95% CI.

RESULTS

A total of 37 enostoses and 25 untreated osteoblastic metastases were evaluated (primary tumors: breast cancer n=12, prostate cancer n=11, ovarian cancer n=1, transitional cell carcinoma n=1). Mean and maximum CT densities of enostoses were 1190 HU and 1323 HU, respectively and of osteoblastic metastases were 654 HU and 787 HU, respectively. Using a cut-off of 885 HU for average density, the AUC was 0.982, sensitivity was 94.6%, and specificity was 96%. Using a cut-off of 1058 HU for maximum CT density, the AUC was 0.976, the sensitivity was 94.6%, and specificity was 96%. ICC for mean density was 0.987 for enostoses and metastases. ICC for maximum density was 0.814 for enostoses and 0.980 for metastases.

CONCLUSION

Density measurements using CT can be used to distinguish untreated osteoblastic metastases from enostoses.

CLINICAL RELEVANCE/APPLICATION

An average density of 885 HU and a maximum density of 1058 HU provide reliable thresholds below which a metastatic lesion is the favored diagnosis.

SSA14-04 Multiparametric Approach with Diffusion Weighted Imaging (DWI) and Dynamic Contrast Enhanced (DCE) Magnetic Resonance Imaging (MRI): A Comparison Study in Differentiation between Benign and Malignant Bone Lesions

Sunday, Nov. 29 11:15AM - 11:25AM Location: E451A

Participants
Young Cheol Yoon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eunsun Oh, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate and compare the diagnostic performance of quantitative parameters derived from DWI and DCE-MRI in differentiating

benign and malignant bone tumor

METHOD AND MATERIALS

This study obtained IRB approved . Fifty five patients (23 men, 32 women; 21-82 years; mean age of 55 years) underwent MRI prior to treatment. ADC values were calculated by using three DW images (b = 0, 400, and 1400). DCE-MRI data were analyzed yielding estimates of Ktrans (volume transfer constant), Ve (extravascular extracellular volume fraction) and Kep (rate constant) with population based arterial input function. Additionally, a ratio of Ktrans and ADC was calculated. Difference of each parameter between benign and malignant bone tumors were evaluated after adjusting age and sex. ROC curve analysis was done to calculate and compare sensitivity, specificity, accuracy, positive predictive value, negative predictive value, and AUC after determining the optimal cut-off value for each parameter. Odds ratio (ORs) with 95% confidence intervals of each parameter in diagnosing malignant bone tumor was calculated with logistic regression.

RESULTS

Fifty five lesions were pathologically proven benign (n =19), and malignant (n=36) bone tumor. All parameters except Ve were significantly different between benign and malignant bone tumors. The highest of AUC was seen in Ktrans, followed by Ktrans/ADC. With comparison of AUC of each parameter, Ktrans, Kep, and Ktrans/ADC showed significantly higher AUC than that of ADC. However, there were no significant difference among these three parameters. The parameters with best sensitivity and specificity were Ktrans/ADC, and Kep, respectively. The best parameters with positive predictive value and negative predictive value were Kep and Ktrans/ADC, respectively. The highest ORs was Ktrans/ADC, presenting 17.38 (P = .0013).

CONCLUSION

Quantitative parameters, Ktrans, Kep, ADC, and Ktrans/ADC, are good to differentiate benign and malignant bone tumor. Ktrans/ADC shows superior performance in differentiation of malignant and benign bone tumors, suggesting that the combination of parameters derived from perfusion and diffusion MRI may be much useful for differentiating benign and malignant bone tumor.

CLINICAL RELEVANCE/APPLICATION

Multiparametric approach for the differentiation of benign and malignant bone is feasible with DWI and DCE-MRI. A parameter combining both DWI and DCE-MRI may be much useful.

SSA14-05 Whole Body MRI Assessment of Bone Involvement in Prostate Cancer and Multiple Myeloma: Diagnostic Accuracy of Different Sequences

Sunday, Nov. 29 11:25AM - 11:35AM Location: E451A

Participants
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PURPOSE

To assess the diagnostic accuracy of the different sequences obtained in whole-body MRI (WB-MRI/DWI) in detecting bone involvement in patients with prostate cancer (PCa) and multiple myeloma (MM).

METHOD AND MATERIALS

Two musculoskeletal radiologists reviewed WB-MRI studies in 50 patients with PCa at high risk for metastasis and in 47 patients with suspicion of MM. WB-MRI examinations included anatomical coronal T1- and STIR-weighted sequences, and functional diffusion-weighted (DWI) sequences. The readers successively assessed individual sequences (T1, STIR, DWIBS), then pairs of sequences (T1/DWIBS, T1/STIR, STIR/DWIBS), and finally all sequences together (T1 / STIR / DWIBS) to detect bone involvement. The gold standard was established on the basis of a panel review of all sequences.

RESULTS

Inter-observer agreement was good to excellent with similar kappa in both groups (.71 to .96).In the 'PCa' group, the study demonstrated the superiority of T1-weighted (Se 100%, Sp 92%) and DWI (Se 97%, Sp 92%) sequences, and of the pair T1 / DWIBS (Se 100%, Sp 100%) for the detection of patients with bone involvement. Isolated reading of STIR sequences lacked accuracy (Se 91%, Sp 92%) for detecting bone metastases.In the "MM" group, the study demonstrated the insufficiency of individual sequences (Se 83-93%, Sp 70%) to detect bone involvement. The best diagnostic accuracy was achieved by the combined reading of all sequences T1 / STIR / DWIBS (Se 93%, Sp 88%).

CONCLUSION

To detect bone involvement, the combined reading of T1- and DWI-weighted sequences appears sufficient in PCa, whereas the combined reading of all sequences is necessary in MM.

CLINICAL RELEVANCE/APPLICATION

Diagnostic accuracy of the different sequences obtained in whole-body MRI (WB-MRI/DWI) are unknown.The combined reading of T1- and DWI-weighted sequences appears sufficient in PCa, whereas the combined reading of all sequences is necessary in MM.

SSA14-06 Correlation between Intravoxel Incoherent Motion Diffusion-weighted MR Imaging Parameters and Dynamic Contrast-enhanced MR Perfusion Parameters in Patients with Bone Metastasis from Non-small Cell Lung Cancer at 3.0 T

Sunday, Nov. 29 11:35AM - 11:45AM Location: E451A

Participants
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PURPOSE

To retrospective investigate whether intravoxel incoherent motion (IVIM) diffusion-weighted imaging (DWI) parameters correlate with dynamic contrast-enhanced (DCE) magnetic resonance imaging (MRI) perfusion parameters in patients with bone metastasis from non-small cell lung cancer (NSCLC) at 3.0 T.

METHOD AND MATERIALS

The institutional review board approved this retrospective study and informed consent was waived. Thirty-two patients (16 men, 16 women, mean age 61 years, range 46-89) with 37 treatment naive bone metastases from NSCLC underwent 3T MRI including IVIM DWI with nine b values (0-800 sec/mm2) and DCE-MRI. Following IVIM parameters including apparent diffusion coefficient (ADC), true diffusion coefficient (Dslow), peudodiffusion coefficient (Dfast), and perfusion fraction (f), DCE MRI perfusion parameters including volume transfer constant (Ktrans), rate constant (Kep), extravascular extracellular volume fraction (Ve), and initial area under the time-signal intensity curve at 60 seconds (iAUC) were calculated. The Spearman rank correlation was performed for statistical analysis.

RESULTS

Median Ktrans, Kep, Ve, and iAUC were 138 (107-213) 10-3/min, 506 (319-647) 10-3/min, 334 (236-513) 10-3, and 16 (11-27), respectively. Median ADC, Dslow, Dfast, and f were 973 (849-1198) μm2/sec, 898 (786-1128) μm2/sec, 274 (224-311) μm2/sec, and 98 (59-118), respectively. Ktrans demonstrated a significant inverse correlation with Dslow (r = - 0.405, P=.013). Kep revealed a significant inverse correlation with ADC and Dslow (r = - 0.370, P = .024; r = - 0.352, P = .033, respectively). There was a significant inverse correlation of iAUC with ADC and Dslow (r = - 0.434, P = .007; r = - 0.486, P = .002, respectively). However, there was no significant correlation between Ve and IVIM parameters.

CONCLUSION

Ktrans inversely correlates with Dslow, while Kep and iAUC inversely correlate with ADC and Dslow in patients with bone metastasis from NSCLC at 3.0 T.

CLINICAL RELEVANCE/APPLICATION

IVIM DWI could help assume tumor perfusion in bone metastasis from NSCLC, particularly when DCE MRI cannot be performed.

SSA14-07 Body Composition Predictors of Progression from MGUS to Multiple Myeloma

Sunday, Nov. 29 11:45AM - 11:55AM Location: E451A

Participants
Joyce Veld, BSc, Boston, MA (*Presenter*) Nothing to Disclose
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Andrew J. Yee, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Martin Torriani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Miriam A. Bredella, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recent studies have suggested that abdominal adiposity may be risk factor of progression from monoclonal gammopathy of undetermined significance (MGUS) to multiple myeloma (MM). The purpose of our study was to determine abdominal body composition parameters on PET/CT that may serve as predictors of progression of MGUS to MM. We hypothesized that patients with MM had higher abdominal adiposity and higher fat metabolic activity compared to subjects with MGUS.

METHOD AND MATERIALS

Our study was IRB approved and complied with HIPAA guidelines. The study group comprised 38 patients (mean age 63±12 y, 20 m, 18 f) with MGUS and 31 patients (mean age 61±11 y, 14 m,17 f) with recently diagnosed MM (mean time from diagnosis to PET/CT: 4.7±6.7 mo). All patients underwent whole body PET/CT. Total abdominal adipose tissue (TAT), abdominal subcutaneous adipose tissue (SAT) and visceral adipose tissue (VAT) cross sectional areas (CSA) (cm2) and metabolic activity (SUV) were assessed at the level of L4 on the unenhanced PET/CT. Date and type of therapy were recorded. None of the patients had active malignancy other than MM at the time of PET/CT. Variables were tested for normality of distribution using the Shapiro-Wilk test. Variables that were not normally distributed were log transformed. Groups were compared by ANOVA.

RESULTS

Results: Patients with recently diagnosed MM had higher TAT and SAT CSA (p=0.03 and p=0.04) and higher TAT and VAT metabolic activity (p<0.0001). Seventeen patients with MM had not undergone MM therapy prior to PET/CT. There were no differences in body composition between MM patients with or without treatment at time of PET/CT (p > 0.5).

CONCLUSION

Patients who were recently diagnosed with MM had higher TAT and SAT CSA and higher fat metabolic activity compared to patients with MGUS, suggesting that these parameters may be serve as novel biomarkers of disease progression in MM. Larger longitudinal studies are necessary to test this hypothesis.

CLINICAL RELEVANCE/APPLICATION

Abdominal adiposity and fat metabolic activity may serve as novel biomarkers for disease progression from MGUS to MM.

SSA14-08 Whole-Body MRI: Value in Chronic Recurrent Multifocal Osteomyelitis (CRMO) and Synovitis, Acne, Pustulosis, Hyperostosis, and Osteitis (SAPHO)

Sunday, Nov. 29 11:55AM - 12:05PM Location: E451A

Participants
Roxanne Giggens, MBBS, Oxford, United Kingdom (*Presenter*) Nothing to Disclose
Karen J. Partington, MBChB, MRCS, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CRMO and SAPHO are characterised by multifocal non-infective osteomyelitis. Lesions are often asymptomatic and therefore, if suspected, whole-body screening is useful to determine multifocality. We aim to evaluate the role of whole-body MRI in the diagnosis, exclusion, and follow-up of CRMO and SAPHO.

METHOD AND MATERIALS

We retrospectively reviewed 22 whole-body MRI examinations performed in 19 patients (12 females, 7 males; age range 10-54 years) for suspected, or known CRMO or SAPHO between May 2012 and February 2015. The protocol consisted of coronal T1-weighted and STIR sequences. The number and location of osseous lesions were evaluated and compared with previous radiological examinations.

RESULTS

14 scans were performed for suspected diagnosis of CRMO or SAPHO; 5/14 (36%) showed a single site of disease and 9/14 (64%) showed multifocal disease. In the multifocal group, 19 previously undetected lesions were visualised in 6/9 (67%) patients. MR findings were used to guide biopsy location in 5 patients.8 scans were performed to assess disease severity in patients with known multi-focal CRMO or SAPHO; 6/8 (75%) showed a change in disease burden compared to previous imaging, with 4 new or worsening lesions, and 12 lesions showing improvement or resolution.

CONCLUSION

Whole-body MRI can demonstrate multifocal disease, including asymptomatic lesions, in CRMO and SAPHO without exposure to ionising radiation. In our series we have shown that whole-body MRI is useful for establishing a diagnosis, visualising occult lesions, providing a baseline of disease distribution, guiding treatment and allowing follow-up to evaluate progression and resolution.

CLINICAL RELEVANCE/APPLICATION

In patients with suspected or confirmed CRMO or SAPHO, whole-body MRI is an ideal initial, and follow-up, diagnostic tool that does not involve ionising radiation.

SSA14-09 Assessment of Therapeutic Response in Ewing's Sarcoma Based on One-, Two-, and Three-dimensional Tumor Size Measurements

Sunday, Nov. 29 12:05PM - 12:15PM Location: E451A

Participants
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Heike E. Daldrup-Link, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The Children's Oncology Group (COG) established criteria to assess therapeutic response in Ewing sarcoma based on three-dimensional tumor size measurements. The purpose of our study was to compare COG criteria with one-dimensional Response Evaluation Criteria in Solid Tumors (RECIST) and two-dimensional tumor measurements defined by the World Health Organization (WHO) and to determine which method correlates best with clinical outcomes.

METHOD AND MATERIALS

Seventy-four patients (mean age of 14.5±6.5 years) with newly diagnosed Ewing sarcoma treated at three medical centers were evaluated. Primary tumor size was assessed on pre- and post-treatment Magnetic Resonance (MR) scans according to COG, RECIST, and WHO criteria. Effective tumor volume (Using OSIRIX software) served as the standard of reference. The agreement of each criterion with the standard of reference was assessed using Cohen kappa coefficient analysis. Tumor therapy responses based on changes in tumor length, area or volume, were compared with patient survival using the Log-rank test and Kaplan-Meier plots.

RESULTS

Based on Cohen's kappa coefficient, the agreement with the standard of reference was very good for COG (κ=0.89) while it was fair for RECIST (κ=0.39) and moderate for WHO (κ=0.55). COG criteria had significantly greater sensitivity to predict responders (92%) compared to RECIST (54%) and WHO (66%). Only COG demonstrated a significant difference in survival between responders and non-responders (p=0.003) compared to RECIST (p=0.41) and WHO (p=0.48).

CONCLUSION

Three-dimensional tumor measurements according to COG criteria are better predictors of therapeutic response of Ewing sarcoma than RECIST or WHO. These results could motivate more aggressive treatment for patients identified as non-responders by COG criteria.

CLINICAL RELEVANCE/APPLICATION

In clinical practice, a high sensitivity of response assessments is warranted in order to avoid ineffective therapies and stratify non-responders to other therapies at a time point when interventions can still impact prognosis. Our data in EFST showed that volumetric tumor measurements are substantially more sensitive for detection of tumor non-response than unidimensional measurements.

SSA16

Neuroradiology/Head and Neck (Temporal Bones)

Sunday, Nov. 29 10:45AM - 12:15PM Location: N226

HN NR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
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Amanda S. Corey, MD, Atlanta, GA (*Moderator*) Consultant, RadMD

Sub-Events

SSA16-01 Is Magnetic Resonance Tractography of Intraparotid Facial Nerve Useful in Patients with Malignant Tumors?

Sunday, Nov. 29 10:45AM - 10:55AM Location: N226

Participants
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PURPOSE

Parotidectomy with facial nerve (VIIn) sacrifice is often necessary in patients with malignant tumor. In all parotid masses, diagnosis of perineural spread is important as a prognosis biomarker since patients may have asymptomatic nerve invasion. Recently, the feasibility of intraparotid VIIn tractography was assessed to identify nerve contact with parotid tumors. The aim of this study was to determine if VIIn fractional anisotropy (FA) was linked to histologic grade in patients undergoing surgery for parotid tumors.

METHOD AND MATERIALS

Study ethics approval was obtained from our institutional review board (IRB 5891). Patients aged 18 or over, were including in this prospective study if they had:(a) A history of parotid tumors, requiring surgical management between December 2013 and April 2015(b) Undergone MR scans with diffusion acquisition and post-processing tractography(c) Surgical intraoperative checking of the intraparotid facial nervePatients underwent MR scans with VIIn tractography calculated with the constrained spherical deconvolution model. We performed scans on a 3T MRI Philips ACHIEVA® 3.0T TX with a 32 channel head coil. The post-processing steps were performed using MRtrix package software. The parameters of the diffusion sequence were: b-value of 1000 s/mm2, 32 directions, voxel size: 2 mm isotropic, scan time: 9'31".

RESULTS

Twenty patients (mean age: 53 years, 5 women) were enrolling in this study. The first group (n=10) referred with a benign tumor without facial nerve compression or invasion as checked by surgical team. The second group (n=10) referred with a malignant tumor and included three patients with clinical facial nerve palsy.The VIIn mean FA value was estimated as being 0.53±0.06 in patients with benign tumors and 0.37±0.08 in malignant tumor group. Mean FA value was significantly lower in the second group (t-test, $p \leq 0.05$) and was also reduced in patients free from clinical facial palsy with surgically evidence of VIIn perineural spread (n=3).

CONCLUSION

In these preliminary results, MRI using diffusion tractography was a promising procedure to assess parotid tumor histologic grade and potential perineural spread.

CLINICAL RELEVANCE/APPLICATION

A reliable imaging biomarker of histologic grade and perineural spread in cases with parotid tumors may help to better inform and manage patients.

SSA16-03 Additive Value of "Otosclerosis Weighted" Images for the Diagnosis of Fenestral Otosclerosis

Sunday, Nov. 29 11:05AM - 11:15AM Location: N226

Participants
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PURPOSE

CT is one of the main diagnostic tool for the detection of otosclerotic foci which are often identified as low density lesions in the

ante fenestral region. Bone densities can be measured in Hounsfield units by the accurate regions of interest (ROIs) setting. However, small ROI settings by less-experienced radiologists may result in false negative findings. Our purpose was to evaluate the diagnostic ability of our proposed method (otosclerosis weighted image) compared with conventional CT images alone.

METHOD AND MATERIALS

Temporal bone CT of consecutive patients with otosclerosis were retrospectively analyzed. The diagnosis of otosclerosis was confirmed during surgery in all cases. All CT images were obtained using a sixty-four-detector-row CT scanner with 0.5-mm collimation, 80 mm FOV, and a 512 × 512 matrix. "Otosclerosis weighted" images were obtained by extracting temporal bone region with threshold technique and reversing the density gradients (black to white). Two independent radiologists took part in two reading sessions. In the first session, the observers read only conventional CT images. In the second session they read "otosclerosis weighted" images along with the conventional CT images. Accuracy was assessed for the two readers (Chi-square test).

RESULTS

Thirty temporal bones of 25 patients with otosclerosis (M:F = 3:22, mean age: 53.9±9.0 years old) were included. For both observers, reading with "otosclerosis weighted" image was associated with higher sensitivity (66.7-76.7%) than with the conventional CT images alone (50-56.7%; $p<0.005$, each).

CONCLUSION

Application of our proposed method based on threshold value may help reduce misdiagnosis of fenestral otosclerosis.

CLINICAL RELEVANCE/APPLICATION

CT is one of the main diagnostic tool for the detection of otosclerotic foci which are often identified as low density lesions. Application of our method based on threshold value helps reduce misdiagnosis of fenestral otosclerosis.

SSA16-04 Preserved Cochlear T2 Signal is an Important Predictor for Hearing Preservation in Patients Treated for Vestibular Schwannoma

Sunday, Nov. 29 11:15AM - 11:25AM Location: N226

Participants
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Girish M. Fatterpekar, MBBS, New York, NY (*Abstract Co-Author*) Editor, Reed Elsevier

PURPOSE

Hearing preservation is a therapeutic goal for many patients with vestibular schwannoma (VS). We examined the relationship between pre-treatment MRI and post-treatment hearing status in an effort to define factors that may influence management.

METHOD AND MATERIALS

From September 2010 through January 2014, consecutive cases of VS treated with stereotactic radiosurgery (SRS) or microsurgery were reviewed. Preoperative MRIs were analyzed by two readers with respect to three dimensional tumor size, shape (round vs. oval), cochlear T2 signal, relationship of tumor to internal auditory canal (IAC), and presence of necrosis. Patients were excluded if they had prior treatment or no pre-treatment MRI within one year. "Serviceable" hearing was defined as speech discrimination score (SDS) ≥70% or AAO-HNS class A/B. Post-treatment hearing "preservation" was defined as maintenance or development of serviceable hearing after SRS or microsurgery using non-translabyrinthine approach. Bivariate statistics were calculated.

RESULTS

191 cases were reviewed; 68 patients met criteria for inclusion. A majority underwent SRS (69%), had tumors in the distal IAC (52%), oval shape (56%), without confluent necrosis (68%), and median volume of 0.95 mL. Of these patients, 55 and 30 had pre- and post-treatment audiometry, respectively; 56% and 67% had "serviceable" pretreatment hearing on SDS and AAO-HNS, respectively. People without serviceable pre-treatment hearing on SDS had significantly larger ($p=0.05$) and round ($p=0.02$) tumors. Reduced cochlear T2 signal trended towards worse hearing on AAO-HNS ($p=0.12$). Preserved cochlear T2 signal was the only variable significantly associated with post-treatment hearing preservation as measured by SDS or AAO-HNS in all tumors ($p<.001$ and $p=.01$, respectively) or SDS for those in the distal IAC ($p=02$). Interobserver agreement measuring cochlear T2 signal was 92%.

CONCLUSION

Preoperative MRI identified patients more likely to have better hearing outcomes, thus aiding clinicians in pretreatment counseling. Decreased cochlear T2 signal may indicate close association with the cochlear neurovascular bundle, influencing endolymph protein concentration and negatively influencing hearing outcome.

CLINICAL RELEVANCE/APPLICATION

Pre-treatment cochlear T2 signal is associated with hearing outcomes after treatment for vestibular schwannoma. Use of thin section MRI has the potential to better inform treatment decisions.

SSA16-05 Slip Interface Imaging: A Novel MR Elastography-Based Method to Predict Tumor-Brain Adhesion in Vestibular Schwannoma

Sunday, Nov. 29 11:25AM - 11:35AM Location: N226

Participants
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Kevin J. Glaser, Rochester, MN (*Abstract Co-Author*) Intellectual property, Magnetic Resonance Innovations, Inc; Stockholder, Resoundant, Inc
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John Huston III, MD, Rochester, MN (*Abstract Co-Author*) Stockholder, Resoundant, Inc

PURPOSE

To assess the clinical feasibility of MR slip interface imaging (SII) for predicting the degree of tumor-brain adhesion in vestibular schwannomas.

METHOD AND MATERIALS

With IRB approval and informed consent, nine patients with pathologically suspected and subsequently confirmed vestibular schwannomas were recruited. The SII acquisition is similar to MR elastography (MRE) in which low-amplitude mechanical vibration is applied to the head with a pillow-like device placed in the head coil and the resulting shear waves are imaged using a phase-contrast pulse sequence with motion encoding gradients synchronized with the applied vibration. Imaging was performed on a 3T MR system with an 8-channel head coil in a scan time of less than 7 minutes. The acquired shear motion data were processed with two different algorithms (shear line analysis and calculation of octahedral shear strain (OSS)) to identify the degree of tumor-brain adhesion. Blinded to the SII results, neurosurgeons qualitatively assessed tumor adhesion at the time of tumor resection as one of three patterns: no adhesion, partial adhesion, and complete adhesion. Correlations between SII and surgical findings were determined, and the ability to use OSS to quantify the tumor adhesion was tested using a Mann-Whitney U test with a statistical significance set at $p < 0.05$.

RESULTS

In SII, the presence of a non-adhesive tumor-brain interface appears as a dark line in the shear line images and exhibits higher OSS values than an adhesive interface. The absence of shear lines corresponded to complete tumor adhesion. Surgical results for the nine patients included 2 cases with complete adhesion, 3 with partial adhesion, and 4 with no adhesion. SII results were concordant with the intraoperative assessment of tumor adhesion in 8 cases (88.9%). One case was identified as having no adhesion with SII, but adhesions were found at surgery. The OSS values for the non-adhesive interfaces were significantly larger ($p=0.012$) than the adhesive interfaces.

CONCLUSION

Our results demonstrate that SII is a clinically feasible method to preoperatively predict the degree of tumor-brain adhesion in patients with vestibular schwannomas.

CLINICAL RELEVANCE/APPLICATION

The SII technique shows promise for allowing radiologists and neurosurgeons to preoperatively quantify the degree of intracranial tumor adhesion and predict potential complications of tumor resection.

SSA16-06 Endolymphatic Hydrops as an Imaging Biomarker: A Chronic Disease with Various Clinical Presentations

Sunday, Nov. 29 11:35AM - 11:45AM Location: N226

Participants
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PURPOSE

MRI seeking for endolymphatic hydrops (EH) was recently found as closely reflecting histopathologic findings in patients with Meniere's disease (MD). However, the lack of healthy subject data was problematic to precisely define the pathological condition. The aim of this study was to assess EH prevalence in a large cohort of patients with four clinical presentations: MD, sensorineural hearing loss (SHL), recurrent peripheral vestibulopathy (RPV) and recurrent benign paroxysmal positional vertigo (rBPPV) in comparison with healthy subjects. We also evaluated EH localization (i.e cochlear or vestibular) in each group.

METHOD AND MATERIALS

300 patients and 25 healthy subjects were recruited between January 2013 and May 2015.Patients were consecutively included in this study if they had:(a) A history of clinically define MD (n=100), RPV (n=100), SHL (n=50) or rBPPV (n=50)(b) Have undergone an MRI scan 4 hours after intravenous gadoteric acid injection using FLAIR imaging (TR: 8000 ms, TE: 316 ms, TI: 2400 ms) with subtraction process.Control subjects inclusion was approved by our institutional review board (IRB 6705/15-CHUG-02).Two radiologists performed blind, semi-quantitative evaluations of MRI scan. Cochlear EH have been noted as present if nodular or irregular dilatation of endolymphatic canal and VH recorded as present when more than 50% of the vestibule have been occupied by endolymphatic space. Patients were graded based on the number and localization of hydrops and results were analyzed using the Student's t-test.

RESULTS

In the control group, 3 healthy subjects were found with EH in either cochlea or vestibule with these criteria.EH prevalence was

approximately estimated as being 85%, 50%, 40% and 40% in MD, SHL, RPV and rBPPV groups respectively.The results showed a significantly higher average number of hydrops localizations in the MD group when compared to other groups (t-test, p<0.01).Cochlear EH was found in 36% and 38% of RPV and rBPPV patients. Vestibular EH was displayed in 20% of SHL patients.

CONCLUSION

MRI criteria for EH allowed to distinguish pathology from healthy condition. However, EH appeared as a chronic disease rather than directly responsible of patient symptoms.

CLINICAL RELEVANCE/APPLICATION

We aimed to better explain pathophysiology of inner ear disorders, allowing better patient information and adapted therapeutic strategies in patients with endolymphatic hydrops.

SSA16-07 Superiority of Heavily T2-weighted 3D-FLAIR Over Regular 3D-FLAIR for the Detection of Cochlear Lymph Fluid Signal Abnormality in Patients with Sudden Sensorineural Hearing Loss

Sunday, Nov. 29 11:45AM - 11:55AM Location: N226

Participants
Shinji Naganawa, MD, Nagoya, Japan (*Presenter*) Nothing to Disclose
Toshiaki Taoka, MD, PhD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Shingo Iwano, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Hisashi Kawai, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Michihiko Sone, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Mitsuru Ikeda, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the signal increase of cochlear lymph fluid on 3D-FLAIR in patients with sudden sensorineural hearing loss (SNHL) between the regular contrast 3D-FLAIR (FL) and heavily T2-weighted 3D-FLAIR (HF).

METHOD AND MATERIALS

25 patients with unilateral sudden SNHL and 8 healthy volunteers were included. Patients were divided into mild group of 9 patients, average hearing level of 60 dB or less; and severe group of 16 patients, hearing level of more than 60dB. All patients and healthy volunteers underwent a MR cisternography (MRC) for anatomical reference of the fluid space, FL and HF at 3T. Region of interest (ROI) was manually drawn on mid-modiolar section of MRC around cochlea. ROI for noise was drawn in the air area. ROIs were copied onto FL and HF. Contrast-to-noise ratio (CNR) between affected and non-affected ear was measured in patients' group and CNR between right and left ear was measured in control group. Differences in CNR on FL and HF among 3 groups were tested by one-way analysis of variance (ANOVA).

RESULTS

There was a statistically significant difference in the mean of CNR on HF among the three groups ($p < 0.001$). Further, from the pairwise comparisons among them, there was a statistically significant difference with each other in the mean of CNR on HF ($p < 0.05$). There was no statistically significant difference in the mean of CNR on FL among the three groups ($p = 0.074$).

CONCLUSION

HF is more sensitive to signal alteration of cochlea with sudden SNHL than FL.

CLINICAL RELEVANCE/APPLICATION

Heavily T2-weighted 3D-FLAIR (HF) is more sensitive to high signal of cochlea in the ears with sudden sensorineural hearing loss (SNHL) than regular contrast 3D-FLAIR (FL) .

SSA16-08 Three-Dimensional Fluid-Attenuated Inversion Recovery Signal Changes as a Prognosis Predictor in Idiopathic Sudden Sensorineural Hearing Loss

Sunday, Nov. 29 11:55AM - 12:05PM Location: N226

Participants
Sheng-Che Hung, MD, Taipei, Taiwan (*Presenter*) Nothing to Disclose
Wen-Huei Liao, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Hsiu-Mei Wu, MD, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Jiing-Feng Lirng, MD, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the relationship of 3D FLAIR findings and outcome in patients with idiopathic sudden sensorineural hearing loss (ISSNHL).

METHOD AND MATERIALS

We retrospectively reviewed consecutive 66 patients presenting with unilateral ISSNHL from June 2013 to September 2014. Before treatment, all patients underwent MRI exams, including 3D-FIESTA, and 3D-FLAIR without gadolinium enhancement. One blind observer registered 3D-FIESTA and 3D-FLAIR on a dedicated workstation and drew ROIs to measure the signal intensity of cochlea in both affected and unaffected ears on 3D-FLAIR.

RESULTS

The ratio of the cochlear signals between the affected and unaffected ears showed significant correlation with the severity of pre-treatment hearing loss and the clinical outcome (Siegel criteria) after treatment. The increased FLAIR signal intensity is a specific prognostic predictor of poorer outcome (Siegel grade III/IV) after treatment. (sens./spec: 32%/86% (cutoff value: 1.2) and 5%/91% (cutoff value, 1.4)).

CONCLUSION

This study demonstrated a correlation between cochlear FLAIR signal and pre-treatment hearing level, and post-treatment outcome. Increased FLAIR signal is a specific prognostic predictor of poorer outcome after treatment.

CLINICAL RELEVANCE/APPLICATION

The causes of sudden deafness now are still idiopathic. In general, labyrinthitis caused by viral infection, blood circulation disorders, or ruptures of the inner ear membrane are believed to cause sudden deafness. The unpredictability of idiopathic sudden sensorineural hearing loss (ISSNHL) presents a challenge to preventive care. Prognosis can be predicted that the patients poor post-treatment outcome from the high intensity signal inner ear of 3D FLAIR sequence on MRI.

SSA16-09 Flat Panel CT in Diagnosis of Superior Canal Dehiscence. A Really New Diagnostic Approach?

Sunday, Nov. 29 12:05PM - 12:15PM Location: N226

Participants
Christina Loberg, MD, Aachen, Germany (*Presenter*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Bruners, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Justus Ilgner, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Westhofen, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Superior canal dehiscence (SCDS) is a rare defect, caused by a thinning or complete absence of temporal bone overlying superior semicircular canal of vestibular system. Treatment of choice is covering the defect with ceramic implant. Flat panel CT is an innovative tecnique that permits visualization of the complex anatomy of temporal bone with high spatial resolution. The utility of flat panel CT has been demonstrated in multiple disease states including neurovascular disease, peripheral vascular disorders and oncology.We therefore evaluated flat panel CT in diagnosis of SCDS.

METHOD AND MATERIALS

30 patients (m = 18/ f = 12) age 36 - 63 (m= 48,2) with symptoms of SCDS underwent flat panel CT examination between January 2013 and January 2015. 13 patient underwent MSCT imaging before, these images were assessed as normal. Flat panel CT was performed by Siemens Axion Artis, rotation 220°. Postprocessing was done at Siemens leonardo workstation with reconstructions in bone window in 3D projection and adapted to superior semicircular canal. Applied Radiation dose inbetween flat panel CT and MSCT was compared.

RESULTS

In 5/ 17(29%) patients who underwent flat panel CT imaging SCDS was confirmed. In 6/ 13 (46%) patients who underwent MSCT and flat panel CT defect of temporal bone overlying superior semicircular canal was found and SCDS was intraoperatively confirmed. Applied radiation dose was nearly equal (flat panel CT 276, 5mGy/ cm / MSCT 277,4mGy/ cm).

CONCLUSION

Flat panel CT should be performed in cases with symptoms SCDS when MSCT is assessed normal. It is a reliable diagnostic tool and a new diagnostic approach in diagnosis of SCDS.

CLINICAL RELEVANCE/APPLICATION

Flat panel imaging is a reliable tool in imaging temporal bone and inner ear structures and can improve preoperative virtual planning.

SSA17

Neuroradiology/Head and Neck (Vascular Disease of the Head and Neck)

Sunday, Nov. 29 10:45AM - 12:15PM Location: N227

HN NR VA MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Mahmud Mossa-Basha, MD, Seattle, WA (*Moderator*) Research support, General Electric Company

Sub-Events

SSA17-01 The CTA Rim Sign: Calcification Pattern Predicts Carotid Intraplaque Hemorrhage

Sunday, Nov. 29 10:45AM - 10:55AM Location: N227

Participants
Laura B. Eisenmenger, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Joseph S. McNally, MD, PhD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Carotid intraplaque hemorrhage (IPH) is associated with a high risk of future stroke. The gold standard for IPH detection is MRI with heavily T1-weighted sequences. This study was undertaken to determine essential CTA imaging predictors of carotid IPH.

METHOD AND MATERIALS

In this IRB-approved retrospective cross sectional study, 172 patients (244 carotid arteries) were studied having undergone carotid disease workup with both MRA and CTA from 2009-present. IPH was detected with the Magnetization Prepared Rapid Acquisition Gradient-recalled Echo (MPRAGE) sequence. CTA predictors included the presence or absence of calcification, type of calcification (rim, adventitial or bulky), percent diameter stenosis, mm stenosis, maximum plaque thickness, ulceration, and intraluminal thrombus. Clinical covariates included age, male sex, diabetes, hypertension, hyperlipidemia and body mass index. Cardiovascular medication confounders included antihypertension, antiplatelet, anticoagulation and statin medication classes. A mixed effects multivariable Poisson regression model was used accounting for 2 vessels per patient. A backwards-elimination method was used to determine the final model, in which prevalence ratios were reported and all remaining predictors had a p<.10. ROC analysis was used to determine discriminatory power measured by area under the curve (AUC).

RESULTS

The final model for carotid IPH prediction included the rim sign (prevalence ratio, PR=8.6, p<.001, 95%CI: 4.0,18.5) and maximum plaque thickness (PR=1.2, p=.001, 95%CI: 1.1,1.4). In the final model, no other imaging criteria were significant predictors of IPH. The discriminatory value of the final model was extremely high (AUC=93.9%), significantly higher than the rim sign alone (86.1%, p<.001), thickness alone (85.2%, p<.001), NASCET stenosis (78.4%, p<.001), mm stenosis (77.7%, p<.001) or ulceration (71.0%, p<.001).

CONCLUSION

The carotid CTA rim sign is highly predictive of carotid IPH.

CLINICAL RELEVANCE/APPLICATION

Because most patients undergoing acute stroke workup receive lumen imaging with CTA, MRI is often not performed and IPH is ignored. The CTA rim sign and maximum plaque thickness allow high discrimination of carotid IPH. Future prospective studies may be envisioned to determine if the rim sign indicates a higher future stroke risk.

SSA17-02 Clinical Risk Prediction Models for the Identification of Patients with High-Risk Carotid Plaque

Sunday, Nov. 29 10:55AM - 11:05AM Location: N227

Participants
Navneet Singh, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Alan R. Moody, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Kush Kapur, PhD,MENG, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

High-risk carotid plaque containing intraplaque hemorrhage predicts stroke, however, it is not yet routinely screened for in practice. We aimed to develop cross-validated clinical models to identify patients at risk of high-risk carotid plaque.

METHOD AND MATERIALS

Between 2003 and 2014, 1862 suspected neurovascular disease patients had MRI. High-risk carotid plaque was defined by presence of intraplaque hemorrhage on 3D T1w GRE black-blood MRI, a sequence routinely included in our institutional neurovascular MRI protocol. Using derivation and validation cohorts with 931 patients each, two risk-prediction logistic regression models considering 11 risk factors, with and without inclusion of stenosis grade, were developed. Receiver-operator characteristic curves were used to compare discriminatory ability of these two models.

RESULTS

The overall prevalence of high-risk carotid plaque was 19.3% (359/1862). Patients with high-risk carotid plaque could be identified

using age, sex, hypercholesterolemia, and peripheral vascular disease (AUC 0.781, 95% CI 0.747 to 0.815). Optimal threshold sensitivity and specificity was 81.8% and 62.4%, respectively. The addition of carotid stenosis grade improved discrimination of patients (AUC 0.826, 95% CI 0.795 to 0.856), and improved optimal threshold specificity to 72.8% without a significant change in sensitivity.

CONCLUSION

Patients prone to high-risk carotid plaque, containing intraplaque hemorrhage, may be identified using a simple clinical risk prediction model of cardiovasacular risk-factors and carotid stenosis grade.

CLINICAL RELEVANCE/APPLICATION

The model provides an opportunity for targeted carotid MRI screening in patients not already undergoing neurovascular MRI, but external validation studies are required.

SSA17-03 Identification of the Vulnerable Carotid Plaque Using Dynamic Contrast Enhanced Ultrasound

Sunday, Nov. 29 11:05AM - 11:15AM Location: N227

Participants
Brahman Dharmarajah, MBBS, MRCS, London, United Kingdom (*Presenter*) Nothing to Disclose
Michalakis A. Averkiou, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Damianos Christofides, MSc, Nicosia, Cyprus (*Abstract Co-Author*) Nothing to Disclose
Ankur Thapar, MBBS, MRCS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Alun Davies, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Edward Leen, MD, FRCR, London, United Kingdom (*Abstract Co-Author*) Equipment support, Koninklijke Philips NV Equipment support, General Electric Company Equipment support, SuperSonic Imagine Research Consultant, General Electric Company Speakers Bureau, Bracco Group Speakers Bureau, Koninklijke Philips NV Speakers Bureau, AngioDynamics, Inc Speakers Bureau, General Electric Company

PURPOSE

Carotid atherosclerosis is implicated in 15-20% of all strokes. Dynamic contrast enhanced ultrasound (DCEUS) is a simple adjunct to color Doppler ultrasound for the assessment of carotid atherosclerosis. It has been identified that DCEUS can demonstrate perfusion within carotid plaques of greater than 50% stenosis with some differentiation observed between symptomatic and asymptomatic patients. In this study the perfusion of carotid plaques is evaluated both qualitatively and quantitatively to evaluate carotid perfusion of symptomatic and asymptomatic patients.

METHOD AND MATERIALS

After ethical approval, the carotid arteries of 24 patients were imaged using the L9-3 probe of the Philips iU22 ultrasound platform. Patients were injected with a bolus of 2ml of Sonovue with subsequent dynamic phase imaging acquisitionOffline blinded analysis was performed using DICOM data transferred to QLAB commercial analysis software. Qualitative perfusion assessment used binary grading: 0 represented less than 50% of carotid plaque area contained moving microbubbles and 1 represented more than 50% of carotid plaque area contained moving microbubbles. Static refelectors were not considered as valid microbubble signal.For quantitative DCEUS analysis, a region-of-interest (ROI) was drawn around the plaque. Plaques were delineated from the lumen signal to remove potentially large amplitude differences between the plaque and lumen signal intensity. A time intentisity curve (TIC) was derived from the dynamic phase ROI signal with mean plaque intensity signal calculated from the TIC.

RESULTS

The qualitative analysis results showed that 75% (9/12) of asymptomatic patients had >50% carotid plaque perfusion in comparison to only 33% (4/12) of symptomatic patients. After quantitative image analysis, the mean DCEUS intensity signal from the TIC of the carotid plaques was again significantly higher for asymptomatic patients than symptomatic patients ($P<0.05$).

CONCLUSION

Contrary to previous studies, this study suggests that patients with greater carotid plaque perfusion are more likely to have an asymptomatic carotid symptom status where as those with reduced perfusion are more likely to be symptomatic from their carotid disease.

CLINICAL RELEVANCE/APPLICATION

In patients with greater than 50% carotid stenosis, reduced plaque perfusion on DCEUS may represent vulnerable, symptomatic carotid atherosclerosis.

SSA17-05 Advanced Atherosclerotic Disease with Intraplaque Hemorrhage is Present in Non-Stenotic Carotid Arteries of Diabetic Patients

Sunday, Nov. 29 11:25AM - 11:35AM Location: N227

Participants
Tishan Maraj, Toronto, ON (*Presenter*) Nothing to Disclose
Alan R. Moody, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Navneet Singh, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Tina Binesh Marvasti, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Mariam Afshin, PhD,MENG, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Pascal N. Tyrrell, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
David Jenkins, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Diabetic patients have an increased risk of ischemic cerebrovascular events with worse outcomes than the non-diabetic population. Carotid artery stenosis currently stratifies patient risk but, even without significant stenosis, intraplaque hemorrhage (IPH) may predict cerebrovascular events. We report the prevalence of IPH in an asymptomatic diabetic population without carotid artery stenosis, using 3-dimensional (3D) magnetic resonance imaging (MRI) and investigate its association with carotid artery wall

volume.

METHOD AND MATERIALS

Patients were recruited from a prospective dietary trial between 2010 and 2013, with a carotid intima-media thickness (IMT) > 1.2mm and non-stenotic carotid arteries on ultrasound. All were asymptomatic type 2 diabetic patients who underwent baseline 3D T1-weighted black blood imaging for visualization of intraplaque hemorrhage (3D-MRIPH) and 3D- time of flight imaging. Carotid artery vessel wall (VW) volumes and IPH volumes were determined bilaterally for a standard 32 mm segment centered at each carotid bifurcation, using a validated approach with the software, VesselMASS (Medis, Netherlands). Descriptive statistics as well as repeated measures linear regression analyses were performed.

RESULTS

159 patients were included with mean age 63.1 + 7.9 years, 62.3% male, 17.9% with a smoking history and 69.2% on hypertensive medication. The prevalence of IPH was 23.3% (n=37) with five patients exhibiting IPH in both carotid arteries. VW volume of the IPH positive carotid arteries was found to be significantly different from IPH negative arteries (β=0.15mm3 SE=0.03, p<0.01) and independent from other factors that affected VW volume - age (β=0.01yrs SE=0.002, p<0.01), sex (β=0.21 SE=0.04, p<0.01), BMI (β=0.22 SE=0.10, p=0.03) - when adjusted (none significant) for disease duration, smoking, blood pressure, and medications (statins, anti-hypertensive, anti-platelet).

CONCLUSION

IPH can be found in the absence of carotid artery stenosis in asymptomatic diabetic patients and is associated with an increased carotid artery wall volume as measured by 3D-MRI. It represents a biomarker of advanced atherosclerotic disease and may identify individuals at higher risk of cardiovascular disease.

CLINICAL RELEVANCE/APPLICATION

3D MRI can identify high risk cardiovascular biomarkers, such as intraplaque hemorrhage, in diabetic patients before onset of stenosis.

SSA17-06 Feasibility of High-resolution MR Imaging for the Diagnosis of Posterior Inferior Cerebellar Artery Dissection

Sunday, Nov. 29 11:35AM - 11:45AM Location: N227

Participants
Miran Han, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Wook Choi, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sun Yong Kim, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Soo Lee, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yoolim Baek, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the feasibility of HR-MR imaging diagnosing posterior inferior cerebellar artery (PICA) dissection and to find most useful imaging findings suggesting dissection

METHOD AND MATERIALS

We retrospectively reviewed 104 patients suspected of having arterial dissection involving posterior cerebral circulation and underwent HR-MR imaging between March 2012 and March 2015. 66 patients were diagnosed with arterial dissection involving posterior cerebral circulation and 16 patients among them (24.2%) were diagnosed with isolated PICA dissection by the consensus among neuroradiologists, neurointerventionist and neurologist after reviewing all clinical and paraclinical investigations available at hospital discharge (initial CT, MR, DSA images and etiologic work-ups) and follow up. Two neuroradiologists independently reviewed the HR-MR images of patients finally diagnosed as PICA dissection and looked for evidence of dissection (mural hematoma, dissection flap, outer diameter enlargement on T2WI) on each sequence of HR-MRI (PDWI, T2WI, T1WI and CE-T1WI). Inter- and intraobserver agreement for detecting evidence of dissection was estimated using the Cohen's kappa coefficient.

RESULTS

Dissection flaps were seen in all cases on T2WI (100%) and secondly detected on CE-T1WI (81.3%). Outer-diameter enlargement of the steno-occlusive lesions on angiography was detected in most of cases (81.3%). A mural hematoma was best detected on CE-T1WI (50.0%). The two reviewers showed substantial to almost perfect agreement for detecting dissection signs on every sequence (Cohen's kappa coefficient: 0.63 ~0.94)

CONCLUSION

HR-MR imaging could be a useful and non-invasive diagnostic tool for PICA dissection and dissection flap with outer wall enlargement on T2WI is most confident sign for suggesting dissection.

CLINICAL RELEVANCE/APPLICATION

HR-MR imaging can demonstrate direct findings of dissection and be non-invasive useful diagnostic tool for the diagnosis of posterior inferior cerebellar artery dissection

SSA17-07 Corrrelation of Carotid Plaque Features with Acute Cerebral Infarction in Type 2 Diabetic Patients - A Magnetic Resonance Imaging Study

Sunday, Nov. 29 11:45AM - 11:55AM Location: N227

Participants
Beibei Sun, Shanghai, China (*Presenter*) Nothing to Disclose
Huilin Zhao, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Xiaosheng Liu, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Ye Cao, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

Jianrong Xu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study was to investigate the association between carotid atherosclerotic plaque characteristics and the severity of acute cerebral infarct (ACI) in symptomatic patients with T2DM.

METHOD AND MATERIALS

We studied 204 arteries in 102 stoke patients by carotid and brain MRI. ACI volume was determined from symptomatic internal carotid artery territory on diffusion-weighted imaging (DWI).The symptomatic carotid plaque burden and compositional characteristics between stroke patients with T2DM and without T2DM were compared by using independents sample t-test and nonparametric Wilcoxon signed rank test after analyzed with MR vessel imaging. Pearson correlation test was applied to determine the correlations between volume of ACIs and carotid features in T2DM patients, then univatiate and multivariate linear regressions were applied to assess the independent associations of carotid characteristics with severity of ACIs.

RESULTS

Out of 104 enrolled stroke patients, 44(42%) had T2DM. They were distinguished as atherosclerotic plaque based on carotid artery with presence of any plaque component on MRI, such as calcification, LRNC, or IPH. The occurrence rate of carotid artery plaque was higher in diabetics vs non-diabetics (76.1% vs 52.6%, p=0.001). Compared with patients without T2DM, the T2DM subjects showed significantly higher prevalence of LRNC (70.5% vs 48.3%, P=0.038) as well as a larger volume of LRNC (76.82±114.31 mm3 vs 35.91±73.79mm3, P=0.042). Among these stroke patients, ACIs size of T2DM subjects in internal carotid artery (ICA) territory (7.75±11.49mm3 vs 3.77±6.33mm3, P=0.042) are greater than that of non-T2DM subjects. In addition, The LRNC volume had superior correlation (r=0.77, p<0.001) with the infarction volume of ipsilateral ICA territory, outperforming the other parameters in T2DM patients. Univariate and multivariate linear regression analysis showed close correlation of LRNC volume and MWT with the severity of ACI (B= 0.15, P<0.01 and B=4.99, P<0.05, respectively).

CONCLUSION

LRNC prevalence and volume of carotid plaques are significantly different between stroke patients with T2DM and without T2DM. In addition, LRNC volume and MWT are independently associated with cerebral infarction as measured by DWI.

CLINICAL RELEVANCE/APPLICATION

Our findings indicate that characterizing atherosclerotic plaque by MR vessel wall imaging might be useful for stratification of plaque risk and infarction severity in T2DM patients.

SSA17-08 Early Atherosclerotic Disease Detected by MRI and CT in the Carotid and Coronary Arteries in Low-moderate Risk Individuals

Sunday, Nov. 29 11:55AM - 12:05PM Location: N227

Participants
Mariana Selwaness, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Veit Sandfort, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Robyn McClelland, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Karen Rodriguez, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Evrim B. Turkbey, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Anna E. Zavodni, MD, MPH, Hamilton, ON (*Abstract Co-Author*) Nothing to Disclose
Puskar Pattanayak, MBBS, FRCR, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Marissa Mallek, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Mark A. Ahlman, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Sibley, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
David A. Bluemke, MD, PhD, Bethesda, MD (*Presenter*) Research support, Siemens AG

PURPOSE

We examined the relationship between positive remodeling in the carotid and coronary arteries and investigated determinants of remodeling in a population with low-moderate risk of cardiovascular disease.

METHOD AND MATERIALS

Study subjects >55 years old with history of hypercholesterolemia underwent high resolution black blood carotid MRI using dedicated surface coils at 3T. In addition, CT angiography was performed using 320 slice scanning. Arterial wall area (outer vessel area-lumen) and the remodelling index (RI) (wall area/outer vessel area) were measured by observers blinded to clinical status. Data were analyzed using Spearman's correlation coefficient and multivariate linear regression analysis adjusted for sex, age, height and weight.

RESULTS

In 201 individuals (mean age 65.3±6.5, 64% men) with a low-moderate risk (Framingham Risk Score 7.8±7.6%), we found a strong association between wall area and outer vessel area in both the carotid (r=0.80;p<0.001, adjusted beta 1.67 [95%CI 1.43-1.92]) as well as the coronary arteries (r=0.82;p<0.001, adjusted beta 1.48 [95%CI 1.24-1.72]). This association was stronger when we compared the third tertile of lumen area to the first tertile, indicating more outward remodeling. The RI of the right and left carotid artery in a study subject was strongly correlated (r=0.75, p<0.001), whereas intra-individual RI between carotid and coronary disease was weak (r=0.20, p<0.001). In multivariate analysis, hypercholesterolemia, height and CAC score were associated with the RI of the coronary arteries.

CONCLUSION

This study is the first to combine MRI and CT imaging to investigate positive remodeling in the carotid and coronary arteries of low-moderate risk individuals from the general population. Early atherosclerosis was associated with positive remodeling with larger diameter in the coronary and carotid arteries. Positive remodeling was not the same for different vascular beds.

CLINICAL RELEVANCE/APPLICATION

Detection of positive remodeling and understanding its role in early atherosclerotic disease could improve prevention strategies and management of stroke and coronary heart disease.

SSA17-09 Characterization of Restenosis after Carotid Endarterectomy Using Contrast-Enhanced Black Blood MRI

Sunday, Nov. 29 12:05PM - 12:15PM Location: N227

Participants
Huan Yang, Baltimore, MD (*Presenter*) Nothing to Disclose
Ye Qiao, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Li Liu, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Gunes Orman, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Zeeshan Anwar, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Jarunee Intrapiromkul, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Hugh Trout III, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Bruce A. Wasserman, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To characterize restenosis after carotid endarterectomy (CEA) using high-resolution contrast-enhanced black blood MRI (CEMRI) and compare with primary atherosclerotic lesions.

METHOD AND MATERIALS

17 consecutive patients (10 male; mean age 73.4±11.9 years) with carotid restenosis (13 unilateral; 4 bilateral) after CEA underwent CEMRI at 3T. The median interval between surgery and CEMRI was 16.5 months (IQR, 9.3-95.5 months). Patients were matched with 20 asymptomatic patients with primary carotid atherosclerosis (19 unilateral; 1 bilateral) by age and luminal stenosis. All MRI images were de-identified and interpreted by two readers who were blinded to the history of CEA. The presence of plaque and plaque components was recorded for each lesion based on previous criteria on CEMRI. The lesions were classified as plaques or intimal hyperplasia based on the presence/absence of plaque features on CEMRI. The MRI morphological measurements included wall thickness (WT), area, normalized wall index and eccentricity (maximum WT- minimum WT)/maximum WT), and the signal measurements included heterogeneity (defined by coefficient of variation of signal intensity) and contrast-enhancement (%CE, the percent change in signal intensity from the pre- to post-contrast images).

RESULTS

A total of 42 carotid lesions from 37 patients were analyzed, and classified as primary plaques (n=21), recurrent plaques (n=13) and intimal hyperplasia lesions (n=8). Compared with plaques (both primary and recurrent), lesions with intimal hyperplasia exhibited smaller eccentricity (0.48 vs. 0.74, $p<0.001$), lower signal heterogeneity (20.0% vs. 27.2%, $p=0.004$) and higher % CE (88.4% vs 43.9%, $p=0.002$). Recurrent plaques had similar MRI characteristics when compared with primary plaques. However, recurrent lesions demonstrated higher CE (57.5% vs 35.4%, $p=0.046$) and more frequently involved in the medial wall of the internal carotid artery, an uncommon location for a plaque formation (recurrent vs. primary; 38.5% vs 4.8%, $p<0.001$).

CONCLUSION

Carotid restenosis from intimal hyperplasia demonstrated distinct imaging characteristics on CEMRI compared with atherosclerotic lesions.

CLINICAL RELEVANCE/APPLICATION

The phenotype of the restenotic lesions after CEA imposes different stroke risks. CEMRI imaging allows for the differentiation of these lesions and may provide insight into the treatment of restenosis.

SSA18

Neuroradiology (New Techniques in Brain Tumor Imaging)

Sunday, Nov. 29 10:45AM - 12:15PM Location: N229

NR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Eu-Meng Law, MBBS, Los Angeles, CA (*Moderator*) Speakers Bureau, Toshiba Corporation; Medical Advisory Board, Bayer AG; Medical Advisory Board, Bracco Group; Medical Advisory Board, FUJIFILM Holdings Corporation;
Rivka R. Colen, MD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSA18-01 Electrical Conductivity Characteristics of Glioma and Potential Usefulness of Noninvasive Electrical Conductivity Measurement in Evaluation of Glioma

Sunday, Nov. 29 10:45AM - 10:55AM Location: N229

Participants
Khin K. Tha, MBBS,PhD, Sapporo, Japan (*Presenter*) Nothing to Disclose
Ulrich Katscher, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Christian Stehning, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Shigeru Yamaguchi, MD,PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Shunsuke Terasaka, MD,PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroki Shirato, MD, PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Direct electrical conductivity measurements to identify tumor location, before the era of CT and MRI, had documented difference in electrical conductivity values of tumors from normal brain parenchyma and among tumor types. Recent advances in MRI have allowed noninvasive measurement of electrical conductivity values. This study aimed to noninvasively determine the electrical conductivity characteristics of glioma and evaluate potential usefulness of noninvasive electrical conductivity measurement in glioma evaluation.

RESULTS

The contrast-enhanced tumor component of grade III gliomas had higher mean and mode of electrical conductivity histograms than the non-contrast-enhanced tumor component and normal-appearing brain parenchyma ($P<0.017$). The non-contrast-enhanced tumor component of grade II gliomas had higher mean electrical conductivity than the normal brain parenchyma ($P=0.012$). Mode of electrical conductivity histograms for both components of grade IV tumors were higher than grade III tumors ($P<0.017$).

CONCLUSION

The electrical conductivity characteristics of glioma were determined noninvasively by MRI. Electrical conductivity difference of gliomas from the normal brain parenchyma and between tumor grades suggests potential usefulness of noninvasive electrical conductivity measurements.

CLINICAL RELEVANCE/APPLICATION

Information about tissue electrical conductivity can be obtained noninvasively by MRI; and this information can be beneficial in distinguishing gliomas.

SSA18-02 Symptomatic Seizures in Primary Glioblastoma: A Radiogenomic Approach towards a Possible Prognostic Factor

Sunday, Nov. 29 10:55AM - 11:05AM Location: N229

Participants
Vera C. Keil, MD, Bonn, Germany (*Presenter*) Nothing to Disclose
Tunc F. Ersoy, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Dariusch R. Hadizadeh Kharrazi, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans H. Schild, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Simon, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In patients with primary glioblastoma (pGB), tumor-induced seizures (TIS) are a common symptom and are possibly a positive prognostic factor for progression free and overall survival (PFS, OS). Explanations of the pathogenesis of TIS range from tumor location and pressure effects to neurochemical particularities based on the genetic profile of the tumor. This study evaluates if TIS in pGB can be correlated with imaging or genetic aspects of the lesion.

METHOD AND MATERIALS

Retrospective analysis of pre-operative 3 T MRI brain scans (Achieva TX; Philips Healthcare) of 64 pGB patients (29 with TIS; 35 without seizures). Analysis criteria: gender, age, PFS and OS, genetic profile (TERT mutation/rs2853669 polymorphism, MGMT promotor status), midline shift, subventricular pGB growth, bilaterality, multifocality as well as multiple volume ratios. Volumetry of contrast-enhancing (vital) tumor (CER), central necrosis (CN) and peri-focal FLAIR hyperintensities was based on 3D contrast-enhanced T1w, T2w and FLAIRw maps. MRI were analyzed with post-processing software (Philips Intellispace) by three readers

independently. Statistic analyses were performed with SPSS 22.0 with TIS as the independent variable.

RESULTS

OS was significantly longer in pGB patients with TIS (p=0.004). There was a tendency for longer PFS in this group (p=0.08; mean 13.3 vs. 8.3 months). In pGB patients with TIS, total tumor volume was significantly smaller (p=0.017; 50.3 v. 29.4 cm^3) and the tumor was significantly more often found in the subventricular zone, yet surprisingly not in the hippocampal area. TIS was not associated with any of the tested genetic markers known to be associated with longer OS and PS.

CONCLUSION

TIS in pGB patients could significantly be correlated with distinct imaging aspects of the tumor (size and location) as well as with longer OS and PFS. Commonly analyzed genetic markers for OS and PFS (MGMT, hTERT) were yet not associated with TIS.

CLINICAL RELEVANCE/APPLICATION

While TIS proved a prognostic factor for OS and PFS, this is not correlated with MGMT and hTERT status in pGB, but TIS does correlate with distinct imaging aspects on MRI. Whether TIS lead to earlier diagnoses of pGB and hence longer OS/PFS due to smaller tumor volume remains an intricate question to solve.

SSA18-03 Investigation into the Effect of Diagnostic Ultrasound and Microbubble on the Blood-Brain Tumor Barrier Permeability of C6 Glioma

Sunday, Nov. 29 11:05AM - 11:15AM Location: N229

Participants
Jinlong Zhang, PhD, Chongqing, China (*Presenter*) Nothing to Disclose
Weiguo Zhang, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the effect of microbubble-enhanced diagnostic ultrasound (MEUS) on the blood-brain tumor barrier permeability and the possible mechanism.

METHOD AND MATERIALS

C6 Glioma-bearing Sprague-Dawley rats were assigned to 3 separate groups; the microbubble-enhanced continued diagnostic ultrasound group (CMEUS), the microbubble-enhanced intermittent diagnostic ultrasound group (IMEUS) and the control group. Rats were insonicated through skull with low-frequency diagnostic ultrasound and injected with Evans Blue (EB) dye and microbubbles through their tail veins to test changes in capillary permeability. Confocal laser scanning microscopy was used to observe the deposition of red fluorescence-dyed EB in tumor tissues. HE staining and MRI SWI were used to evaluate whether MEUS can damage normal brain tissue. The distribution and expressing levels of JAM-1 and calcium-activated potassium channels (Kca channels) was detected by western blot and immunohistochemical.

RESULTS

In the MEUS groups, EB exudation exhibited a significant increase in the tumor tissue compared with the control group. While the IMEUS group had more EB exudation than the CMEUS group. LSCM showed that a bright red fluorescence of EB was extensively distributed in the tumor interstitium. Western blot and immunohistochemical recealed MEUS significantly increased Kca channel protein expression and reduced JAM-1 expression in glioma tissue. And this changes were more obvious in the IMEUS group than the CMEUS group.

CONCLUSION

MEUS could effectively increase blood-brain tumor barrier permeability without causing damage to normal nerve tissue. The mechanism might be up-regulation of KCa channels expression in glioma tissue and affecting the formation of tight junction in blood-brain tumor barrier by reduction of JAM-1 expression. These findings might provide some new guidance to find a therapeutic option to site-specific open the BTB and deliver anti-cancer agents to glioma.

CLINICAL RELEVANCE/APPLICATION

These findings might provide some new guidance to find a therapeutic option to site-specific open the BTB and deliver anti-cancer agents to glioma.

SSA18-04 Improved Clinical DCE-MRI Pipeline for High Resolution, Whole Brain Imaging: Application to Brain Tumor Patients

Sunday, Nov. 29 11:15AM - 11:25AM Location: N229

Participants
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Yinghua Zhu, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
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Mark S. Shiroishi, MD, Los Angeles, CA (*Abstract Co-Author*) Consultant, Guerbet SA; Research Grant, Toshiba Corporation;
Eu-Meng Law, MBBS, Los Angeles, CA (*Abstract Co-Author*) Speakers Bureau, Toshiba Corporation; Medical Advisory Board, Bayer AG; Medical Advisory Board, Bracco Group; Medical Advisory Board, FUJIFILM Holdings Corporation;

PURPOSE

To develop novel DCE-MRI acquisition, reconstruction, and processing approaches that are targeted towards providing complete clinical assessment of brain tumors

METHOD AND MATERIALS

A clinical prospective evaluation of a novel sparse sampling and constrained reconstruction scheme to enable whole brain DCE-MRI imaging (22x22x20 cm3 coverage at spatial resolution of 0.9x0.9x1.9mm3) is demonstrated. Our approach uses multiple sparsity constraints in the spatial and temporal domain, which are spatial wavelet, spatial total variation and temporal finite difference, all with low weights, to mitigate potential bias from any one constraint. We compare with a current clinical scan (Rate 2 SENSE: 22x22x4.2cm3 at spatial resolution of 0.9x1.3x7mm3) on 15 brain tumor (BT) patients. PK parameters (Ktrans, vp) were derived, and image quality scores (4 point Likert scale) from two experienced neuroradiologists were used to evaluate the anatomic images and PK maps. We also propose two novel constraints that leverage knowledge from the PK model, to improve the above constraints, and obtain reduced dependence on free parameters; these are evaluated in a retrospective undersampling study of 10 BT patients.

RESULTS

We obtained higher image quality scores with our experimental scan compared to the clinical scan. The combined radiologists scores for each of the time-resolved, post-contrast, Ktrans images, respectively for the accelerated and clinical scans were 1.2+ 0.6 v/s 2.2+ 0.7 ($p<0.001$). Fig1 demonstrates two examples of improved volume coverage in imaging a patient with a 6cm glioblastoma multiforme tumor, and a patient with 14 metastatic lesions spread throughout the brain. In the retrospective study, the novel PK derived constraints achieved improved PK parameter map depiction at acceleration rates greater than 20; (not shown)

CONCLUSION

A novel high resolution whole brain DCE-MRI method using constrained reconstruction that is clinically feasible is demonstrated; which constituted a substantial 36 fold improvement in resolution and coverage compared to current clinical scans

CLINICAL RELEVANCE/APPLICATION

The combined use of modern sparse sampling, and constrained reconstruction techniques enables whole brain isotropic resolution DCE-MRI which greatly improves the clinical value of DCE-MRI in characterizing brain tumors (eg. guaranteed imaging of large tumors, multiple small lesions, assessment of anti-angiogenic therapies for brain tumors).

SSA18-05 Two-dimensional Localized Correlated Spectroscopy (2D L-COSY) at 7T for Detection of 2-hydroxyglutarate in Gliomas with IDH Mutations

Sunday, Nov. 29 11:25AM - 11:35AM Location: N229

Participants
Gaurav Verma, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose
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Steven Brem, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
MacLean Nasrallah, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
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Lisa M. Desiderio, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Harish Poptani, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Rajakumar Nagarajan, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Mutations in the isocitrate dehydrogenase (IDH) 1 and 2 genes in oligodendroglioma, astrocytoma and secondary glioblastoma are associated with better prognosis. Previous magentic resonance spectroscopy (MRS) studies have suggested the oncometabolite 2-hydroxyglutarate (2HG) as a potential biomarker for these mutant gliomas. Two-dimensional localized correlated spectroscopy (2D L-COSY) has demonstrated unambiguous and reliable measurement of several brain metabolites, including 2HG. Spectroscopy at ultra-high fields affords proportionally higher signal quality and spectral separation resulting in improved sensitivity and specificity. In this study we demonstrate the utility of 2D L-COSY for detection of 2HG in human gliomas.

METHOD AND MATERIALS

Seven brain tumor patients with prior magnetic resonance imaging/spectroscopy (MRI/MRS) scans at 3T were studied using 2D L-COSY on a 7T whole-body scanner with a 32-channel transmit/receive head coil. Scan parameters were as follows: TE = 20 ms, TR = 2 s, 8 averages, 64 $\Delta t1$ increments of 0.4 ms, 2048 t2 points with F2 bandwidth = 4000 Hz and F1 bandwidth = 2500 Hz, scan time 17 min. Voxels were localized using T2-weighted fluid-attenuated inversion recovery (FLAIR) imaging and ranged from 11-15 ml. L-COSY data were reconstructed offline using a custom MATLAB-based post-processing algorithm and quantified through peak volume integration. IDH1/2 mutation status was subsequently determined with pathology.

RESULTS

2D L-COSY detected 2HG peaks in two of the seven patients. A third patient was prospectively declared inconclusive due to artifact ridging in the region where 2HG would be expected. Pathology results confirmed IDH1 mutation in these three patients and the absence of mutation in the remaining four. 2D L-COSY further demonstrated the unambiguous separation of other metabolites including choline-containing metabolites like phosphocholine (PC) and glycerophosphocholine (GPC) and separation of lactate (Lac) from background lipid signal.

CONCLUSION

This study using 2D L-COSY represents the unambiguous detection of 2HG in vivo at 7T, which could serve as an biomarker for malignant progression in brain tumors.

CLINICAL RELEVANCE/APPLICATION

Pre-surgical detection of 2HG could alter treatment strategies as both an early marker for malignant progression and as an endpoint for targeted therapy (AGIOS 121 drug) against IDH1 mutation.

SSA18-06 Amide Proton Transfer and Magnetization Transfer Imaging of Primary CNS Lymphomas and High-grade Gliomas: Differential Diagnostic Performance and Comparison with Nuclear-Cytoplasm Ratios

Sunday, Nov. 29 11:35AM - 11:45AM Location: N229

Participants
Shanshan Jiang, MSc, Guang Zhou, China (*Presenter*) Nothing to Disclose
Jinyuan Zhou, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Xianlong Wang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Hao Yu, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yufa Li, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhibo Wen, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To show the ability of using the novel amide proton transfer-weighted (APTW, sensitive to mobile proteins, such as those in the cytoplasm), as well as conventional magnetization transfer (MT, sensitive to semi-solid macromolecules) MRI signals as imaging biomarkers to differentiate primary CNS lymphomas (PCNSLs) from high grade gliomas (HGGs), and evaluate the correlations between APTW and MT imaging signals and nuclear-cytoplasm (N/C) ratios.

METHOD AND MATERIALS

Eleven patients with lymphomas and 21 patients with HGGs were studied. MT spectra over an offset range of ±6 ppm (eight acquisitions at ± 3.5 ppm to increase the signal-to-noise ratio) and the conventional MT ratio (MTR) at 15.6 ppm (2 kHz) were acquired. The multiple APTW signals and MTR signal were obtained and compared between PCNSLs and HGGs. The diagnostic performance was assessed with the receiver-operating-characteristic (ROC) analysis. Image analysis software (Image-Pro Plus) was applied to calculating N/C ratios on HandE sections.

RESULTS

The PCNSLs usually showed more homogeneous APTW hyperintensity (spatially compared to the normal brain tissue) than the HGGs. The maximum APTW signal (APTWmax) and APTW signal inhomogeneity (APTWmax-min = APTWmax - APTWmin) within a lesion were significantly lower ($P < 0.05$ and 0.001, resp.), while the MTR signal was significantly higher ($P < 0.01$) in PCNSL lesions than in HGG lesions. APTWmax-min had the highest area under the ROC (0.963) and accuracy (94.1%) in differentiating PCNSLs from HGGs. There were significantly larger N/C ratios in PCNSLs (1.69 ± 0.72) than in HGGs (0.55 ± 0.21; $P < 0.01$), consistent with the APTW and MTR measurements. There was a strong, significantly negative correlation between APTWmax and N/C ratio ($R = 0.576$, $P < 0.01$), and there was a moderate positive correlation between MTR and N/C ratio ($R = 0.326$, $P < 0.084$).

CONCLUSION

The endogenous protein-based APTW signal would be a valuable MRI biomarker that can to provide an additional value to identify PCNSLs and HGGs presurgically.

CLINICAL RELEVANCE/APPLICATION

The addition of APT imaging to the currently used MRI protocol (including the conventional and advanced MRI sequences) would enhance the differential diagnostic accuracy of MRI between PCNSLs and HGGs ultimately.

SSA18-07 Computer Extracted Texture Descriptors from Different Tissue Compartments within the Tumor Habitat on Treatment-naïve MRI Predict Clinical Survival in Glioblastoma Patients

Sunday, Nov. 29 11:45AM - 11:55AM Location: N229

Participants
Pallavi Tiwari, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose
Jay B. Patel, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
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Prateek Prasanna, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Anant Madabhushi, MS, Piscataway, NJ (*Abstract Co-Author*) Research partner, Siemens AG Research partner, General Electric Company Research partner, F. Hoffmann-La Roche Ltd Founder and President, IbRiS, Inc

PURPOSE

Glioblastoma Multiforme (GBM) is a highly aggressive and heterogeneous brain tumor. Currently all GBM patients are given "one-dose-fit-all" treatment. Identification of prognostic markers can allow for personalized therapy options for GBM. The underlying hypothesis of this study is that the heterogeneity in GBM (due to subtle variations in tumor enhancement, cellular density, fibrosis, necrosis that are not visually appreciable on volumetric analysis of MRI) is prognostic and can be captured using computerized texture descriptors extracted from within different tumor compartments (enhancing tumor, necrotic core, edema). These compartments together define tumor "habitat", and computerized texture features from within the habitat can be predictive of short-term (STS) (overall survival (OS) <6-months) from long-term survival (LTS) (OS>24-months).

METHOD AND MATERIALS

A total of 62 3 Tesla MRI studies (27 STS, 35 LTS) with Gd-T1C, FLAIR, and T2w protocols were obtained from the TCIA repository. Enhancing tumor, and necrotic regions on Gd-T1 and edematous region jointly on T2-w and FLAIR, were manually segmented by an expert using Slicer 3D. 135 2-D texture descriptors on a per-voxel basis (e.g. co-occurrence matrices, gray-level dependence matrices, Gabor), and volumetric measurements were extracted from each oftumor, necrosis, edema compartments on every MRI protocol. Feature selection was used to identify most discriminative features with a random forest classifier trained via 3-fold cross validation. Kaplan-Meier (KM) curves were used for survival analysis, with correction for multiple hypothesis testing to identify features that were significantly ($p<0.05$) correlated with survival.

RESULTS

Contributions from top 18 texture features within the tumor habitat, (from edema, necrotic core, enhanced tumor), when analyzed together, were most significantly associated with survival, across Gd-T1-C ($p=0.003$), FLAIR ($p=0.006$), and T2-w ($p=0.02$) as compared to individual features, and volumetric measurements from the tumor habitat.

CONCLUSION

Computerized texture features when jointly interrogated across compartments within the tumor habitat appear more prognostic of clinical survival in GBM than features from enhancing tumor and tumor volume alone.

CLINICAL RELEVANCE/APPLICATION

Identifying MRI differences in survival characteristics for patients with long term and short-term survival can allow for designing personalized therapeutic decisions for GBM.

SSA18-08 Using Pre-Operative Dynamic Contrast-Enhanced MRI to Evaluate Tissue Factor Expression: A Potential Role in Prediction of Glioma Malignancy

Sunday, Nov. 29 11:55AM - 12:05PM Location: N229

Participants
Tian Xie, Chongqing, China (*Presenter*) Nothing to Disclose
Xiao Chen, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose
Wei Xue, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose
Weiguo Zhang, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To correlate dynamic contrast-enhanced MRI (DCE-MRI) parameters with tissue factor (TF) expression for assessing glioma malignancy

METHOD AND MATERIALS

Thirty-two patients with histopathologically diagnosed supratentorial glioma received DCE-MRI. Extended Tofts linear model based parameters(Ktrans, Kep, Ve, Vp) were obtained, which were analyzed by hot-spot and whole tumor cross-sectional method, as well as histogram. Four serial paraffin sections were stained with TF, CD105, CD34 and α-SMA, respectively. Percentage area of TF was calculated at 200 × magnification. Microvascular parameters were caldulated at 100 x mgnification, including microvascular density (MVD), microvascular area (MVA), proliferating capillary index (PCI), and microvessel pericyte coverage index (MCI), Pearson correlation was performed between TF and multiple microvascular indexes, DCE-MRI parameters.

RESULTS

TF was associated with glioma grade and significantly correlated with proliferating capillary index (PCI), microvascular pericyte coverage index (MPI) ($r=0.798$, $p<.001$; $r=0.835$, $p<.001$) and also showed moderate correlation with microvascular area (MVA) and microvessels density (MVD). volume transfer constant from plasma to tissue (Ktrans) hot-spot value best correlated with TF ($r=0.886$, $p<.001$), followed by 90th percentile Ktrans value ($r=0.801$, $p<.001$). Moreover, histogram analysis of Ktrans value demonstrated that weak TF expression was associated with less heterogeneous and positively skewed distribution.

CONCLUSION

Correlation of TF with microvascular indexes indicated that TF tightly linked with glioma malignancy. And Ktrans parameters provided reliable estimation of TF expression in glioma patients.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI could pre-operatively evalute tissue factor expression, thus it can be utilized for assessing glioma malignancy, particularly on neovascularization, like vascular endothrlium proliferation and pericytes coverage

SSA18-09 Chemical Shift Imaging (CSI) for Detection of 2-Hydroxyglutarate (2HG) in Human Gliomas at 3T

Sunday, Nov. 29 12:05PM - 12:15PM Location: N229

Participants
Gaurav Verma, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Harish Poptani, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
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Steven Brem, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Suyash Mohan, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, ACR Image Metrix; Investigator, Rad Dx

PURPOSE

The "oncometabolite" 2-hydroxyglutarate (2HG) has been shown to be an ideal biomarker for detection of isocitrate dehydrogenase (IDH) mutated gliomas. The presence of IDH mutation may be an early genetic marker of malignant transformation in gliomas and non-invasive detection of 2HG may aid in better treatment planning of these tumors. Chemical Shift Imaging (CSI) at 3T has been proposed for detection of 2HG and this study was performed to prospectively detect 2HG in tumors suspected of gliomas on imaging.

METHOD AND MATERIALS

Five patients were studied on a 3T scanner with a 12-channel receive head coil. Scan parameters were: TE=97 ms, TR=1.7s, NEX=3 with weighted phase-encoding, 1024 complex points, bandwidth=2000 Hz, 16x16 matrix, scan time 7 min. Voxels were localized using FLAIR or contrast enhanced images and were each 1 x 1 x 3 cm3. CSI data were reconstructed offline and quantified using the LCModel prior-knowledge based fitting program. A Cramer-Rao lower bound (CRLB) of 40% was used along with the criteria that multiple neighboring voxels show presence of 2HG. IDH1/2 mutation status was subsequently determined on pathology.

RESULTS

2HG resonance was detected in three patients who were later found to be: low grade (WHO Grade II, n=2) and high grade (WHO Grade III, n=1). The remaining two patients did not show a 2HG peak and were found to be: WHO grade IV, n=1; metastases, n=1. Presence of mutant IDH mutation was subsequently confirmed on pathology in all three patients where 2HG was detected while the

remaining two patients were IDH mutation negative.

CONCLUSION

LCModel fitting of CSI data successfully detected 2HG, confirming previous studies. This study further confirms the role of 2HG as a marker for malignant transformation indicating that IDH positive low grade gliomas where 2HG is detected should be treated more aggressively and can be ideal candidates for IDH targeted therapies.

CLINICAL RELEVANCE/APPLICATION

In vivo 2HG detection has significant translational implications: Early biomarker of malignant progression, treatment response and recurrence Endpoint for therapy (AGIOS 121 drug) targeted against IDH1

SSA21

Physics (Image Processing/Analysis I)

Sunday, Nov. 29 10:45AM - 12:15PM Location: S405AB

BQ CT MR PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Kenneth R. Hoffmann, PhD, Buffalo, NY (*Moderator*) Vice President, Imagination Software Corporation; Stockholder, Imagination Software Corporation; Officer, Imagination Software Corporation ;
Robert M. Nishikawa, PhD, Pittsburgh, PA (*Moderator*) Royalties, Hologic, Inc;

Sub-Events

SSA21-01 Mapping the Brain by a New Multiparametric Quantitative MRI Method

Sunday, Nov. 29 10:45AM - 10:55AM Location: S405AB

Participants
Giuseppe Palma, PhD, Naples, Italy (*Presenter*) Nothing to Disclose
Enrico Tedeschi, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Pasquale Borrelli, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Sirio Cocozza, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Carmela Russo, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonietta Canna, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Marco Comerci, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Bruno Alfano, PhD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Marcello Mancini, MD, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose

Background

Multi-parametric quantitative MRI (qMRI) has long been an active field of research, with several approaches aiming to estimate a subset of R1, R2, R2*, proton density (PD) and magnetic susceptibility (QSM) maps of the tissues. We used a set of Steady-State sequences, acquired with variable flip angles (FAs) and different phase coherence, to derive, in a fully analytical way, quantitative volumetric R1, R2, R2*, PD and QSM maps.

Evaluation

Two dual-echo fully flow-compensated (FC) FLASH and one phase-cycled balanced Steady-State Free-Precession (bSSFP) sequences were acquired at different FAs with very low sensitivity to blood or Cerebrospinal Fluid (CSF) flow. The full brain of each volunteer was scanned in a total acquisition time of 14 minutes with a voxel size of 0.6 mm3. The datasets were processed to remove banding artifacts and used to invert voxelwise the relaxometry equations in the FOV.

Discussion

Unlike most existing approaches, the maps obtained by our method entirely rely on widely available 3D sequences, thus overcoming usual 2D resolution constraints, and are not affected by intra-voxel biases arising from imperfect 2D radio frequency-pulse profiles, which in turn cause different isochromat evolutions in response to different effective FAs. Moreover, unlike other 3D schemes based on unbalanced SSFP, our method does not suffer from high sensitivity to flow of relatively long T2 fluids (as CSF), thus being apt to image other body districts. Also, several issues of the DESPO methods are solved. In particular, the B1± inhomogeneity dependence can be either removed by providing a measured B1 field map, if an ad hoc protocol is available on the scanner, or largely compensated for by the proposed information theory approach. Furthermore, a judicious use of the Bloch equations for the acquired MR signals proved useful to skip the acquisition of the high-FA bSSFPs required by DESPOT2, thus limiting the acquisition time and avoiding at once SAR issues and CSF pulsation artifacts.

Conclusion

Our method allows for the quantitation of 5 independent parameters and gets rid of the sensitivity to B0 inhomogeneity by means of a fully analytical solution, thus also speeding up the computation step.

SSA21-02 Hybrid Exact Maximum Likelihood Estimation (HE-ML) Algorithm for Accurate qMRI Over the Full T2 Biological Spectrum with Only Two Echoes

Sunday, Nov. 29 10:55AM - 11:05AM Location: S405AB

Participants
Hernan Jara, PhD, Belmont, MA (*Presenter*) Patent holder, qMRI algorithms Research Grant, General Electric Company Royalties, World Scientific Publishing Co
Stephan W. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Osamu Sakai, MD, PhD, Boston, MA (*Abstract Co-Author*) Speaker, Bracco Group; Speaker, Eisai Co, Ltd; Consultant, Guerbet SA

Background

To develop a T2 qMRI mapping algorithm for the DE-TSE pulse sequence that is accurate over the full T2 biological range. To create a T2 mapping program that combines the exact dual echo T2 formula and the methods of maximum likelihood (ML) estimation for estimating long T2 values.The dual echo turbo spin echo (DE-TSE) pulse sequence is consistently being adopted for routine clinical use and for research protocols: it is fast, efficient, highly resilient to susceptibility artifacts, and diffusion insensitive. It also has qMRI applications for mapping T2 and the proton density (PD). The main limitation in terms of qMRI is that only two echoes are

available for T2 mapping, thus limiting the accuracy range of T2 estimation. The purpose of this work was to develop a T2 qMRI mapping algorithm for the DE-TSE pulse sequence that is accurate over the full T2 biological range, from soft tissues to pure cerebrospinal fluid (CSF). Specifically, to create a T2 mapping program that combines the exact dual echo T2 formula as well as the methods of maximum likelihood (ML) estimation for estimating long T2 values. ML estimators are optimal in the sense that the variance of the estimates reaches asymptotically the greatest lower bound of the variance.

Evaluation

HE-MLE algorithm was programed in Mathcad using the formulation of Bonny el al. (MRM 1996; 36(2):287-293.) and used to process the images of a phantom and the head images of a volunteer. The T2 values were compared to those obtained with a single slice multi spin echo (mSE) sequence. The phantom T2 obtained with both techniques are graphed in Fig. 1a: linear correlation analysis reveals strong linear relationship (R2=0.9988) with a slope of 0.975.

Discussion

DE-TSE is available from all major MRI manufacturers and efficiently produces excellent PD- and T2-weighted images with high anatomic coverage in less than four minutes.

Conclusion

The developed hybrid exact maximum likelihood T2 qMRI algorithm produces accurate measurements over the full T2 biological spectrum and could extend the usefulness of the DE-TSE pulse sequence in clinical and research applications.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Hernan Jara, PhD - 2014 Honored Educator
Osamu Sakai, MD, PhD - 2013 Honored Educator
Osamu Sakai, MD, PhD - 2014 Honored Educator
Osamu Sakai, MD, PhD - 2015 Honored Educator

SSA21-03 Prognostic Value of Quantitative MRI Biomarkers for Treatment Response Assessment of Multiple Myeloma

Sunday, Nov. 29 11:05AM - 11:15AM Location: S405AB

Participants
Chuan Zhou, PhD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Qian Dong, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Heang-Ping Chan, PhD, Ann Arbor, MI (*Abstract Co-Author*) Institutional research collaboration, General Electric Company
Daniel R. Couriel, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Attaphol Pawarode, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Jun Wei, PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Lubomir M. Hadjiiski, PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We are investigating a radiomics approach to treatment response assessment of multiple myeloma (MM) using MRI. This study assessed the value of our developed MRI biomarkers as prognostic factors in patients with MM after autologous bone marrow transplant (BMT).

METHOD AND MATERIALS

With IRB approval, 63 pairs of spine MRI scans performed pre- and post-BMT (3-6 months) and clinical tests (< ± 7 days of post-MRI) were collected retrospectively from 63 MM patients. A 3D dynamic intensity entropy transformation (DIET) method was developed to transform MR T1-weighted signal voxel by voxel to a quantitative entropy enhancement value (qEEV), from which two MR image biomarkers, the mean difference in qEEV between the pre- and post-BMT MR scans over the vertebras (m-qEEV) and the percentage of vertebras with an increased qEEV in the post-BMT scan (p-qEEV), were derived for each patient to estimate progression-free survival. The values of age, gender, and the clinical test outcomes including M-protein in serum and urine, ratio of free light chain (FLC), % plasma cell (PC), beta-2-microglobulin and immunoglobulin levels were also assessed. Univariate analysis was performed with the Kaplan-Meier method and log-rank test, and multivariate analysis was performed with the Cox proportional hazards regress model, with respect to the time to progression (TTP) censored at 3 years.

RESULTS

The univariate analysis showed that the patients with optimal cutoff points of m-qEEV < - 0.1 and p-qEEV < 10% determined by the maximally selected rank statistics had significantly shorter TTP ($P = 0.047$ and $P < 0.001$, respectively). The age (<60), gender and all individual clinical tests in their normal ranges did not significantly predict longer TTP, except normal FLC ($P = 0.040$) and PC ($P = 0.022$). The multivariate analysis showed that the best predictive factor for TTP was p-qEEV ($P < 0.018$; hazard ratio (HR) 31.2). Other factors such as m-qEEV ($P = 0.276$; HR=5.6), FLC($P = 0.510$; HR = 1.4) and PC ($P < 0.217$; HR = 1.2) did not provide significant predictive value for TTP.

CONCLUSION

The study demonstrated the feasibility of using the quantitative MRI biomarker (p-qEEV) as prognostic predictor for patients with MM after BMT.

CLINICAL RELEVANCE/APPLICATION

MR-based radiomic biomarker with prognostic significance may improve the accuracy for staging and assessing treatment response for MM, allowing clinicians to optimize therapy for individual patients.

SSA21-04 Validation of a Quantitative Masking Index for Digital Mammography

Sunday, Nov. 29 11:15AM - 11:25AM Location: S405AB

Participants
James G. Mainprize, PhD, Toronto, ON (*Presenter*) Institutional research agreement, General Electric Company
Olivier Alonzo-Proulx, Toronto, ON (*Abstract Co-Author*) Institutional research agreement, General Electric Company
Martin J. Yaffe, PhD, Toronto, ON (*Abstract Co-Author*) Research collaboration, General Electric Company Founder, Matakina International Ltd Shareholder, Matakina International Ltd Co-founder, Mammographic Physics Inc

PURPOSE

Mammography has reduced sensitivity for detecting cancer in dense breasts, for which superposition of shadows of normal structures can "mask" the presence of cancer either by a loss of contrast or by the distracting complexity of the surrounding parenchymal structures. We have developed a quantitative measure of masking by evaluating the signal-to-noise ratio (SNR) of a localized model observer.

METHOD AND MATERIALS

On a grid of sub-regions (ROIs), the parenchymal texture was quantified by extracting the inverse power-law exponent, β, from the noise power spectrum (NPS). The localized detection task SNR, d_L, for a simulated 5 mm diameter lesion was estimated using a non-prewhitening observer and measurements of the system MTF, and NPS from each ROI. The resulting map of d_L is analyzed to extract the masking potential of each mammogram.The d_L maps were validated with a 4 alternative forced choice (4AFC) of a simulated lesion (diameter 5 mm) inserted into ROIs randomly selected from a single mammogram, across 7 β categories (0.5 intervals from 1.5-5.0). A second reader study compared a radiologist's perception and accuracy to the d_L maps generated for a set of 78 screening cases.

RESULTS

The 4AFC study was performed on 20 mammograms and over 5000 ROIs. Preliminary results on one reader showed that mean d_L was highly correlated with inverse threshold lesion thickness ($r=0.897$, $p<1e-10$).In the second study, a radiologist estimated the probability of malignancy, BIRADS density and assessed the difficulty level of each case. Initial results showed a 36% difference ($p<1e-6$) in mean d_L between non-dense and dense mammograms and a 28% difference ($p<1e-3$) in mean d_L between "easy" and "hard" images.

CONCLUSION

A quantitative measure of masking by background parenchyma has been developed. Strong correlation is seen with both breast density and texture. Two preliminary reader studies confirm that local task SNR tracks with reader performance, in both simulated conditions and clinical evaluations of mammograms.

CLINICAL RELEVANCE/APPLICATION

A measure of masking by mammographic density can have a number of applications, e.g., to conform to recent changes to BIRADS density assessment, to categorize mammograms that require more careful assessment, or as a selection tool to identify those women who should be invited to be screened with alternative technologies.

SSA21-05 Virtual Monochromatic CT Numbers from a Dual-Energy MDCT Acquisition: Comparison between Single-Source Projection-Based and Dual-Source Image-Based Platforms in a Phantom Environment

Sunday, Nov. 29 11:25AM - 11:35AM Location: S405AB

Participants
Achille Mileto, MD, Durham, NC (*Presenter*) Nothing to Disclose
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Rendon C. Nelson, MD, Durham, NC (*Abstract Co-Author*) Consultant, General Electric Company Consultant, Nemoto Kyorindo Co, Ltd Consultant, VoxelMetrix, LLC Research support, Bracco Group Research support, Becton, Dickinson and Company Speakers Bureau, Siemens AG Royalties, Wolters Kluwer nv

PURPOSE

To investigate in a phantom experiment whether there is any variability in virtual monochromatic CT numbers from a dual energy MDCT acquisition, across single- and dual-source hardware implementations.

METHOD AND MATERIALS

A polyethylene terephthalate torso phantom, filled with water, was employed to simulate the human abdominal environment. This contained a cylindrical polypropylene bottle, filled with 12 mg/mL of iopamidol 300, with serially suspended polyethylene terephthalate spheres (15 and 18 mm) filled with two iodine-to saline iodine dilutions (0.8 mgI/mL and 1.2 mgI/mL). Dual energy (80/140 kVp) and single energy (100 and 120 kVp) scans were performed using single-source (HD750 GSI, GE Healthcare) and dual-source (SOMATOM Definition Flash, Siemens Healthcare) MDCT systems. Virtual monochromatic images were reconstructed at energy levels ranging from 40 to 140 keV (at 10 keV increments), in either the projection- or the image-space domains.

RESULTS

There were significant differences between the single-source projection-based platform and the dual-source image-based platform in the measured attenuation values of the simulated lesions tested ($P<0.001$, for all comparisons). The magnitude of these differences was greatest at lower monochromatic energy levels and at lower iodine concentrations. The dual energy hardware platform, the virtual monochromatic energy level, and the lesion iodine concentration had a highly statistically significant effect on the difference in the measured attenuation values between the two platforms, indicating that the platforms respond differently to changes in these variables ($P<0.001$, for all comparisons).

CONCLUSION

A significant variability in CT numbers exists between single-source projection-based and dual-source image-based virtual monochromatic datasets, as a function of the selected energy level and the lesion iodine content.

CLINICAL RELEVANCE/APPLICATION

The variability in monochromatic CT numbers between the two clinically available dual energy platforms may impact clinical decisions that depend on subtle differences in measured attenuation values. For example, when minimally-vascularized abdominal neoplasms are repeatedly imaged with different dual energy platforms, differences in measured attenuation values between the imaging studies due to variability between scanners might be erroneously attributed to changes in tumor vascularity.

SSA21-06 Accuracy Enhancement with Deep Convolutional Neural Networks for Classifying Regional Texture Patterns of Diffuse Lung Disease in HRCT

Sunday, Nov. 29 11:35AM - 11:45AM Location: S405AB

Participants
Guk-Bae Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Kyu-Hwan Jung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Employee, VUNO Korea Inc
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Presenter*) Stockholder, Coreline Soft, Inc
Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
June-Goo Lee, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To introduce deep learning-based feature extraction method which adaptively learns the most significant features for the given task using deep structure to classify six kinds of regional patterns in diffuse lung disease.

METHOD AND MATERIALS

HRCT images were selected from images of 106 patients having diffuse lung disease from a Siemens CT scanner (Sensation 16, Siemens, Forchheim, Germany) and 212 patients from a GE CT scanner (Lightspeed 16, GE, Milwaukee, WI, USA). Two experienced radiologists marked sets of 600 rectangular regions of interest (ROIs) with 20×20 pixels on HRCT images obtained from GE and Siemens scanners, respectively. These were consisted of a hundred of ROIs for each of six local patterns including normal, consolidation, emphysema, ground-glass opacity, honeycombing, and reticular opacity (Fig. 1(a)). Performance of convolution neural network (CNN) classifier having a deep architecture (Fig. 1(b)) was compared with that of support vector machine (SVM) having a shallow architecture. In the SVM classifier, 22 features including histogram, gradient, run-length, gray level co-occurrence matrix, low-attenuation area cluster, and top-hat transform were extracted. In the CNN classifier, a hundred features in the last layer (FC #1), however, were extracted automatically with deep learning classifier manner. All experiments were performed based on forward feature selection and five fold cross-validation with 20 repetitions.

RESULTS

The accuracies of the SVM classifier were achieved 92.34 ± 2.26 % at 600 ROI images acquired in a single scanner (GE) and 91.18 ± 1.91 % at 1200 ROI images of the integrated data set (GE and Siemens). The accuracies of the CNN classifier showed a higher performance of 93.72 ± 1.95 % and 94.47 ± 1.19 % in a single and the integrated HRCT, respectively (Fig. 1(c)).

CONCLUSION

The SVM accuracy in the integrated data showed not inferior to that in a single vender data, due to the effect of different scanners. In the CNN classifier, however, the CNN performance in the integrated data might be better, due to more robustness to image noise and higher performance in larger data set. In addition, the CNN shows higher performance than the SVM in both of data types.

CLINICAL RELEVANCE/APPLICATION

Deep learning based automated quantification system of regional disease patterns at HRCT of interstitial lung diseases can be more useful in the diagnosis, severity assessment, and monitoring of treatment effects.

SSA21-07 Predicting Radiologists' Diagnostic Performances Using Quantitative Image Features: Preliminary Analysis

Sunday, Nov. 29 11:45AM - 11:55AM Location: S405AB

Participants
Juhun Lee, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Robert M. Nishikawa, PhD, Pittsburgh, PA (*Presenter*) Royalties, Hologic, Inc;
Ingrid Reiser, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
John M. Boone, PhD, Sacramento, CA (*Abstract Co-Author*) Research Grant, Siemens AG Research Grant, Hologic, Inc Consultant, Varian Medical Systems, Inc

PURPOSE

The endpoint for assessing image quality should be related to radiologists' diagnostic performances, instead of imaging statistics, such as contrast to noise ratio. The purpose of this preliminary study is to evaluate breast computed tomography (CT) image quality using quantitative image features that are correlated with radiologists' diagnostic performances.

METHOD AND MATERIALS

A total of 102 pathology proven breast lesions in 92 dedicated breast CT images were used. An iterative image reconstruction (IIR) algorithm was used to obtain CT images with different image qualities (28 different qualities). Through image feature analysis from breast lesions (developing classifiers on image features from the lesion), two reconstruction options (i.e., 2 out of 28 different qualities) and one clinical reconstruction with area under the ROC curve (AUC) values of 0.67, 0.75, and 0.86 were selected for a reader study. A subset of breast lesions (N = 50, half malignant) were selected for the reader study. One experienced MQSA

radiologist read 150 cases (50 lesions x 3 image qualities) and reported each lesion's probability of malignancy following BI-RADS. The radiologist's performance was evaluated by measuring the AUC. Under leave-one-out-cross-validation, a logistic regression classifier was trained and tested over the image features (via a feature selection technique) and the probability of malignancy from the radiologist. The classifier's AUC was measured and compared with that of the radiologist.

RESULTS

The radiologist's AUCs for each quality were 0.74, 0.79, and 0.81. The trained classifier achieved averaged AUCs of 0.72, 0.76, and 0.77. The linear correlation coefficients between the classifier's probability and the radiologist's probability on the test set were 0.51, 0.6, and 0.54 (all p-values < 0.001).

CONCLUSION

The classifier was able to learn the radiologist's estimation of lesion malignancy. More readers are required to generalize our results.

CLINICAL RELEVANCE/APPLICATION

Quantitative image features were used to correlate radiologists' diagnostic performances. These features may be useful for optimizing reconstruction algorithms and evaluating dose reduction techniques.

SSA21-08 Multivariate Modeling for Prediction of Cervical Cancer Treatment Outcomes

Sunday, Nov. 29 11:55AM - 12:05PM Location: S405AB

Participants
Baderaldeen A. Altazi, MS, Tampa, FL (*Presenter*) Nothing to Disclose
Daniel Fernandez, MD,PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Geoffery Zhang, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Eduardo G. Moros, PhD,MS, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose

Background

Several studies reported univariate correlation analysis of radiomics as predictive factors for treatment clinical outcomes. This study investigated building a multivariate linear regression model that combines several predictive metrics in correlation with treatment outcomes.

Evaluation

Our dataset consisted of the pretreatment PET/CT scans from a cohort of 74 patients diagnosed with cervical cancer, FIGO stage IB-IVA, age range 31-76 years, treated with external beam radiation therapy to a dose range between 45-50.4 Gy (median dose: 45 Gy), concurrent cisplatin chemotherapy and MRI-based Brachytherapy to a dose of 20-30 Gy (median total dose: 28 Gy). Pearson's correlation (PC) and Area under (AUC) the receiver operator curve (ROC) were used to assess the correlation with treatment outcomes. Radiomics features were extracted; Co-occurrence (COM), Gray Level Size Zone (GLSM) and Run Length (RLM) and Intensity Based (IBM) Matrices algorithms. Afterwards, they were selected using sequential backward selection to predict for distant metastases (DM), Locoregional recurrence (LRR) and last follow-up status (LFS).

Discussion

The models consisted of linear combination of 2 to 3 radiomics features for each outcome. LRR model consisted of (Intensity contrast and Low Gray-Level Run Emphasis). LFS model consisted of (Different Entropy, Intensity contrast and Low-Intensity small-area emphasis). DM models consisted of (size zone variability and small-area emphasis) and (surface/Area and Volume). Models showed PC scores range (0.3-0.5) and AUC range (0.75-0.9) with 95% CI (0.6-1.0). All models scored low Variance Inflation Factor (VIF < 5) based on multicolinearity diagnostics test. All tests were statistically significant (p<0.05).

Conclusion

Multivariate linear regression models of radiomics features improved prediction power of treatment outcomes in comparison to univariate analysis. Morever, all models passed multicolinearity diagnostics test. LRR model scored highest improved predictive power followed by LFU then DM models respectively. This approach may contribute to incorporate PET radiomics in patient's response analysis in clinic.

SSA21-09 Increasing the Interscan Reproducibility of Coronary Calcium Scoring by Partial Volume Correction in Low-Dose non-ECG Synchronized CT: Phantom Study

Sunday, Nov. 29 12:05PM - 12:15PM Location: S405AB

Participants
Jurica Sprem, MSc, Urecht, Netherlands (*Presenter*) Nothing to Disclose
Bob De Vos, MSc, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Rozemarijn Vliegenthart, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Max A. Viergever, Utrecht, Netherlands (*Abstract Co-Author*) Research Grant, Pie Medical Imaging BV;
Pim A. De Jong, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Ivana Isgum, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Research Grant, Pie Medical Imaging BV; Research Grant, 3mensio Medical Imaging BV;

PURPOSE

Coronary calcium (CAC) scores obtained in low-dose chest CT without ECG-synchronization, as acquired in lung cancer screenings, are strong and independent predictors of cardiovascular events (CVE). However, due to acquisition, interscan CAC score reproducibility is moderate. This may result in incorrect CVE risk prediction. To increase the interscan reproducibility of CAC scores, we have developed a method to quantify CAC using partial volume correction (PVC).

METHOD AND MATERIALS

Three phantoms were scanned (Philips Brilliance 64, 120 kVp, 20 mAs, 3.0 mm slice thickness, 3.0 mm increment), each containing 3 inserts differing in size (9.1, 24.6 and 62.8 mm^3) and calcium density (0.197, 0.401 and 0.796 mg/mm^3). Total CAC volume per scan

was 96.5 mm³. Each phantom was scanned 3 times with slight rotation and translation between acquisitions, and in 3 different scenarios: 1 stationary and 2 moving with speed of 10 mm/s and 30 mm/s without ECG-synchronization, resulting in total of 27 scans. CAC was scored by clinically used thresholding at 130 HU. Thereafter, PVC employing Expectation-maximization algorithm for learning a multi-dimensional Gaussian mixture was used to determine partial content of calcium in the voxels of each identified calcification and its vicinity. The total CAC volumes per scan were computed by thresholding and using the proposed PVC method.

RESULTS

For the stationary phantom with low, medium and high density inserts, thresholding resulted in CAC volumes of 60.9, 142.9 and 213.2 mm³, while PVC determined 70.4, 88.9 and 92.9 mm³, respectively. For the phantom moving at 10 mm/s, thresholding resulted in CAC volumes of 50.3, 149.8 and 224.6 mm³, while PVC gave 58.2, 91.2 and 96.7 mm³, respectively. For the phantom moving at 30 mm/s, thresholding resulted in CAC volumes of 15.1, 147.2, and 306.3 mm³ and PVC determined 51.8, 78.8 and 106.5 mm³, respectively.

CONCLUSION

Thresholding underestimates volume of low density and overestimates volume of high density calcifications. The effect is emphasized with increasing motion artefacts. PVC provides better estimates of true calcium volume and it is less affected by motion.

CLINICAL RELEVANCE/APPLICATION

CAC quantification using PVC may increase interscan reproducibility of the CAC volume score.

VSPD11

Pediatric Series: Neuro

Sunday, Nov. 29 10:45AM - 12:15PM Location: S100AB

NR MR PD

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

Participants
Robert C. McKinstry III, MD, PhD, Saint Louis, MO (*Moderator*) Travel support, Siemens AG Speaker, Siemens AG
Thierry Huisman, MD, Baltimore, MD (*Moderator*) Nothing to Disclose

Sub-Events

VSPD11-01 Malformations of Cortical Development

Sunday, Nov. 29 10:45AM - 11:05AM Location: S100AB

Participants
Robert C. McKinstry III, MD, PhD, Saint Louis, MO, (mckinstryb@mir.wustl.edu) (*Presenter*) Travel support, Siemens AG Speaker, Siemens AG

LEARNING OBJECTIVES

A radiologist attending this session will learn 1) The stages of cortical development. 2) The malformations associated with abnormal neuronal proliferation and/or apoptosis. 3) The malformations associated with abnormal neuronal migration. 4) Learn the malformations associated with abnormal postmigrational development

ABSTRACT

This presentation will review the stages of normal cerebral cortical development. Malformations of cortical development will be organized according to abnormal development at each stage: proliferation/apoptosis, migration, and postmigrational organization. Tubulinopathies (e.g., polymicrogyria) and defects in the mTOR pathway (e.g., Tuberous Sclerosis) will illustrate emerging knowledge tying genotype to endophenotype.

Active Handout:Robert C. McKinstry

http://abstract.rsna.org/uploads/2015/15002018/VSPD11-01.pdf

VSPD11-02 Comparison of Three Diffusion Models for Differentiating Low- and High-Grade Pediatric Brain Tumors

Sunday, Nov. 29 11:05AM - 11:15AM Location: S100AB

Participants
Muge Karaman, PhD, Chicago, IL (*Presenter*) Nothing to Disclose
Yi Sui, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
He Wang, PhD, Shangai, China (*Abstract Co-Author*) Nothing to Disclose
Frederick C. Damen, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Yu Hua Li, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Xiaohong J. Zhou, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the performance of monoexponential, biexponential, and continuous time random walk (CTRW) diffusion models for differentiating low-grade (LG) and high-grade (HG) pediatric brain tumors.

METHOD AND MATERIALS

With IRB approval, 54 children (4 months to 13 years old) with brain tumors were enrolled in the study and underwent MRI scans at 3T. The imaging protocol included pre-/post-contrast T1, T2, FLAIR, and diffusion-weighted imaging with 12 b -values (0 to 4000 s/mm2). The parameters of the mono-exponential (apparent diffusion coefficient, D), biexponential (fast and slow diffusion coefficients, Df and Ds ; fast diffusion fraction, f) and CTRW (diffusion coefficient, Dm ; fractional powers of the waiting time and jump length, α and β) models were estimated from the diffusion data. Surgical biopsy or surgery was performed to determine the tumor grade histopathologically according to the WHO guidelines, resulting in 24 patients with LG and 30 with HG tumors. The mean values of all parameters over the tumor ROIs were compared between the two groups using a Mann-Whitney-Wilcoxon U-test. A k -means clustering algorithm was employed to differentiate LG and HG tumors based on the biexponential or CTRW parameters, followed by a comparison using histopathology as a reference.

RESULTS

Significant differences between the two tumor groups (LG vs. HG) were observed in the parameters of any of the three models with p-values < 0.001 (D :0.90±0.34 vs. 0.56±0.17 in monoexponential; Df: 2.6±1.1 vs. 1.8±0.5, Ds :0.58±0.1 vs. 0.31±0.1, f :0.73±0.11 vs. 0.59±0.09 in biexponential; Dm :1.5±0.5 vs. 0.75±0.2, α:0.95±0.04 vs. 0.90±0.03, β:0.92±0.07 vs. 0.81±0.06 in CTRW, with D 's in units of μm2/ms). The combination of CTRW parameters produced better accuracy (85% vs. 79%), sensitivity (87% vs. 83%), and specificity (83% vs. 75%) than the combination of biexponential parameters for identifying tumor grades. Both models outperformed the monoexponential model in accuracy (75%) and specificity (54%).

CONCLUSION

The CTRW diffusion model performed the best in determining pediatric brain tumor malignancy when compared with the monoexponential and biexponential models.

CLINICAL RELEVANCE/APPLICATION

The CTRW diffusion model can provide quantitative imaging markers to improve diagnosis of pediatric brain tumors.

VSPD11-03 Evaluation of Pediatric Intracranial Tumors with Intravoxel Incoherent Motion MR Imaging

Sunday, Nov. 29 11:15AM - 11:25AM Location: S100AB

Participants
Kazufumi Kikuchi, MD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Akio Hiwatashi, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Osamu Togao, MD, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Koji Yamashita, MD, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoyuki Okuaki, RT, Chuo-Ku, Japan (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Intravoxel incoherent motion (IVIM) is a non-invasive MR imaging technique to measure microcirculation and diffusivity simultaneously. The purpose of this study was to evaluate the utility of perfusion fraction (f) and diffusion coefficient (D) derived from IVIM to characterize pediatric intracranial tumors.

METHOD AND MATERIALS

This retrospective study included 16 children (M: F = 9: 7; age range 2 month-19 year-old, median 5 year). There were 6 high-grade tumors (HGTs; 3 anaplastic ependymoma, 1 glioblastoma, 1 medulloblastoma, and 1 atypical teratoid/rhabdoid tumor), 9 low-grade tumors (LGTs; 4 pilocytic astrocytoma, 2 craniopharyngioma, 1 diffuse astrocytoma, 1 choroid plexus papilloma, and 1 subependymoma) and 1 germinoma. IVIM imaging was obtained using single-shot SE-EPI sequence with 13 b-factors (0, 10, 20, 30, 50, 80, 100, 200, 300, 400, 600, 800, 1000 s/mm²). Other parameters of IVIM were as follows: TR/TE = 2500/70 ms, FA = 90, FOV = 230 x 230 mm², matrix = 128 x 126, slice thickness = 5 mm, slices = 11, average = 1. The signal equation: $S = S0 \cdot [(1-f)\exp(-bD)+f\exp(-BD^*)]$ was fitted to obtain f pixel-by-pixel. The f and D were measured in the three hot spot regions-of-interest in a tumor in each map. Histopathologic vascular density was measured in three microscopic fields (x200) of the most intense vascularization on CD-31-immunostainted histopathologic specimens. Statistical analysis was performed with the Pearson correlation coefficient and receiver operating characteristic (ROC). A p value less than .05 was considered significant.

RESULTS

The f-value (4.2-27.1%) significantly correlated (r = 0.72, P = 0.0018) with vascular density (0.60-13.4%). The f of HGTs (19.1±4.6%) was significantly higher than LGTs (7.7±4.0%; P = 0.0047). The D of HGTs (0.93±0.34 x 10^-3/mm²) was significantly lower than LGTs (1.70±0.34 x 10^-3/mm²; P = 0.0032). ROC analysis showed high Az values with f (0.94) and D (0.96) without a statistically significant difference (P = 0.74).

CONCLUSION

The f-value derived from IVIM significantly correlated with vascular density of pediatric brain tumors. Both f and D parameters could discriminate HGTs from LGTs.

CLINICAL RELEVANCE/APPLICATION

Using IVIM, we could simultaneously evaluate flow and diffusivity in pediatric brain tumors. The f-value derived from IVIM significantly correlated with vascular density. Both f and D could discriminate HGTs from LGTs.

VSPD11-04 rADC and Location Differ between Posterior Fossa Pilocytic Astrocytomas with and without Gangliocytic Differentiation

Sunday, Nov. 29 11:25AM - 11:35AM Location: S100AB

Participants
Julie Harreld, MD, Memphis, TN (*Presenter*) Nothing to Disclose
Scott N. Hwang, MD, PhD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
Ibrahim Qaddoumi, MD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
David W. Ellison, MD,PhD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Pediatric gangiogliomas (GG) are rare (≤4% of pediatric brain tumors), and only ~5% of gangliogliomas occur in the posterior fossa. A recently defined GG variant, histopathologically resembling pilocytic astrocytoma but with focal gangliocytic differentiation (PA-GG) that can be overlooked, can be mistaken for the common pilocytic astrocytoma (PA). We investigated whether MRI features could differentiate posterior fossa PA-G from PA.

METHOD AND MATERIALS

Pre-operative MRIs (and CTs where available) of 42 children (3mo-15 years, mean 7.11±3.8 years; 57% male; 8 PA-GG, 34 PA) were evaluated by two neuroradiologists blinded to pathologic diagnosis for tumor location and gross morphology; presence of hemorrhage or calcification; circumscription; degree of enhancement, edema, and %cyst/necrosis; and minimum rADC (compared to thalamus). Data for PA-GG and PA were compared.

RESULTS

Location differed significantly between PAs and PA-Gs (Pearson ChiSquare, p=0.0194); 16/34 PAs, but no PA-GGs, were centered in the cerebellar hemisphere. All PA-GGs predominantly involved midline structures (vermis, medulla, midbrain), compared to 13 of 34 PAs. Minimum rADC was significantly lower in PA-GGs (mean 0.95±0.21; 95%CI 0.73, 1.17) than in PAs (mean 2.01±0.38; 95%CI 1.86,2.16) (p<.0001). 24/34 PAs and 1/8 PA-GGs had "cyst+nodule" morphology, 7/34 PAs and 4/8 PA-GGs had evidence of hemorrhage, with no statistically significant difference between these or the remaining evaluated features.

CONCLUSION

Minimum rADC and location appear to differ significantly between posterior fossa PAs with or without gangliocytic differentiation.

CLINICAL RELEVANCE/APPLICATION

For differentiation between posterior fossa PAs with and without gangliocytic differentiation, location and minimum rADC may be a useful adjunct to histopathologic diagnosis, which is subject to sampling error.

VSPD11-05 Systematic Comparison of MR Imaging Findings in Pediatric Ependymoblastoma with Ependymoma and CNS-PNET NOS

Sunday, Nov. 29 11:35AM - 11:45AM Location: S100AB

Participants
Johannes Nowak, MD, Wurzburg, Germany (*Presenter*) Nothing to Disclose
Carolin Seidel, Wurzburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Torsten Pietsch, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Balint Alkonyi, Wurzburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Taylor Laura Fuss, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Carsten Friedrich, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Katja von Hoff, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan Rutkowski, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Monika Warmuth-Metz, Wurzburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Ependymoblastoma (EBL), ependymoma (EP), and primitive neuroectodermal tumors of the central nervous system (CNS-PNET NOS = not otherwise specified) are pediatric brain tumors that can be differentiated by histopathology in the clinical setting. Recently, we first described specific MRI features of EBL. In this study, we compare standardized MRI characteristics of EBL with EP and CNS-PNET NOS in a series comprising of 22 patients in each group.

METHOD AND MATERIALS

We systematically analyzed the initial cranial MRI scans at diagnosis according to 25 standardized criteria, and paired comparison was performed for EBL and EP, as well as for EBL and CNS-PNET NOS. All 66 cases of this multi-center study were centrally reviewed regarding histopathology, MR imaging and multimodal therapy.

RESULTS

We found differences between EBL and EP regarding age at diagnosis, MR signal intensity, tumor margin and surrounding edema, presence and size of cysts, and contrast enhancement pattern. Although MRI appearance of EBL shares many features with CNS-PNET NOS, we revealed significant differences in terms of age at diagnosis, tumor volume and localization, tumor margins, edema, and contrast enhancement.

CONCLUSION

We systematically analyze and compare MRI characteristics of pediatric EBL with EP and CNS-PNET NOS in a series of 22 centrally reviewed cases of each group. A definite differentiation of these entities with MRI seems to be difficult; however, we identify particular imaging features that might help distinguishing these histologically distinct tumor types.

CLINICAL RELEVANCE/APPLICATION

This is the first study that systematically compares multiple parameters of MR imaging in pediatric EBL with findings in EP and CNS-PNET NOS. Since EBL is very rare, our data provides important information that might help differentiating EBL from other pediatric brain tumor entities in the clinical setting.

VSPD11-06 Quantitative Approach to the Posterior Cranial Fossa and Cranio-cervical Junction in Asymptomatic Children with Achondroplasia

Sunday, Nov. 29 11:45AM - 11:55AM Location: S100AB

Participants
Rosalinda Calandrelli, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Marco Panfili, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Gabriella D'Apolito, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Giuseppe M. Di Lella, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Cesare Colosimo, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Achondroplasia, the best-known form of congenital dwarfism, is caused by a disturbance of endochondral bone formation. We proposed a MRI-based quantitative morpho-volumetric approach to the posterior cranial fossa and cranio-cervical junction to understand posterior cranial fossa changes responsible of ventriculomegaly and life-threatening medullary compression.

METHOD AND MATERIALS

We analyzed brain MRI of 12 children with a diagnosis of achondroplasia (mean age 39 + 16 months) and no surgical treatment. 3DFSPGR T1weighted images were used for1)evaluation of the posterior fossa synchondroses;2)volumetric analysis of the posterior fossa (posterior cranial fossa volume=PCFV, posterior cranial fossa brain volume=PCFBV, PCFV/PCFBV ratio, hemispheres'cerebellar volume=Ce.V, cerebellar vermis volume=Ve.V, brainstem volume, CSF spaces volume, IV ventricle volume);3)morphometric analysis of the posterior fossa (clivus, supraocciput, exocciput lengths, tonsillar herniation, tentorial angle) and cranio-cervical junction (A-P and LL diameters of the foramen magnum);4)measurements of foramen magnum and jugular foramina areas;5) volumetric analysis of supratentorial ventricles.These patients were compared with age-matched control group.

RESULTS

All patients showed synostosis of spheno-occipital synchondroses while six patients showed synostosis of anterior and posterior

intra-occipital synchondroses, cervical myelopathy without swelling cord.Compared to control group, clivus and exocciput lengths, L-L and A-P diameters of the foramen magnum, foramen magnum area and jugular foramina area were significantly reduced; supraocciput length, tentorial angle, PCFV, PCFBV, CeV , Ve, brainstem volume and supratentorial ventricular system volume were significantly increased($p<0.05$) while PCFV/PCFBV ratio, the subarachnoid spaces volume of the PCF and IV ventricle volume were not significant ($p>0.05$).

CONCLUSION

The quantitative approach to the posterior fossa and cranio-cervical junction modifications shows a complex relationship among the maldevelopment of the posterior cranial fossa, the foramen magnum stenosis, the development of ventriculomegaly and medullary compression.

CLINICAL RELEVANCE/APPLICATION

Posterior cranial fossa changes and foramen magnum stenosis should be evaluated together to the status of synchondroses in order to plan the prophylactic cervicomedullary decompression.

VSPD11-07 Congenital Spine Anomalies: Diagnosis and Classification

Sunday, Nov. 29 11:55AM - 12:15PM Location: S100AB

Participants
Erin S. Schwartz, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the embryologic derangements behind the more common congenital spinal anomalies encountered in clinical practice.
2) Be able to apply a clinical-radiological classification to facilitate the interpretation of imaging studies of patients with spinal dysraphism.

ABSTRACT

Encouraging imaging studies on patients with congenital spinal anomalies can be intimidating for radiologists, particularly when pediatric imaging and/or neuroimaging are not a large part of your practice. A clinical-radiological classification system developed by Tortori-Donoti, et al (Neuroradiology, 2000), remains a valuable approach to correctly diagnosing these children, largely dividing entities into open or closed spinal dysraphism based on the absence or presence of overlying skin, respectively. Closed spinal dysraphism is further subdivided into those lesions that present with a subcutaneous mass versus does that do not. Lesions without a subcutaneous mass can be further subdivided into simple and complex, and may be associated with other cutaneous stigmata such as hemangioma, skin dimple, and/or focal hairy patch.

BRS-SUA

Breast Sunday Poster Discussions

Sunday, Nov. 29 12:30PM - 1:00PM Location: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants
Elizabeth McDonald, MD, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose

Sub-Events

BR219-SD-SUA1 Correlation between Intra-voxel Incoherent Motion MRI and Dynamic Contrast Enhanced MRI in Breast Cancer at 3T

Station #1

Participants
Jing Yuan, PhD, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Gladys G. Lo, MD, Happy Valley, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Oi Lei Wong, MSc, Happy Valley, Hong Kong (*Presenter*) Nothing to Disclose
Abby Y. Ding, PhD, Happy Valley, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Helen H. Chan, MBChB, Hong Kong, China (*Abstract Co-Author*) Nothing to Disclose
Ting Ting Wong, Happy Valley, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Polly Cheung, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Intravoxel incoherent motion (IVIM) has been proposed to reveal both perfusion and diffusion of breast tumor non-invasively, while its correlation with DCE-MRI has not been well understood. This study prompts to comprehensively study the correlation between quantitative IVIM parameters and semi-quantitative DCE-MRI parameters in malignant breast tumors at 3T.

METHOD AND MATERIALS

DCE and IVIM-MRI (pre-contrast) were conducted at 3T on 27 histology-confirmed breast tumors (23 IDC, 1 ILC, 3 DCIS) of 27 female patients (IVIM: voxel=1.82x1.82x3mm², TE/TR= 102/5800ms, b=0, 50, 100, 150, 200, 400, 600, 1000s/mm². DCE: voxel=0.74x0.74x2mm³, flip angle=20°, TE/TR=3.2/7.3ms, acquired at 0, 60s, 150s, 210s, 270s and 330s). Voxel-wise IVIM parameters (segmented bi-exponential fitting) and ADC were calculated, then ROI-averaged values were correlated to DCE parameters of wash-in slope (at 90s), wash-in rate, wash-out (90s v.s. 330s) slope, wash-out rate, max enhancement, max enhancement rate, total time-intensity-curve (TIC) area, enhanced TIC area, and relative enhanced TIC area. Spearman correlation coefficients (r) and two-tailed p-values were reported.

RESULTS

2 tumors failed in IVIM-fitting were excluded. True diffusion coefficient D, pseudo-diffusion coefficient D* and ADC were negatively correlated with wash-in slope, max enhancement and rate, and all TIC areas, but were not significant. Pseudo-diffusion fraction f was positively correlated to many DCE parameters but weakly-correlated (-0.1

CONCLUSION

Significant negative correlation between D and maximum enhancement indicates that lower tumor diffusivity may be highly associated with peak contrast uptake amount. The correlation between D* and maximum enhancement rate may reveal the relationship between microvascular blood flow velocity and tumor perfusivity.

CLINICAL RELEVANCE/APPLICATION

Intravoxel incoherent motion (IVIM) MRI has potential to complement DCE-MRI to assess perfusion and diffusion of breast cancer non-invasively.

BR220-SD-SUA2 Analysis of Factors Influencing the Detectability on Diffusion-weighted MRI and Diffusion Background Signals in Invasive Breast Cancer Patients

Station #2

Participants
Eun Sook Ko, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Boo-Kyung Han, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Young Ko, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the factors influencing the detectability of diffusion-weighted (DW) magnetic resonance imaging (MRI) and diffusion background signals in invasive breast cancer.

METHOD AND MATERIALS

Institutional Review Board approval was obtained and patient consent was waived. 167 patients with newly diagnosed invasive ductal carcinoma, not otherwise specified (IDC NOS), who underwent preoperative breast MRI with diffusion-weighted imaging (DWI) were included in this study. Detectability on DWI and contrast-enhanced subtracted T1-weighted images, background parenchymal enhancement (BPE) and diffusion background signal were qualitatively rated. Detectability on DWI was compared with clinicopathologic findings including menopausal status, mammographic density, and molecular subtype. Multivariate ordinal logistic regression analysis was performed to determine variables independently associated with detectability on DWI and diffusion

background signals.

RESULTS

In multivariate analysis, the diffusion background signal (adjusted odds ratio = 0.23, P < 0.001), histologic grade (adjusted odds ratio = 1.91, P = 0.004), tumor size (adjusted odds ratio = 1.06, P = 0.004) and lymphovascular invasion (adjusted odds ratio = 2.30, P = 0.019) were independently correlated with the detectability on DWI in invasive breast cancer. Only BPE was independently correlated with the amount of diffusion background signals on DWI.

CONCLUSION

In invasive breast cancers, detectability on DWI was significantly affected by diffusion background signal.

CLINICAL RELEVANCE/APPLICATION

For robust use of breast DWI as a screening method without contrast material, detection of the lesion on DWI is essential. Little is known about the factors influencing the detectability on diffusion-weighted MRI and diffusion background signals in invasive breast cancer patients.

BR221-SD-SUA3 2D Mammography, Digital Breast Tomosynthesis, and Whole Breast Sonography: Which Should be Used for the Different Breast Densities in Screening for Breast Cancer?

Station #3

Participants
Anna Starikov, BA, New York, NY (*Presenter*) Nothing to Disclose
Michele B. Drotman, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Keith D. Hentel, MD, MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Janine T. Katzen, MD, New York, NY (*Abstract Co-Author*) Research funded, Seno Medical Instruments, Inc.
Elizabeth K. Arleo, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine which breast imaging modality (2D mammography [2D], digital breast tomosynthesis [DBT], whole breast sonography [WBS]) or combination of modalities should be used for patients with different breast densities presenting for screening mammography.

METHOD AND MATERIALS

All women having presenting to our institution for screening mammography in 2013 were included and sorted by breast density into subgroups. Subgroups were then further subdivided by screening modalities received (2D, 2D + DBT, 2D + WBS, or 2D + DBT + WBS); recall and cancer detection rates were then calculated.

RESULTS

Of 16,789 screening mammograms performed, 2888 were recalled (overall recall rate =17.2%) and 67 cancers were screen-detected (cancer detection rate = 67/16,789=4 per 1000 screening mammograms). Overall, 2D + DBT had the lowest recall rate (10.2%, p<0.001), while 2D + DBT + WBS had the highest recall rate (23.6%, p<0.001); this trend was preserved in subjects with non-dense (p=0.03) and dense breasts (just shy of statistical significance, p=0.055). However, the addition of WBS to 2D mammography significantly increased the detection of all cancers (p = 0.02), including invasive cancers (from 2.3 to 5.1, p=0.06).

CONCLUSION

If a woman has dense breasts, then 2D+3D+WBS would optimize cancer detection, but at the expense of a significantly increased risk of being recalled for additional imaging. If a woman does not have dense breasts, then the addition of either DBT or WBS to 2D would almost equally improve cancer detection; however, given that the addition of WBS incurs a significantly increased risk of being recalled, 2D+DBT seems logically optimal.

CLINICAL RELEVANCE/APPLICATION

A recent ACR Statement on Breast Tomosynthesis states that it will be "important to learn which subgroups of women might benefit from these exams (…by breast density)," and our study addresses this, adding to the growing body of tomosynthesis literature by stratifying subjects by breast density and considering the effect of adding whole breast sonography.

BR101-ED-SUA5 A Collective Review of the Imaging Characteristics of Various Common and Uncommon Skin Processes of the Breast.

Station #5

Participants
Rachelle C. Cruz-Centeno, DO, Hershey, PA (*Presenter*) Nothing to Disclose
Susann E. Schetter, DO, Hershey, PA (*Abstract Co-Author*) Consultant, Siemens AG
Claudia J. Kasales, MD, Lewisburg, PA (*Abstract Co-Author*) Nothing to Disclose
Alison L. Chetlen, DO, Hershey, PA (*Abstract Co-Author*) Research Consultant, Siemens AG

TEACHING POINTS

1. A review of the anatomy of the skin of the breast and its importance in evaluation during breast imaging exams2. Descriptions of the mammographic, sonographic, and MRI imaging characteristics of various common and uncommon skin processes and potential artifacts3. An understanding of the pathophysiology of each described skin process in correlation with its imaging appearance

TABLE OF CONTENTS/OUTLINE

A. Review of normal skin anatomy of the breastB. Review of imaging findings, example cases: 1. Normal Skin Findings: Skin calcifications, Kopans caves 2. Benign skin lesions: Epidermal Inclusion cyst, Post Surgical Changes. 3. Inflammatory/Infectious Processes: Cellulitis, Subareolar Mastitis, Post Radiation Changes, Ruptured Sebaceous Cyst. 4. Systemic Processes: Lymphedema, Scleroderma. 5. Malignant Processes: Inflammatory Carcinoma, Paget's disease of the Nipple, Superficial Invasive Ductal Carcinoma,

Superficial DCISC. Review of pathophysiology associated with each case presentationD. Conclusion/Summary 1. Recognition of the imaging appearance of various skin lesions 2. Understand potential pitfalls associated with superimposed artifacts related to skin lesions 3. Correlate the imaging appearance of each skin lesion with the corresponding pathophysiology

BR183-ED-SUA6 **O Recurrent Breast Cancer, Where Art Thou? A Guide for Detecting Locally Recurrent Breast Cancer after Lumpectomy and Radiation.**

Station #6

Awards
Certificate of Merit

Participants
Stephanie A. Lee-Felker, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Kara-Lee Pool, MD , Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Mariam Thomas, MD, Sylmar, CA (*Abstract Co-Author*) Nothing to Disclose
Guita Rahbar, MD, Beverly Hills, CA (*Abstract Co-Author*) Nothing to Disclose
Denise M. Andrews-Tang, MD, Sylmar, CA (*Abstract Co-Author*) Nothing to Disclose
Esha A. Gupta, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Antoinette R. Roth, MD, Sylmar, CA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. To review the expected imaging findings following breast-conserving surgery and radiation therapy in women with early stage breast cancer 2. To illustrate examples of locally recurrent breast cancer 3. To show examples of recurrent breast cancer mimics and diagnostic pitfalls

TABLE OF CONTENTS/OUTLINE

1. Selection criteria for breast-conserving surgery and radiation therapy 2. Early (before six months) benign post-treatment findings on mammography and sonography: hematoma, seroma, fat necrosis 2. Late (at or after six months) benign post-treatment findings: skin thickening, skin retraction, increased parenchymal trabeculation, architectural distortion, evolved fat necrosis 3. Late malignant post-treatment findings in cases of biopsy-proven locally recurrent breast cancer: new or increasing mass or architectural distortion, new suspicious calcifications 4. Management of locally recurrent breast cancer 5. Mimics and potential pitfalls of locally recurrent breast cancer: Bovie cautery artifact, FloSeal hemostatic sealant artifact, fat necrosis

GIS-SUB

Gastrointestinal Sunday Poster Discussions

Sunday, Nov. 29 1:00PM - 1:30PM Location: GI Community, Learning Center

GI

AMA PRA Category 1 Credit ™: .50

Participants
Elena K. Korngold, MD, Portland, OR (*Moderator*) Nothing to Disclose

Sub-Events

GI334-SD-SUB1 Prediction of Postoperative Bleeding Due to Abnormality of Gastroduodenal Artery Stump after the Whipple Procedure

Station #1

Participants
Ga Jin Han, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Nam Kyung Lee, MD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Suk Kim, MD, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Minkyu Kwak, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Tae Un Kim, MD, Yangsan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeongmyeong Kim, MD, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate CT manifestations in patients with hemorrhage due to abnormality of gastroduodenal artery (GDA) stump after the Whipple surgery and to assess the risk factors predictive of these hemorrhage.

METHOD AND MATERIALS

This study included 152 retrospectively identified patients undergone Whipple surgery. The hemorrhage due to abnormality of GDA stump was diagnosed by CT or angiographic findings including sentinel clot sign, contrast extravasation or pseudoaneurysm. Two radiologists reviewed CT images within 7 days after surgery, including fluid or abscess in abdominal and pelvic cavity and their density, fluid along hepaticojejunostomy (HJ) and pancreaticojejunostomy (PJ), inhomogeneous arterial enhancement of liver, and diameter of common hepatic artery and visible GDA stump. Variation of celiac trunk and the ratio of common hepatic artery and GDA on preoperative CT were also assessed. Laboratory data including amylase, lipase, CRP and total cholesterol and tumor size reported on pathologic report were reviewed and recorded. Simple and multivariate logistic regression analyses were performed to identify independent clinical and imaging variables associated with postoperative bleeding by abnormality of GDA stump.

RESULTS

Seventeen of the 152 patients (11%) showed hemorrhage due to abnormality of GDA stump (either pseudoaneurysm or active extravasation). Of the 17 patients with bleeding, 12 exhibited sentinel clot sign and 13 exhibited contrast extravasation on CT. Intraluminal and extraluminal hematoma were noted in six (35.3%) and nine (52.9 %) patients, respectively. Although the results of the univariate analysis showed that fluid collection in abdominal and pelvic cavity, fluid near the HJ or PJ, abscess and larger size of GDA stump were associated with bleeding, multivariate analysis revealed that only size of the stump correlated with the GDA stump bleeding ($p<0.001$).

CONCLUSION

Postoperative hemorrhage after the Whipple procedure is a well-known complication. The GDA stump size seen on postoperative CT may represent an independent marker for bleeding from GDA stump, requiring intensive postoperative follow up.

CLINICAL RELEVANCE/APPLICATION

CT after Whipple surgery could play an important role in predicting and assessing complications.

GI335-SD-SUB2 Clinical Impact of MR Defecography

Station #2

Participants
Neeraj Lalwani, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Peyvand Pordeli, MD, New Westminster, BC (*Abstract Co-Author*) Nothing to Disclose
Malak Itani, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the role of MR Defecography in the management of patients presenting with constipation and difficulty in defecation with particular attention to the subgroup presenting with suspected dyssynergia and functional constipation on clinical grounds. How MR Defecography affected the patient's management and differentiated surgical vs. non-surgical cases.

METHOD AND MATERIALS

Approximately 46 patients with history of constipation or obstructed defecation presenting to gastroenterology or urogynecology clinics in our institution from September of 2012 to May 2014 were retrospectively evaluated. Clinical data recorded from the charts include clinical notes and assessment and plan documented by the clinician before and after MRI. MRIs were evaluated for imaging findings suggestive of dyssynergia or functional constipation including ability to evacuate, presence of paradoxical contraction of puborectalis or non-relaxing external sphincter, inadequate defecatory propulsion. Presence of additional pelvic floor abnormalities like cystocele, urethral hypermobility, uterine or cervical descent, enetrocele/peritoneocele, rectocele and rectal intussusception

were also documented. Imaging findings were correlated with other clinical investigations including manometery, EMG or balloon expulsion test if available. Sensitivity, specificity, positive and negative predictive values and accuracy for the diagnosis of dyssynergic defecation were calculated. Clinical plan before and after MR defecography was compared without consideration of the MRI results by two different blinded observers. Data how MR Defecography impacted the patient management was obtained if patient underwent surgical treatment based on MR investigation.

RESULTS

MR defecography has impacted the management of 32 patients (69%) out of 46. This impact has been mostly in the form of including or excluding structural abnormality seen at the time of defecation which precludes or requires surgical treatment.

CONCLUSION

MR defecography not only provides anatomical overview of the lower GI tract it provides important information regarding the functional status of the defecation and hence has a major role in the management of these patients.

CLINICAL RELEVANCE/APPLICATION

MR Defecography can seggregate surgical vs. non-surgical candidate. Diagnosis of dyssynergia on MR Defecography has high overall accuracy.

GI337-SD-SUB4 Role of MRI in Predicting Pathological Response to Neoadjuvant Chemoradiation Therapy in Locally Advanced Rectal Cancer

Station #4

Participants
Anna Palmisano, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonio Esposito, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Gabriele Ironi, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo Passoni, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic resonance imaging is commonly used in post-neoadjuvant evaluation of local advanced rectal cancer (LARC). There is a growing interest in the identification of early markers of response to therapy in order to plan a tailored therapy to improve therapeutical success. Aim was to evaluate the performance of multiparametric-MRI in the early assessment of LARC response to neoadjuvant CT-RT.

METHOD AND MATERIALS

42 pts with LARC underwent 1.5T MRI before the beginning of CT-RT (preMRI), after 6 week of treatment (midMRI), and at the end of CT-RT (postMRI). High-resolution axial-T2w sequences were acquired, cancer volume manually segmented and the percentage of volume modification evaluated (ΔV). In a subset of 20 patients also DWI sequences and DCE-MRI studies were acquired. ADC and Ktrans, and the percentage of their modification over time was assessed. All patients underwent surgical intervention and histopahological Tumor Regression Grade (TRG) evaluated. Patients with TRG=0-2 were considered Non-Responder (NR), with TRG=3-4 Responder (R)

RESULTS

Based on TRG, 31 Patients were R and 11 NR. ΔV at postMRI was significantly higher in responders (R: 67±17% vs NR: 28±19%, p<0,01). In subset of responders, 11/31 had TRG=4 and 20/31 TRG=3; At midMRI ΔV was higher in TRG=4 than TRG=3 (83±7% vs 58±14%, p=0.002), while ΔV at the end of treatment was not different in relation to TRG 3 or 4. ΔV <30% at mid-MR predicted the absence of response to treatment (TRG 0-2) with a sensitivity of 97%. Moreover, ΔADC at midMRI showed a significant inverse correlation with TRG (R -0,516 p <0,05). No correlations with TRG were found for ΔKtrans both at mid and postMRI .

CONCLUSION

Volume and ADC modifications obtained during neoadjuvant chemoradiation, at midMRI, may represent a feasible and reliable tool to assess tumor response for local advenced rectal cancer.

CLINICAL RELEVANCE/APPLICATION

MRI at 6 weeks after CT-RT may discriminate degree of response to therapy, and, therefore, may help to early identify NR patients in order to candidate them to more intensive or alternative treatment.

GI338-SD-SUB5 Liver Imaging Reporting and Data System (LI-RADS) v2014 with Gadoxetic Acid-enhanced MR Imaging: Outcome Analysis in LI-RADS Category 4 and 5 Criteria

Station #5

Participants
Sang Hyun Choi, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jae Ho Byun, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Jung Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Yeon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyung Jin Won, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong Moon Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Pyo Nyun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the outcome of the Liver Imaging Reporting and Data System (LI-RADS) v2014 category 4 and 5 criteria on gadoxetic acid-enhanced magnetic resonance imaging (MRI) in patients with chronic liver disease

METHOD AND MATERIALS

From January 2012 to December 2012, 412 patients with chronic liver disease who had newly detected hepatic nodules 3.0 cm or smaller in diameter on initial gadoxetic acid-enhanced MRI were included. A LI-RADS category was retrospectively assigned to each nodule detected on MRI. Final diagnosis was assessed using pathologic diagnosis only (operation or core-needle biopsy) and pathologic and clinical diagnosis (marginal recurrence after treatments or interval change of the lesion on follow-up imaging). For the outcome analysis of LI-RADS category 4 and 5 criteria, positive-predictive value (PPV) and false-positive rate (FPR) for diagnosing hepatocellular carcinoma (HCC) were compared. Local recurrence rate (LRR) between the two category nodules was also compared.

RESULTS

297 nodules and 295 nodules were classified into the LI-RADS category 4 and category 5, respectively. Using pathologic diagnosis only, the PPV for category 5 criteria was significantly higher than that for category 4 criteria (92.5% versus 81.0%, P=.008), with showing a significantly lower FPR (7.5% versus 19.0%, P=.008). Using pathologic and clinical diagnosis, the PPV for category 5 criteria was significantly higher than that for category 4 criteria (92.5% versus 77.0%, P<.001). The overall LRR for category 5 nodules was not significantly different from that for category 4 (17.8% versus 23.4%, P=.108).

CONCLUSION

In patients with chronic liver disease, LI-RADS category 5 criteria on gadoxetic acid-enhanced MRI had a high PPV for the diagnosis of HCC and its nodule showed a similar LRR to category 4 nodule after treatments.

CLINICAL RELEVANCE/APPLICATION

On gadoxetic acid-enhanced MRI, LI-RADS v2014 category 5 criteria are useful for diagnosing HCC in patients with chronic liver disease, whereas LI-RADS category 4 criteria are not.

GI130-ED-SUB6 A Bag of Tricks: Multimodality Approach to Challenging Gallbladder Pathology and Differential Diagnosis

Station #6

Awards
Certificate of Merit

Participants
Joel N. Roberson, MD, Royal Oak, MI (*Presenter*) Nothing to Disclose
Dominic L. Scola, MD, Troy, MI (*Abstract Co-Author*) Nothing to Disclose
Benjamin D. Lack, MD, Royal Oak, MI (*Abstract Co-Author*) Nothing to Disclose
Hanh V. Nghiem, MD, Royal Oak, MI (*Abstract Co-Author*) Nothing to Disclose
Farnoosh Sokhandon, MD, Bloomfield Hills, MI (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is: 1. Review the imaging spectrum of gallbladder pathology. 2. Discuss characteristic multimodality imaging features of common and uncommon gallbladder pathology and their mimickers. 3. Recognize atypical presentations and pitfalls in gallbladder imaging. 4. Present challenging gallbladder cases with lessons learned, and discuss how an appropriate differential diagnosis can positively impact patient care.

TABLE OF CONTENTS/OUTLINE

I. Brief review of the spectrum of gallbladder pathology and key imaging characteristics using correlative multimodality imaging. II. Present challenging gallbladder cases, pitfalls and lessons learned. Representative cases will include: A) Xanthogranulomatous cholecystitis mimicking gallbladder cancer B) Gallbladder lymphoma masquerading as acute cholecystitis C) Cholecysto-colonic fistula mimicking emphysematous cholecystitis D) Gallbadder adenocarcinoma resembling acute cholecystitis E) Chronic cholecystitis imitating gallbladder adenocarcinoma III. Discuss the approach to challenging gallbladder cases.

GI181-ED-SUB7 No Follow-up Needed: Definitively Diagnosed Benign Masses on Single Phase CT of the Abdomen and Pelvis

Station #7

Awards
Identified for RadioGraphics

Participants
Christopher D. Sanders, MD, Fairfield, CA (*Presenter*) Nothing to Disclose
Steven D. Lewis, MD, Fairfield, CA (*Abstract Co-Author*) Nothing to Disclose
Dell P. Dunn, MD, Newton, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

•Incidental findings are present in up to 24% of CT scans.•Not all incidental findings require further imaging. As the future of radiology transitions from volume-based to value-based practice, reducing unnecessary imaging becomes even more important.•Even though there are many incidentalomas that do not require further workup, it is important to recognize the exceptions and when further imaging or intervention is necessary.•While not all inclusive, the discussed topics cover a wide gamut of common intra-abdominal findings that often trigger primary care teams to request additional imaging.

TABLE OF CONTENTS/OUTLINE

•Adrenal Adenomas•Adrenal Myelolipoma•Renal Angiomyolipoma•Gall Bladder Polyp•Hepatic Cysts•Splenules•Omental Infarct•Misty Mesentery•Ovarian Cysts•Uterine Leiomyomas•Pseudolipoma of the Glisson Capsule•Pelvic lipomatosis•Hemorrhagic Renal Cysts•Hepatic Perfusional Anomalies

GI262-ED-SUB8 Review of the 2012 Revised Altanta Classification of Acute Pancreatitis with Emphasis on Different

Treatment Options

Station #8

Awards
Certificate of Merit

Participants
Matthew Peckham, MD, Worester, MA (*Presenter*) Nothing to Disclose
Young Hwan Kim, MD, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Differentiating between interstitial edematous pancreatitis and acute necrotizing pancreatitis. Characterizing pseudocyst vs walled off necrosis. Illustration of different treatment options.

TABLE OF CONTENTS/OUTLINE

A Case-based discussion of the imaging features that separate interstitial edematous pancreatitis and acute necrotizing pancreatitis. Discussion of CT, MRI and US imaging finding of acute peripancreatic collections, pseudocysts, acute necrotic collections, and walled off necrosis (WON). Once established diagnosis will be used to select intervention whether: CT guided percutaneous drainage, endoscopic pancreatic stent placement, or endoscopic cystogastrostomy/necrotectomy.

GI003-EB-SUB Current Anticoagulant Management for Percutaneous Liver Biopsy

Hardcopy Backboard

Participants
Richard H. Marshall JR, MD, New Orleans, LA (*Presenter*) Nothing to Disclose

TEACHING POINTS

This review of recent literature and guidelines describes mechanisms of action of both old, well known anticoagulants and newer agents that have gained popularity and are more frequently encountered. This manuscript provides a synopsis of available guidelines and data and provides recommendations for management of anticoagulants. Where data is sparse, the authors make recommendations based on opinion to provide the reader with a guideline in these situations. A chart provides a succinct reference for the reader understand these medications and management related to percutaneous liver biopsy.

TABLE OF CONTENTS/OUTLINE

1. Introduction2. Description of Classes of Anticoagulants A. Vitamin K Inhibitors a. Mechanism of action b. Available data c. Recommendations B. Factor IIa and Xa Inhibitors (Heparins) a. Mechanism of action b. Available data c. Recommendations C. Indirect Factor Xa Inhibitors a. Mechanism of action b. Available data c. Recommendations D. Direct Thrombin Inhibitors a. Mechanism of action b. Available data c. Recommendations3. Antiplatelet Agents A. Mechanism of action B. Available data C. Recommendations4. Non-Steroidal Anti-Inflammatory Agents5. Conclusion

RC109

MR Techniques in GI Cancers

Sunday, Nov. 29 2:00PM - 3:30PM Location: E352

GI MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC109A Liver Specific Contrast Agents

Participants
Giuseppe Brancatelli, MD, Palermo, Italy, (gbranca@yahoo.com) (*Presenter*) Speaker, Bayer AG

LEARNING OBJECTIVES

1) Describe the mechanism of action of liver specific contrast agents. 2) Understand the added value of liver-specific contrast agents in the characterization of focal liver lesions. 3) Identify the most common pitfalls and limitations of liver specific contrast agents.

ABSTRACT

RC109B Diffusion-weighted Imaging

Participants
Ihab R. Kamel, MD, PhD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the basic concepts for DWI in body applications. 2) Describe the emerging role of DWI in assessing response in cancer. 3) Discuss the application of DWI in whole body imaging.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ihab R. Kamel, MD, PhD - 2015 Honored Educator

RC109C MR Perfusion

Participants
Hersh Chandarana, MD, New York, NY (*Presenter*) Equipment support, Siemens AG; Software support, Siemens AG; Consultant, Bayer, AG;

LEARNING OBJECTIVES

1) Understand basic principles of Perfusion Weighted Imaging (PWI) 2) Understand steps involved in performing PWI 3) Clinical applications and limitations will be highlighted.

ABSTRACT

ABSTRACT:DCE-MRI refers to the high temporal resolution imaging performed before and after administration of gadolinium contrast. This dynamic contrast-enhanced (DCE)-MRI can be used to assess organ and/or tumor perfusion (PWI). PWI can provide insight into tumor vascularity and possibly early treatment response to antiangiogenic therapies. Basic concept of perfusion weighted imaging as well as acquisition and image analysis schemes will be briefly discussed. Potential clinical applications and challenges to clinical implementation will be highlighted.

RC109D PET MR

Participants
Alexander R. Guimaraes, MD, PhD, Portland, OR (*Presenter*) Speakers Bureau, Siemens AG; Expert Witness, Rice, Dolan, Kershaw

LEARNING OBJECTIVES

1) Understand the unique challenges in the physics underlying PET/MRI. 2) Understand the unique role of PET/MRI in diagnosing and staging GI Malignancies. 3) Understand the potential future role of PET/MRI in both diagnosing GI malignancies and in assessing novel therapeutic response.

ABSTRACT

RC113

Pediatric Series: Fetal/Neonatal

Sunday, Nov. 29 2:00PM - 3:30PM Location: S102AB

GU OB MR PD

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

Participants
Daniela Prayer, MD, Vienna, Austria (*Moderator*) Nothing to Disclose
Amy R. Mehollin-Ray, MD, Houston, TX, (armeholl@texaschildrens.org) (*Moderator*) Nothing to Disclose

Sub-Events

RC113-01 Fetal MRI of Genitourinary Tract Abnormalities

Sunday, Nov. 29 2:00PM - 2:20PM Location: S102AB

Participants
Ann M. Johnson, MD, Philadelphia, PA, (johnsona@email.chop.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn basic fetal MRI techniques and relevent embryology. 2) Understand what fetal MRI can add in evaluation of genitourinary (GU) abnormalities. 3) Become familiar with patterns of fetal GU abnormalities with an emphasis on complex lesions affecting multiple organ systems, such as cloacal malformation spectrum and exstrophy. 4) The purpose of the course is to understand the potential role of fetal MRI in the evaluation of fetal genitourinary tract abnormalities. There will be an emphasis on complex lesions affecting multiple organ systems, such as cloacal malformation spectrum and exstrophy.

RC113-02 Novel Nanoparticle Gd Contrast Agent Does Not Penetrate the Placental Barrier

Sunday, Nov. 29 2:20PM - 2:30PM Location: S102AB

Participants
Anil N. Shetty, PhD, Houston, TX (*Presenter*) Nothing to Disclose
Ketan B. Ghaghada, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Robia Pautler, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Wesley Lee, MD, Houston, TX (*Abstract Co-Author*) Research support, General Electric Company Research support, Koninklijke Philips NV Research support, Siemens AG Research support, Samsung Electronics Co Ltd
Haijun Gao, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Chandra Yallampalli, DVM,PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
David Rendon, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Ananth Annapragada, PhD, Houston, TX (*Abstract Co-Author*) Stockholder, Marval Pharma Ltd Stockholder, Alzeca Biosciences LLC Stockholder, Sensulin LLC Stockholder, Abbott Laboratories Stockholder, Johnson & Johnson

PURPOSE

Gd contrast agent usage in placental imaging is generally contraindicated, for concerns related to fetal contrast agent exposure. We therefore developed a A novel liposomal Gd nanoparticle contrast agent for T1-MRI, retaining the Gd on the maternal side, thus shielding the fetus from potential toxicities. In this study, we tested this agent in placental imaging in a mouse model, and measured its transplacental permeability.

METHOD AND MATERIALS

Female C57BL/6 mice, pregnant at gestational age E16.5±1 days, were imaged by T1-MRI on a 9.4T small animal MRI (Bruker Instruments) using a conventional contrast agent (Multihance, a meglumine salt of Gd-BOPTA chelate) (13 mice) and using the novel nanoparticle Gd agent (9 mice). DCE-MRI was conducted using consecutive 3D-SPGRE sequences at a constant flip angle of 16°, TE/TR=1.93ms/6ms, FOV = 3x3x2.5cm, matrix = 128x128x16. Each image was converted to a T1 map, and the contrast agent concentration on a pixel-by-pixel basis, estimated from the known relaxivity. After imaging, the mice were sacrificed and the Gd content of the placenta and fetus measured using ICP-AES.

RESULTS

Image and data shown below are representative of each cohort. The placentae are rather small (2mmx3mm) but are still clearly defined, and obviously not invasive into the uterine wall. Signal intensities in the placental and fetal ROI's, indicative of Gd concentration in each compartment, clearly show that the conventional Gd chelate agent penetrates the placental barrier and enters the fetus. The nanoparticle agent however, does not do so, indicated by zero signal in the fetal compartment throughout the duration of this experiment. The ICP-AES study confirmed the imaging study results, with no detectable Gd in the fetal compartment. A separate study in human placentae using an ex vivo perfused placenta preparation, also confirmed these results.

CONCLUSION

The nanoparticle contrast agent does not penetrate the placental barrier in a mouse model. The data are consistent with separate tests on a perfused human placenta model.

CLINICAL RELEVANCE/APPLICATION

The incidence of placenta accreta has increased 8-fold in the last 30 years, and improved methods for placental imaging are sorely needed. Nanoparticle Gd contrast agents described in this work could be useful for placental imaging, while maintaining fetal safety.

RC113-03 Normal and Abnormal Development of the Cerebellar Vermis - A Quantitative Fetal MRI Study

Sunday, Nov. 29 2:30PM - 2:40PM Location: S102AB

Participants
Gregor Kasprian, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Gregor Dovjak, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Peter C. Brugger, MD, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Gerlinde Gruber, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Georg Langs, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Michael Weber, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Ernst Schwartz, MSc, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Dieter Bettelheim, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Daniela Prayer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Postnatal neurodevelopmental outcome of fetuses with hindbrain malformations is dependent on normal growth and development of the cerebellar vermis. This comparative in vivo and post mortem fetal MRI study aims to quantitatively assess the relative dimensions of respective vermian lobules between 18 to 32 gestational weeks (GW) in normal and pathological conditions.

METHOD AND MATERIALS

75 fetuses (18-32 GW, mean 25.7GW) with normal brain development and 20 fetuses with different types of hindbrain malformations were scanned prenatally (1.5T, T2-TSE, voxel size 0.72/0.72/4.4mm - 1.0/1.0/4.4mm) and seven fetuses (16-30GW, mean 21.9GW, 3T, CISS sequence, resolution: 0.33/0.33/0.33mm) scanned within 24 hours postmortem were selected for postprocessing. A T2-weighted midline sagittal slice was identified and 2D vermian segmentation was performed using ITK snap (Figure).

RESULTS

The mean proportional size of 7/9 discriminable vermian lobules did not differ between in vivo and post mortem measurements. The relative size of the following lobules increased during gestation (Pearson, $p<0.05$): Culmen ($r^2=.460$) and Declive/Folium/Tuber ($r^2=.453$). The proportions of Lingula ($r^2=-.439$), Centrum ($r^2=-.554$), Pyramis ($r^2=-.303$) and Nodulus ($r^2=-.491$) decreased with gestational age. The relative size of the Uvula did not show age specific changes ($p=.201$). Certain types of hindbrain malformations showed common patterns of cerebellar lobular hypoplasia.

CONCLUSION

Fetal vermian lobulation can be accurately assessed by MRI between 18 and 32GW in normal and pathological conditions in vivo . Growth of specific vermian lobules is nonuniform during the second and third trimester. Distinct patterns of vermian lobular hypoplasia can be described antenatally.

CLINICAL RELEVANCE/APPLICATION

Knowledge about the distinct growth patterns of specific vermian lobules is helpful in the prognostic classification of fetal hindbrain malformations.

RC113-04 MRI-US Fusion Imaging in Real-Time Virtual Sonography for the Evaluation of Fetal Anomalies: Preliminary Stud

Sunday, Nov. 29 2:40PM - 2:50PM Location: S102AB

Participants
Silvia Bernardo, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Valeria Vinci, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Matteo Saldari, MD, PhD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonella Giancotti, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Lucia Manganaro, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Camilla Aliberti, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic resonance imaging (MRI) and ultrasound (US) scanning complement each other in the screening and diagnosis of fetal anomalies. Real-time virtual sonography (RVS) is a new technique that uses magnetic navigation and computer software for the synchronized display of real-time US and multiplanar reconstruction MRI images. The purpose of this study was to evaluate the feasibility and ability of RVS to assess the main pathologies in fetuses with suspected US anomalies.

METHOD AND MATERIALS

This study was conducted over a two-month period march-april 2015 in 30 patients referred for a morphological fetal US-based evaluation. Patients undergone Fetal MRI at 1.5 T for fetal anomalies were offered fusion imaging (Hitachi HI Vision Ascendus).The MRI image dataset acquired at the time of the examination was loaded into the fusion system and displayed together with the US image on the same monitor. Both sets of images were then manually synchronized and image were registered using multiple planes MR imaging.The ability of this combined image (RVS imaging) to assess the main anatomical sites and fetal anomalies was evaluated and compared with standard B-Mode US and MRI images previously acquired.

RESULTS

In all cases RVS was technically possible, with a 100% match between MR images and US images. Data registration, matching and fusion imaging were performed in less than 15-20 minutes. On a total of 30 fetuses, 20 were for the encephalic district and 10 for the body (8 thoraco- abdominal; 2 heart). In all cases RVS was technically possible, with a 100% match between MR images and US images. In 10 cases of body abnormalities, fusion imaging helped the diagnosis in 20%. In the 10/20 cases of encephalic pathology, fusion imaging improved the diagnosis; in the other 10 cases MRI was superior to US even using the RVS.

CONCLUSION

The present work is a preliminary study on the feasibility and practical use of a Fetal MRI-US real-time fusion imaging. Thanks to

informations from both US and MRI, fusion imaging allows better identification of the different fetal pathologies and could improve the performance of ultrasound examination.

CLINICAL RELEVANCE/APPLICATION

Fusion imaging is feasible for the assessment of fetal abnormalities. Because it combines information from both US and MRI techniques, fusion imaging allows better identification of the different fetal pathologies.

RC113-05 Predictive Value of the MRI-based Ratio of Fetal Lung Volume to Fetal Body Volume in Congenital Diaphragmatic Hernia in Comparison to the MR Fetal Lung Volume and the Sonographic Lung-to-Head Ratio

Sunday, Nov. 29 2:50PM - 3:00PM Location: S102AB

Participants
Claudia Hagelstein, MD, Mannheim, Germany (*Presenter*) Nothing to Disclose
Silke von Mittelstaedt, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Meike Weidner, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Christel Weiss, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Regine Schaffelder, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Schaible, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan O. Schoenberg, MD, PhD, Mannheim , Germany (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Wolfgang Neff, MD, PhD, Alzey, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate prognostic accuracy of the MRI-based ratio of fetal lung volume to fetal body volume (MR-FLV/FBV) in fetuses with congenital diaphragmatic hernia (CDH) and to compare it to established prognostic parameters (the observed-to-expected MR fetal lung volume [o/e-MR-FLV] and the US-based observed-to-expected lung-to-head ratio [o/e-LHR]) with regard to survival, extracorporeal membrane oxygenation (ECMO) requirement and development of a chronic lung disease (CLD).

METHOD AND MATERIALS

Fetal MRI was performed in 132 patients with isolated CDH (mean gestational age 32.8±3.8 weeks) to measure FLV and FLV/FBV. Sonographic assessment of the LHR was performed within three days before or after fetal MRI. To obtain parameters that were independent from gestational age, the o/e-MR-FLV and the o/e-LHR were calculated based on normal controls, whereas calculation of the MR-FLV/FBV is independent from normal controls.

RESULTS

91% of the neonates survived, 37% needed ECMO therapy and 45% developed a CLD. All prenatal parameters revealed an excellent correlation with patients´ clinical outcome. MR-FLV/FBV, o/e-MR-FLV and o/e-LHR were significantly higher in survivors (p always <0.0001). Patients with ECMO requirement and patients with CLD showed a significantly lower MR-FLV/FBV, o/e-MR-FLV or o/e-LHR (p always <0.0001). Prognostic accuracy regarding survival was quite similar for the three parameters (AUC MR-FLV/FBV : 0.830, AUC o/e-MR-FLV : 0.868, AUC o/e-LHR : 0.845). Regarding ECMO requirement (AUC MR-FLV/FBV : 0.844, AUC o/e-MR-FLV : 0.843, AUC o/e-LHR : 0.736) and development of CLD (AUC MR-FLV/FBV : 0.778, AUC o/e-MR-FLV : 0.795, AUC o/e-LHR : 0.738) the MR-FLV/FBV and o/e-MR-FLV showed a slightly better prognostic accuracy compared to the o/e-LHR.

CONCLUSION

In CDH, assessment of pulmonary hypoplasia based on the MR-FLV/FBV, the o/e-MR-FLV or the o/e-LHR is quite similar in predicting survival. Regarding ECMO requirement and development of CLD, the o/e MR-FLV and the MR-FLV/FBV showed a slightly better prognostic accuracy compared to the US-based o/e-LHR. Compared to other prognostic parameters, MR-FLV/FBV has the advantage of being independent from the reference to a normal control group.

CLINICAL RELEVANCE/APPLICATION

In CDH, MRI-based MR-FLV/FBV and o/e-MR-FLV as well as US-based o/e-LHR are excellent and almost equivalent parameters to predict survival, ECMO-requirement and development of CLD.

RC113-06 Correlation between Fetal and Postmortem Magnetic Resonance Imaging and Conventional Autopsy in the Detection of Fetal Abnormalities

Sunday, Nov. 29 3:00PM - 3:10PM Location: S102AB

Participants
Matteo Saldari, MD, PhD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Silvia Bernardo, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Valeria Vinci, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Lucia Manganaro, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare Fetal and postmortem MRI and conventional autoptic findings in cases of major pathological abnormalities.

METHOD AND MATERIALS

In this prospective study we enrolled 128 fetuses with identified US findings of severe fetal malformations, with local research ethics committee approval. Among these, we performed 94 whole body Fetal MRI on 94 fetuses using a 1.5 T MR scanner and of these, only 89 women undewent termination of pregnancy because of the fetal abnormalities. Of the 89 patients, 80 (90%) consented to postmortem MRI alone; 59 (66%) women consented to both postmortem MRI and conventional autopsy and formed our study group. Following delivery, fetuses were stored in refrigerated compartments prior to MR imaging and autopsy. Also for the post-mortem imaging evaluation we acquired whole body MR imaging using a 1.5 T MR scanner. MR images were reviewed by a team of two radiologists blinded to the autoptic data. Pathologists who performed conventional autopsy were blinded to the MR data; autoptic data were considered the gold standard.

RESULTS

Final autoptic diagnoses were: polycystic kidney disease (n=15), diaphragmatic hernia (n=10), lissencephaly (n=4), type-2 Arnold-Chiari malformation (n=6), Dandy-Walker syndrome (n=13), cloacal malformation (n=1), anencephaly (n=1), holoprosencephaly (n=4), rhombencephalosynapsis (n=2), Walker-Warburg syndrome (n=2), schizencephaly (n=1).MRI-autopsy provided additional information in 10/59 (17%) compared to fetal MRI.In 6 cases (10%) conventional autopsy provided superior diagnostic information compared to MRI-autopsy. On the other hand, in 7 cases (12%) the disruption of the anatomy during autoptic dissection of the fetal body couldn't allow a correct identification of the pathology.

CONCLUSION

MR autopsy is accepted by nearly all mothers while conventional autopsy is accepted by about two-thirds of mothers, it provides similar information compared to conventional autopsy in case of fetal malformations and it allows the evaluation of the pathology in case of tissue disruption during the autoptic evaluation.

CLINICAL RELEVANCE/APPLICATION

Fetal MRI can add significant additional information and may be use to guide conventional autopsy

RC113-07 Imaging of Ambiguous Genitalia

Sunday, Nov. 29 3:10PM - 3:30PM Location: S102AB

Participants
Jeanne S. Chow, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The purpose of this course is to understand the important role of the radiologists in infants with ambiguous genitalia. Imaging techniques as well as important imaging findings will be detailed.

ABSTRACT

RC117

MR-Guided High Intensity Focused Ultrasound (HIFU)

Sunday, Nov. 29 2:00PM - 3:30PM Location: S504CD

MR US IR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Pejman Ghanouni, MD, PhD, Stanford, CA, (ghanouni@stanford.edu) (*Moderator*) Nothing to Disclose

Sub-Events

RC117A Neurologic Applications of MR-guided HIFU

Participants
Max Wintermark, MD, Lausanne, Switzerland, (max.wintermark@gmail.com) (*Presenter*) Advisory Board, General Electric Company;

LEARNING OBJECTIVES

1) To understand the neuro applications of HIFU. 2) To understand the challenges of applying HIFU for neuro applications. 3) To review the ongoing trials of neuro applications of HIFU.

ABSTRACT

MR guided focused ultrasound is a new, minimally invasive method of targeted tissue thermal ablation that may be of use to treat central neuropathic pain, essential tremor, Parkinson tremor, and brain tumors. The system has also been used to temporarily disrupt the blood-brain barrier to allow targeted drug delivery to brain tumors. We will discuss current and potential neuro applications of this exciting technology.

RC117B Gynecologic Applications of MR-guided HIFU

Participants
Young-Sun Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Explain pros and cons of MR-guided HIFU in the treatment of uterine fibroids and adenomyosis as compared to other therapeutic modalities 2) Assess important factors in screening MR exams of MR-guided HIFU therapy of uterine fibroids 3) Explain treatment strategy of MR-guided HIFU therapy of uterine fibroids to improve therapeutic outcomes 4) Describe the current limitations of MR-guided HIFU of uterine fibroids and explain how to overcome limitations

ABSTRACT

Uterine fibroid and adenomyosis are the most popular clinical applications of MR-guided HIFU (high-intensity focused ultrasound) therapy. As a totally non-invasive interventional therapeutic modality using small foci of hyperthermia, MR-guided HIFU has pros and cons as compared to other therapeutic modalities. However, owing to its greatest merit of complete non-invasiveness, its clinical adoptions are increasing worldwide.MR-guided HIFU therapy has certain inborn limitations, therefore, appropriate screening in MR-guided HIFU of uterine fibroids is extremely important to improve overall therapeutic outcomes. In order to do so, properties of the target fibroids, safe pathway of sonications, complication-related factors should be well analyzed in screening MR exams. Furthermore, the symptom-relevant fibroid or the portion of fibroid should be recognized and completely ablated.As accumulations of clinical experiences of MR-guided HIFU therapy, there have been several techniques or strategies developed to overcome such limitation or to improve therapeutic efficacy, which will be covered in this presentation.

Handout:Young-Sun Kim

http://abstract.rsna.org/uploads/2015/13012024/RSNA2015_KimYS - handout.pptx

RC117C Body Applications of MR-guided HIFU

Participants
Alessandro Napoli, MD, Rome, Italy (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with the basic physical principles of HIFU and the potential of MR guidance. 2) To approach selection criteria in MRI screening examinations for accurate indications and identify contraindications and non-suitable patients. 3) To appreciate current results and potential therapy regimens. 4) To understand recent technical developments and their potential.

ABSTRACT

The concept of ideal tumor surgery is to remove the neoplastic tissue without damaging adjacent normal structures. High-intensity focused ultrasound (HIFU) was developed in the 1940s as a viable thermaltissue ablation approach. In clinical practice, HIFU has been applied to treat a variety of solid benign and malignant lesions, including pancreas, liver, prostate, and breast carcinomas, soft tissue sarcomas, and uterine fibroids. More recently, magnetic resonance guidance has been applied for treatment monitoring during focused ultrasound procedures (magnetic resonance-guided focused ultrasound, MRgFUS). Intraoperative magnetic resonance imaging provides the best possible tumor extension and dynamic control of energy deposition using real-time magnetic

resonance imaging thermometry. The fundamental principles and clinical indications of the MRgFUS technique will be introduced; different treatmentoptions and personal outcomes will be discussed.

RC117D Palliation of Painful Metastases to Bone

Participants
Pejman Ghanouni, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Therapeutic options for palliation of painful metastases to bone. 2) Patient selection for MR guided focused ultrasound palliation of painful bone metastases. 3) Results of Phase III pivotal study of ExAblate MR guided focused ultrasound for palliation of painful bone metastases. 4) Technical aspects of successful patient treatment. 5) Immediate post-treatment imaging-based assessment of results. 6) Future applications of MR guided focused ultrasound for the management of osseous metastatic disease.

ABSTRACT

Cancer patients commonly have metastases to bone; as the survival of cancer patients is prolonged by more effective therapies, the prevalence of patients with metastases to bone is also increasing. Bone metastases are often painful, and often diminish the quality of life. Radiation therapy (RT) is the standard of care for the treatment of bone metastases, but a significant subset of patients do not respond to RT. MR guided focused ultrasound non-invasively achieves localized tissue ablation and provides a proven method of pain relief in patients who do not respond to radiation therapy. MR imaging provides a combination of tumor targeting, real-time monitoring during treatment, and immediate verification of successful treatment. The results of the pivotal Phase III trial that led to FDA approval of the ExAblate MR guided focused ultrasound device for the palliation of painful metastases to bone will be reviewed. In particular, patient selection, the technical aspects of successful patient treatment, and post-treatment assessment of results will be described. Concepts for future development of this technology with regard to the management of osseous metastatic disease will also be presented.

RC122

MRI: Imaging for Treatment Planning

Sunday, Nov. 29 2:00PM - 3:30PM Location: E353A

MR RO PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Eric Paulson, Milwaukee, WI (*Moderator*) Nothing to Disclose

ABSTRACT

Sub-Events

RC122A MRI for Anatomical Definition

Participants
Eric Paulson, Milwaukee, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the advantages of MRI simulation for anatomical delineation in both external beam radiation therapy and brachytherapy. 2) Understand the differences between images obtained during MRI simulation versus diagnostic MRI. 3) Understand the current solutions to address technical challenges of using MRI for anatomical delineation in Radiation Oncology.

ABSTRACT

MRI is rapidly emerging as a primary imaging modality in Radiation Oncology, fueled by innovations in MRI-guided treatment delivery, MRI simulation systems, and the role of MRI in individualizing and adapting radiation therapy. This course will discuss the advantages and technical challenges of using MRI for anatomical definition in radiation treatment planning. Current solutions to tailor MRI to the unique demands of Radiation Oncology will be explored. Clinical examples illustrating the use of MRI for anatomical delineation in both external beam radiation therapy and brachytherapy will be presented.

RC122B MRI for Functional Definition

Participants
Uulke A. van der Heide, PhD, Amsterdam, Netherlands (*Presenter*) Speaker, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Get an overview of the most relevant functional MRI modalities are available. 2) Understand how they can be used to improve target definition. 3) Understand their limitations and specific concerns for use in radiation oncology.

ABSTRACT

In addition to anatomical imaging, MRI affords a range of functional techniques. Diffusion-weighted MRI images the restriction of water mobility in tissue, thus probing microanatomy. This is used to identify tumors and monitor response to treatment. Dynamic contrast-enhanced MRI shows the tracer kinetics of contrast agents and reflects the characteristics of the microvasculature, such as flow and permeability. These and other techniques can be used to improve target definition, and to characterize tumor tissue for radiotherapy dose painting.

RC124

Pediatric MR: Normal or Not?

Sunday, Nov. 29 2:00PM - 3:30PM Location: N228

GI MK NR MR PD

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Geetika Khanna, MD, MS, Iowa City, IA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Differentiate normal and abnormal signal intensity patterns of abdominal structures in children. 2) Recognize normal developmental variants that can simulate abdominal pathology.

ABSTRACT

Sub-Events

RC124A Musculoskeletal MR

Participants
Nancy A. Chauvin, MD, Philadelphia, PA, (chauvinn@email.chop.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the MR appearance of normal marrow conversion in the developing skeleton. 2) Identify common pediatric marrow pitfalls that might be mistaken for pathology. 3) Describe the MR appearance of common bone marrow abnormalities in children.

RC124B Brain and Spine

Participants
Tina Y. Poussaint, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Assess MR features associated with normal brain and spine development and maturation. 2) Identify abnormal MR imaging features associated with specific brain diseases and disorders of development in childhood.

ABSTRACT

In pediatric neuroradiology, magnetic resonance imaging is used to assess central nervous system (CNS) disease in the infant, child, and teenager. This requires 1) an understanding of normal brain development and maturation from gestation through adolescence; 2) a technical mastery of the neuroimaging techniques that are used in evaluating brain diseases of childhood; and 3) an overall grasp of the imaging features of numerous brain pathologies, both acquired and congenital. This lecture will focus on the common MR imaging features of the normal pediatric brain and spine and will compare and contrast with MR imaging features in specific brain diseases and disorders of development.

RC124C Abdominal MR

Participants
Geetika Khanna, MD, MS, Iowa City, IA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Differentiate normal and abnormal signal intensity patterns of abdominal structures in children. 2) Recognize normal developmental variants that can simulate abdominal pathology.

RC129

Should I Scan That Patient? A Very Interactive Session on MR Safety and Regulations (An Interactive Session)

Sunday, Nov. 29 2:00PM - 3:30PM Location: E353C

HP MR SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jeffrey C. Weinreb, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Emanuel Kanal, MD, Pittsburgh, PA (*Presenter*) Consultant, Boston Scientific Corporation; Consultant, Medtronic, Inc; Consultant, St. Jude Medical, Inc; Consultant, Bayer AG; Investigator, Bracco Group; Royalties, Guerbet SA;

LEARNING OBJECTIVES

1) Analyze the cause and avoidance of a spectrum of common MR safety issues, including burns. 2) List the factors (including regulation and guidelines) which should be evaluated in order to determine the safety of MRI in patients with implants, devices, or foreign objects. 3) Answer questions from the audience concerning MRI safety issues

ABSTRACT

The major potential safety considerations in magnetic resonance imaging relate to those stemming from the static magnetic field, the time varying radiofrequency oscillating magnetic fields, the time varying switched gradient magnetic fields, the contrast agents often utilized in the MR imaging process, sedation/anesthesia and monitoring-related issues unique to the MR imaging environment, and cryogen related potential safety concerns. These can present confounding situations for MR practitioners faced with questions relating to the safety of exposing particular patients and devices, implants, or foreign bodies to MR imaging examinations. This session will introduce and briefly explain the above safety considerations, and highlight specific issues likely to confront MR practitioners in their daily practice by utilizing real-life examples. The methodology and reasoning process used to approach these clinical examples in determining risk-benefit ratios for accepting or rejecting such patients from MR exposure will be stressed. The emphasis will be on not so much the particular examples used, but rather having the attendee feeling more comfortable with the approach to such clinical and research situations in order to better enable them to appropriately address such questions in their own daily practice routines. Audience polling and interaction will be actively utilized throughout this session. This will help enable the attendee to not only hear the opinions of the presenters on the cases being discussed, but also to assess their own responses to the questions being posed relative to that of the other attendees of this session.

RC150

MR Imaging-guided Breast Biopsy (Hands-on)

Sunday, Nov. 29 2:00PM - 3:30PM Location: E260

BR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Amy D. Argus, MD, Cincinnati, OH (*Presenter*) Advisory Board, Devicor Medical Products, Inc
Christopher P. Ho, MD, Atlanta, GA, (christopher.ho@emory.edu) (*Presenter*) Nothing to Disclose
Su-Ju Lee, MD, Cincinnati, OH, (su-ju.lee@uchealth.com) (*Presenter*) Spouse, Stockholder, General Electric Company.
Michelle V. Lee, MD, Saint Louis, MO, (leem@mir.wustl.edu) (*Presenter*) Nothing to Disclose
Mitva J. Patel, MD, Columbus, OH (*Presenter*) Nothing to Disclose
Stamatia V. Destounis, MD, Scottsville, NY (*Presenter*) Research Grant, FUJIFILM Holdings Corporation; Research Grant, Hologic, Inc; Research Grant, QT Ultrasound LLC
Wade C. Hedegard, MD, Rochester, NY (*Presenter*) Nothing to Disclose
Carol H. Lee, MD, New York, NY (*Presenter*) Nothing to Disclose
Colleen H. Neal, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Carol M. Dell, MD, Lexington, KY (*Presenter*) Nothing to Disclose
Roberta A. Jong, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Gary J. Whitman, MD, Houston, TX (*Presenter*) Book contract, Cambridge University Press
Christiane K. Kuhl, MD, Bonn, Germany (*Presenter*) Nothing to Disclose
Hiroyuki Abe, MD, Chicago, IL, (habe@radiology.bsd.uchicago.edu) (*Presenter*) Consultant, Seno Medical Instruments, Inc
Karla A. Sepulveda, MD, Houston, TX (*Presenter*) Nothing to Disclose
Amy L. Kerger, DO, Columbus , OH, (amy.kerger@osumc.edu) (*Presenter*) Nothing to Disclose
Jill J. Schieda, MD, Cleveland, OH, (jschieda@metrohealth.org) (*Presenter*) Nothing to Disclose
Mai A. Elezaby, MD, Madison, WI (*Presenter*) Nothing to Disclose
Amado B. del Rosario, DO, Chicago, IL (*Presenter*) Nothing to Disclose
Andrew Bowman, MD, PhD, Jacksonville, FL (*Presenter*) Nothing to Disclose
Elizabeth R. Deperi, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose
Candice W. Bolan, MD, Jacksonville, FL, (bolan.candice@mayo.edu) (*Presenter*) Nothing to Disclose
Jiyon Lee, MD, New York, NY, (jiyon.lee@nyumc.org) (*Presenter*) Nothing to Disclose
Kirti M. Kulkarni, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Establish criteria for MR Image-guided breast biopsy patient selection. 2) Cultivate a working understanding of MR Image-guided biopsy and needle localization instrumentation and implementation. 3) Basic MR Image-guided biopsy and needle localization parameters and requirements for appropriate coil, needle and approach selection. 4) Discuss practice integration issues. 5) Discuss pearls and pitfalls associated with successful MR Image-guided biopsy.

ABSTRACT

This course is intended to provide both basic didactic instruction and hands-on experience in the application of MRI guided breast biopsy. MRI provides greater sensitivity for detecting breast cancer compared with mammography and ultrasound, although with imperfect specificity. MRI guided biopsy is required to confirm or exclude maligancy for MRI only findings. This course will be devoted to the understanding and identification of the following pertaining to MRI guided biopsy: 1) appropriate patient selection 2) optimal positioning for biopsy 3) target selection and confirmation 4) various biopsy technologies and techniques 5) potential problems and pitfalls.

RC151

Modern Non-invasive Imaging of Cholestatic Liver Diseases

Sunday, Nov. 29 2:00PM - 3:30PM Location: S404AB

GI MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Ahmed Ba-Ssalamah, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Aliya Qayyum, MBBS, Houston, TX (*Presenter*) Nothing to Disclose
Richard M. Gore, MD, Evanston, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe MRI ; MRCP techniques for evaluating biliary disease. 2) List applications in malignant biliary disease. 3) List applications in benign conditions of the biliary tract.

ABSTRACT

This workshop is designed to review the broad spectrum of morphologic and functional features encountered in patients with cholestatic liver diseases involving the intrahepatic and extrahepatic bile ducts and adjacent liver parenchyma, in correlation with the histopathologic hallmark of this group of diseases the so-called "vanishing duct sign. We will start by explaining the role of various different imaging modalities including invasive endoscopic retrograde cholangiopancreatography (ERCP) and non-invasive conventional T2 weighted magnetic resonance cholangiography (MRCP) as well as gadoxetic acid-enhanced T1 MRCP and diffusion weighted images to expedite the evaluation of patients with known or suspected cholestatic liver diseases. Next, we will discuss the broad spectrum of biliary disorders that define cholestatic liver diseases including: primary sclerosing cholangitis (PSC), primary biliary cirrhosis (PBC), ischemic cholangiopathy, chronic rejection following liver transplant, drug-induced liver injury (DILI), infectious secondary cholangitis, cystic fibrosis (CF), etc.

SPSH20

Hot Topic Session: PET/MR and Hyperpolarized MR for GU Imaging

Monday, Nov. 30 7:15AM - 8:15AM Location: E450B

GU MR NM OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Zhen J. Wang, MD, Hillsborough, CA, (jane.wang@ucsf.edu) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with current PET-MR imaging strategies. 2) To learn the current and future applications of PET-MR in genitourinary oncology including gynecological cancers and prostate cancer. 3) To understand the principles of hyperpolarized carbon-13 MR metabolic imaging 4) To learn the clinical utility of hyperpolarized carbon-13 MR for measuring prostate cancer aggressiveness and response to therapy

ABSTRACT

URL

Sub-Events

SPSH20A PET/MRI of Gynecological Malignancies

Participants
Raj M. Paspulati, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) PET-MRI protocol and workflow for Gynecological cancer. 2) Role of PET-MRI in Gynecological cancer staging, treatment planning and follow up for treatment response. 3) PET-MR Imaging pit falls and limitations.

SPSH20B Imaging of Prostate Cancer: Potential of PET/MRI with Tracers beyond FDG

Participants
Matthias Roethke, MD, Heidelberg, Germany (*Presenter*) Speaker, Siemens AG

LEARNING OBJECTIVES

View learning objectives under main course title.

Handout:Matthias Roethke

http://abstract.rsna.org/uploads/2015/15006404/Roethke Prostate RSNA handout.pdf

SPSH20C Hyperpolarized 13C MR Clinical Trials of Prostate Cancer

Participants
John Kurhanewicz, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

MSCM21

Case-based Review of Magnetic Resonance (An Interactive Session)

Monday, Nov. 30 8:30AM - 10:00AM Location: S100AB

GI GU MK MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
John R. Leyendecker, MD, Dallas, TX (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be familiar with the MRI appearance of common musculoskeletal derangements of the hip. 2) Develop a differential diagnosis for musculoskeletal soft tissue tumors based on MRI appearance. 3) Distinguish between common benign and malignant liver neoplasms. 4) Be familiar with the typical MRI appearance of select female pelvic disorders.

ABSTRACT

This session will help attendees recognize and manage select, commonly encountered musculoskeletal and abdominopelvic abnormalities based on their MRI appearances using a case-based, interactive format.

Sub-Events

MSCM21A Musculoskeletal MRI of the Hip and Pelvis

Participants
Mini N. Pathria, MD, San Diego, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Active Handout:Mini Nutan Pathria

http://abstract.rsna.org/uploads/2015/15002720/Active -MSCM21A.pdf

MSCM21B MRI of Soft Tissue Masses of the Extremities

Participants
Kirkland W. Davis, MD, Madison, WI, (kdavis@uwhealth.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Distinguish characteristic extremity soft tissue masses on the basis of signal characteristics, such as high signal on T1-weighted images or low signal on all sequences.

ABSTRACT

MSCM21C MRI of the Liver

Participants
Nicole M. Hindman, MD, New York, NY, (Nicole.Hindman@nyumc.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize and analyze benign but unusual liver lesions. 2) Analyze uncommon presentations of liver lesions. 3) Recognize neoplastic mimics of benign lesions in the liver (eg, a colon metastasis mimicking a hemangioma) .

ABSTRACT

This session will cover common and uncommon presentations of liver lesions on several modalities (ultrasound, CT and MRI). A brief interactive review of common, but atypical presentations of both benign and malignant liver lesions will be presented. Malignant mimics of benign liver lesions will also be shown, with features that should be analyzed in order to better characterize the lesion, and appropriately raise concern (eg, for a metastasis or intrahepatic cholangiocarcinoma instead of a benign hemangioma). Recent advances in liver lesion characterization will be covered.

MSCM21D MRI of the Female Pelvic Organs

Participants
Christine O. Menias, MD, Scottsdale, AZ, (menias.christine@mayo.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality

educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Christine O. Menias, MD - 2013 Honored Educator
Christine O. Menias, MD - 2014 Honored Educator
Christine O. Menias, MD - 2015 Honored Educator

MSMI21

Molecular Imaging Symposium: Basics of Molecular Imaging

Monday, Nov. 30 8:30AM - 10:00AM Location: S405AB

BQ MI MR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Jan Grimm, MD, PhD, New York, NY (*Moderator*) Nothing to Disclose
Zaver M. Bhujwalla, PhD, Baltimore, MD (*Moderator*) Nothing to Disclose

Sub-Events

MSMI21A MI Using Radioactive Tracers

Participants
Jan Grimm, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) In this course, we will discuss the various radio tracers and their applications in Molecular Imaging studies. Participants will understand in which situations to use which radio tracers, what to consider when developing the imaging construct and what controls to obtain for nuclear imaging studies. Examples will contain imaging with small molecules, with antibodies and nanoparticles as well as with cells in order to provide the participants with examples how o correctly perform their imaging studies. Most of the examples will be from the oncology field but their underlying principles are universally applicable to other areas as well.

ABSTRACT

Nuclear Imaging is currently the only true "molecular" imaging method utilized in clinic. It offers quantitative imaging of biological processes in vivo. Therefore, it is not surprising that it is also highly frequented in preclinical imaging applications since it is currently the only true quantitative imaging method. Multiple agents have been developed, predominantly for PET imaging but also for SPECT imaging.In this talk, we will discuss the application of radio tracers to molecular imaging and what to consider. Common pitfalls and mistakes as well as required measures to avoid these will be discussed. We will discuss various examples of imaging constructs, ranging from small molecules to antibodies, nanoparticles and even cells. In addition, the imaging modalities will also briefly discussed, including PET, SPECT and Cherenkov imaging.

MSMI21B Molecular MRI and MRS

Participants
Zaver M. Bhujwalla, PhD, Baltimore, MD, (zbhujwa1@jhmi.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

To define the role of MRI and MRS in molecular and functional imaging and cover specific applications in disease processes. The primary focus will be advances in novel theranostic approaches for precision medicine.

ABSTRACT

With an array of functional imaging capabilities, magnetic resonance imaging (MRI) and spectroscopy (MRS) techniques are valuable in obtaining functional information, but the sensitivity of detection is limited to the 0.1-1 mM range for contrast agents and metabolites, respectively. Nevertheless, MRI and MRS are finding important applications in providing wide-ranging capabilities to tackle key questions in cancer and other diseases with a 'molecular-functional' approach. An overview of these capabilities and examples of MR molecular and functional imaging applications will be presented with a focus on theranostic imaging for precision medicine.

MSMI21C Nanoparticles

Participants
Heike E. Daldrup-Link, MD, Palo Alto, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand important safety aspects of USPIO. 2) To recognize the value of immediately clinically applicable iron oxide nanoparticles for tumor MR imaging applications. 3) To learn about clinically relevant new developments of theranostic USPIO.

ABSTRACT

Nanoparticles Nanoscale materials can be employed to develop novel platforms for understanding, diagnosing, and treating diseases. Integrating nanomedicine with novel multi-modality imaging technologies spurs the development of new personalized diagnostic tests and theranostic (combined diagnostic and therapeutic) procedures. This presentation will provide an overview over the safety, diagnostic applications and theranostic developments of clinically applicable ultrasmall superparamagnetic iron oxide nanoparticles (USPIO). USPIO which are currently used for clinical applications include ferumoxytol (Feraheme), an FDA-approved iron supplement, and ferumoxtran-10 (Combidex/Sinerem), which is currently undergoing renewed clinical trials in Europe. Safety considerations for these agents will be discussed. Both compounds provide long lasting blood pool enhancement, which can be used for MR angiographies and tissue perfusion studies. Subsequently, USPIO are slowly phagocytosed by macrophages in the reticuloendothelial system (RES), which can be used to improve MRI detection of tumors in liver, spleen, lymph nodes and bone

marrow. A slow phagocytosis by macrophages in inflammations and high grade tumors can be used to grade the severity of the disease process and monitor new immune-modulating therapies. Novel developments include synthesis of multi-functional nanoparticles, which can be detected with two or more imaging modalities, as well as clinically applicable approaches for in vivo tracking of stem cell therapies. Since USPIO are not associated with any risk of nephrogenic sclerosis, they can be used as alternative contrast agents to gadolinium chelates in patients with renal insufficiency or in patients in whom creatinine lab values are not available. Ongoing pre-clinical developments include the development of improved, targeted and activatable nanoparticle formulations, which can further improve sensitivity, specificity and theranostic imaging capabilities.

MSMI21D Contrast Ultrasound

Participants
Steven B. Feinstein, MD, Chicago, IL (*Presenter*) Research support, General Electric Company; Consultant, General Electric Company; Investor, SonoGene LLC;

LEARNING OBJECTIVES

1) Inform: Clinical utility and safety of contrast enhanced ultrasound (CEUS) imaging. 2) Educate: Current diagnostic and therapeutic approaches. 3) Introduce: Newer concepts for combined diagnostic and therapeutic applications.

MSMI21E Quantitative Imaging Biomarkers

Participants
Richard L. Wahl, MD, Saint Louis, MO (*Presenter*) Research Consultant, Nihon Medi-Physics Co, Ltd;

LEARNING OBJECTIVES

1) Identify at least one method of assessing anatomic tumor response quantitatively. 2) Identify at least one method of assessing metabolic tumor response using FDG PET quantitative. 3) Identify an MRI quantitative metric which is associated with cellularity of biological processes.

ABSTRACT

Radiology initially developed as an analog imaging method in which non quantitative data were interpreted in a 'qualitative and subjective' manner. This approach has worked well, but modern imaging also is digital, quantitative and has the opportunity for more quantitative and objective interpretations. This lecture will focus on a few areas in which quantitative imaging is augmenting qualitative image assessments to lead to more precise interpretation of images. Examples of such an approach can include measuremental of tumor 'metabolic' activity using formalisms such as PERCIST 1.0; methods of assessment of tumor size and volumes using the RECIST 1.1 and emerging formalisms and metrics of tumor heterogeneity, density, receptor density, diffusion, vascular permeability and elasticity using techniques incuding PET/SPECT, MRI, CT and ultrasound. With quantitative imaging, the opportunity to move from qualitative methods to precise in vivo quantitative pheontyping is a real one, with a quantitative 'phenome' complementing other 'omics' such as genomics. However, the quality of quantitation may vary and close attention to technical methodologies and process are required to have reliable and accurate quantitation. The RSNA QIBA effort will be briefly reviewed as one approach to achieve precise quantiative phenotyping. Examples of the use of quantitative phenotyping to inform patient management will be discussed.

Honored Educators

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Richard L. Wahl, MD - 2013 Honored Educator

RC203

Imaging Nonischemic and Ischemic Disease of the Myocardium

Monday, Nov. 30 8:30AM - 10:00AM Location: S504AB

CA CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC203A MRI and CT of Cardiac Masses

Participants
Phillip M. Young, MD, Rochester, MN, (young.phillip@mayo.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review role of MR and CT in assessing cardiac masses. 2) To highlight the potential for detection, characterization, staging, and guiding surgical decision making with cardiac MR and CT through clinical cases. 3) To review some practical tips and tricks to keep in mind when imaging these challenging cases.

ABSTRACT

RC203B Infiltrative Diseases (Amyloid, Hemochromatosis Fabrys, Sarcoid)

Participants
Kristopher W. Cummings, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of cardiac MR in the evaluation of infiltrative cardiomyopathy. 2) Describe typical patterns and locations of MR late gadolinium enhancement associated with various types of infiltrative disease. 3) Explain the role of noncontrast MR in the evaluation for myocardial iron deposition.

ABSTRACT

RC203C Non Infiltrative Non-ischemic Cardiomyopathies (HCM, Noncompaction, ARVD, Myocarditis, Takatzubo etc.)

Participants
Karen G. Ordovas, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand how to differentiate ischemic from non-ischemic cardiomyopathies on cardiac MRI. 2) To recognize the cardiac MR findings suggestive of the diagnosis of different types of non-ischemic cardiomyopathies. 3) To identify cardiac MR findings that have a prognostic role in patients with non-ischemic cardiomyopathies

ABSTRACT

RC203D T1-mapping, T2 Mapping and Quantitative Imaging

Participants
Arthur E. Stillman, MD, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the role of T1, T2 and ECV mapping for aiding cardiac disease diagnosis. 2) To review the potential of T1 and T2 mapping for monitoring therapy.

ABSTRACT

Recent advances permit quantitative MRI imaging using T1- and T2- maps. These provide a new method for tissue characterization and can be used to aid diagnosis and for monitoring treatment. Examples relating to cardiac imaging in include acute myocardial infarction, myocarditis, amyloid and Fabry disease. Recent literature suggests that quantitative T1-and T2- maps improve diagnostic capabilities compared with T1- and T2 weighted MRI. When used following the administration of gadolinium contrast, T1-maps can be used to calculate the extracelluar volume maps of myocardium. This literature will be reviewed and illustrated with case examples.

RC204

Musculoskeletal Series: Knee and Hip MR Imaging

Monday, Nov. 30 8:30AM - 12:00PM Location: E451B

MK MR

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

Participants
Lynne S. Steinbach, MD, San Francisco, CA, (lynne.steinbach@ucsf.edu) (*Moderator*) Nothing to Disclose
Miriam A. Bredella, MD, Boston, MA, (mbredella@mgh.harvard.edu) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC204-01 Pitfalls in Knee MRI Interpretation

Monday, Nov. 30 8:30AM - 8:55AM Location: E451B

Participants
Lynne S. Steinbach, MD, San Francisco, CA, (lynne.steinbach@ucsf.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize common causes of false positives on MRI of the knee including misinterpretation of normal structures and normal variants, such as the dorsal defect of the patella. 2) Review causes of false negatives on MRI of the knee that may be undetected due to lack of recognition or that may look normal over time, such as a chronic cruciate ligament tear.

ABSTRACT

MRI if highly accurate for evaluation of the knee joint. This lecture will emphasize common pitfalls and pearls to get around them when evaluating the knee with MRI. Some anatomic structures and normal variants can simulate an abnormality of the menisci, ligaments, cartilage, bone and surrounding soft tissues of the knee on MRI. In addition there are some abnormalities that can be missed or misinterpreted.

RC204-02 The Anterolateral Ligament of the Knee: A Regular Ligament or Our Imagination? Correlation of MR Imaging with Anatomical Findings

Monday, Nov. 30 8:55AM - 9:05AM Location: E451B

Participants
Enver G. Tahir, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
Christoph A. Berliner, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Sinef Yarar, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Georg Luers, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Murat Karul, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Jin Yamamura, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recently, evidence has been accumulating for the existence of a previously unknown structure at the anterolateral aspect of the human knee named anterolateral ligament (ALL). The aim of this study was to evaluate the visibility and to describe the anatomical features of the ALL using magnetic resonance imaging (MRI) and to correlate the results with gross anatomical findings.

METHOD AND MATERIALS

16 human knees were obtained from cadavers (4 male, 9 female) at a mean age of 84.3 ±5.2 years. All specimens were examined with plain film radiography to exclude advanced degenerative arthrosis, prior osseous injuries as well as joint replacement. Subsequently, MRI scans were performed with a 3 Tesla machine (Ingenia, Philips). Two musculoskeletal radiologists independently reviewed coronal and axial T1- and proton density-weighted images to assess the visibility of the ALL. In all 16 knees the lateral supporting structures were carefully dissected by an orthopedic surgeon and an anatomist to identify the course and anatomy of the ALL as well as its length and thickness.

RESULTS

On the basis of MR imaging a consistent structure correspondent to the ALL was identified in 11 knees (68%). On anatomical dissection the ALL was found in 13 knees (81%). It originated at the lateral femoral epicondyle and its proximal part was blended with the lateral collateral ligament (LCL) making it difficult to distinguish these two structures. The ALL was distally separate from the LCL and ran obliquely to insert on the lateral tibial plateau between Gerdy's tubercle and the fibular head. Measurements of a completely visible ALL on anatomic dissections revealed an average proximal length of 42.8 ±4.6 mm and a distal length of 34.3 ±10.8 mm, whereas its width was 6.46 ±2 mm.

CONCLUSION

MRI of the knee was accurate and sensitive in the identification of the intact ALL. It appeared as a thin black structure on T1 weighted sequences and was best visualized on coronal images. Information concerning this structure may be crucial with respect to the diagnosis and understanding of knee pathologies.

CLINICAL RELEVANCE/APPLICATION

The ALL is believed to be responsible for the Segond fracture and its rupture has been associated with anterolateral rotational knee instability. MRI imaging may provide valuable information about the ALL.

RC204-03 Anterolateral Ligament Injury in Patient with Acute ACL Tears on MRI: Prevalence, Patterns and Relationships with Tibial Contusions

Monday, Nov. 30 9:05AM - 9:15AM Location: E451B

Participants
Angel J. Lopez-Garib, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Nogah Shabshin, MD, MBA, Haifa, Israel (*Abstract Co-Author*) Consultant, Active Implants Corporation

PURPOSE

The anterolateral ligament (ALL) of the knee is believed to be involved in maintaining rotatory stability of the knee, may be injured with the anterior cruciate ligament (ACL) tear during pivot shift injuries and may be accountable for failed ACL repairs. We sought to describe the incidence and patterns of ALL injury in patients with acute ACL tears, and investigate if there is a relationship with various bone contusions, meniscal tears and posterolateral injuries.

METHOD AND MATERIALS

Knee MR examinations of 81 patients with acute ACL tears were retrospectively reviewed by two musculoskeletal radiologists to assess the ALL: visualization, location of tibial insertion, sprain and presence of an anterolateral tibia insertional bone contusion. Additional bone contusions in the posteromedial, posterolateral and anteromedial tibia and lateral femoral condyle were noted, as well as meniscal tears and posterolateral injuries (popliteus tendon and fibular collateral ligament [FCL]). Statistical analysis for relationships of these findings with ALL injuries was obtained utilizing the Pearson correlation and Chi2 tests.

RESULTS

ALL injury, including sprain and/or an anterolateral tibia traction contusion, was seen in 49/81 (60%) (34/81 [42%] and 32/81 [40%], respectively), with an avulsion fracture in 3/32 (9%). Anteromedial and posterolateral tibial contusions were significantly more common in patients with ALL injury (p=0.004 and p=0.006, respectively). The anterolateral tibial traction contusion was characteristically subcortical, elongated (mean size (mm) 10.7CC x 12.7AP x 4.6TV), and involved the middle anteroposterior third of the tibia. There was correlation with posterolateral injury (p=0.046) and medial meniscal tears (32/81, p=0.049). There was no relationship between lateral meniscus tear, posterolateral tibial or lateral femur bone contusion and ALL injury.

CONCLUSION

ALL injury is present in more than 50% of ACL tears. It is specifically associated with anteromedial and posterolateral tibial contusions, and some demonstrate a characteristic anterolateral traction contusion.

CLINICAL RELEVANCE/APPLICATION

ALL injury is common on MRIs of acute ACL tears. Anteromedial and posterolateral tibia contusions are suspicious and anterolateral, elongated subcortical tibia contusion and ALL sprain should be assessed.

RC204-04 Distal MCL Tears of the Knee: MRI Features of Stener-like Lesions

Monday, Nov. 30 9:15AM - 9:25AM Location: E451B

Participants
Robert D. Boutin, MD, Sacramento, CA (*Presenter*) Nothing to Disclose
Russell C. Fritz, MD, Mill Valley, CA (*Abstract Co-Author*) Nothing to Disclose
Richard E. Walker, MD, Calgary, AB (*Abstract Co-Author*) Nothing to Disclose
Mini N. Pathria, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Cassandra A. Lee, MD, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Lawrence Yao, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To analyze the MRI characteristics of distal MCL tears, without and with displacement superficial to the pes anserinus (Stener-like lesion [SLL]).

METHOD AND MATERIALS

In this IRB-approved study, MRI examinations of the knee at three institutions were selected which showed partial or complete tears of the (superficial) MCL centered distal to the joint line. MRI examinations were evaluated independently by two musculoskeletal radiologists for: a SLL of the distal MCL; coexistent tears of the meniscotibial and meniscofemoral ligaments; a wavy contour to the more proximal MCL; the vertical distance of the stump from the medial joint line; and the transverse distance of the stump from the medial tibial cortex. Additional co-existent knee injuries also were recorded.

RESULTS

The study included 32 patients (median age: 27 years; interquartile range 18 years). A SLL of the MCL was identified in 11 of 32 cases. The proximal stump margin was located significantly (p<.01, Mann Whitney U) more distal in cases with a SLL (mean=35 mm, sd=11 mm), as compared to without a SLL (mean=16 mm, sd=15 mm). The incidence of ACL tear, PCL tear, meniscotibial/meniscofemoral ligament tear, and lateral compartment osseous injury was high in cases with a SLL (91%, 36%,73%, and 91%, respectively), but not significantly different (p>0.10, Fisher's exact test) from cases without a SLL (81%, 33%, 57%, and 91%, respectively). The MCL had a wavy appearance in 82% of cases with a SLL, and in 62% without a SLL.

CONCLUSION

A SLL of the MCL should be considered in the setting of a high-grade, distal MCL tear, particularly when there is a wavy appearance to the MCL. These lesions are accompanied very frequently by tears of the ACL and meniscotibial/meniscofemoral ligaments.

CLINICAL RELEVANCE/APPLICATION

A SLL of the distal MCL is important to recognize for appropriate treatment and operative decision making.

RC204-05 Postero-lateral Instability (PLI) of the Knee: Can the Right Diagnosis of Postern-lateral Corner (PLC) Structures Involvement, Using the WB-MRI, Evades a Future Anterior Cruciate Ligament (ACL) Reconstruction Failure?

Monday, Nov. 30 9:25AM - 9:35AM Location: E451B

Participants
Silvia Mariani, MD, L'Aquila, Italy (*Presenter*) Nothing to Disclose
Alice La Marra, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco Arrigoni, Coppito, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonio Barile, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Masciocchi, MD, L'Aquila, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of our study was to evaluate the value of weight-bearing (WB)-MRI compared to standard-MRI in unmasking PLC structures involvement to determinate a PLI

METHOD AND MATERIALS

We prospectively analyzed 200 patients positive for an acute ACL injury, only 100 of them with suspicion of a PLI. All patients underwent a dedicated MRI in supine and WB position with knee flexion of 12°-15°. We evaluated knees for 3 direct signs of ACL injury (discontinuity, ACL alterated morphology and deflection) and for 4 indirect signs (bone bruise, anterior tibial traslation, uncovered lateral meniscus and hyperbuckled posterior cruciate ligament (PCL). We evaluated the involvment of PLC capsuloligamentous structures. All patients underwent arthroscopy.

RESULTS

Among the direct signs we obtained that ACL deflection resulted the most statistical significant ($p<0.004$) ; among the indirect signs the anterior tibial traslation was the most statistical significant ($p<0.0001$) followed by the uncovered lateral meniscus ($p<0.005$). Finally we evaluated the involvement of PCL capsulo-ligamentous structures (antero-lateral and postero-medial popliteo-meniscal ligaments) : both the ligaments were involved in 65/89 of the cases insteas only the inferior one was involved in 24/89 of the cases. Arthroscopy confirmed ACL tear with diagnosis of PLI in 89% of cases. The 100 patients with no clinical suspicion of PLI didin't show modifications of signs during the standard and WB-MRI.

CONCLUSION

The study discovers the value of WB-MRI in recognising the most sensitive direct and indirect signs of ACL injury and to diagnose a PLC involvement, leading patients to the right surgical treatment

CLINICAL RELEVANCE/APPLICATION

The diagnosis of the PLI is always clinical however there is no a pre-operative specific test to diagnose it. The added value of the weight-bearing MRI is to provide further information in unmasking direct/indirect signs of ACL injury negative at standard-MRIThis may be very helpful for the orthopedic surgeon in the choice of possible treatment and to avoid an ACL graft failure

RC204-06 Posterolateral Corner Injuries

Monday, Nov. 30 9:35AM - 10:00AM Location: E451B

Participants
William B. Morrison, MD, Philadelphia, PA (*Presenter*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc

LEARNING OBJECTIVES

1) Understand the anatomy of the posterolateral corner of the knee. 2) Realize the importance of the posterolateral corner in injury of the knee. 3) Be able to recognize major and minor posterolateral corner injury on MRI.

RC204-07 Postoperative Meniscus

Monday, Nov. 30 10:10AM - 10:30AM Location: E451B

Participants
Robert D. Boutin, MD, Sacramento, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Differentiate between the 3 surgical techniques applied to the torn meniscus (the "three R's": Resection, Repair, and Replacement) -- each resulting in a different 'normal' MRI appearance of the postoperative meniscus. 2) Detect recurrent/residual tears in the post-operative meniscus on MRI.

ABSTRACT

After highlighting relevant anatomy, we review the current indications and techniques used for meniscus surgery, and focus on MRI interpretation of the postoperative meniscus, including recurrent tears and outcomes/complications.

RC204-08 Pitfalls in Hip MRI Interpretation

Monday, Nov. 30 10:30AM - 10:55AM Location: E451B

Participants
Donna G. Blankenbaker, MD, Madison, WI, (dblankenbaker@uwhealth.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Develop a search pattern in the evaluation of the painful hip. 2) Identify common pitfalls in hip MRI interpretation. 3) Describe different features for conditions affecting the hip. 4) Differentiate between normal variants and pathology of the hip.

ABSTRACT

Relevant hip anatomy will be reviewed, followed by imaging features of intra-articular, internal and osseous pathology in the patient with the painful hip. Interpretive imaging pitfalls of these structures will be discussed.

RC204-09 Can MRI Predict a Future Bucket Handle Type Meniscus Tear in Patients with Recent Knee Trauma and ACL Injury?

Monday, Nov. 30 10:55AM - 11:05AM Location: E451B

Participants
Roula Bou Sader, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Michael G. Kendrick, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc
Adeel H. Azam, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Johannes B. Roedl, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Michael G. Ciccotti, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Adam C. Zoga, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We anecdotally observed patients suffer bucket handle type meniscus tears (BHMT) after ACL reconstruction, requiring a 2nd surgery. We sought to assess if a knee MRI performed post initial injury can predict a potential future BHMT using a novel assessment algorithm for traumatic meniscal injury.

METHOD AND MATERIALS

A PACS and report database was searched for MRI knee examinations describing a medial BHMT from 2006 to 2013. These exams were then screened for the availability of a prior MRI performed after a trauma with no BHMT. The prior MRI was reviewed for presence of a meniscal tear or lesion borderline for a tear, tear configuration (oblique, horizontal, vertical, or complex), tear location (anterior horn, body, and/or posterior horn), tear zone (red, white, and/or pink), tear extension to articular surfaces of the meniscus (inferior, superior or both) and the presence of concomitant anterior cruciate ligament pathology (disruption or reconstruction). The time interval between the initial MRI and the BHMT MRI was recorded, as was patient age and gender.

RESULTS

931 MRIs with reported BHMT yielded 39 subjects with prior MRI. Of these, only 7/39 (17.9%) had no clear meniscus tear on the initial study and 6/7 had edema type signal at the posteromedial margin of the medial meniscus. Of the 32/39 (82.1%) with prior meniscal tears: 27/32 (84.4%) were vertical or complex with a vertical component, 4/32 (12.5%) were oblique, and 1/32 (3.1%) were horizontal. All of the prior meniscal tears involved the posterior horn while 10/32 (31.2%) also involved the meniscal body. The red zone was most often involved (28/32, 87.5%), while the white and pink zones were involved in 12/32 (37.5%) and 15/32 (46.8%) respectively. Concomitant ACL pathology was common on the initial exams, seen in 26/39 (66.6%). Of the 26 patients with ACL pathology, 16 had an active ACL tear and 10 had a prior ACL reconstruction. 28/32 (87.5%) of the initial meniscus tears including all vertical tears involved both articular surfaces.

CONCLUSION

In the setting of knee trauma and ACL injury, MR findings of a vertical medial meniscus tear involving the red zone and both articular meniscal surfaces should raise concern for the potential evolution of a BHMT.

CLINICAL RELEVANCE/APPLICATION

A non displaced peripheral vertical medial meniscal tear is an important observation on a posttraumatic knee MRI. Orthopedists should consider repair to prevent the evolution of a BHMT.

RC204-10 Hip MR Arthrography: Are We Underdiagnosing Laxity Pre-operatively?

Monday, Nov. 30 11:05AM - 11:15AM Location: E451B

Participants
Geoffrey M. Riley, MD, Half Moon Bay, CA (*Presenter*) Nothing to Disclose
Michael L. Richardson, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Jonathan Packer, MD, Redwood City, CA (*Abstract Co-Author*) Nothing to Disclose
Marc Safran, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Robert D. Boutin, MD, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Michelle Nguyen, MD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The preoperative clinical exam is known to be unreliable for the diagnosis of hip laxity and often an exam under anesthesia is necessary for diagnosis. The purpose of this study is to ascertain if MR arthrography findings are associated with laxity.

METHOD AND MATERIALS

After obtaining IRB approval, we identified 57 consecutive patients (36 women, 21 men) undergoing first hip MR arthrography and then arthroscopy by a single hip arthroscopist, within a maximum of 10 months (excluding patients with hip hardware, fractures, or tumors). The original MR report was reviewed for the preoperative diagnosis of laxity. An MSK radiologist and an MSK fellow blinded to surgical results then re-reviewed, by consensus, the MR arthrograms for 2 morphologic findings that have been associated with hip laxity: Widening of the anterior hip joint recess (>5 mm) and thinning of the adjacent joint capsule (< 3mm). Measurements were made on an axial T1-weighted image without fat saturation at the level of the anterior capsule insertion onto the greater

trochanter. An orthopaedic surgeon (blinded to MR findings) reviewed the arthroscopy reports for the documentation of clinical laxity determined by examination under anesthesia (reference standard).

RESULTS

None of the 57 MR reports described the findings related to laxity. Logistic regression was performed using clinical laxity as the dependent variable and gender, age, and MR findings of laxity scored as independent variables. Clinical laxity was much more common in women (26 women, one man). It was also more common in older patients. Statistically significant associations were noted between clinical laxity and gender (odds ratio for men = 0.009, p = 0.0001) and the presence of both MR findings of laxity (odds ratio = 11.1, p = 0.039).

CONCLUSION

Hip laxity is commonly underdiagnosed on pre-operative MR reports, compared with exam under anesthesia. We were able to confirm an association between clinical laxity and the MR findings of anterior recess widening and anterior capsular thinning.

CLINICAL RELEVANCE/APPLICATION

Atraumatic hip instability is increasingly recognized as a cause of hip pain that is potentially treatable, but difficult to diagnose preoperatively. MR may help identify patients with laxity, thus influencing surgical management.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Michael L. Richardson, MD - 2013 Honored Educator
Michael L. Richardson, MD - 2015 Honored Educator

RC204-11 Supine Versus Standing Radiographs for Ischiofemoral Impingement Using a Propensity Score-Match

Monday, Nov. 30 11:15AM - 11:25AM Location: E451B

Participants
Kyu-Sung Kwack, MD, PhD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Hoon Park, MD, Suwon-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seulgi You, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Yoolim Baek, MD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aims of this study were to test useful parameters for ischiofemoral impingement (IFI) on both supine and standing anteroposterior hip radiographs, and to suggest optimal cut-off points for detection of IFI on radiograph.

METHOD AND MATERIALS

We performed a retrospective study for all patients who had a clinical history of hip pain. All hip joints with quadratus femoris muscle (QFM) edema characterized by increased signal intensity on axial FatSat T2-weighted MR images were selected as a IFI patient group, and an age- and sex-matched control group was created from the same cohort by propensity-score matching. Two readers independently measured the parameters, including ischiofemoral space (IFS), quadratus femoris space (QFS) and hamstring tendon area (HTA) on MR images. The ischiofemoral distance (IFD) and femur neck shaft angle (NSA) were also measured on radiographs. Differences in each parameters between the two study groups were assessed by using the Mann-Whitney U test. Interobserver agreement was quantified by using the intraclass correlation coefficient. The area under the ROC curve (AUC) was calculated as a measure of discriminative ability. Youden's J statistic was used to select the optimum cut-off points for each parameters on radiograph.

RESULTS

A total of 30 patients with QFM edema (44 hip joints, age: 54.8±11 years) were included in the IFI patient group. A total of 88 patients without QFM edema (88 hip joints, age: 51.8 ± 13.4) were selected as control group from a cohort after propensity score matching. IFS, QFS, NSA and IFD showed statistically significant differences between two groups ($p < 0.05$). IFS, QFS and IFD showed almost perfect interobserver agreements ($r > 0.8$). IFDs showed good discrimination abilities (AUC > 0.80). Optimal cut-off points for IFD by reader 1 were 19.9 mm and 16.2 mm on supine radiograph and standing radiograph, respectively. Optimal cut-off points for IFD by reader 2 were 21.1 mm and 17.0 mm, respectively.

CONCLUSION

IFDs on both supine and standing hip radiographs showed good diagnostic performances for detection of IFI. It could be used as a good screening tool with optimal cut-off points.

CLINICAL RELEVANCE/APPLICATION

The measurements of ischiofemoral distances on both supine and standing hip radiographs are useful screening tool with good diagnostic performances for detection of ischiofemoral impingement.

RC204-12 Validation of 3D MRI for the Measurement of Skeletal Muscle Volumes

Monday, Nov. 30 11:25AM - 11:35AM Location: E451B

Participants
Elizabeth Robinson, London, United Kingdom (*Presenter*) Nothing to Disclose
Johann Henckel, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Marc Modat, PhD, Hertforshire, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Christian Klemt, MSc, Hertforshire, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

Jorge Cardoso, PhD, Hertforshire, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Keshthra Satchithananda, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sebastien Ourselin, PhD, Hertforshire, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Alister Hart, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To validate the use of 3D MRI in volumetric computation of muscle wasting To demonstrate the role for 3D MRI in evaluating diseased muscles around hip replacements

METHOD AND MATERIALS

We have applied a novel automated segmentation propagation framework to the MR images of 18 patients with unilateral metal on metal hip replacements. The MR images were manually segmented into the following muscles: Gluteus maximus, Gluteus minimus, Iliopsoas and Tensor Fasciae Latae. MR images were bias-field corrected. The scans were divided in half to create two databases, healthy and diseased, which were processed separately. Each MR image in the database was affinely registered to all the other images using a block matching algorithm and aligned to a common space. We obtained an average matrix for the alignment of images in the database using least trimmed square regression. Consensus segmentation was achieved using similarity and truth estimation algorithm for propagated segmentations (STEPS). The proposed framework was assessed using a leave-one out validation approach. This was used to quantify a clinically relevant imaging biomarker.

RESULTS

The MR images of 18 patients (11 female, 7male) aged 64 ± 15yrs underwent novel automated segment propagation. The leave-one out cross validation framework assessing the influence of non-rigid registration and label fusion parameters gave the average Dice score for healthy hip muscles is 0.864 (range 0.804-0.931). The average Dice score for pathological hip muscles is 0.827 (range 0.753-0.899).

CONCLUSION

The accuracy of the proposed automated framework was verified by leave one out cross validation. The values obtained for the average are promising given that only 17 MR images are in the database. We would expect these scores would to rise with a larger database of images. Future work would involve the expansion of this database in order to define more variability and obtain more accurate automated segmentation.

CLINICAL RELEVANCE/APPLICATION

3D MRI, a technique applied successfully in brain imaging, offers a novel way to monitor the muscle disease formation and progression in patients with hip arthroplasties. This automated segmentation framework can be used to verify volume discrepancies in unilateral hip arthroplasty patients which is currently done manually. This technique will aid patient monitoring and surgical planning.

RC204-13 Extraarticular Hip MRI

Monday, Nov. 30 11:35AM - 12:00PM Location: E451B

Participants
Miriam A. Bredella, MD, Boston, MA, (mbredella@mgh.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with normal anatomy and common pathology of muscles, tendons, and bursae around the hip. 2) Demonstrate understanding of the pathomechanisms and imaging findings of extra-articular hip impingement syndromes.

ABSTRACT

Relevant extra-articular hip anatomy will be reviewed, followed by MRI findings of common pathology of tendons, muscles, and bursae around the hip. Pathomechanisms and imaging findings of extra-articular hip impingement syndromes will be discussed.

RC205

Neuroradiology Series: Spine

Monday, Nov. 30 8:30AM - 12:00PM Location: N228

NR CT MR

ARRT Category A+ Credits: 4.00
AMA PRA Category 1 Credits ™: 3.25

FDA Discussions may include off-label uses.

Participants
Michael N. Brant-Zawadzki, MD, Newport Beach, CA (*Moderator*) Nothing to Disclose
Gordon K. Sze, MD, New Haven, CT (*Moderator*) Investigator, Remedy Pharmaceuticals, Inc

Sub-Events

RC205-01 Rational Imaging of the Patient with Spine Pain

Monday, Nov. 30 8:30AM - 9:00AM Location: N228

Participants
Timothy P. Maus, MD, Rochester, MN (*Presenter*) Institutional research contract, Sorrento Therapeutics, Inc

LEARNING OBJECTIVES

1) The learner will be able to identify the major specificity fault of spine imaging . 2) The learner will be able to describe the major sensitivity fault of spine imaging. 3) The learner will be able to describe the utility of spine imaging in the acute presentation of back or limb pain. 4) The learner will be able to describe appropriate utilization of spine imaging in the back / limb pain patient based on guidelines published by major specialty societies.

ABSTRACT

AbstractSpine imaging rightfully has a pivotal role in the evaluation of the patient with back or limb pain, primarily in the exclusion of systemic disease as a cause of symptoms. Unfortunately, imaging is frequently over utilized, providing no measurable benefit to the patient while incurring significant societal cost and potential patient harm. It is imperative to examine the literature to understand the appropriate interpretation, value to the patient, and evidence-based utilization of spine imaging. Systemic disease underlies only 5% of back or limb pain presentations; most imaging findings are categorized as "degenerative." This constitutes the primary specificity fault of spine imaging: the vast majority of reported "degenerative" changes involving the spinal articulations, the disc and facet joints, are asymptomatic and reflect only expected age-related change. They are not a degenerative disease; labeling them as such is misleading. Spine imaging also suffers a sensitivity fault: most advanced imaging is done in a recumbent position, without axial load and physiologic posture. This renders imaging insensitive to dynamic structural alterations present only in the upright patient. Reliance on anatomic structural changes alone must ultimately yield to imaging identification of the local inflammatory processes that are necessary for spine nociception. Utilization of spine imaging must occur as a risk / benefit calculation. The benefits of diagnosis of systemic disease, or guiding therapeutic intervention for truly symptomatic structural/inflammatory changes, must be weighed against the harms of inappropriately labeling the patient as suffering from a degenerative disease, radiation exposure, patient / societal cost, and the precipitation of interventions that are often poorly based on evidence. Evidence-based guidelines for imaging utilization, in combination with an evidence-based understanding of its interpretation, can help physicians employ this powerful tool more effectively and efficiently.

RC205-02 Ossification of the Posterior Longitudinal Ligament: Sex Difference and Prevalence on Computed Tomography (CT)

Monday, Nov. 30 9:00AM - 9:10AM Location: N228

Participants
Kamyar Sartip, MD, Washington, DC (*Presenter*) Nothing to Disclose
Sanmeet Singh, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Tuo Dong, BS, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Alexandra M. Millet, BS, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Motahar Basam, BA, Silver Spring, MD (*Abstract Co-Author*) Nothing to Disclose
Bonnie C. Davis, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Han Y. Kim, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Andre J. Duerinckx, MD, PhD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We report the prevalence of ossification of the posterior longitudinal ligament (OPLL) in the cervical spine on computed tomography (CT) in the North American population using the original and newer classification systems proposed by the Japanese Ministry of Public Health and Welfare (JMPHW).

METHOD AND MATERIALS

We retrospectively reviewed CT examinations of the cervical spine in adult patients performed from January 1st, 2009 through March 31st, 2010 at our institution. OPLL type, prevalence, and thickness were recorded. The OPLL types as described in the original JMPHW classification scheme were: continuous, segmental, mixed, and circumscribed. The CT classification comprised of two schemes: A or axial. Classification A described OPLL as bridging or nonbridging. In the axial classification, the location of the OPLL at the level of maximal stenosis on axial imaging was characterized as central or lateral.

RESULTS

We reviewed CT scans on 837 patients, 555 males (66%), with average age of 44.1 years (ranged from 18 to 100 yrs). We

detected 39 OPLL lesions in these 837 patients (4.7%). The OPLL types based on the original classification were 28 segmental, 8 circumscribed, 2 mixed, and 1 continuous. According to classification A, 31 were nonbridge (79%). According to the axial classification, 34 were central (87%). Of the 28 patients with segmental OPLL, 20 (71%) were male. Of the 8 circumscribed OPLL, only 5 (63%) were male. The two patients with mixed type were female.

CONCLUSION

We found the prevalence of OPLL to be 4.7% which is higher than previously reported. Additionally, although prevalence among males was higher than females, we discovered that in the cervical spine that this sex difference is not uniform and depends on type of OPLL.

CLINICAL RELEVANCE/APPLICATION

Ossification of the posterior longitudinal ligament is a well-known cause of spinal stenosis and neurologic dysfunction. The reported prevalence of OPLL based on radiography ranges between 0.1-1.7% in Europe and US, 0.4-3% in Asia excluding Japan, and 1.9-4.3% in Japan. However, we found the prevalence of OPLL to be much higher than previously reported. Given the wide spread use of CT in today's clinical practice, radiologists will identify incidental OPLL in asymptomatic patients. We believe recognition of OPLL and knowledge of its natural history will be important for guiding patient management.

RC205-03 CT Findings Predict Clinical Outcome after Dynamic Posterior Stabilization in Patients with Painful Segmental Instability of the Lower Spine

Monday, Nov. 30 9:10AM - 9:20AM Location: N228

Participants
Benedikt J. Schwaiger, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Alexandra S. Gersing, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Michael Behr, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Claus Zimmer, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose
Florian Ringel, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Jan S. Kirschke, MD, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Although clinical results after dynamic posterior stabilization in patients with painful degenerative segmental instability of the lower spine are promising, few is known about preoperative CT imaging parameters to select patients who will benefit from this procedure. Purpose therefore was to identify CT findings that predict post-surgical outcome.

METHOD AND MATERIALS

63 patients (age 66±11.7; 38 women) treated with dynamic stabilization for painful segmental instability with/without spinal stenosis were identified. Preoperative MDCT scans were assessed for quantitative and qualitative parameters defining degenerative changes of the thoracolumbar spine. BMD measurements were performed in asynchronously calibrated MDCT. For clinical follow-up at 24 months, visual analogue scale (VAS), Oswestry Disability Index (ODI), Short Form 36 physical (PCS) and mental (MCS) component summaries were assessed. For statistical analysis classification and regression trees, linear regression and non-parametrical tests were used.

RESULTS

At follow-up, all clinical scores showed significant improvement compared to preoperative values (delta VAS 4.1±2.9, delta ODI 32.1±17.2, delta PCS 4.9±2.3 and delta MCS 4.2±1.7; P<0.001, respectively).PCS improvement was significantly decreased in patients with higher grades of disc herniation (P<0.001) and spondylolisthesis (P=0.011) as well as with larger cross-sectional area (CSA) of the dural tube at disc level (P=0.043). PCS improvement was significantly higher in patients with high intervertebral disc height (P=0.006) and high grades of vertebral body sclerosis (P=0.002). Patients with high BMD and initially low AP diameter of intervertebral foramina showed a significantly higher improvement of ODI (P<0.05).

CONCLUSION

In patients treated with dynamic posterior stabilization, postoperative clinical improvement was predicted by the following CT parameters: high grades of vertebral body sclerosis, spondylolisthesis or disc herniation, high BMD and disc space height, larger CSA of the dural tube and AP diameter of intervertebral foramina. Preoperative evaluation of these CT parameters therefore may improve therapy selection for patients with degenerative disease of the lower spine.

CLINICAL RELEVANCE/APPLICATION

The identified CT parameters predict post-surgical outcome and therefore support appropriate therapy selection for patients with painful degenerative segmental instability of the lower spine.

RC205-04 Accuracy and Efficacy of Fluoroscopic guided Pars Interarticularis Injections on Immediate and Short-Term Pain Relief

Monday, Nov. 30 9:20AM - 9:30AM Location: N228

Participants
Lloyd M. Kershen, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Nicholas C. Nacey, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
James Patrie, MS, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Michael G. Fox, MD, Charlottesville, VA (*Presenter*) Stockholder, Pfizer Inc;

PURPOSE

To determine the accuracy and short-term efficacy of fluoroscopic guided steroid and anesthetic injections for symptomatic pars interarticularis (pars) defects.

METHOD AND MATERIALS

Following IRB approval, all fluoroscopically guided injections of symptomatic pars defects at a single institution from June 2010 to

Following IRB approval, all fluoroscopically guided injections of symptomatic pars defects at a single institution from June 2010 to October 2014 were retrospectively and independently reviewed by two MSK radiologists with 2 and 13 years of post-fellowship experience to determine if the injections from a single procedure were all intra-pars (n=48), all peri-pars (n=3), or partially intra-pars (n=6). The patient's pain score graded on a 0-10 numeric pain scale was recorded pre-injection, 5-10 minutes and 1 week post-injection. Age, gender, pre-pain level and fluoroscopic times were recorded. Univariate and multivariate statistical analysis were performed.

RESULTS

A total of 57 procedures (106 pars injections) were performed on 41 patients (mean age 37; 21M,20F). Exact agreement between the 2 readers was present in 86% (49/57) of the procedures with a consensus intra-pars location recorded in 91.5% (97/106) of injections. The mean pre-injection and 5-10 minute post-injection pain scores for the all intra-pars procedures was 5.9 and 2.9, respectively with a mean change in pain of -3.0 (95% CI -3.8, -2.2; p<0.001). For the all intra-pars procedures with a 1-week post-injection pain score recorded (n=18 pts; 34 pars), the mean 1-week post-injection change in pain was -0.8 (95% CI -1.8, 0.2; p=0.10).The mean pre-injection and 5-10 minute post-injection pain scores for the 9 peri-pars/partially-in procedures were 6.1 and 3.4, respectively with a mean change in pain of -2.7 (95% CI -4.5, -0.9; p<0.004).When accounting for radiologist performing the procedure, the mean fluoroscopic time per pars injected was 43 s (CI 37, 50) for the all intra-pars group versus 73 s (CI 52, 103) for the peri-pars injections (p=0.001).

CONCLUSION

Fluoroscopically guided intra-pars injections for symptomatic spondylolysis can be performed accurately in ~90% of cases with minimum fluoroscopic time. There is statistically significant pain reduction immediately following the procedure, with a trend in pain reduction at one week.

CLINICAL RELEVANCE/APPLICATION

Symptomatic pars interarticularis defects can be successfully injected with limited fluoroscopic time in ~90% of cases with significant immediate pain relief, obviating the need for CT to perform these injections

RC205-05 Acute Myelopathy Following Epidural and Spinal Anesthesia

Monday, Nov. 30 9:30AM - 9:40AM Location: N228

Participants
Ruth Eliahou, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Alexander Losus, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Eliel Ben-David, MD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
John M. Gomori, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, Medymatch Technology Ltd
Asaf Honig, MD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Spinal and epidural anesthesia (E-SA) are widely used and generally considered as safe procedures. However, rarely, myelopathy may develop acutely and may result in permanent neurological sequela. This study suggests three different mechanisms of post-procedure myelopathy including direct cord injury, toxic/allergic myeloradiculitis and cord ischemia.

METHOD AND MATERIALS

Over 300 medical files of an acute myelopathy were reviewed. Patients presenting acute myelopathies appearing within 24 hours after E-SA were included.

RESULTS

12 patients (mean age 44.7, range 25-74 years) presenting progressive spinal motor, sensory and autonomic dysfunction within 3-24 hours following E-SA met inclusion criteria. 4/12 women (ages 25-30 years) manifested acute myeloradiculitis. MRI showed cord and cauda equina nerve root enhancement and T2 hyperintense cord lesions, suggesting toxic/ allergic reaction. 7/12 patients (32-71 years) presented Brown-Seequard-like symptoms with detrusor instability in conus medullaris injuries (6 patients) or tetraparesis in cervical cord injury (1 patient). Most cases showed unilateral cord injury. MRI showed focal blood products on SWI and cord edema at the site of injection. Follow up MRI showed decreased edema with syrinomyelia as a late sequela in all cases, consistent with direct traumatic damage to the spinal cord.One 74 year old patient developed restricted diffusion on DWI-MRI and central grey matter T2 signal cord abnormality, suggesting local hypoperfusion and cord ischemia.

CONCLUSION

Acute myelopathy may develop following E-SA due to direct traumatic cord injury, toxic/allergic response or cord ischemia, with possibility of permanent neurological damage. Focal syringomyelia as a late sequela is typical.Characteristic MRI findings aid with the diagnosis and management.

CLINICAL RELEVANCE/APPLICATION

Acute myelopathy following spinal and epidural anesthesia is a rare but serious complication with potential for permanent neurological sequelae. SWI and DWI -MRI sequences aid the diagnosis and help characterize the mechanism of injury.

RC205-06 Epidural Steroid Injections for Spinal Stenosis: Helpful or Harmful?

Monday, Nov. 30 9:40AM - 10:10AM Location: N228

Participants
Jeffrey G. Jarvik, MD, MPH, Seattle, WA, (jarvikj@uw.edu) (*Presenter*) Co-founder, PhysioSonics, Inc; Stockholder, PhysioSonics, Inc; Intellectual property, PhysioSonics, Inc ; Consultant, HealthHelp, LLC; Author, Springer Science+Business Media Deutschland GmbH; Advisory Board, General Electric Company; Consultant, Alphabet Inc

LEARNING OBJECTIVES

1) Review the rationale and design of the Lumbar Epidural Steroid injections for spinal Stenosis (LESS) study. 2)Examine the results of the LESS study. 3) Discuss the limitations of LESS study. 4) Discuss the policy implications of the LESS conclusion: in the

treatment of lumbar spinal stenosis symptoms, epidural steroid injections offered minimal to no benefit compared to epidural injections of lidocaine at six weeks.

ABSTRACT

The Lumbar Epidural Steroid injections for spinal Stenosis (LESS) study was double-blind study comparing epidural steroid injections (ESIs) with lidociaine to lidocaine injections alone. The study included 400 patients with back and leg pain from lumbar spinal stenosis who were randomized to receive either an epidural injection containing lidocaine or an epidural injection containing lidocaine plus a glucocorticoid. Sixteen U.S. centers participated in the study.Compared to injections with local anesthetic alone, injections with glucocorticoids provided these patients with minimal or no additional benefit. The primary outcomes were the Roland-Morris Disability Questionnaire and a leg pain numerical rating scale. Patients who received glucocorticoid reported greater satisfaction with treatment, with 67% of those patients reporting being very satisfied or somewhat satisfied compared to 54% of those who received lidocaine alone reporting the same level of satisfaction with the treatment. There were more adverse events in the patients who received the injections that included glucocorticoid. Furthermore, patients receiving the combination injections were more likely to have low morning serum cortisol levels at 3 weeks and 6 weeks after the injection, suggesting that the corticosteroid may have a broad systemic effect.In conclusion, for the treatment of lumbar spinal stenosis symptoms, ESIs offered minimal to no benefit compared to epidural injections of lidocaine at six weeks.; The small improvement with corticosteroid observed at 3 weeks was due solely to the interlaminar approach and not transforaminal approach injections. There is evidence of sustained systemic effects of the corticosteroid including cortisol suppression that should be considered, particularly in older adults.

RC205-07 Lumbar Disc Nomenclature 2.0: Recommendations of the Combined Task Force

Monday, Nov. 30 10:20AM - 10:50AM Location: N228

Participants
Gordon K. Sze, MD, New Haven, CT (*Presenter*) Investigator, Remedy Pharmaceuticals, Inc

LEARNING OBJECTIVES

1) To understand the scope and nature of the revisions of the lumbar disc nomenclature update, version 2.0. 2) To investigate the rationale for the revisions. 3) To comprehend the most important revisions.

ABSTRACT

'Lumbar disc nomenclature: version 2.0. Recommendations of the combined task forces of NASS, ASSR, and ASNR' is the updated and revised version of the original 'Nomenclature and classification of lumbar disc pathology' and is the product of a multidisciplinary effort over the course of nearly 10 years. The revised document resembles the original in format and language, but provides changes that are consistent with current concepts in radiologic and clinical care. The modifications center on: 1. updating and expanding the text, glossary, and references; 2. revision of the figures; 3. emphasizing the term anular fissure to replace anular tear; 4. refinement of the definitions of acute and chronic disc herniations; 5. revision of the differentiation between disc herniation and bulging disc. Several other minor amendments were also made, such as deleting the section on Reporting and Coding, which was outdated in the original and would become outdated in the current update as soon as it was published.

RC205-08 Assessment of Sensitivity and Radiologic Reporting of Oncologic Epidural Lesions on Body CT: A 12-year Retrospective Review

Monday, Nov. 30 10:50AM - 11:00AM Location: N228

Awards
Trainee Research Prize - Fellow

Participants
Lauren M. Kim, MD, Bethesda, MD (*Presenter*) Nothing to Disclose
Evrim B. Turkbey, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Ronald M. Summers, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Royalties, iCAD, Inc; Research funded, iCAD, Inc;

PURPOSE

Metastatic epidural spinal cord compression is a debilitating neurological complication which occurs in approximately 5-10% of patients with terminal cancer. Early detection of epidural lesions commonly actuates treatment which can prevent and even reverse this process, thereby substantially improving a patient's quality of life. Given the inherent difficulty of seeing epidural lesions on body CT due to their relatively small size and low contrast from surrounding tissues, we hypothesized that oncologic epidural lesions were being under-reported by radiologists interpreting body CT.

METHOD AND MATERIALS

A search of our institution's radiology information system identified patients who underwent a body CT within 30 days before or after undergoing a spine MRI. A board-certified radiologist then reviewed these CT and MRI examinations and the respective patients' medical records to determine etiology and location of the epidural mass, whether the epidural mass reported on MRI was plainly visible on CT, and whether an epidural mass plainly visible on body CT was reported by the interpreting radiologist.

RESULTS

From 09/01/2001 to 12/31/2013, there were 340 spine MRIs demonstrating at least one epidural mass of oncologic etiology with a body CT performed within 30 days. An epidural mass reported on MRI was plainly evident in 244 (71.7%) of the 340 body CTs. Of these 244 body CTs representing 129 unique patients, 61 CT reports (25.0%) did not mention the presence of an epidural mass, even in some cases wherein an MRI examination preceded and reported its presence (27 of 61 cases; 44.3%). There was no statistically significant correlation with respect to the omission of CT reporting and patient gender, age, primary diagnosis, epidural mass location, reporting radiologist, CT or MR scanner, or preceding MRI diagnosis of an epidural mass (univariate chi-squared analysis; $p < 0.05$).

CONCLUSION

In this retrospective analysis, body CT is 71.7% sensitive in detecting an epidural mass of oncologic etiology which is demonstrable on MRI. Additionally, oncologic epidural masses are commonly (25.0%) unreported on body CT, even in cases where there is preexisting imaging evidence to confirm their presence.

CLINICAL RELEVANCE/APPLICATION

Given the moderate sensitivity of body CT in demonstrating epidural masses, radiologists should incorporate the integrity of the spinal canal into their body CT search pattern for oncologic patients.

RC205-09 Lumbar MR Imaging: Does Epidemiologic Data in Radiology Reports Affect Patient Management and Outcomes in the Primary Care Setting?

Monday, Nov. 30 11:00AM - 11:10AM Location: N228

Participants
Jessica G. Fried, MD, Lebanon, NH (*Presenter*) Nothing to Disclose
Brook I. Martin, MPH, Lebanon, NH (*Abstract Co-Author*) Nothing to Disclose
David A. Pastel, MD, Lebanon, NH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

A significant challenge to the appropriate diagnosis and management of low back pain is that lumbar MRI commonly reveals numerous findings that can be considered pathologic, even in asymptomatic individuals. Referring primary care providers may not understand the epidemiologic significance of the findings in the lumbar MRI reports they use to make patient-care decisions, potentially leading to unnecessary specialist referrals and overly aggressive treatment plans.

METHOD AND MATERIALS

A verified epidemiologic statement regarding prevalence rates of common findings in asymptomatic patients was included in all relevant lumbar MRI reports beginning July 01, 2013 at a single academic medical center. Patients referred for lumbar MRI by in-network primary care providers for uncomplicated low-back pain were followed prospectively for one year. Chart-review was utilized to capture health care utilization rates following MRI, including physical therapy referral, narcotic prescription, specialist referral, and spine surgery. A pre-statement-implementation cohort was compared to a post-statement-implementation cohort.

RESULTS

There were 323 patients who met inclusion criteria for the study, with 154 in the pre-statement cohort and 169 in the post-statement cohort. There was no significant difference in baseline demographic characteristics between the two cohorts. After one year of follow-up, there was a trend in decreased referral to spine specialists (53.6% v. 46.0%, p=0.234) and lumbar spine surgeries performed(10.9% v. 7.1%, p=0.290) when comparing the pre-statement cohort to the post-statement cohort. There were no apparent differences in referral for physical therapy or narcotic prescription rates in the study.

CONCLUSION

While the study is limited by small sample size, the trend in decreased referral to spine specialists by primary care physicians and fewer surgeries performed with the implementation of the statement motivates further investigation into the utility of enhancing imaging reports with epidemiologic information. This simple intervention may have meaningful impact on the management of these patients by referring primary care physicians.

CLINICAL RELEVANCE/APPLICATION

The addition of a simple, verified epidemiologic statement to lumbar MRI reports may impact the medical management of low-back pain in the primary care setting.

RC205-10 Open Surgical Biopsy of Degenerated Discs with Correlation of Associated MRI Modic Changes

Monday, Nov. 30 11:10AM - 11:20AM Location: N228

Participants
Mark Georgy, Escondido, CA (*Presenter*) Nothing to Disclose
Mark Stern, MD, Escondido, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recent publication had suggested evidence of chronic infection of degenerated disc spaces with Propionibacterium Acnes (PA) as a cause of chronic back pain that linked to type I Modic changes. Researches had advocated for antibiotic treatment of patients with chronic back pain. This had created extensive debate in the medical community. We are presenting our pilot data as a part of larger NIH prospective study of serial biopsies of degenerative disc spaces during open surgery.

METHOD AND MATERIALS

An IRB approval was obtained to conduct this retrospective study in a multicenter single neurosurgery practice over a 9-month period. Biopsies were obtained from the disc space during open surgery when possible for all patients who underwent surgery for degenerative disc disease. Biopsy materials were sent for gram stain and culture in all cases. Pre operative MRI images were evaluated for the presence of Modic changes.

RESULTS

Complete data were available from 21 lumbar disc surgeries, 10 of them (48%) had a positive culture. 5 levels were positive for PA, one level was positive for S. Aureus, one level was positive for Actinomycen and three levels were positive for S. Epidermis. There were a total of 7 cases with Modic changes and none of them were positive for PA.Biopsies were collected from 26 cervical cases, and 9 of them (35%) showed a positive biopsy. There were 16 cases with Modic changes that included 6 (37.5%) of the positive cultures. Three of the positive cultures showed no Modic changes. 10 cases with Modic changes had a negative culture

CONCLUSION

Our results concur with the published date of high incidence of PA infection of the degenerated nucleus. However we did not show any constant relationship to Modic changes which could be due to the small sample size. The etiology of Modic changes may be related to factors other than infectious processes. Furthermore, the patho-physiology of the Modic changes in the cervical and lumbar spine could be different. Further evaluation of these results with a larger prospective controlled study is underway.

CLINICAL RELEVANCE/APPLICATION

There may be a high incidence of P Acne infection in the degenerated discs. However, there may not be a constant relationship to Modic changes.

RC205-11 Lumbar Plexus in Patients with Chronic Inflammatory Demyelinating Polyneuropathy: Evaluation with New MR Neurography (3D SHINKEI)

Monday, Nov. 30 11:20AM - 11:30AM Location: N228

Participants
Akio Hiwatashi, MD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Osamu Togao, MD, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Koji Yamashita, MD, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazufumi Kikuchi, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Masami Yoneyama, Tokyo, Japan (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic resonance neurography is useful to evaluate nerves in patients with inflammations, tumors, and trauma. The purpose of this study was to evaluate feasibility of 3D nerve-sheath signal increased with inked rest-tissue rapid acquisition of relaxation enhancement Imaging (3D SHINKEI) in the ganglions and the nerves of lumbar plexus in patients with chronic inflammatory demyelinating polyneuropathy (CIDP).

METHOD AND MATERIALS

This study included 12 patients with CIDP (9 males and 3 females; age range 14-66 year-old; median 34 year) and 13 normal subjects (10 males and 3 females; age range 27-81 year-old; median 53 year). 3D SHINKEI is a turbo spine echo with a diffusion-weighted prepulse called improved motion-sensitized driven equilibrium. The imaging parameters were as follows; TR/TE = 2500/90 ms, FOV = 280 x 280 mm, voxel size = 0.98 x 0.98 x 2.0 mm^3, b = 10 s/mm^2, acquisition time = 5 min 48 s. Regions of interests (ROIs) were placed at the ganglions and nerves from T12 to L5 bilaterally. Signal-to-noise ratio (SNR) and contrast-radio (CR) were calculated. The size of the ganglions and the nerves was also measured. Statistical analyses were performed with Mann-Whitney U test. P-values less than 0.05 were considered significant.

RESULTS

The size of the ganglions and the nerves was larger in patients with CIDP (6.80 ± 1.90 mm and 5.81 ± 2.72 mm) than in normal subjects (5.22 ± 1.15 mm and 4.25 ± 1.08 mm, $P < 0.0001$, respectively). SNR of the ganglions and the nerves was larger in patients with CIDP (539.73 ± 789.57 and 519.31 ± 882.72) than in normal subjects (89.85 ± 91.29 and 44.03 ± 55.19, $P < 0.0001$, respectively). CR of the ganglions and the nerves was larger in patients with CIDP (0.74 ± 0.11 and 0.66 ± 0.16) than in normal subjects (0.72 ± 0.10 and 0.48 ± 0.16, $P < 0.05$ and $P < 0.0001$, respectively).

CONCLUSION

With 3D SHINKEI we could obtain high-resolution MR neurography. CIDP could be discriminated from normal subjects on 3D SHINKEI.

CLINICAL RELEVANCE/APPLICATION

With 3D SHINKEI we can evaluate the size and signal intensity of the lumbar plexus and can discriminate patients with CIDP from normal subjects.

RC205-12 Magnetic Resonance Neurography as an Adjunct for Back Pain and Extraspinal Sciatica

Monday, Nov. 30 11:30AM - 12:00PM Location: N228

Participants
John A. Carrino, MD, MPH, New York, NY (*Presenter*) Consultant, BioClinica, Inc; Consultant, Pfizer Inc; Advisory Board, General Electric Company; Advisory Board, Halyard Health, Inc; ;

LEARNING OBJECTIVES

1) Apply the critical technical elements for MR Neurography. 2) Comprehend the potential role for MR Neurography in spinal imaging. 3) Analyze pathologies identified with MR Neurography.

ABSTRACT

Neuromuscular imaging with MR neurography can be challenging technically because of requirements for high spatial resolution sometimes over an extended field of view such as an entire extremity unless the lesion or symptoms are well localized. Thus the concept of a "target zone" is useful to tailor protocols for high resolution portions. The trend is to use 3T MRI because of increased signal to noise ratio (SNR). The use of surface coils combinations may be needed to cover the entire region of interest or to evaluate distal muscles innervated. The availability of 3D isotropic pulse sequences avoids multiple 2D planar acquisitions and facilitates arbitrary reconstruction planes along and orthogonal to the structures of interest. The administration of intravenous contrast material is typically selectively used for mass lesions, post-operative situations or inflammatory conditions although dynamic contrast enhance MRI (DCE-MRI) has the potential to evaluate the vasa nervosum. Novel MRI techniques including diffusion-weighted imaging (DWI) and diffusion tensor imaging (DTI) may have a role in MR Neurography. Whole body MRI (WBMRI) has also been applied for MR Neurography. The general indication for MR Neurography is a suspected peripheral nerve dysfunction and is complementary to electrodiagnostic testing (e.g. electromyography). Broad categories of indications include confirming a diagnosis (e.g. brachial neuritis), elucidating pathoanatomy (e.g. thoracic outlet syndrome), establishing the location of a lesion for (e.g. nerve avulsion for pre-surgical planning), to evaluate unexplained neuromuscular symptoms (e.g. extra-spinal sciatica with a normal lumbar spine MRI) or to exclude a neoplasm (e.g. neurofibroma). MR Neurography can also be an adjunct to spine imaging. MRI findings may be related to nerve, muscle or compressive etiology (tumor, pathoanatomy or predisposing variant). Normal peripheral nerves will often although not invariably show a fasicular appearance on axial images. Contrast enhancement cannot always distinguish different pathoetiologies of neuropathy and is more likely to be abnormal with an inflammatory or neoplastic etiology. Endoneurial fluid increases when nerve is compressed, irritated or injured, leading to nerve image hyperintensity in an MR Neurography image. Acute axonal nerve lesions cause a hyperintense signal on T2-weighted images at and distal to the lesion site

corresponding to Wallerian degeneration. Denervation produces a non-specific muscle edema-like signal alteration. Muscle signal alteration occurs within a few days (as early as 72 hours) of denervation. Muscle atrophy is a late finding likely reflecting disuse. Fatty replacement (retained bulk and contour of muscle with fibers replaced by fat) is associated with neuromuscular etiologies (neurogenic or myogenic) or inflammatory myopathies. The MRI signal changes are reversible when the recovery of motor function occurs as a result of further muscle innervation. Tumor related neuropathy may be caused by a primary nerve neoplasm or a lesion compressing or infiltrating the nerve. Peripehral nerve sheath tumors (PNST) include neurilemmoma (schwanoma) and neurofibroma. The majority of PNST lesions are benign. Malignant PNST (MPNST) typically occurs in the setting of neurofibromatosis. It may be difficult for MRI to distinguish benign from malignant PNST and currently FDG PET has a role showing increased uptake in malignancies. Larger heterogeneous appearing lesions that have changed over time, either by clinical symptoms or imaging features suggests MPNST. Compressive lesions include non-neoplastic tumors (ganglions, hematoma), benign neoplasms (osteochondromas) or malignant neoplasm (sarcoma) that residing along the course of a nerve or within a fibro-osseous tunnel. Nerve infiltration and invasion may occur from lymphoma or metastatic neoplasm.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

John A. Carrino, MD, MPH - 2013 Honored Educator
John A. Carrino, MD, MPH - 2015 Honored Educator

RC207

Genitourinary Series: Prostate MR 2015: Current Role in Staging and Surveillance and Intervention

Monday, Nov. 30 8:30AM - 12:00PM Location: N227

GU MR OI

AMA PRA Category 1 Credits ™: 3.50
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants
Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Moderator*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc

LEARNING OBJECTIVES

1) To understand why prostate cancer is currently under- and over-diagnosed. 2) To understand the role of multiparametric prostate MRI in guiding biopsy of the prostate. 3) To understand the role in the diagnosis, surveillance and recurrence of cancer. 4) To review current progress in the focal treatment of prostate cancer.

ABSTRACT

The paradox of prostate cancer is that it is currently being overdiagnosed and underdiagnosed. PSA and blind biopsy has resulted in the overtreatment of men with low risk disease and the undertreatment of men with intermediate high risk tumors that evade blind biopsy. Multiparametric MRI is a major breakthrough in the diagnosis of prostate cancer. Moreover it can be used to monitor patients for active surveillance and guide treatment. New standards for reporting of prostate MRI have been recently development. This course will not only review these important developments but will provide new research results to participants.

Sub-Events

RC207-01 Intro to Prostate Cancer

Monday, Nov. 30 8:30AM - 8:55AM Location: N227

Participants
Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Presenter*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc

LEARNING OBJECTIVES

1) To understand the limitations of PSA screening and random prostate biopsy. 2) To introduce the concepts of novel screening tests and genomic analysis of prostate biopsies. 3) To review the importance of MRI in improving tumor localization, guiding biopsy, monitoring active surveillance and focally ablating prostate cancer.

ABSTRACT

See overview abstract

ABSTRACT

The diagnosis of prostate cancer is evolving quickly. There is increasing recognition that the combination of routine PSA screening and random prostate biopsy overdiagnoses low grade disease and underdiagnoses high grade disease. Autopsy studies show that the normal prostate harbors many low grade and microscopic cancers that never becomes clinically apparent. On the other hand, random biopsies undersample the anterior prostate gland. More accurate screening tests (e.g. PCA-3) are under development for determining which men warrant biopsy. Genomic testing of prostate biopsy samples is also becoming more common and it is thought to improve the prediction of tumor aggressiveness. The increased use of genomics to guide therapy clearly requires that the biopsy sample be representative of the tumor. MR guided biopsies, whether performed in gantry or using MR-US fusion, will improve the quality of the prostate biopsy specimen enabling more accurate genomic testing. Armed with more accurate and reliable tissue diagnosis, more rational decisions regarding active surveillance and/or focal therapy can be made. This course will review advances in MR guided diagnosis, biopsy and therapy of prostate cancer.

RC207-02 Detection and Characterization of Prostate Cancer with Multiparametric MRI (mpMRI): Do Learning and Experience Matter for Diagnostic Accuracy?

Monday, Nov. 30 8:55AM - 9:05AM Location: N227

Participants
Rajan T. Gupta, MD, Durham, NC (*Presenter*) Consultant, Bayer AG; Speakers Bureau, Bayer AG; Consultant, Invivo Corporation
Daniele Marin, MD, Cary, NC (*Abstract Co-Author*) Nothing to Disclose
Bhavik N. Patel, MD,MBA, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Kirema Garcia-Reyes, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Kingshuk Choudhury, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Lisa M. Ho, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Tracy A. Jaffe, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Polascik, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate effect of dedicated reader education on accuracy/Gleason score estimation of index and anterior prostate cancer (PCa) diagnosis with mpMRI in attending radiologists compared to abdominal imaging fellows.

METHOD AND MATERIALS

4 blinded attending abdominal imagers with 2-16 years of experience evaluated 31 prostate mpMRIs in this IRB-approved, HIPAA-compliant, retrospective study for index lesion and anterior PCa detection (including Gleason score estimation). Following dedicated education program, readers reinterpreted cases after a 2-4 month memory extinction period, blinded to initial reads. Reference standard was established combining whole mount histopathology with mpMRI findings by a board-certified radiologist with 5 years of prostate mpMRI experience. Multivariate analysis was performed to assess the effects of learning and reader experience. Results for attending radiologists were then compared with prior reader study results in radiology fellows (using the same set of cases).

RESULTS

Index cancer detection (attending vs. fellow): pre-education accuracy 64.5% vs. 74.2%; post-education accuracy 71.8% vs. 87.7% (p=0.12 vs. p=0.003). Gleason score estimation (index): pre-education accuracy 46.8% vs. 54.8%; post-education accuracy 57.3% vs. 73.5% (p=0.04 vs. p=0.0005). Anterior PCa detection: pre-education accuracy 46.4% vs. 54.3%; post-education accuracy 75% vs. 94.3% (p=0.02 vs. p=0.001). Gleason score estimation (anterior): pre-education accuracy 42.9% vs. 45.7%; post-education accuracy 67.9% vs. 80% (p=0.03 vs. p=0.002). These effects were all attributable to learning and not to reader experience based on multivariate analysis.

CONCLUSION

Accuracy of anterior PCa detection and Gleason score estimation for both index and anterior cancers significantly increased following dedicated reader education for both attendings and fellows. In addition, accuracy for index cancers was statistically significantly improved for fellows post-education. The degree of statistically significant improvement was higher for fellows vs. attendings overall.

CLINICAL RELEVANCE/APPLICATION

Performance in detection and characterization of PCa on mpMRI can be improved with dedicated reader education, however, it may be that the earlier the educational intervention is done, the more significant the improvement.

RC207-04 Abbreviated Prostate MRI (AP-MRI)

Monday, Nov. 30 9:15AM - 9:25AM Location: N227

Awards
RSNA Country Presents Travel Award

Participants
Robin Bruhn, Aachen, Germany (*Presenter*) Nothing to Disclose
Simone Schrading, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

It has recently been shown that an Abbreviated MRI Protocol is suitable for breast cancer screening. Aim of this study was to investigate whether an Abbreviated Prostate MRI protocol (AP-MRI), consisting of 2 pulse sequences only (high resolution T2-TSE and DWI in a single plane), acquired without endorectal coil, is sufficient to diagnose prostate cancer (PCa) in men presenting with elevated PSA-levels.

METHOD AND MATERIALS

Ongoing prospective reader study on 222 men (mean age 53.6 years) with median PSA of 7.1 who underwent multiparametric 3.0T-MRI with multi-element surface coil. The AP-MRI took a table time of just under 10 min. The full diagnostic protocol (FDP) took 30 min and included the pulse sequences of the AP-MRI (0.4 mm in-plane axial T2-TSE and DWI with 4 b-values up to 1400 s/mm²), plus additional T2-TSE planes, coronal T1-TSE, and DCE. All MRI studies were read prospectively by two GU-radiologists in consensus according to PIRADS 2.0. Readers first read the AP-MR images and made their diagnoses. Then, they read the FDP. Results of MR-guided biopsy, TRUS/saturation biopsy, and/or final surgical pathology, or MRI and PSA follow up of at least 24 months served as SOR.

RESULTS

PCa was finally diagnosed in 85/222 men (38.3%), with median size 12 mm, classified as Gleason-6 in 25 patients, Gln-7 in 31, Gln ≥ 8 in 29. Diagnostic indices of the AP-MRI vs. the FDP were: Sensitivity: 93% (79/85) vs. 94% (80/85); Specificity: 89% (122/137) vs. 87% (120/137); PPV: 84% (79/94) vs. 82% (80/97), NPV: 95% (122/128) vs. 96% (120/125). The single cancer that went undetected by AP-MRI was a Gln-6-cancer diagnosed by DCE. A total five additional cancers (Gln-6 in 3, and Gln-7 in 2 patients) went undetected by both, AP-MRI and FDP, and were detected by TRUS biopsy. NPV for biologically relevant prostate cancer (> Gln-6) was 98.8% (95%CI: 95.7%-99.9%) for both, AP-MRI and FDP.

CONCLUSION

Abbreviated prostate MRI allows diagnosis of biologically relevant PCa in under 10 minutes magnet time, without endorectal coil and without contrast agent, and offers a diagnostic accuracy that is equivalent to that of a full state-of-the-art multi-parametric prostate MRI protocol.

CLINICAL RELEVANCE/APPLICATION

Abbreviated prostate MRI, if confirmed by further studies, may open the door for systematic MRI screening for prostate cancer.

RC207-05 The Natural History of Low-grade Prostate Cancer: Lessons from an Active Surveillance Cohort

Monday, Nov. 30 9:25AM - 9:35AM Location: N227

Participants
Francesco Giganti, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Neophytos Petrides, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Caroline M. Moore, London, United Kingdom (*Abstract Co-Author*) Speakers Bureau, Myriad Genetics, Inc; Research Grant,

GlaxoSmithKline plc; Consultant, STEBA Biotech NV
Mark Emberton, London, United Kingdom (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc; Consultant, sanofi-aventis Group; Consultant, Glide Pharmaceutical Technologies Limited; Consultant, SonaCare Medical, LLC
Clare M. Allen, MBBCh, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Alex P. Kirkham, BMBCh, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe the natural history of low-grade prostate cancer by mpMRI changes in patients under active surveillance (AS).

METHOD AND MATERIALS

This study had an authorization from our institutional ethics review board. From our database on patients with prostate cancer, a total of 86 were enrolled in an AS program and had their first mpMRI in 2012 or before. The two reading radiologists, in consensus, knew tumor location and PSA but were blinded to both patient demographics and date of scan. The scans were reported randomly (reducing any bias assuming an increase in size with time). For each visible lesion we measured volume on the sequence best showing the tumor (the same for all scans), as well as attributing a score based on the European Society of Uroradiology -ESUR-2012 guidelines.

RESULTS

1. 66/86 patients had Gleason 3+3 and 20/86 Gleason 3+4 tumor. Median maximum cancer core lengths were 1 and 3.5 mm, respectively.2. 38/86 patients did not have a visible lesion on the initial MRI (< 3, ESUR criteria). Of these patients, none had developed at a median of 3.56 years of follow up.3. 40/86 patients had a lesion scoring 3/5 or more (ESUR criteria) on more than 2 scans, enabling an estimation of annual growth rate. 25 had Gleason 3+3, and 15 Gleason 3+4. Median monthly increase in volume was 0.4% for Gleason 3+3 and 1.2% for 3+4 (p=0.049, Mann-Whitney test). No significant difference in the median monthly PSA increase between these groups (0.9 vs 0.6%, p=0.42) was observed.4. In 38/40 patients having 2 scans separated by a median of 1.19 years, 9/38 showed a decrease in lesion size between 5 and 50 %.

CONCLUSION

In a group of men on AS, we never observed development of a convincing lesion in those negative on the first scan. Conversely, it was possible to measure a growth rate in visible tumors, and it was significantly different for Gleason 3+3 and 3+4. Finally, there is considerable inter-scan variability in volume: this must be taken into account when attrbuting a significant increase to a small lesion.

CLINICAL RELEVANCE/APPLICATION

The significant difference in rate of increase between small tumors of different grades under AS suggests that it is possible to monitor their size on MRI.

RC207-06 Multi-parametric MRI (including PIRADS)

Monday, Nov. 30 9:35AM - 10:00AM Location: N227

Participants
Clare M. Tempany-Afdhal, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The state of the art mpMR protocols/sequences for prostate cancer imaging. 2) How to acquire and interpret high quality images. 3) What ACR-Pi-Rads is and how it can be implemented in clinical practice. 4) Current and future role of Prostate MR and ACR- PiRads.

ABSTRACT

The current state of the art approaches to prostate cancer Multi-parametric MR(mpMR) Prostate imaging will be presented. MRI techniques at 1.5T and 3.0T and pulse seqeunce optimization for a state of the art mpMRI exam will be reviewed. The roles of each seqeunce will be illustrated with clinical case examples to outline technical aspects and interpretative approaches. As the examinations have become complex and the clinical demands are increasing there isa need for standarization of our techniques and interpretative reporting. Thus in keeping with Bi-Rads and Li-Rads, we are developing Pi-Rads. The current ACR-PiRads will be reviewed - goals, methods and clinical applications will be presented and future vision for the role of prostate MR and ACR-PiRADS will be presented

RC207-07 Active Surveillance with MRI

Monday, Nov. 30 10:05AM - 10:30AM Location: N227

Participants
Sadhna Verma, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) What is active surveillance and how it is done. 2) Who is a candidate for active surveillance. 3) The role of mpMRI in risk stratification for active surveillance. 4) The relevance of mpMRI in addition to clinical parameters in disease management.

ABSTRACT

ABSTRACT

Active Surveillance with MRI Active surveillance is increasingly acknowledged as a preferred strategy for most men with low-risk disease. This lecture will discuss low risk prostate cancer and how it is managed clinically. Role of mpMRI will be reviewed with clinical case examples to show selection, follow- up or possible removal of patients from active surveillance protocols.

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Sadhna Verma, MD - 2013 Honored Educator

RC207-08 Longitudinal Follow-up Study of Prebiopsy Multiparametric MRI with Cancer- Negative Findings in Patients with Suspicious Prostate Cancer: A Single Institution Experience

Monday, Nov. 30 10:30AM - 10:40AM Location: N227

Participants
Jun Gon Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chan Kyo Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Jae Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byung Kwan Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Few follow-up studies of prebiopsy prostate multiparametric MRI (mpMRI) with cancer-negative findings have been reported. The aim of this study was to investigate the chance and characteristics of missing cancers on prebiopsy mpMRI with cancer-negative findings based on Prostate Imaging Reporting and Data System (PI-RADS) in patients with suspicious prostate cancer (PCa).

METHOD AND MATERIALS

584 consecutive patients (mean, 62.7 years; range, 30-86 years) with suspicious PCa who performed initial (n= 391) or repeated prostate biopsies (n= 193) were enrolled in this retrospective study. All patients underwent prebiopsy 3-T mpMRI including T2-weighted, diffusion-weighted and dynamic contrast-enhanced imaging. Random systemic core biopsies and MR-targeted core biopsies in cases of cancer-positive MRI findings were performed, while cases with cancer-negative MRI findings underwent random systemic core biopsies during subsequent follow-up. Biopsy-based definition of clinically significant cancer (CSC) was Gleason ≥ 3 + 4 or Gleason 6 with maximal cancer core length (MCL) ≥ 4 mm. The likelihood of PCa on mpMRI was evaluated based on PI-RADS version 2: score 4 or 5 was considered cancer positive.

RESULTS

Pathologically the cancers were found in 25% (146/584). The cancer-positive MRI findings were found in 17% (99/584) patients and of these, 85.9% (85/99) had pathologically cancer cores. Of 485 patients with cancer-negative MRI findings, a total of 61 (12.5%) had cancer cores [Gleason 6 (n= 42), 3 + 4 (n= 14), 4 + 3 (n= 2), 8 (n= 2), and 9 (n= 1)]: biopsy-naive patients (n= 38) and patients with negative previous biopsy (n= 23). The mean MCL was 3.4 mm (range, 1-12.6 mm). The CSCs were found in 47.5% (29/61). Accordingly cancer-negative MRI findings missed 6% (29/485) CSCs: 4.1% (20/485) in biopsy-naive patients and 1.9% (9/485) in patients with negative previous biopsy.

CONCLUSION

Prebiopsy 3-T mpMRI with cancer-negative findings misses approximately 12.5% PCa including 6% CSCs in a cohort of biopsy-naive patients and patients with negative previous biopsy.

CLINICAL RELEVANCE/APPLICATION

In a cohort of biopsy-naive patients or patients with negative previous biopsy, 3-T multiparametric MRI can improve the detection of clinically significant prostate cancers, which can help to select optimal treatment strategies.

RC207-09 Magnetic Resonance/Ultrasound (MR/US) Fusion Biopsy in Clinical Practice: Is Systematic Biopsy still Needed to Detect Clinically Significant Prostate Cancers?

Monday, Nov. 30 10:40AM - 10:50AM Location: N227

Participants
Andrei S. Purysko, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD, Rio De Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Antonio C. Westphalen, MD, Mill Valley, CA (*Abstract Co-Author*) Nothing to Disclose
Andrew J. Stephenson, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Erick M. Remer, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Brian R. Herts, MD, Cleveland, OH (*Abstract Co-Author*) Research Grant, Siemens AG
Erika Schneider, PhD, Cleveland, OH (*Abstract Co-Author*) Stockholder, General Electric Company Stockholder, Pfizer Inc Stockholder, NitroSci Pharmaceuticals, LLC
Jennifer Bullen, MSc, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Cristina Magi-Galluzzi, MD, PhD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Eric Klein, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the detection rates of clinically significant (CS) prostate cancer (PCa), herein defined as a tumor with Gleason score >= 3 + 4, by MR/US fusion biopsy and systematic extended-sextant TRUS (S-TRUS) biopsy.

METHOD AND MATERIALS

IIRB-approved, HIPAA compliant retrospective study included 256 men (mean age: 62.3 yrs.) with either suspected PCa (n = 187) or enrolled on active surveillance (n = 69). All patients underwent multiparametric MRI (mpMRI) of the prostate on a 3.0 T magnet without endorectal coil as part of clinical care prior to biopsy, with T2, high B-value diffusion, and dynamic contrast enhancing imaging. Patients with potential tumor by mpMRI (n= 193) underwent MR/US fusion biopsy followed by 12-core systematic biopsy (SB) in the same procedure and performed by the same urologist who was aware of the location of the targets; those with negative mpMRI underwent SB only (n = 63). The results of both biopsy techniques alone and combined were evaluated.

RESULTS

The overall detection rate of PCa in this population was 51.2% (131/256), and CS PCa was detected in 26.6% (68/256) of the men. In those with positive mpMRI, there was no significant difference in the number of men with CS PCa detected by either biopsy technique (MR/US fusion biopsy: 46 men [23.8%]; SB: 48 men [24.9%]), and both techniques combined detected more men with CS PCA (66 men [34.2%]). CS PCa was detected exclusively by MR/US fusion biopsy in 18 men (9.3%), and by SB in 20 men (10.4%). In most men with CS PCa exclusively detected by SB, the sextants involved were the same (n = 14) or the immediately adjacent ipsilateral sextant (n = 3) where the MRI target was described; in only 3 men (1.5%) the targets were located in a distant sextant from the site involved by CS PCa. PCa was detected in 28.6% (18/63) of the men with negative mpMRI, but only 2 cases (3.2%) were CS PCa.

CONCLUSION

More CS PCa was detected when MR/US fusion biopsy was combined with SB, with greater contribution from biopsies of the same or immediately adjacent sextants of the MRI targets.

CLINICAL RELEVANCE/APPLICATION

In clinical practice, MR/US fusion biopsy should be performed in conjunction with systematic biopsy of the same and immediately adjacent sextants of MRI-targets to ensure the detection of CS PCa detected by mpMRI.

RC207-10 MR and MR-US Guided Biopsy

Monday, Nov. 30 10:50AM - 11:15AM Location: N227

Participants
Daniel J. Margolis, MD, Los Angeles, CA, (daniel.margolis@ucla.edu) (*Presenter*) Research Grant, Siemens AG

LEARNING OBJECTIVES

1) List the indications for in-bore MR-guided and MR/US fusion-guided prostate biopsy. 2) Optimize the protocol and image post-processing of prostate MRI for lesion detection, selection, and delineation. 3) Understand the differences between in-bore MR-guided and MR/US fusion-guided prostate biopsy. 4) Describe the advantages and disadvantages of the different kinds of MR/US fusion-guided prostate biopsy. 5) Communicate with referrers to ensure all information is processed correctly for the biopsy session.

ABSTRACT

Interest in, and growth of, prostate MRI has been largely driven by increasing use of this technology for lesion detection rather than treatment planning. This shift in focus is accompanied by changes in the MRI protocol, and how this information is used. A growing number of opportunities for targeted biopsy, both in-bore direct MRI-guided and MRI-ultrasound image fusion targeting, is accompanied by nearly as many different approaches. Each has advantages and disadvantages, some obvious, and some surprising. Awareness of these issues and how to master them is crucial for providing optimal patient care. These issues range from the hardware and software necessary to plan and perform the biopsy, to the intricacies of information and data communication, to referral and follow-up. A comprehensive, service-line approach ensures patients are followed appropriately at all stages of this process.

ABSTRACT

Multiparametric MRI has transformed from a tool primarily used for staging of known cancer into one for detection, localization, and sampling of suspected cancer. This has allowed for streamlining and simplifying the protocol use for imaging the prostate, which presents its own challenges, including managing decreased signal-to-noise ratios and interfacing with image-guided targeted biopsy software and hardware. The various platforms available for image-fusion targeted biopsy include in-bore MRI-directed, "cognitive-" or "mental-fusion" MRI-ultrasound targeted biopsy, software image fusion, articulated arm, and electromagnetic tracking. Attendees will learn how to incorporate image-guided targeted biopsy into their practice, how to interface with clinical collaborators and referrers, and how image-guided targeted biopsy improves confidence in managing men with suspected or known prostate cancer.

URL

http://1drv.ms/1kzFy7W

RC207-11 12 Months Follow-Up Results of MRI-Guided Transurethral Ultrasound Ablation for Treatment of Localized Prostate Cancer

Monday, Nov. 30 11:15AM - 11:25AM Location: N227

Participants
Maya B. Mueller-Wolf, MD, Heidelberg, Germany (*Presenter*) Nothing to Disclose
Sascha Pahernik, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Boris Hadaschik, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Timur Kuru, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Ionel V. Popeneciu, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gencay Hatiboglu, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Joseph Chin, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Michele Billia, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
James D. Relle, MD, West Bloomfield, MI (*Abstract Co-Author*) Nothing to Disclose
Jason M. Hafron, MD, West Bloomfield, MI (*Abstract Co-Author*) Nothing to Disclose
Kiran R. Nandalur, MD, Northville, MI (*Abstract Co-Author*) Nothing to Disclose
Mathieu Burtnyk, DIPLPHYS, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Heinz-Peter Schlemmer, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Roethke, MD, Heidelberg, Germany (*Abstract Co-Author*) Speaker, Siemens AG

PURPOSE

MRI-guided transurethral ultrasound ablation (MR-TULSA) is a novel minimally-invasive technology to treat organ-confined prostate cancer (PCa), aiming to provide local disease control with a low side-effect profile. Directional plane-wave high-intensity ultrasound generates a continuous volume of thermal coagulation to the prostate using real-time MR-thermometry control. A prospective, multi-institutional Phase I clinical study investigated safety, feasibility, and assessed efficacy of MR-TULSA treatment for PCa.

METHOD AND MATERIALS

30 patients with biopsy-proven, low-risk prostate cancer were enrolled: age>=65y, T1c/T2a, PSA<=10ng/ml, Gleason<=3+3 (3+4 in Canada only). Under general anaesthesia, the ultrasound device (TULSA-PRO, Profound Medical Inc., Canada) was positioned in the prostatic urethra with guidance from a 3T MRI (Siemens, Germany). Treatment planning was performed under MRI visualization with therapeutic intent of whole-gland ablation. Treatment was delivered under continuous MRI thermometry feedback control.

RESULTS

MR-TULSA was well-tolerated by all patients without intraoperative complications. Median (5th-9th percentile) treatment time and prostate volume were 36 (24-54) min and 44 (30-89) ml, respectively. Maximum temperature measured during treatment depicted a continuous region of heating shaped accurately to the prostate to within 0.1 ± 1.3 mm. CE-MRI confirmed the resulting conformal non-perfused volume, and correlated well with the ablative temperatures on MR-thermometry. Successful treatment was further indicated by a median PSA decrease from 5.8 (2.8-8.9) ng/ml to 0.8 (0.1-3.2) ng/ml after one month remaining stable at 0.8 (0.1-3.7) ng/ml to 12 month. MRI and biopsy findings at 12 month show diminutive prostate volumes, averaging 51% fibrosis (n=29). Positive biopsies (55% of patients) demonstrate 61% reduction in total cancer length.

CONCLUSION

MRI-guidance enables accurate treatment planning, real-time dosimetry and control of the thermal ablation volume. Primary outcomes show that MR-TULSA is safe and precise for prostate ablation. Phase I data are sufficiently compelling to study MR-TULSA in a larger efficacy trial.

CLINICAL RELEVANCE/APPLICATION

Whole-gland ablation can be safely and accurately achieved using MR-TULSA, which represents a minimally-invasive treatment option for organ-confined prostate cancer.

RC207-12 A Pilot Study to Evaluate Outpatient, Transrectal, Magnetic Resonance-guided Laser Focal Therapy for Treatment of Localized Prostate Cancer

Monday, Nov. 30 11:25AM - 11:35AM Location: N227

Participants
Bernadette M. Greenwood, BS, RT, Indian Wells, CA (*Abstract Co-Author*) Nothing to Disclose
John F. Feller, MD, Indian Wells, CA (*Presenter*) Consultant, Koninklijke Philips NV Consultant, Visualase, Inc
Stuart T. May Sr, MD, Indian Wells, CA (*Abstract Co-Author*) Nothing to Disclose
Roger McNichols, PhD, Houston, TX (*Abstract Co-Author*) Employee, BioTex, Inc
Wes Jones, Indian Wells, CA (*Abstract Co-Author*) Nothing to Disclose
Axel Winkel, DiplEng, Schwerin, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV

PURPOSE

In the United States alone, new prostate cancer cases for 2014 were estimated at 233,000 and deaths at 29,480. Focal therapies for low risk and intermediate risk localized prostate cancer are increasingly being explored. Our objective is to investigate the safety and feasibility of using outpatient MR- (magnetic resonance) guided laser focal therapy for MR-visible prostate cancer utilizing a transrectal approach for laser applicator placement and therapy delivery.

METHOD AND MATERIALS

All MR-guided therapy was delivered using a 1.5T Philips Achieva XR system (Philips Healthcare, Best, The Netherlands) for both image acquisition and real-time thermometry. Follow-up multiparametric MRI's (mpMRI) were performed on the same scanner as were all follow-up MR-guided prostate biopsies. DynaCAD and DynaLOC (Invivo, Orlando, FL, USA) software were used for image analysis and interventional planning. Laser therapy was delivered using a Visualase (BioTex, Houston, TX, USA) 15W 980 nm laser applicator introduced transrectally using the DynaTRIM (Invivo, Orlando, FL, USA)

RESULTS

34 men were treated. 45 cancer foci were treated. Total procedure time was between 1.5 and 4 hours. MRI volume of coagulation necrosis ranged from 1.2-5.0cc. No serious adverse events or morbidity were reported. 7 treatment regions were positive at 6 month biopsy, consistent with residual/recurrent cancer (23% of subjects, 15% of treated regions). 4 regions were retreated with laser focal therapy. We observed a 35% decrease in mean PSA 1 year post-therapy and no statistically significant change is IPSS and SHIM scores at 6 months post-treatment. 4 patients went on to whole gland therapy: 3 incidence cancer patients (2 Gleason Score 4+4=8, 1 Gleason Score 4+3=7 multi-focal) elected radical prostatectomy (RP). No additional technical difficulty with dissection was reported by the surgeon performing RP. 1 Gleason 3+3=6 elected proton beam therapy (PBT) before undergoing 6 month follow-up and biopsy. Incidence cancer rate was 10%.

CONCLUSION

Our data indicate that outpatient transrectally delivered MR-guided laser focal therapy for localized prostate cancer is both safe and feasible.

CLINICAL RELEVANCE/APPLICATION

In the current climate of cost-reduction and emphasis on minimally-invasive treatment of cancer, focal treatment of prostace cancer with a precisely delivered energy source under MRI-guidance may have favorable results for cost control and quality of life.

RC207-13 Focal Therapies

Monday, Nov. 30 11:35AM - 12:00PM Location: N227

Participants
Aytekin Oto, MD, Chicago, IL, (oto@uchicago.edu) (*Presenter*) Research Grant, Koninklijke Philips NV; ; ;

LEARNING OBJECTIVES

1) Emerging paradigm of focal therapy for early stage low risk prostate cancer. 2) Current status of different focal therapy methods

including laser ablation, high intensity focused US, electroporation and cryotherapy. 3) Challenges in patient monitoring following focal therapy. 4) Future developments in focal therapy of prostate cancer and the importance of radiologist's involvement.

ABSTRACT

TITLE: Image guided focal therapy of prostate cancer Focal therapy of low risk early stage prostate cancer is increasingly important as a minimally invasive option for many patients. The rationale, patient selection criteria and challenges for image-guided focal prostate cancer therapy will be discussed. The essential technical details, advantages and disadvantages of clinically available focal therapy methods will be reviewed. Post-therapy patient monitoring options will be presented. Future developments in the area of focal therapy of prostate cancer and opportunities for involvement of radiologists in focal therapy will be explored.

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Aytekin Oto, MD - 2013 Honored Educator

RC213

Pediatric Series: MSK

Monday, Nov. 30 8:30AM - 12:00PM Location: N230

MK MR PD

ARRT Category A+ Credits: 3.50
AMA PRA Category 1 Credits ™: 3.25

Participants
Andrea S. Doria, MD, Toronto, ON (*Moderator*) Consultant, Bayer AG; Consultant, Novo Nordisk AS; Consultant, Baxter International Inc
Tal Laor, MD, Cincinnati, OH (*Moderator*) Nothing to Disclose
Siddharth P. Jadhav, MD, Houston, TX (*Moderator*) Nothing to Disclose
Sarah D. Bixby, MD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

RC213-01 Magnetic Resonance Imaging of Children with Juvenile Idiopathic Arthritis

Monday, Nov. 30 8:30AM - 8:50AM Location: N230

Participants
Tal Laor, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the nomenclature and criteria for the diagnosis of juvenile idiopathic arthritis (JIA) in children. 2) To recognize the sites in children commonly affected by JIA. 3) To illustrate the spectrum of abnormalities identified with magnetic resonance imaging in children with JIA.

ABSTRACT

RC213-02 Predictive Value of Magnetic Resonance Imaging in Clinically Inactive Juvenile Idiopathic Arthritis?

Monday, Nov. 30 8:50AM - 9:00AM Location: N230

Participants
Charlotte M. Nusman, MSc, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Robert Hemke, MD,PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Cristina Lavini, DPhil, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Dieneke Schonenberg-Meinema, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marion Van Rossum, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Koert M. Dolman, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Merlijn van den Berg, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Taco Kuijpers, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mario Maas, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mirkamal A. Tolend, BSc, Toronto, ON (*Presenter*) Nothing to Disclose

PURPOSE

The value of subclinical synovitis on magnetic resonance imaging (MRI) in clinically inactive patients with juvenile idiopathic arthritis (JIA) is yet to be unraveled. This study was performed to determine whether (dynamic) contrast-enhanced MRI parameters of a previously affected target joint in patients with clinically inactive JIA can predict a flare of joint inflammation during 2-year follow-up.

METHOD AND MATERIALS

Thirty-two JIA patients with clinically inactive disease at the time of MRI of the knee were prospectively included. Dynamic contrast-enhanced (DCE) MRI provided both descriptive measures and time-intensity-curve shapes, representing functional properties of the synovium. Conventional MRI outcome measures included validated scores for synovial hypertrophy, bone marrow edema, cartilage lesions and bone erosions. During a 2-year period the patients were examined at regular time points and clinical flares were registered.

RESULTS

MRI analysis revealed synovial hypertrophy in 13 (39.4%) of the clinically inactive patients. Twelve patients (37.5%) had at least one flare during 2-year clinical follow-up. Median time-to-flare was 0.68 years (IQR 0.18-1.97) and 50% of the flaring patients did so within the first 6 months (Figure 1). Persistently inactive and flaring patients differed significantly in the maximum enhancement of the DCE-MRI ($p<0.05$), whereas no difference was found between these two groups in any of the baseline scores of conventional MRI.

CONCLUSION

Our prospective clinical follow-up study indicates that the assessment of 'maximum enhancement' upon DCE-MRI may be able to predict a clinical flare within 2 years in inactive JIA patients. In the future, functional imaging biomarkers, such as DCE-MRI can be combined with serum markers or gene profiling data, leading to the construction of a predictive model to more precisely decide about treatment strategies in any individual patient.

CLINICAL RELEVANCE/APPLICATION

The presence of a relatively high maximum enhancement on dynamic contrast-enhanced MRI of the knee in clinically inactive patients with juvenile idiopathic arthritis indicates a risk of flaring.

RC213-03 Periosteal Entrapment in Salter-Harris Injuries: Too Much on the Plate

Monday, Nov. 30 9:00AM - 9:10AM Location: N230

Participants
Peter H. Van Geertruyden, MD, Fort Belvoir, VA (*Abstract Co-Author*) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (*Presenter*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc
Adam C. Zoga, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Timothy G. Sanders, MD, Keswick, VA (*Abstract Co-Author*) Nothing to Disclose
Jana M. Crain, MD, Atherton, CA (*Abstract Co-Author*) Nothing to Disclose
Brendan T. Doherty, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To present a series of Salter-Harris injuries with periosteal entrapment, to better understand incidence and distribution, appearance and potential complications with regard to healing.

METHOD AND MATERIALS

Two musculoskeletal radiologists retrospectively reviewed 142 MRI exams with Salter-Harris injuries from 2007 to present for the presence of periosteal entrapment. Evaluation included Salter-Harris grade, location, presence of periosteal entrapment, and degree of entrapment measured in distance extending within the physis. Available follow-up imaging findings and clinical evaluations were recorded.

RESULTS

Of 144 Salter-Harris injuries on MRI, 59 cases were type I injuries, 48 cases were type 2 injuries, 20 cases were type 3 injuries, 14 cases were type 3 injuries, and 3 cases were type 5 injuries. The most common location for type I injuries was the distal fibula. The most common location for type 2 injuries was the distal radius. Type 3 and 4 Salter-Harris injuries showed no particular location preference. Of the 144 cases, 96 cases were in boys and 48 in girls. Average age of boys was 13 years, 9 months. The average age for girls was 12 years, 4 months.

CONCLUSION

Periosteal entrapment is observed in 7% of Salter-Harris injuries by MRI; entrapment is an under-reported phenomenon in current literature. In our series periosteal entrapment occurred most commonly at the distal tibia and fibula. Continued follow-up will reveal whether premature physeal arrest/growth disturbance is associated with periosteal entrapment.

CLINICAL RELEVANCE/APPLICATION

To make aware the frequency and potential implications of perisosteal entrapment in Salter Harris fractures.

RC213-04 Plastic Bowing Fractures of the Pediatric Forearm: Evaluation of a Novel Computer Aided Method for Detection

Monday, Nov. 30 9:10AM - 9:20AM Location: N230

Participants
Uygar Teomete, MD, Miami Beach, FL (*Presenter*) Nothing to Disclose
Yuwei Zhou, Coral Gables, FL (*Abstract Co-Author*) Nothing to Disclose
Ozgur Dandin, MD, Bursa, Turkey (*Abstract Co-Author*) Nothing to Disclose
Weizhao Zhao, Coral Gables, FL (*Abstract Co-Author*) Nothing to Disclose
Taner Dandinoglu, Bursa, Turkey (*Abstract Co-Author*) Nothing to Disclose
Onur Osman, PhD, Istanbul, Turkey (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, PhD, MSc, Orlando, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

(1) To develop a computer aided diagnosis (CAD) system for detection of plastic bowing fractures of the pediatric forearm and (2) to compare its feasibility with respect to the radiologists' interpretation.

METHOD AND MATERIALS

Following IRB approval, we retrospectively analyzed the forearm radiographs of the patients presenting to the pediatric emergency room following trauma. We included a total of 55 pediatric patients from all age groups. We used morphological operations to extract the forearm diapyseal features. In geometry, the radius of curvature, R, is a measure of the radius of the circular arc which best approximates the curve at that point. Along with the border of the bone, at every point, the more "bending" of the curve, the smaller of the radius of curvature; the "flatter" of the curve, the bigger of the radius of curvature. Average of R increases with increased bowing level. Curvature of the radial and ulnar diaphyses were caculated for the normal patients with normal interpretation and for the patients with plastic bowing fracture. Leave one out cross validation scheme was used for avoiding bias in our evaluations. Results were compared with the radiologist's interpretation. t-test was used to determine statistical significance level.

RESULTS

Curvature values were obtained from our CAD method in the training step. With a sensitivity of 80% in detecting plastic bowing fractures, we recorded 92% specificity. When compared to radiologists' conventional readings, we did not find significant differences between the proposed method and the radiologists' reading using t-test ($p>0.05$).

CONCLUSION

The proposed automated computer aided detection method can be used as a second opinion to aid the radiologist's decision making by highlighting the suspicious regions for plastic bowing fracture. To best of our knowledge, this is the first attempt towards automatizing quantitative evaluation of pediatric buckle fractures from radiographs.

CLINICAL RELEVANCE/APPLICATION

Our CAD method is fast, effective an reliable. It can be used as a standalone application or as a plugin to the PACS viewer in a radiology workstation. Its use as a second opinion may obviate the need to obtain additional radiographs of the contralateral forearm for comparison, preventing unnecessary radiation exposure to the child.

RC213-05 Growth Recovery Lines are More Common in Infants at High- vs. Low-risk for Abuse

Monday, Nov. 30 9:20AM - 9:30AM Location: N230

Participants
Matthew A. Zapala, MD,PhD, Boston, MA (*Presenter*) Nothing to Disclose
Andy Tsai, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Paul K. Kleinman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Growth recovery lines (GRLs), AKA growth arrest, Harris, and Parks lines are transverse radiodense metaphyseal bands believed to be due to a temporary arrest of enchondral ossification-caused by local or systemic insults such as intermittent illness and malnutrition. The purpose of this study was to determine if GRLs are more common in infants at high- vs. low-risk for abuse.

METHOD AND MATERIALS

The reports of initial high detail ACR compliant skeletal surveys done at a large pediatric hospital between 1999 and 2013 were reviewed, along with the relevant clinical records. Infants were considered at low-risk for abuse if they had a skull fracture without significant intracranial injury (ICI) on CT, a history of a fall and the determination of Child Protection Team (CPT)/social work assessment. High risk infants had significant ICI, retinal hemorrhages, skeletal injuries (other than skull fractures) and the determination of risk by CPT/social work assessment. There were 53 low-risk infants (age range, 0.4-12 months; mean, 4.7 months) and 21 high-risk infants (range, 0.8-9.1; mean, 4.2). Using a 4 point Likert scale, a pediatric radiology attending and fellow independently evaluated the frontal radiographs of the lower extremities from the skeletal surveys for the presence of at least one GRL involving the distal femurs/tibias. The data were pooled and differences between the two groups were calculated.

RESULTS

Intra- and inter-reader agreement was very good (Cohen's kappa inter-reader = 0.77 and intra-reader = 0.82 and 0.84). The relative prevalence of GRLs in the low-risk groups was 38% (SD 8%, reader 1 = 17/53, reader 2 = 23/53) vs. 71% (SD 7%, reader 1 = 16/21, reader 2 = 14/21) in the high-risk group ($p < 0.001$, odds ratio 4.1, 95% CI 1.8 to 9.8).

CONCLUSION

GRLs are encountered at a significantly higher rate in infants at high- vs. low-risk for abuse. This difference may reflect the response of enchondral ossification to intermittent stresses associated with abusive events. However, since healing classic metaphyseal lesions may appear as radiodense transverse metaphyseal bands, some of the apparent GRLs in the high-risk group may reflect the residua of inflicted metaphyseal injury.

CLINICAL RELEVANCE/APPLICATION

GRLs may carry special significance when encountered in infants with suspected abuse. The possibility that some apparent GRLs may in-fact reflect healing occult metaphyseal injuries deserves further study.

RC213-06 Definition of a Scoring System for Assessment of Skeletal Age Using MRI of Hand and Wrist in Healthy Males and Females Children: Gender Differences

Monday, Nov. 30 9:30AM - 9:40AM Location: N230

Participants
Milvia Martino, MS, Rome, Italy (*Presenter*) Nothing to Disclose
Rosa Maria Ammendola, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Ernesto Tomei, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Sofia Battisti, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Richard C. Semelka, MD, Chapel Hill, NC (*Abstract Co-Author*) Research support, Siemens AG.; Consultant, Guerbet SA.
Iacopo Carbone, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic Resonance Imaging (MRI) of hand and wrist is a radiation free tool used to create a gender specific scoring system method for the skeletal age (SA) estimation in the healthy pediatric population.

METHOD AND MATERIALS

96 healthy young male (chronological age (CA)1y6mo to 19y) and 108 females (CA range 4y to 19y) were enrolled. 9 bones of the wrist and hand have been analyzed at different stages of the skeletal maturation detecting different pattern of growth among tubular and carpal bones based on several anatomic features of the cartilaginous and osseous component .Two operators first in consensus and after 6 months blinded from CA established a MRI scoring system. Correlation between CA and MRI bone age estimation was determined with Pearson coefficient (R2). Spearman's correlation coefficient (r) was used to analyze each carpal and tubular bones stages development.

RESULTS

A significant linear correlation (R2) between MRI bone age estimation and CA was demonstrated in males (R2 = 0.976, A operators in consensus, R2 = 0.978 B first operator in the double-blind, R2 = 0.977 C second operator in double-blind) and females (R2 = 0,9694, operators in consensus, R2= 0.9751 B first operator double-blind, R2= 0.9710 C second operator in double-blind).Radius and Ulna showed a stronger correlation with the skeletal age in both males and (Radius r= 0.96; Ulna r = 0,963, p = <0.0001) females (Radius r = 0.975, Ulna r = 0.963720 p <.05000) . A good linear correlation was observed (males R2=0,96; females R^2 = 0.9472) between the sum of scoring system assigned for each subject and the CA in years. The growth curve resulting from the correlation

between CA and SA shows in males 2 peaks than 3 observed in females and related to the growth spurt in the pubertal age following by phases of deceleration.

CONCLUSION

The score system for MRI bone age estimation can be potentially used as a clinical tool to evaluate skeletal development. Males and females have patterns of maturation corresponding to a different clinical speed of growth. The MRI score system shows specific anatomical details characterizing the pubertal age when between the sexes there is a gap of about 2 years.

CLINICAL RELEVANCE/APPLICATION

Bone age estimation is performed in pediatric patients with growth failure and advanced or delayed puberty maturation mainly covering the clinical areas of endocrine, skeletal and metabolic diseases.

RC213-07 Pediatric Elbow MR

Monday, Nov. 30 9:40AM - 10:00AM Location: N230

Participants
John D. MacKenzie, MD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company

LEARNING OBJECTIVES

1) Review developmental anatomy of the pediatric elbow as depicted by MRI. 2) Review technical imaging considerations when imaging the pediatric elbow with MRI. 3) Review unqiue lesions that occur at the pediatric elbow as depicted by MRI.

ABSTRACT

MRI presents an unique view into the detection and characterization of pediatric elbow pathology. Developmental changes at the pediatric elbow have a characteristic and predictable anatomy and it is important for the radiologist to understand the normal developmental appearance and separate this from pathology. Technical imaging considerations for high resolution MRI will be reviewed. Common pathologies unique to the pediatric elbow will be discussed and placed into context with their appearance on MRI.

RC213-08 Imaging of Slipped Capital Femoral Epiphysis: From Early Diagnosis to Late Sequelae

Monday, Nov. 30 10:20AM - 10:40AM Location: N230

Participants
Delma Y. Jarrett, MD, Boston, MA, (delma.jarrett@childrens.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize imaging findings of SCFE using radiographs, MR, CT, and US. 2) Understand surgical management and normal post-operative appearance of SCFE. 3) Recognize imaging findings of immediate and delayed post-operative complications of SCFE.

RC213-09 Absence of Rickets in Infants with Fatal Abusive Head Trauma and Classic Metaphyseal Lesions

Monday, Nov. 30 10:40AM - 10:50AM Location: N230

Participants
Jeannette M. Perez-Rossello, MD, Boston, MA (*Presenter*) Nothing to Disclose
Anna McDonald, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Andrew E. Rosenberg, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Andy Tsai, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Paul K. Kleinman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if rickets is present in infant homicides with classic metaphyseal lesions (CMLs) and other skeletal injuries.

METHOD AND MATERIALS

This study was exempt from the institutional human subjects board review because the infants were all deceased. An archival review (1984-2012) was performed of the radiologic and histopathologic findings of 46 consecutive infant fatalities referred from the state Medical Examiner's Office for the evaluation of possible child abuse. Thirty infants with distal femoral histologic material were identified. Additional inclusion criteria were: 1) The medical examiner determined that the infant had sustained a head injury and that the manner of death was a homicide; 2) At least one CML was evident on skeletal survey; 3) CMLs were confirmed at autopsy; and 4) Non-CML fractures were also present. Nine infants (mean age 3.9 months, range: 1-9 months) were identified. Two pediatric radiologists independently reviewed the skeletal surveys for rachitic changes at the wrists and knees. A bone and soft tissue pathologist reviewed the distal femoral histologic sections for rickets.

RESULTS

There were no radiographic or pathologic features of rickets in the cohort.

CONCLUSION

Our findings provide no support for the view that the CML is due to rickets. Rather, they strengthen a robust literature that states that the CML is a traumatic injury commonly encountered in physically abused infants.

CLINICAL RELEVANCE/APPLICATION

This work confirms the traditional view that the classic metaphyseal lesion is a fracture encountered in abused infants rather than a manifestation of rickets. The classic metaphyseal lesion is a characteristic fracture in child abuse and should be reported as such.

RC213-10 Can Coronal STIR be Used as Screening for Acute Non-traumatic Hip Pain in Children?

Monday, Nov. 30 10:50AM - 11:00AM Location: N230

Participants
Monica M. Forbes-Amrhein, MD, PhD, Zionsville, IN (*Presenter*) Nothing to Disclose
Matthew R. Wanner, MD, Zionsville, IN (*Abstract Co-Author*) Nothing to Disclose
Trenton D. Roth, MD, Indianapolis, IN (*Abstract Co-Author*) Institutional research support, Siemens AG; Institutional research support, Koninklijke Philips NV
Megan B. Marine, MD, Carmel, IN (*Abstract Co-Author*) Nothing to Disclose
Boaz Karmazyn, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate if coronal STIR can be used as a screening test for acute non-traumatic hip pain in children

METHOD AND MATERIALS

A 4 year (2008-2012) retrospective analysis was performed of pediatric (age< 18 years) pelvic MRI studies. Only patients with the following indications were accepted; acute hip pain, limping, or refusal to bear weight. Exclusion criteria included known trauma, known pelvic pathology, and follow-up studies. Each study was anonymized. The coronal STIR series and later the full MRI studies, including all series, were reviewed in a randomized order independently by a pediatric radiologist (rad1) and a musculoskeletal radiologist (rad2). The full MRI study was considered the gold standard. Analysis of the interobserver variability on the negative and positive studies of the STIR only series was reported using Kappa statistics, and overall percentage agreement.

RESULTS

A total of 127 studies were included. 103 (83%) studies were positive by both radiologists. The most common pathologies that were identified by rad1 and rad2 were: hip effusion (63% and 57%), osteomyelitis (58% and 59%) and myositis (37% and 38%). 46% and 54% patients had more than one pathology.Using the full MR as the gold standard, the STIR-only series yields a sensitivity and specificity of 94% and 83% (rad1) and 94% and 67% (rad2). In 42% and 54% of the 97 true positive STIR-only studies, inconsistencies were found on the full MR scans, the most common of which were missed osteomyelitis (20% and 21% by rad1 and rad2) and myositis (7% and 13% by rad1 and rad2). The readers agreed on 111 (87.4%) coronal STIRs (95 abnormal; 16 normal), Kappa statistic is moderate, 0.59.

CONCLUSION

Coronal STIR of the pelvis has high sensitivity (94%) with good interobserver agreement in detecting pathology in children with acute hip pain. However, the study should be supervised by a radiologist and, when positive, a full MR study should be performed as it may change findings in 42% to 54% of cases.

CLINICAL RELEVANCE/APPLICATION

Coronal STIR MR can be used as a screening for evaluation of acute non traumatic hip pain in children. However, when positive, a full MR study should be performed as it can alter the findings in about half of the cases.

RC213-11 Utility of Post Intervention Hip Spica MRI, Retrospective Evaluation of Experience at a Large Children's Hospital

Monday, Nov. 30 11:00AM - 11:10AM Location: N230

Participants
Siddharth P. Jadhav, MD, Houston, TX (*Presenter*) Nothing to Disclose
Farahnaz Golriz, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Wei Zhang, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Vinitha Shenava, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
J. H. Kan, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The objective of this study is to evaluate utility of post intervention hip spica MRI and to determine if there are pre-intervention predictors of failed reduction and need for reintervention. We also evaluate rates of reintervention after closed and open reduction.

METHOD AND MATERIALS

All patients who had hip spica MRI at our institution from 2008 to 2014 were retrospectively identified. This included 42 hips in 29 patients. Data was retrospectively reviewed including age at intervention, acetabular angle, degree of lateral and superoinferior displacement of the femoral head, intervention performed, MRI findings and need for reintervention. Wilcoxon scores were calculated and Wilcoxon two sample tests were performed to find correlation between age, acetabular angle, degree of lateral displacement and degree of superoinferior displacement and the need for re-intervention

RESULTS

Mean age at time of intervention was 20.1 months (range 4.7 to 63.8). Mean acetabular angle was 37.5 degrees (range 20-52). Mean lateral displacement was 11.2 mm (range 3-20mm) and mean superoinferior displacement was 5.7 mm (range 0-19mm). There was no correlation between age (P value=0.12), acetabular angle (P value=0.46), degree of lateral displacement (P value=0.82) and degree of superoinferior displacement (P value=0.54) and the need for re-intervention. Out of 19 hips that underwent closed reduction, 8 (42%) needed reintervention. Out of 23 hips that underwent open reduction, 1 (4%) needed reintervention but this could have been determined on the fluoroscopic images alone. Variables leading to a 42% rate of re-intervention in children who undergo closed reduction may be operator dependent or be related to extra-articular causes such as femoral version and biomechanical muscle imbalance.

CONCLUSION

Hip spica MRI is useful in determining need for reintervention after closed hip reduction. Value of MRI after open reduction is not clear since only 1 patient (4%) in our study needed reintervention after open reduction. This needs further evaluation. There is no correlation between age and pre-intervention imaging findings and the need for reintervention.

CLINICAL RELEVANCE/APPLICATION

Post intervention hip spica MRI is useful in determining need for reintervention after closed hip reduction but its role after open reduction is questionable.

RC213-12 Isolated Posteromedial Subtalar Coalitions: Incidence and Associated Morphologic Alterations of the Sustentaculum Tali

Monday, Nov. 30 11:10AM - 11:20AM Location: N230

Participants
Sarah D. Bixby, MD, Boston, MA (*Presenter*) Nothing to Disclose
Delma Y. Jarrett, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Patrick Johnston, MSc, Cambridge, MA (*Abstract Co-Author*) Employee, Ora, Inc
Susan Mahan, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Paul K. Kleinman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the prevalence and morphologic alterations of subtalar coalitions which lie entirely posterior to the middle facet (MF), AKA "posteromedial subtalar (PMST) coalition."

METHOD AND MATERIALS

After obtaining IRB approval, radiology records from 2004-2012 were reviewed to identify CT studies of patients with confirmed subtalar coalition. 97 subjects (48 male, 49 female, mean age 13.73 years) with subtalar coalition were identified. Electronic medical records were reviewed and symptoms of foot or ankle pain were confirmed in all subjects. In 41 (42%) subjects the coalition was bilateral. CT images of 138 subtalar coalitions were reviewed to determine site of coalition. In those patients with isolated PMST coalitions, multiplanar reformatted images along the long axis of the sustentaculum tali (ST) were generated, from which the antero-posterior dimensions of the ST and MF were measured. A posterior sustentaculum (PS) measurement was then calculated defining the posterior extension of the ST beyond the middle facet (PS = ST-MF). Ratios of the MF to the PS measurements were calculated. 33 patients undergoing CT for triplane ankle fracture (21 male, 12 female, mean age 13.70 years) served as controls. Measurement were performed independently by two readers, and intra- and inter-reader reliability was estimated via a component of variance model.

RESULTS

97 of the 138 coalitions (70.2%) affected the MF and 2 (1.4%) involved the posterior facet. There were 39 (28.2%) isolated PMST coalitions identified in 33 patients (18 male, 15 female, mean age 14.07 years). The mean AP measurement of the MF and PS in the patients with PMST coalition were 12.70 mm and 15.90 mm, respectively, compared to 16.50 mm and 6.36 mm in the control population ($p<0.001$). The ratio of the MF to PS was 0.80 for PMST coalition patients versus 2.6 for controls ($p<0.001$).

CONCLUSION

In our cohort, 1/4 of all subtalar coalitions were of the PMST variety associated with an intact, but significantly shorter MF, and longer ST. This observation may aid in accurate diagnosis and provide insights into the morphogenesis of this relatively common disorder

CLINICAL RELEVANCE/APPLICATION

The presence of a "normal" middle facet at imaging may lead to missed isolated PMST coalitions; the morphology of the ST and MF provide helpful imaging clues to the diagnosis.

RC213-13 A Retrospective Study to Evaluate the Effect Recent Changes to NICE Guidelines Will Have on Imaging of the Paediatric Cervical Spine in Blunt Trauma in the UK

Monday, Nov. 30 11:20AM - 11:30AM Location: N230

Participants
Joseph Davies, MBBS, MRCS, London, United Kingdom (*Presenter*) Nothing to Disclose
Sammy Anwuzia, BSC,MSc, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Jane Evanson, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Susan Cross, MBChB, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Paediatric cervical spine (c-spine) injury is a rare but devastating event. Imaging, particularly Computed Tomography (CT) is the investigation of choice to exclude injury. CT is however associated with increased thyroid radiation dose and risk of developing malignancy vs plain radiographs. Insufficient paediatric c-spine trauma data exists to produce robust imaging guidelines. There have been recent changes to NICE UK guidelines relating to evaluation of paediatric (<10 years) c-spine injury in trauma. We set out to investigate effects these changes have on the use of Computed Tomography (CT) in the investigation of c-spine injury

METHOD AND MATERIALS

5 year retrospective study of c-spine imaging in patients <10 years presenting to a level 1 trauma centre following blunt trauma. Data was collected relating to trauma mechanism, clinical presentation, radiologic evaluations and injury type. Patients with incomplete data were excluded. Criteria for c-spine CT in NICE head injury guideline 56 (CG 56) (GCS<8, inadequate plain radiographs, strong suspicion despite normal plain radiographs) and NICE head injury guideline 176 (CG176) (GCS <13, intubated, focal neurology, polytrauma, suspicion despite normal radiographs) were retrospectively applied to all cases with complete data to determine the proportion of patients requiring c-spine evaluation with CT.

RESULTS

278 patients underwent c-spine imaging and 217 had complete data. 80 patients met the criteria for a CT of the c-spine under CG 56, 4 of which had a significant c-spine injury. 1 patient with c-spine injury and a presenting GCS of 14 did not meet CG 56. 206 patients met the criteria for a CT under CG 176, 5 of which had a significant injury. Overall, there was one patient who presented

with significant c-spine injury who did not meet CG 56 guidelines, but falls under CG 176 criteria.

CONCLUSION

CG 176 is more inclusive and if followed will result in higher proportion of paediatric blunt trauma cases being eligible for a c-spine CT without an initial plain radiograph series. Increased paediatric thyroid radiation exposure will result.

CLINICAL RELEVANCE/APPLICATION

New guidelines are more sensitive for selecting c-spine injury, specificity is lower and results in potentially unnecessary thyroid irradiation. Further study is required to develop more robust paediatric trauma imaging guidelines.

RC213-14 Three-Point Dixon Technique for Fat Quantification and for Identifying Wasting Progression Rate of Pelvic and Thigh Muscles in Duchenne Muscular Dystrophy

Monday, Nov. 30 11:30AM - 11:40AM Location: N230

Participants
Jing Du, MD, Beijing, China (*Presenter*) Nothing to Disclose
Jiangxi Xiao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoying Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ying Zhu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Fei Y. Li, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Three-point Dixon technique was applied to quantify fat fraction (FF) and identify the annual rate of disease progression of leg muscles in Duchenne muscular dystrophy (DMD).

METHOD AND MATERIALS

This prospective study was approved by the Ethical Committee. Ninety boys with genetically and/or pathologically confirmed DMD were recruited. Imaging was performed with a 3-T unit by using a 32 channel phased-array coil. A quantitative water-fat separation method (IDEAL-Quant) was used. Imaging parameters were as follows: TR=6.3ms, TE=1ms, 6 echoes, bandwidth=111.11 kHz, FOV=32-40cm, slice thickness=7mm, matrix=160x160, flip angle= 3°, covering from the iliac crest to the knee, total imaging time=1min3sec. Images were processed on ADW4.6 workstation and FF of each muscle was calculated. The region of interest (ROI) was manually placed by tracing the outline of the individual muscle on the section level of the muscle belly. 18 muscles on each side were analyzed. Spearman correlation test was used to evaluate the correlation between age and FF. Linear correlation was used to show the relationship between age and FF.

RESULTS

90 DMD boys aged 2-13 (mean 5.8 years) were enrolled. The gluteus maximus was the most severely infiltrated (mean FF 28.82%±19.96%), followed by the adductor magnus (mean FF 23.13%±22.47%). The least affected muscle was the obturator externus (mean FF 3.67%±1.13%). Positive correlation was obtained between FF value and age for all the muscles with correlation coefficient varied from 0.28 to 0.76. Significant correlation was seen in the gluteus maximus muscle (r=0.68), adductor magnus (r=0.74), and the quadratus femoris (r=0.74~0.76). The muscle wasting progression can be calculated as (A + B*age). A stands for a constant and B stands for annual progression rate varied from 0.3% to 6.1% for different muscles.

CONCLUSION

IDEAL-Quant method can be used to quantitatively assess leg muscle fatty infiltration and identify muscle wasting progression in DMD patients.

CLINICAL RELEVANCE/APPLICATION

IDEAL-Quant method can be used to quantitatively assess leg muscle fat infiltration in DMD. This method should be used to monitor disease severity and follow-up.

RC213-15 Sports Injuries of the Pediatric Knee

Monday, Nov. 30 11:40AM - 12:00PM Location: N230

Participants
Jennifer Stimec, MD, Toronto, ON (*Presenter*) Nothing to Disclose

RC215

Breast Series: Hot Topics in Breast Imaging

Monday, Nov. 30 8:30AM - 12:00PM Location: Arie Crown Theater

BR DM MR US

ARRT Category A+ Credits: 4.00
AMA PRA Category 1 Credits ™: 3.25

Participants
Wendie A. Berg, MD, PhD, Pittsburgh, PA, (wendieberg@gmail.com) (*Moderator*) Consultant, SuperSonic Imagine; Departmental Research Grant, General Electric Company ; Departmental Research Grant, Hologic, Inc; Equipment support, Gamma Medica, Inc; Equipment support, General Electric Company; Equipment support, Hologic Inc; ;
Sarah M. Friedewald, MD, Chicago, IL (*Moderator*) Consultant, Hologic, Inc; Research Grant, Hologic, Inc
Elizabeth A. Morris, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

RC215-01 Tomosynthesis

Monday, Nov. 30 8:30AM - 8:50AM Location: Arie Crown Theater

Participants
Liane E. Philpotts, MD, New Haven, CT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Assess the increasing body of literature concerning digital breast tomosynthesis. 2) Describe its use in both the screening and diagnostic mammography environments. 3) Evaluate the benefits of tomosynthesis and understand how it is dramatically changing the whole practice of breast imaging.

ABSTRACT

Tomosynthesis is revolutionizing breast imaging. The evidence to date reveals consistent reductions in false positives and increases in invasive cancer detection in screening mammography. This should have a profound effect on shifting the balance of benefits and harms of screening mammography. In addition, tomosynthesis has a dramatic effect on diagnostic mammography, resulting in expedited imaging, fewer patients requiring follow up, and increases in the positive predictive value of biopsy recommendations. Interpretation time and learning curve are considerations in utilizing tomosynthesis. Correct utilization requires careful interpretation of images and careful correlation with multi-modality imaging, particularly ultrasound. Downstream effects of tomosynthesis lead to dramatic changes in workflow. Cost analyses point to cost savings with tomosynthesis.

RC215-02 Three Consecutive Years of Screening with Digital Breast Tomosynthesis: Are the Outcomes Sustainable?

Monday, Nov. 30 8:50AM - 9:00AM Location: Arie Crown Theater

Participants
Emily F. Conant, MD, Philadelphia, PA (*Presenter*) Speaker, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Siemens AG
Andrew Oustimov, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, Siemens AG
Elizabeth McDonald, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Marie Synnestvedt, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Mitchell D. Schnall, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Studies have shown improved screening outcomes when digital breast tomosynthesis (DBT) is combined with digital mammography (DM) compared to screening with DM alone. However, questions exist regarding the sustainability of outcomes over consecutive years. Are the improved DBT outcomes due to prevalence rather than incidence screening? What impact is there on interval cancer rates? We investigate these issues by comparing outcomes from 3 years of consecutive DBT screening of our entire clinic population. Cancer registry data is used to determine interval cancer rates.

METHOD AND MATERIALS

We have screened over 33,000 patients with DBT after complete conversion in 9/2011. Recall rates, cancer detection rates, PPVs, biopsy rates and interval cancer rates within 1 year will be compared over the 3 year period with prior DM rates. A positive screen is defined as recall prompting a biopsy recommendation (cat. 4, 5). Patients assigned to short-term follow-up (cat. 3) are considered negative screens. Network cancer registry data through 12/2014 is used to determine interval cancer rate (defined as symptomatic cancers presenting at <1 year).

RESULTS

The reduction in recall from the baseline DM rate of 10.4% remained statistically significant over 3 DBT years ($p<0.001$, <0.001 and 0.003, respectively) however, showed a non-significant trend upward from DBT yr 1 to 3 (8.8, 9.0 and 9.2%). Cancer detection rates/1000 screened continued to increase from baseline DM rate of 4.6 to 5.5, 5.8 and 6.1 for DBT yr 1 to 3, but the trend was non-significant ($p=0.108$). The biopsy rate remained relatively stable, however, PPV1, 2 and 3 showed continued increases over time, with the trend in PPV1 statistically significant ($p=0.025$). The interval cancer rate decreased from 0.9/1000 screened for DM to 0.5 for DBT yr 1 and 0.1 for DBT yr 2. There is not adequate follow-up to calculate interval cancer rate for DBT yr 3.

CONCLUSION

Our data shows that not only are DBT screening outcomes sustainable, there are continued trends of increased cancer detection and PPVs over time. There was also a decrease in interval cancer rate with DBT within 1 year of screening suggesting that DBT detects more, clinically significant interval cancers.

CLINICAL RELEVANCE/APPLICATION

Consecutive years of screening with DBT demonstrate sustainable and even continually improving outcomes as measured by increased cancer detection and a trend of decreasing interval cancers.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Mitchell D. Schnall, MD, PhD - 2013 Honored Educator

RC215-03 Screen-detected and Interval Cancers before, During, and after Implementation of Digital Breast Tomosynthesis in a Population-based Mammography Screening Program

Monday, Nov. 30 9:00AM - 9:10AM Location: Arie Crown Theater

Participants
Per Skaane, MD, PhD, Oslo, Norway (*Presenter*) Equipment support, Hologic, Inc; Consultant, Hologic, Inc; Support, Hologic, Inc
Sofie Sebuodegard, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
David Gur, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Randi Gullien, RT, Oslo, Norway (*Abstract Co-Author*) Support, Hologic Inc; Travel support, Hologic, Inc
Solveig S. Hofvind, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To analyze cancer detection and interval cancer rates before, during, and after implementation of digital breast tomosynthesis (DBT) in organized breast cancer screening.

METHOD AND MATERIALS

The prospective screening trial including DBT was approved by the Ethical Committee. All participating women signed a written consent. The screening program includes women 50-69 years invited biannually to two-view full-field digital mammography (FFDM) screening. Image interpretation is carried out in batch reading mode with independent double reading using a 5-point rating scale for probability of cancer, with consensus/arbitration decision for all positive scores before final decision to recall. Incident screening exams (prior exams performed 2 years earlier) of the first years of four subsequent screening rounds in 2007 (FFDM), 2009 (FFDM), 2011 (FFDM plus DBT), and 2013 (FFDM only) were analyzed. Prevalent screen exams were excluded from analysis. Interval cancers of incident screened women in 2007, 2009, and 2011 were recorded based on a two-year follow-up period. Attendance as well as cancer detection rates (invasive cancers and DCIS), and interval cancer rates were compared using t-test with 95% confidence intervals (CI).

RESULTS

The number of women in the study population was 10.755, 11.069, 8.269, and 8.580 in 2007, 2009, 2011, and 2013, respectively. The numbers and rates (per 1.000 screen exams) of screen-detected cancers were 67 and 6.2 (95% CI 4.7-7.7), 52 and 4.7 (95% CI 3.4-6.0), 81 and 9.7 (95 CI 7.6-11.8), and 41 and 4.8 (95% CI 3.3-6.2) in 2007, 2009, 2011, and 2013. The numbers and rates (per 1.000 screen exams) of interval cancers were 22 and 2.1 (95% CI 1.2-2.9), 32 and 2.9 (95% CI 1.9-3.9), 17 and 2.1 (95% CI 1.1-3.0) for women screened in 2007, 2009, and 2011, respectively.

CONCLUSION

Implementation of digital breast tomosynthesis increases the cancer detection rate in mammographic screening. The interval cancer rate remained stable.

CLINICAL RELEVANCE/APPLICATION

Tomosynthesis increases cancer detection rate in organized mammographic screening. Further studies are needed for evaluating the interval cancer rates.

RC215-04 Missed Breast Cancer by Digital Mammography and Tomosynthesis

Monday, Nov. 30 9:10AM - 9:20AM Location: Arie Crown Theater

Participants
Miguel A. Pinochet, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Eleonora Horvath, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Monica P. Rochels, MD, Santiago , Chile (*Presenter*) Nothing to Disclose
Claudio S. Silva Fuente-Alba, MD, MSc, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Marcela Uchida, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Maria Paz Duran Caro, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Heriberto Wenzel, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Eduardo Soto, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Maria Cecilia P. Galleguillos, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Maria E. Droguett, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Full-field digital mammography (FFDM) plus digital breast tomosynthesis (DBT) have shown to improve the sensitivity of breast cancer detection in screening programs. The purpose of this study was to analyze the imaging and histopathological characteristics of the breast cancers missed by FFDM and DBT.

METHOD AND MATERIALS

IRB approved, retrospective review of 223 consecutive breast cancers evaluated by FFDM plus DBT and Ultrasound (US) examination between 2013 and 2014. Variables assessed were: age, breast density (ACR 1-4), tumor size, location in the parenchyma, presence of microcalcifications, detailed morphological features in different imaging methods, histopathological tumor type and molecular subtype. Qualitative variables were described by percentage distribution, median and range.

RESULTS

Detection-rate of FFDM and DBT were: 83.0% and 90.5% respectively, with a substantial interreader agreement (k=0.67±0.06). In total we found 38 cancers (17%) undetectable in FFDM. Of these, 17 (7.5%) were recognized by DBT as a focal distortion or spiculated mass; 14 of them in dense breast (ACR 3-4). Finally 21 cancers (9.5%) among 20 women (median age: 53 years; range 41-64 years) were occult also in DBT, all identified by US. Breast density according to ACR 2, 3 and 4 was 10%, 65%, and 25% respectively. Median tumor size was 8.5 mm (range 4-35 mm). All cancers had an intraparenchymatous location, were microlobulated, without microcalcifications nor distortion. Two cases were DCIS and 19 infiltrating (14 ductal and 5 lobular). Thirteen were luminal A, 4 luminal B and 2 HER2 positive subtypes.

CONCLUSION

DBT improved the detection-rate of the FFDM, depicting more cancers that appeared as distortions or spiculated masses in dense breast tissue.However, the DBT also has limitations: it is not able to recognize 9.5 % of all breast cancers, mainly those small, infiltrating, non-calcified, non-spiculated, within dense parenchyma. Complementary breast US allows their earlier detection.

CLINICAL RELEVANCE/APPLICATION

We describe the imaging characteristics of those cancers that remain occult in FFDM and in DBT.

Active Handout:Monica Patricia Rochels

http://abstract.rsna.org/uploads/2015/15008044/RC215-04.pdf

RC215-05 Performance Measures When Interpreting FFDM Examinations with Increasing Experience with DBT Based Screening in a Mixed FFDM/DBT Practice

Monday, Nov. 30 9:20AM - 9:30AM Location: Arie Crown Theater

Participants
David Gur, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Margarita L. Zuley, MD, Pittsburgh, PA (*Abstract Co-Author*) Research Grant, Hologic, Inc;
Jules H. Sumkin, DO, Pittsburgh, PA (*Abstract Co-Author*) Scientific Advisory Board, Hologic, Inc

PURPOSE

To assess radiologists' recall and cancer detection rates when interpreting full field digital mammography (FFDM) examinations as experience with digital breast tomosynthesis (DBT) increased in a mixed FFDM and DBT practice.

METHOD AND MATERIALS

Using MQSA and pathology reporting data, we reviewed FFDM recall and cancer detection rates for 12 radiologists in a mixed FFDM and DBT practice before they interpreted DBT and then after they each interpreted 500 DBT screening examinations, and for 5 radiologists after interpreting 1000 DBT examinations. All diagnostic recommendations were obtained from our radiology databases and outcome measures were verified by pathology. Individual and pooled data were assessed at a two sided significance level of $p<0.05$.

RESULTS

A total of 41,871 FFDM examinations were reviewed and analyzed pre DBT and 38,664 and 18,395 FFDM examinations were reviewed and analyzed post 500 and 1000 interpretations of DBT examinations, respectively. We observed no significant changes ($p>0.05$) in recall rates for FFDM as experience with DBT increased from virtually none to 500 DBT interpretations and later to over 1000 DBT interpretations. Average recall rates for FFDM were 11.4%, 11.6% and 11.3%, respectively, with no individual demonstrating a significant change or a relative rank order change on a relative scale ($p>0.05$). We observed no significant changes in cancer detection rates (CDRs) with increased experience with DBT from virtually none to 500 DBT interpretations and later to over 1000 DBT interpretations. Group CDRs were 4.7, 5.0, and 4.7 per 1000 FFDM screening examinations during the three periods, respectively ($p>0.05$). Pooled data group changes in recall rates had concordant trend changes in CDRs, albeit the trends were not statistically significant ($p>0.05$).

CONCLUSION

Despite expectations for improved performance, in particular in terms of recall rates, when interpreting FFDM examinations as experience with DBT increases in a mixed FFDM/DBT practice, radiologists reporting patterns and cancer detection rates did not change significantly.

CLINICAL RELEVANCE/APPLICATION

In a mixed FFDM/DBT practice, radiologists reporting patterns and cancer detection rates when interpreting FFDM examinations did not change significantly as experience with DBT increased.

RC215-06 Integrated Interpretation of Digital Breast Tomosynthesis and Ultrasound in Asymptomatic Women with Dense Breasts

Monday, Nov. 30 9:30AM - 9:40AM Location: Arie Crown Theater

Participants
Jung Min Chang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Won Hwa Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Kyung Moon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performances of combined digital mammography (DM) and digital breast tomosynthesis (DBT) versus combined DM and breast ultrasound (US) in asymptomatic women with dense breasts, and to evaluate the performance of an integrated interpretation of DBT and US.

METHOD AND MATERIALS

This study was approved by our Institutional Review Board and all patients provided informed consent. 196 pairs of DBT and US images from asymptomatic women with dense breasts (median age, 51 years; range, 21-77), who underwent screening examinations comprised our study population. Two independent prospective reading sessions of DBT and US with information of DM were performed in parallel by 12 radiologists blinded to the other examinations, and the integration of the results from both examination was performed by 2 expert breast radiologists in consensus, downgrading BI-RADS 3 lesions on US to BI-RADS 2 if DBT showed benign findings (BI-RADS categories 1 to 3). Sensitivity, specificity, negative predictive value (NPV), and positive predictive value (PPV) for recall of DBT, US, and their integrated results were compared using McNemar test, and Fisher's exact test.

RESULTS

Among 196 women, 27 lesions were assessed as showing suspicious findings on DBT, and 60 on US. Five cancers (mean invasive tumor size, 1.9cm; range 0-2.8cm) were detected on both DBT and US. Sensitivities and NPVs were 100% for both DBT and US. Specificity and PPVs for recall were 96.9% and 18.5% for DBT and 90.6% and 8.3% for US. The specificity for DBT was significantly higher than that of US (P=0.008). Integrated results downgrading BI-RADS 3 lesions on US to BI-RADS 2 if DBT showed benign findings yielded a significant reduction in the recall rate (30.6% vs. 12.2%, P=0.0004) without sensitivity loss.

CONCLUSION

For asymptomatic women with dense breasts, DBT combined with DM showed higher specificity than US combined with DM, and the integration of DBT information to US, resulted in decreased recall rates without loss in sensitivity.

CLINICAL RELEVANCE/APPLICATION

DBT is a beneficial method in evaluating dense breasts on DM, and integrated reading of DBT and US may induce reduction of short-term follow-up without change in sensitivity.

RC215-07 Whole Breast Ultrasound

Monday, Nov. 30 9:40AM - 10:00AM Location: Arie Crown Theater

Participants
Regina J. Hooley, MD, New Haven, CT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the indications for whole breast ultrasound. 2) Be familiar with the advantages and disadvantages of automated and handheld whole breast ultrasound. 3) Review optimal technique and strategies to improve specificity of whole breast ultrasound.

ABSTRACT

Technological advances and improvements in scan resolution have led to increased utility of whole breast ultrasound. Whole breast ultrasound is more widely accepted as a supplemental screening tool in women with dense breasts and a negative mammogram, but may also be used to evaluate disease extent in women with a new diagnosis of breast cancer. Whole breast ultrasound may be performed using a traditional handheld technique or using an automated scanner, which is less operator dependent. Careful attention to scanning technique is essential to produce high quality images, as well as to improve overall sensitivity and specificity.

ActiveHandout:Regina J. Hooley

http://abstract.rsna.org/uploads/2015/15002285/ActiveRC21.pdf

RC215-08 Update on Technologist-performed, Screening Breast Ultrasound in Women with Dense Tissue 5 Years after CT Public Act No. 09-41: How Are We Doing Now?

Monday, Nov. 30 10:00AM - 10:10AM Location: Arie Crown Theater

Participants
Liane E. Philpotts, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Madhavi Raghu, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Melissa A. Durand, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, Hologic, Inc
Laura J. Horvath, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Reni S. Butler, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Paul H. Levesque, MD, Madison, CT (*Abstract Co-Author*) Nothing to Disclose
Regina J. Hooley, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Much experience has been gained during 5 years of performing screening whole breast ultrasound (US) on women with dense tissue. The purpose of this study was to assess current outcomes of these exams and compare to results obtained in our first year.

METHOD AND MATERIALS

A HIPAA-compliant, retrospective review of the breast imaging database (PenRad, MN) was performed to identify all screening ultrasound exams performed at a satellite office of a tertiary academic cancer hospital, during a 5 month period (10/1/14-2/28/15). All screening US exams were performed by dedicated breast technologists using hand-held scanning and with on-site dedicated breast radiologists available. Only cases reported as normal and dense on recent screening mammogram were included. Patients undergoing diagnostic mammography or follow up ultrasounds were not included. The BIRADS final assessment, positive predictive value (PPV3) and cancer detection rate (CRD) was determined and compared to results obtained in our practice in the first year of performing screening ultrasound (10/1/09 - 9/30/10).

RESULTS

756 supplemental screening US were performed during the time period, of which 708 (94%) were reported as normal (BIRADS 1,2). 40 cases (5%) were reported as BIRADS 3. Only eight biopsies were recommended (BIRADS 4,5 1%) of which 2 were malignant (both invasive ductal carcinoma), PPV3=25%. This yield a cancer detection rate of 2.6 per 1000 (2/756). In comparison to our first year results, there has been significant changes with and increase in the rate of BIRADS 1,2 (75% vs 94%, p<0.0001), a decrease in the rate of BIRADS 3 (20% vs 5%, p<0.0001), fewer biopsies recommended BIRADS 4,5 (5% vs 1%, p<0.0001), and an improvement in the PPV3(6.5% vs 25%, p<0.0001) with maintained CDR (3.2 vs 2.6 per 1000).

CONCLUSION

There has been a large shift in the outcome of supplemental screening ultrasound performed during 5 years with significantly fewer false positives and a higher PPV with maintained CDR, resulting in greatly improved performance of this exam.

CLINICAL RELEVANCE/APPLICATION

With experience, the performance and outcome of supplemental screening ultrasound is greatly improved.

RC215-09 Radiologists' Specificity in Reading Automated Breast Ultrasound (ABUS) Can Be Improved by Computer Aided Arbitration

Monday, Nov. 30 10:10AM - 10:20AM Location: Arie Crown Theater

Participants
Jan Van Zelst, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Tao Tan, Nijmegen, Netherlands (*Abstract Co-Author*) Research Grant, QView Medical, Inc
Andre R. Grivegnee, MD, Linkebeek, Belgium (*Abstract Co-Author*) Nothing to Disclose
Mathijn D. De Jong, MD, 's-Hertogenbosch, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Nico Karssemeijer, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Shareholder, Matakina Technology Limited; Consultant, QView Medical, Inc; Shareholder, QView Medical, Inc; Director, ScreenPoint Medical BV; Shareholder, ScreenPoint Medical BV;
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG

PURPOSE

Screening for breast cancer with supplemental Automated Breast Ultrasound (ABUS) increases the amount of unnecessary recalls for benign lesions that otherwise would not have been observed. We investigated the effect of using Computer Aided Detection (CADe) software as independent arbiter on radiologists' findings on the sensitivity and specificity of ABUS for breast screening.

METHOD AND MATERIALS

The IRB waived the need for informed consent for this study. Randomly selected views from ABUS scans (Siemens, ABVS) of 89 women were included. 19 women had malignancies, 30 had benign lesions and 40 women had no abnormalities. Three dedicated breast radiologists and a 4th year resident with experience in reading ABUS participated in this multi-reader-multi-case (MRMC) study. They read all 89 cases without aid from CADe and were instructed to mark and report their findings using a 0-100 likelihood-of-malignancy scale. The CADe program (Qview Medical Inc, Los Altos, Ca.) also analyzed the 89 cases independent from the radiologists, providing suspicious region candidates for each case.The locations of the findings of the radiologists were compared to the locations of the CADe software findings. Radiologist's findings were considered suspicious only when the marked lesions matched to the candidates of CADe. Radiologists' findings that were not marked by CADe were regarded as benign.MRMC ROC analysis was used to compare the area under the ROC curve (AUC) of the normal unaided readings to the AUC of the readings after computer aided arbitration.

RESULTS

The AUC improved significantly from 0.77 to 0.88 after arbitration, using the CADe software ($p = 0.01$). Furthermore, the partial AUC in the range of 90-100% specificity also improves significantly from 0.05 to 0.065 ($p=0.04$). The radiologists' findings that were subsequently overruled by the CADe program were mostly true benign lesions or artefacts. None were malignant.

CONCLUSION

Using CADe software for computer aided arbitration has the potential to improve the specificity of breast radiologists screening with ABUS.

CLINICAL RELEVANCE/APPLICATION

CADe arbitration may help to identify unnecessary referrals for non-malignant lesions that can be reevaluated by second readers and potentially increase specificity without losing sensitivity.

RC215-10 Supplemental Automated Breast Ultrasound Screening in BRCA Gene Mutation Carriers; Is There Any Value?

Monday, Nov. 30 10:20AM - 10:30AM Location: Arie Crown Theater

Participants
Jan Van Zelst, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Gwendolyn Woldringh, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Roel D. Mus, MD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Peter Bult, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Matthieu Rutten, MD, Hertogenbosch, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG
Nicoline Hoogerbrugge, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Nico Karssemeijer, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Shareholder, Matakina Technology Limited; Consultant, QView Medical, Inc; Shareholder, QView Medical, Inc; Director, ScreenPoint Medical BV; Shareholder, ScreenPoint Medical BV;

PURPOSE

Intensive yearly breast cancer screening programs for BRCA carriers with MRI and mammography (XM) detect many cancers at an

early stage. However, BRCA carriers still present with interval cancers. In this prospective study we investigated whether automated breast ultrasound (ABUS) leads to earlier or additional detection of breast cancer.

METHOD AND MATERIALS

This study was approved by a local IRB and is HIPAA compliant. 295 female BRCA gene mutation carriers signed informed consent for this study. They were offered 5 round of screening in two years. A team of 4 dedicated breast radiologists read all examinations. We analyzed sensitivity, specificity and positive predictive value (PPV) of all three modalities. Furthermore, we retrospectively reevaluated prior ABUS scans of cancer patients and the ABUS scans of ultrasound negative cases in this cohort.

RESULTS

Out of 295 BRCA gene mutation carriers, 16 women were diagnosed with a screening-detected breast cancer. In six women, pure DCIS with no invasive component was found. None of the DCIS, not prospectively or in retrospect, was found on ABUS. In ten women, invasive breast cancer (IBC) was detected. Seven of these IBCs were found on ABUS. No additional cancers were found with ABUS. For six out of ten IBCs a prior ABUS scan was available. In retrospect, two IBCs (33,3%) were retrospectively visible on the ABUS scan six months earlier and one of these was detected but classified as BI-RADS 2. Also two interval IBCs (12.5%) occurred in between screening rounds and one of these cancer was also detected six months earlier but classified as BI-RADS 2. For XM, MRI, and ABUS sensitivity was 0.50, 0.88 and 0.44, specificity 0.97, 0.95 and 0.95 and PPV 0.32, 0.28 and 0.09, respectively

CONCLUSION

In our BRCA screening program, MRI and XM together detect most of the cancers. In this study, adding ABUS did not increase cancer detection. In retrospect, some cancers were seen earlier, but regarded benign due to a benign appearance, which is common in the BRCA population.

CLINICAL RELEVANCE/APPLICATION

High interval cancer rates in the BRCA carrier population justifies intensifying the yearly screening regimen of MRI and XM, however at this point adding ABUS does not seem to offer a solution.

RC215-11 Supplemental Screening US in Combination with Elastography and Color Doppler US: Interim Results of a Prospective Multicenter Study

Monday, Nov. 30 10:30AM - 10:40AM Location: Arie Crown Theater

Participants
Su Hyun Lee, MD,PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sung Ui Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
A Jung Chu, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Sun Bae, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Kyung Moon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To validate the added value of elastography and color Doppler ultrasonography (US) for supplemental screening US in a multicenter study.

METHOD AND MATERIALS

This study was conducted with institutional review board approval, and written informed consent was obtained. From November 2013 to December 2014, 1,241 women (mean age, 46 yrs) with breast masses (mean size, 1.0cm) detected on supplemental screening US and assessed as BI-RADS category 3 or higher were prospectively recruited from 10 tertiary care centers. After identifying the mass of interest on B-mode US, elastography (strain elastography in 4 sites; shear-wave elastography in 6 sites) and color Doppler US were performed. Investigators assessed the likelihood of malignancy as a percentage at the time of enrollment using the four data sets: B-mode US alone, B-mode US with elastography, B-mode US with color Doppler US, and B-mode US with elastography and color Doppler US. Reference standard of biopsy or at least 1 year of follow-up was completed in 1,050 women (84.6%) and included in the interim analysis.

RESULTS

71 of 1,050 breast masses (6.8%) were malignant. The areas under the receiver operating characteristics curve (AUC) of B-mode US increased from 0.878 to 0.922 (P=.039) and 0.911 (P=.157) when elastography or color Doppler US was added, respectively. When both elastography and color Doppler US were added to B-mode US, the highest AUC (0.957) was achieved (P<.001). The majority of breast masses in our cohort (91.5%, [961/1050]) was assessed as BI-RADS category 3 or 4A on B-mode US and included 25 malignancies (9 DCIS, 16 invasive carcinoma). None of invasive cancers but only one DCIS showed negative findings on both elastography and color Doppler US. If the BI-RADS category 3 or 4A masses with negative findings on both elastography and color Doppler US were managed with 1-year follow-up, a considerable number of benign biopsies (84.0%, [539/642]) and unnecessary short-term follow-up (85.7%, [252/294]) can be reduced yielding higher PPV (27%, [70/258]) compared to that of B-mode US alone (6.8%, [71/1050]).

CONCLUSION

Combined use of elastography and color Doppler US can increase the PPV of supplemental screening US for breast cancer detection.

CLINICAL RELEVANCE/APPLICATION

Combined use of elastography and color Doppler US can reduce a considerable number of unnecessary biopsies or short-term follow-up induced by supplemental screening breast US.

RC215-12 Breast MRI: Screening and Diagnostic Use

Monday, Nov. 30 10:50AM - 11:10AM Location: Arie Crown Theater

Participants
Christiane K. Kuhl, MD, Bonn, Germany (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To list shortcomings of mammographic screening for breast cancer. 2) To define the term 'overdiagnosis' and distinguish it from 'false positive diagnoses'. 3) To list the current indications for screening with Breast MRI. 4) To describe pathophysiological processes that determine diagnosis of breast cancer in MRI vs. in mammography. 5) To list the advantages and limitations of non-mammographic screening.

RC215-13 Prospective Abbreviated MRI (AB-MR) Exam in a Screening Cohort Compared with Conventional Breast MRI

Monday, Nov. 30 11:10AM - 11:20AM Location: Arie Crown Theater

Participants
Claudia R. Seuss, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Yiming Gao, MD, New York, NY (*Presenter*) Nothing to Disclose
Amy N. Melsaether, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hildegard B. Toth, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Linda Moy, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate an AB-MR in women at intermediate and high-risk (HR) for breast cancer.

METHOD AND MATERIALS

An IRB approved study was performed on 86 asymptomatic women who underwent 114 breast MRI exams from 12/2011 - 12/2013. All women were at risk for breast cancer, had dense breasts, had surgery and/or follow up imaging. The breast MRI was performed on a 3T magnet with an acquisition time of 10 minutes. A single reader prospectively interpreted the AB-MR by reviewing the first post-contrast scan, T2 scan and prior studies. Comparison was made to the original diagnostic interpretation. Also, two additional readers retrospectively review the AB-MR exams. Final BIRADS assessment and confidence score was assessed for each lesion.

RESULTS

Of 86 women, 17 (19.8%) at HR, of which 11 (12.8%) were BRCA carriers, and 58 (67.4%) were at intermediate risk. Mean age was 46 years, range 29-76 years. Mean lesion size was 0.7cm (range 0.3 - 4cm). Sensitivity was 100%; 8 cancers (3 DCIS and five invasive cancer) were identified by the readers. All four cancers in BRCA carriers were identified by all readers. Using the abridged protocol, the specificity was 71% and an additional 14 findings were identified prospectively. The specificity for the retrospective review was 59 - 76%. Kappa score showed good interobserver agreement among the 3 readers. Mild to moderate BPE (p=0.02) small lesion size (< 0.6cm) (p=0.03) and absence of high signal T2 correlate (p=0.01) were significantly correlated with decreased confidence by all 3 readers. Of the 114 exams, 78 (68.4%) were originally assessed as BIRADS 1 or 2, 9 (7.9%) as BIRADS 3, 27 (23.7%) as BIRADS 4 or 5. Among the 3 readers, there was a statistically increase rate of BIRADS 3 assessments - 9.1 -17.6% (p=0.04) but not for BIRADS 4 assessments 19.2 -26.3% (p=.76).

CONCLUSION

An abridged breast MRI in a screening population had a high sensitivity but moderate specificity.

CLINICAL RELEVANCE/APPLICATION

An AB-MR screening exam can detected all the breast cancers but at the expense of a higher rate of follow up imaging.

RC215-14 Efficacy of Annual MRI for High-risk Breast Cancer Screening

Monday, Nov. 30 11:20AM - 11:30AM Location: Arie Crown Theater

Participants
Sarah Stamler, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Janice S. Sung, MD, New York, NY (*Presenter*) Nothing to Disclose
Jennifer B. Kaplan, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Tammy Huang, MD, Short Hills, NJ (*Abstract Co-Author*) Nothing to Disclose
Carol H. Lee, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
D. David Dershaw, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Morris, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher E. Comstock, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the need for annual MRI in high-risk screening.

METHOD AND MATERIALS

IRB approved retrospective review was performed to identify breast cancers detected on screening breast MRI between January 2005-December 2010. Medical records were reviewed for risk factors (family history, personal history, BRCA status, prior high risk lesion) and tumor histopathology. The time intervals between the MRI on which the cancer was detected and the patient's baseline and most recent prior screening MRI were determined.

RESULTS

18,065 screening MRIs in 7,517 women were performed during the study period. 170 cancers were detected in 167 women (2.2%).

63/170 (37%) cancers were detected on baseline MRI. Of 107 (63%) cancers detected on a subsequent MRI, 81 (75%) were invasive, mean size= 0.7 cm, 9/107 (8%) node positive. 82/107 (77%) had a negative screening MRI within 1.3 years prior to the MRI on which the cancer was detected. Cancers were found at 1 year follow up (<1.5 years) in 17 (16%), at 2 years (1.5-2.5) in 25 (23%), and 65 (61%) on additional years of follow up. Results were independent of risk factors.

CONCLUSION

Annual MRI effective detects node negative, subcentimeter invasive cancers in a high-risk population. These cancers were not seen on MRI 1 year earlier suggesting the need for annual screening in this population.

CLINICAL RELEVANCE/APPLICATION

Annual MRI is the most appropriate screening interval for high-risk women, detecting node negative subcentimeter invasive cancers.

RC215-15 Longitudinal Results of a Breast MRI Screening Program for Patients at High and Intermediate Risk: Does BRCA Status Matter?

Monday, Nov. 30 11:30AM - 11:40AM Location: Arie Crown Theater

Participants
Suzan Vreemann, MSc, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Albert Gubern-Merida, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Susanne Lardenoije, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Bram Platel, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
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Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG

PURPOSE

Breast cancer screening in women at elevated risk is performed with yearly MRI and mammography. This includes women with BRCA mutations and women at elevated risk for other causes (mainly family history). The purpose of this study was to assess differences between BRCA mutation carriers and non-BRCA patients in a longitudinal MRI screening program in terms of recall rate, positive predictive value, and detection.

METHOD AND MATERIALS

An IRB approved, retrospective review of patient files from women screened with breast MRI between 2003 and 2013 was performed at our academic center. We analysed 9.504 screening MR examinations in 2843 women (age: 45 ± 12.09 years), including 761 BRCA patients, and 2082 non-BRCA patients. Recall rate (RR), positive predictive value (PPV), and cancer detection rate (CDR) were evaluated for first round examinations and follow-up examinations separately. BRCA patients were compared with non-BRCA patients. Chi-square tests were used to determine statistical significance.

RESULTS

The RR for BRCA patients in the first round of screening was 86.07 per 1000 examinations and 52.58 per 1000 examinations in non-BRCA patients ($p<0.001$). The PPV for BRCA patients in the first round of screening was found to be 0.44, compared to 0.50 in non-BRCA patients ($p=0.013$). The CDR was 38.25 per 1000 examinations for BRCA patients and 26.53 per 1000 examinations for non-BRCA patients ($p<0.001$). In follow up, the RR was found to be 24.92 per 1000 examinations for BRCA patients and 22.81 per 1000 examinations for non-BRCA patients ($p<0.001$). The PPV was 0.46 for BRCA patients and 0.21 for non-BRCA patients ($p<0.001$). CDR was 11.42 per 1000 examinations for BRCA patients and 4.86 per 1000 examinations for non-BRCA patients ($p<0.001$).

CONCLUSION

RR and CDR are high for all patients in the first round. RR and CDR significantly decreased in follow-up rounds ($p<0.001$). PPV remained at an acceptable level for both patient groups, and remains particularly high in BRCA carriers. RR, PPV, and CDR differed significantly between BRCA and non-BRCA patients in both first and follow up rounds.

CLINICAL RELEVANCE/APPLICATION

These results underline that MRI is an excellent tool for screening high risk patients. Cancer detection is very high in the first round in all patients, but remains high only in BRCA carriers in follow up rounds.

RC215-16 Ultrafast Dynamic Contrast Enhanced (DCE) MRI of the Whole Breasts: A Novel Imaging Technique for Breast Cancer Detection with Super High Temporal Resolution- Comparison of MIP Images between Ultrafast MRI and Regular DCE MRI

Monday, Nov. 30 11:40AM - 11:50AM Location: Arie Crown Theater

Participants
Hiroyuki Abe, MD, Chicago, IL (*Presenter*) Consultant, Seno Medical Instruments, Inc
Naoko Mori, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Keiko Tsuchiya, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Kirti M. Kulkarni, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Deepa Sheth, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
David V. Schacht, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Federico Pineda, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Gregory S. Karczmar, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Milica Medved, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether DCE ultrafast MRI (UFMRI) is equal or superior to regular DCE MRI in terms of cancer detection using maximum intensity projection (MIP) images.

METHOD AND MATERIALS

The acquisition protocol of UFMRI consisted of 5 pre and 8 post-contrast bilateral, fat-suppressed ultrafast acquisitions of whole breasts, with temporal resolution of 7 sec for 3T (spatial resolution: 1.5 x 1.5 x 3 mm), or 9 sec for 1.5T (spatial resolution: 1.5 x 1.5 x 3.75 mm); followed by four high spatial resolution acquisitions (spatial resolution: 0.8 x 0.8 x 0.8 mm) with temporal resolution of 75 sec for 3T or followed by five acquisitions (spatial resolution: 1.0 x 1.0 x 1.0 mm) with temporal resolution of 65 sec for 1.5T. Two radiologists compared MIP images of regular MRI (first phase) and UFMRI (first to eighth phase) of 16 patients with breast cancer, to see if tumors are detectable with MIP images of each acquisition method. In total 30 known cancers were evaluated.

RESULTS

All 30 masses (100%) were detected on MIP images of the UFMRI, while 22 masses (73%) were detected on the MIP image of the regular MRI. Among the 22 masses detected on both, 3 masses were subtle on the regular MIP, but clearly seen on the UFMRI MIP. Eight masses were not visible on regular MRI due to strong parenchymal enhancement (6 masses), misregistration artifacts (1 mass), and overwrap with large vessels (1 mass).

CONCLUSION

UFMRI could represent a better method than regular MRI for the detection of breast cancer with MIP images.

CLINICAL RELEVANCE/APPLICATION

Enhancing lesions are clearly visualized with UFMRI due to the lack of interference from background parenchymal enhancement. MIP images of UFMRI may be useful as a new screening MRI protocol which would shorten the performance and interpretation time without lowering the sensitivity and therefore decrease costs.

RC215-17 Abbreviated MRI (AB-MR) of the Breast - Do We Need a Second Post-Contrast Scan?

Monday, Nov. 30 11:50AM - 12:00PM Location: Arie Crown Theater

Participants
Amy N. Melsaether, MD, New York, NY (*Presenter*) Nothing to Disclose
Yiming Gao, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Claudia R. Seuss, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Laura Heacock, MS, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Linda Moy, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

AB-MR exam has a high sensitivity for the detection of breast cancers. However, for AB-MR to be an effective screening tool, it should maintain a high sensitivity and specificity. The purpose of this study was to assess the diagnostic accuracy of an AB-MR using one and two post-contrast scans in a screening cohort.

METHOD AND MATERIALS

An IRB approved retrospective review of 145 women with 205 findings who underwent a breast MRI at 3T was performed by two readers. Women with dense breasts who were at risk for breast cancer were included. 61 (42%) women were newly diagnosed with breast cancer and 84 (58%) were asymptomatic high-risk women. The scan time for the 3 T1-scans was 4 minutes; the scan time for the T2-sequence was 4 minutes. Prior to this study, each reader interpreted 400 AB-MR exams. Final BIRADS assessment and confidence score was assessed for each lesion. Comparison was made to the original diagnostic interpretation.

RESULTS

73 (97%) of 76 invasive cancers and all 61 known cancers, especially those presenting as masses were detected on the first post-contrast scan. However, the second post-contrast scans allowed improved characterization of foci and NME but not for masses ($p<0.03$). Of interest, about 10 (50%) of 20 DCIS were better seen on the second post contrast scan. Seven of 10 lesions were low or intermediate grade DCIS. With a single post contrast data set, 15 (10.3%) incidental NME not reported on the full breast MRI protocol was noted and recommended for additional imaging, follow-up or biopsy. The second post-contrast scan was as such able to downgrade a BIRADS 3 assessment in 9 (60%) lesions to a BIRADS 2 diagnosis assessment, none of which were malignant at follow-up. One interval cancer, low grade DCIS, was missed by both readers on the abbreviated two post-contrast data set protocol.

CONCLUSION

In an intermediate risk population with dense breasts, a second post-contrast scan both increased cancer detection and improved characterization of benign lesions, which led to a decrease in BI-RADS 3 assessments.

CLINICAL RELEVANCE/APPLICATION

Two post-contrast scans may be sufficient for an AB-MR exam to have a high sensitivity and specificity.

RC217

Quantitative CT and MR Perfusion Imaging

Monday, Nov. 30 8:30AM - 10:00AM Location: S504CD

CT GI MR OI BQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Max Wintermark, MD, Lausanne, Switzerland, (max.wintermark@gmail.com) (*Moderator*) Advisory Board, General Electric Company;

LEARNING OBJECTIVES

1) To understand the principles of CT perfusion analysis for tumor assessment. 2) To understand the pathophysiological basis of CT perfusion parameters for tumors. 3) To understand unique CT perfusion analysis of the liver due to its characteristic dual blood supply. 4) To describe the potential clinical applications, with a focus on hepatic and extrahepatic applications and clinical trials. 5) To discuss several recent challenging issues regarding CT perfusion. 6) To discuss areas for further development including assessment of tumor heterogeneity.

ABSTRACT

With the emergence of novel targeted therapies for cancer, imaging techniques that assess tumor vascular support have gained credence for response assessment alongside standard response criteria. CT perfusion techniques that quantify regional tumour blood flow, blood volume, flow-extraction product, and permeability-surface area product through standard kinetic models, are attractive in this scenario by providing evidence of a vascular response or non-response. Additionally, these techniques may provide prognostic and predictive information to the clinician. Their increasing acceptance in oncological practice in recent years has been related to the combination of clinical need and technological improvements in CT, including faster tube rotation speeds, higher temporal sampling rates, the development of dynamic 3D acquisitions and development of commercial software programmes embedded within the clinical workflow. Recently published consensus guidelines provide a way forward to perfoming studies in a more standardized manner. To date single centre studies have provided evidence of clinical utility. Future studies that include good quality prospective validation correlating perfusion CT to outcome endpoints in the trial setting are now needed to take CT perfusion forward as a biomarker in oncology.These presentations will cover the principles of CT perfusion analysis for tumor assessment and its pathophysiological basis. Clinical applications will be discussed focusing on hepatic and extrahepatic applications and clinical trials. Areas for further development including assessment of tumor heterogeneity will also be discussed.

Sub-Events

RC217A CT Perfusion in Oncology: Hepatic Imaging

Participants
Se Hyung Kim, Seoul, Korea, Republic Of (*Presenter*) Research Grant, Mallinckrodt plc; Research Grant, Samsung Electronics Co Ltd

LEARNING OBJECTIVES

1) To understand basic principles, acquisition protocol, and pharmacokinetic models of CT perfusion. 2) To learn unique CT perfusion analysis of the liver due to its characteristic dual blood supply. 3) To describe the potential clinical applications, with a focus on hepatic applications. 4) To discuss several recent challenging issues regarding CT perfusion.

ABSTRACT

RC217B CT Perfusion in Oncology: Extrahepatic Imaging

Participants
Vicky J. Goh, MBBCh, London, United Kingdom (*Presenter*) Research Grant, Siemens AG; Speaker, Siemens AG

LEARNING OBJECTIVES

1) To understand the principles of CT perfusion analysis for tumor assessment. 2) To understand the pathophysiological basis of CT perfusion parameters for tumors. 3) To describe the potential clinical applications, with a focus on extrahepatic applications and clinical trials. 4) To discuss areas for further development including assessment of tumor heterogeneity.

ABSTRACT

With the emergence of novel targeted therapies for cancer, imaging techniques that assess tumor vascular support have gained credence for response assessment alongside standard response criteria. CT perfusion techniques that quantify regional tumour blood flow, blood volume, flow-extraction product, and permeability-surface area product through standard kinetic models, are attractive in this scenario by providing evidence of a vascular response or non-response. Additionally, these techniques may provide prognostic and predictive information to the clinician. Their increasing acceptance in oncological practice in recent years has been related to the combination of clinical need and technological improvements in CT, including faster tube rotation speeds, higher temporal sampling rates, the development of dynamic 3D acquisitions and development of commercial software programmes embedded within the clinical workflow. Recently published consensus guidelines provide a way forward to perfoming studies in a more standardized manner. To date single centre studies have provided evidence of clinical utility. Future studies that include good quality prospective validation correlating perfusion CT to outcome endpoints in the trial setting are now needed to take CT perfusion forward as a biomarker in oncology. This presentation will cover the principles of CT perfusion analysis for tumor assessment and its pathophysiological basis. Clinical applications will be discussed focusing on extrahepatic applications and clinical trials. Areas for further development including assessment of tumor heterogeneity will also be discussed.

RC217C Quantitative MR Perfusion Imaging of the Brain

Participants
Max Wintermark, MD, Lausanne, Switzerland, (max.wintermark@gmail.com) (*Presenter*) Advisory Board, General Electric Company;

LEARNING OBJECTIVES

1) Understand the difference between quantitative and qualitative perfusion measurements. 2) Distinguish several approaches for obtaining quantitative perfusion maps in the brain. 3) Appreciate the strengths and weaknesses between the two major techniques, arterial spin labeling and bolus contrast dynamic susceptibility imaging.

RC222

MRI: Imaging for Treatment Guidance and Verification

Monday, Nov. 30 8:30AM - 10:00AM Location: S502AB

MR RO PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

FDA Discussions may include off-label uses.

Participants
Rojano Kashani, Saint Louis, MO (*Moderator*) Investigator, Koninklijke Philips NV; Investigator, ViewRay, Inc

Sub-Events

RC222A In-room MRI for Treatment Guidance

Participants
Rojano Kashani, Saint Louis, MO (*Presenter*) Investigator, Koninklijke Philips NV; Investigator, ViewRay, Inc

LEARNING OBJECTIVES

1) Understand the main concepts of MRI-guided radiation therapy. 2) Understand the advantages and limitations of MRI-guided radiotherapy systems currently in use or under development. 3) Understand the use of in-room MRI guidance for management of intr- and inter-fraction variations in anatomy.

RC222B Integrating MRI, the Clinician Perspective

Participants
Cynthia Menard, MD, Montreal, QC, (cynthia.menard@umontreal.ca) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the clinical benefits associated with the integration of MRI into Radiotherapy. 2) Describe the uncertainties and challenges that exist in MR for radiotherapy.

RC223

Molecular Imaging Mini-Course: Advanced Molecular Imaging

Monday, Nov. 30 8:30AM - 10:00AM Location: E350

MI MR NM PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC223A Novel Tracers

Participants
Timothy R. DeGrado, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the major considerations when developing a novel molecular imaging probe. 2) Compare the strengths and weaknesses of the various imaging modalities with regard to probe development and implementation. 3) Define appropriate experiments for probe validation. 4) Gain an understanding of the process of translation of a probe to clinical practice.

ABSTRACT

Molecular imaging is rapidly advancing as new imaging biomarkers are invented to allow noninvasive assessment of biochemical function. Those who embark on the process of developing novel probes come to know the excitement of imaging biological processes for the first time, but are also well aware of the great effort and many pitfalls that can impede progress. This introductory lecture will provide an overview of the process of molecular imaging probe conception, development, preclinical validation, and translation. Specific examples will be used to illustrate the presenter's experience with meeting these challenges.

RC223B Novel Instrumentation (PET/MR)

Participants
Ciprian Catana, MD, PhD, Charlestown, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Distinguish the technical approaches that have been proposed for integrating PET and MRI for the purpose of simultaneous data acquisition. 2) Evaluate the latest methodological developments in PET/MRI for improving PET data quantification. 3) Incorporate simultaneous PET/MRI techniques into research and clinical projects.

ABSTRACT

RC223C Molecular Imaging with MR

Participants
Bruce R. Rosen, MD, PhD, Charlestown, MA, (bruce@nmr.mgh.harvard.edu) (*Presenter*) Research Consultant, Siemens AG

RC225

Physics Series: Quantitative Imaging Mini-Course: Image Modality Specific Issues

Monday, Nov. 30 8:30AM - 12:00PM Location: S403B

BQ CT MR NM PH

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.75

FDA Discussions may include off-label uses.

Participants
Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Director*) Institutional research agreement, Siemens AG; Research support, Siemens AG; ; ; ; ;
Edward F. Jackson, PhD, Madison, WI, (efjackson@wisc.edu) (*Moderator*) Nothing to Disclose
Paul L. Carson, PhD, Ann Arbor, MI (*Moderator*) Research collaboration, General Electric Company; Research collaboration, Light Age, Inc

Sub-Events

RC225-01 Quantitative Imaging for Computed Tomography: Applications and Future Directions

Monday, Nov. 30 8:30AM - 9:00AM Location: S403B

Participants
Samuel G. Armato III, PhD, Chicago, IL, (s-armato@uchicago.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the role of computed-tomography-based quantitative imaging in the clinical and research settings.

ABSTRACT

RC225-02 Quantification of Vascular Response in Rodent Brown Adipose Tissue Using Spectral CT

Monday, Nov. 30 9:00AM - 9:10AM Location: S403B

Participants
Xin-Gui Peng, MD,PhD, Nanjing, China (*Presenter*) Nothing to Disclose
Zhen Zhao, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Di Chang, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Shenghong Ju, MD, PhD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Brown adipose tissure (BAT) has abundant mitochondrion, uncoupling protein 1 and vascularizaiton to provide sufficient energy compared to white adipose tissure (WAT). Our study is to assess the changes of iodine/water base material concentration in BAT after injecting norepinephrine (NE).

METHOD AND MATERIALS

The animal study was approved by the institutional Committee on Animal Research. Spetral CT scan (GE, Discovery CT750) was performed to measure the iodine/water concentration based on base material mapping in the BAT (interscapular) and WAT (visceral) of Wistar rat (n=6, 14 weeks, 304g±12g) at baseline condition. To induce the blood flow increase, animals were given NE (1μg/kg/min, 10min, totle 1ml) or saline (1ml) from caudal vein. The enhanced CT imaging (6ml/kg, iopromide 300) was performed after the injection of the drug. The iodine/water concentraction of BAT and WAT, the BAT/Arota and WAT/Arota ratio were calculated. Statistical analysis was performed with independent sample t test and paired sample t test .

RESULTS

There was no difference in mean base iodine (water) material concentration of BAT and WAT at the baseline condition between the NE and saline groups (P>0.05). After injecting NE, the base iodine material concentration of BAT increased significantly compared to controls (NE: -5.41±1.20mg/cm3 and 23.57±8.71mg/cm3; saline: -7.66±2.01mg/cm3 and 8.71±3.68mg/cm3, respectively; P<0.001) (Fig.A). However, there were no statistically significant changes observed in iodine and water material concentration of WAT between both groups. The BAT/Arota ratio, WAT/Arota ratio of iodine concentration and BAT/Arota ratio of water concentration after injection NE increased significantly (iodine: BAT/Arota ratio, 0.26±0.96 and 0.10±0.04, WAT/Arota ratio, -0.12±0.04 and -0.16±0.03; water: BAT/Arota ratio:1.06±0.02 and 0.93±0.04, respectively; P<0.001) (Fig.B). There was no difference of WAT/Arota ratio in water concentration imaging between both groups (P>0.05) (Fig.C).

CONCLUSION

The iodine/water base material concentration detected the pharmacologic activation of BAT. Energy spectrum CT has protential to evaluate the change of BAT and WAT after treatment.

CLINICAL RELEVANCE/APPLICATION

Spectral CT provided a new noninvasive method to be translated to a clinical setting for evaluation the difference of adipose tissue and monitoring the responses to specific therapeutic strategies.

RC225-03 Determinants of the Accuracy of the Quantification of Glandularity and Iodine Uptake in Contrast-Enhanced Digital Mammography

Monday, Nov. 30 9:10AM - 9:20AM Location: S403B

Participants
Kristen C. Lau, MS, Philadelphia, PA (*Presenter*) Nothing to Disclose
Moez K. Aziz, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Young Joon Kwon, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Andrew D. Maidment, PhD, Philadelphia, PA (*Abstract Co-Author*) Research support, Hologic, Inc; Research support, Barco nv; Spouse, Employee, Real-Time Radiography, Inc; Spouse, Stockholder, Real-Time Radiography, Inc

PURPOSE

To develop a method for determining breast tissue composition in dual-energy (DE) contrast-enhanced digital mammography (CE-DM). The motivation for this arises from our difficulty to resolve contrast uptake at the boundaries of the breast in DE subtraction.

METHOD AND MATERIALS

Phantoms were constructed using 1 cm thick uniform blocks of 100% glandular-equivalent and 100% adipose-equivalent materials (CIRS, Norfolk, VA). The thickness of the phantoms ranged from 3 to 8 cm, in 1 cm increments. For a given thickness, the glandular/adipose composition of the phantom was varied using different combinations of blocks. The phantoms were imaged using a prototype DE Hologic Selenia Dimensions DBT system. A 0.3 mm copper filter is used for the high-energy (HE) x-rays (49 kVp) and a 0.7 mm aluminum filter is used for the low-energy (LE) x-rays (32 kVp). X-ray energies were chosen so the k-edge of the contrast agent was in the range spanned by the LE and HE x-ray spectra. DE images were obtained by a weighted logarithmic subtraction of the HE and LE image pairs. The images were smoothed using a 2D convolution with a 4x4 matrix prior to quantitative analysis. LE and HE signal intensities were normalized by the mAs, and mean and standard deviation values were calculated for the normalized log HE and log LE images.

RESULTS

The mean LE and HE values varied with phantom thickness and glandularity. The log LE and log HE signals decrease linearly with increasing glandularity for a given thickness. The signals decrease with increasing phantom thickness; for a given glandularity, the x-ray signal decreases linearly with thickness. As the thickness increases, the attenuation difference per additional glandular block decreases, indicating beam hardening. Using these data, we have created a mapping between signal intensity and breast thickness. These data facilitate the subtraction of tissue in the periphery of the breast, and aid in discriminating between contrast agent uptake in glandular tissue and subtraction artifacts.

CONCLUSION

We have shown that breast thickness and composition can be predicted based on signal intensities in DE CE-DM. This has implications for the weighting factor used in DE subtraction.

CLINICAL RELEVANCE/APPLICATION

DE CE-DM can be improved by taking into account breast thickness and composition. Combining these techniques into a single procedure is a powerful tool for the detection and diagnosis of breast cancer.

RC225-04 Mapping of Medullar Adiposity of the Lumbar Spine in MRI

Monday, Nov. 30 9:20AM - 9:30AM Location: S403B

Participants
Nicolas Demany, Brest, France (*Abstract Co-Author*) Nothing to Disclose
Julien Ognard, MD, MSc, Brest, France (*Presenter*) Nothing to Disclose
Jawad Mesrar, MD, Brest, France (*Abstract Co-Author*) Nothing to Disclose
Serge Ludwig Aho-Glele, Dijon, France (*Abstract Co-Author*) Nothing to Disclose
Alain Saraux, Brest, France (*Abstract Co-Author*) Nothing to Disclose
Douraied Ben Salem, MD, PhD, Brest, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The bone medullar adiposity is a marker of bone quality to the point that it should be better to know the factors which influence or not the density and distribution of this fat in the spine, especially at the lumbar level.

METHOD AND MATERIALS

A sagittal sequence IDEAL IQ (MRI GE 1.5T) was performed on the lumbar spine of 46 subjects without bone disease (21 women and 25 men, aged 18 to 77 years old). Medulla adiposity was determined directly from the measurement of the fat fraction of each vertebral body (T12 to S1) obtained on the fat cartography automatically generated by the IDEAL sequence.

RESULTS

Average vertebral fat fraction was 36.48% (DS 12.82 ; 14.69% - 72.8%], increasing with age, and it is higher among men. We observed a craniocaudal gradient of the fat fraction (B = 1,37 ; p < 0,001 ; DS 0,06) increasing with age in the lumbar spine from T12 to L5. Through a multivariate analysis, this gradient was independent of sex, weight and height of subjects.

CONCLUSION

This study shows the existence of a physiological craniocaudal gradient of vertebral medullar adiposity from T12 to L5. This gradient increases with age but it is independent of sex or BMI. The IDEAL sequence allows quick and reproducible measurement of the spine vertebral medullar adiposity.

CLINICAL RELEVANCE/APPLICATION

IDEAL IQ is a Rapid sequence, Allowing easy and reproducible measurements with ROIs. The need is to recruit a wider population to establish standards fat percentage by age strata and compare them with bone mineral density obtained by densitometry. For example, in an attempt to establish thresholds for a subject to beconsidered as osteopenic or osteoporotic. The IDEAL IQ sequence allows a fast and reproductible measure of the bone marrow fat of the spine, that could easily completing a lumbar MRI assessment

RC225-05 Automatic Quantification of Iodine and Calcium using Monoenergetic Virtual Images Generated by

Spectral Detector Dual-Layer CT: A Phantom Study

Monday, Nov. 30 9:30AM - 9:40AM Location: S403B

Participants
Isaac Leichter, PhD, Jerusalem, Israel (*Presenter*) Nothing to Disclose
Tzvi Lipschuetz, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Tzvi Vichter, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Zimam Romman, Haifa, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jacob Sosna, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, ActiViews Ltd Research Grant, Koninklijke Philips NV

PURPOSE

To use Monoenergetic Virtual images generated by Spectral Detector Dual-Layer CT (SDCT) for automatic reliable identification and concentration calculation of calcium and iodine solutions.

METHOD AND MATERIALS

Tubes of 11.1 mm diameter filled with iodine and calcium solutions at concentrations of 10 to 60 mg/ml and 100 to 1000 mg/ml, respectively, were inserted in a water-equivalent anthropomorphic CT phantom (QRM, Moehrendorf, Germany). The phantom, of two sizes (25×35 cm and 30×40 cm), was scanned with a SDCT (Philips Healthcare, Cleveland, OH, USA) at 120kVp and 200 mAs. Software was developed to calculate the relationship between gray-level values of pixels containing iodine and calcium solutions in the monoenergetic virtual images generated by SDCT. The relationship obtained for the image of the small phantom was used to create spectral maps that uniquely characterize the material in the pixel, independently of its concentration. For any given image, the software searched and identified pixels which fitted into the spectral map equations of calcium and iodine and displayed them in different colors. In order to evaluate the effect of beam hardening, iodine and calcium was searched in images of both phantom sizes. The concentration of each solution identified by the software was evaluated.

RESULTS

In the small phantom (98.9±1.6)% of the pixels containing iodine or calcium were correctly identified and displayed in different colors. In the large phantom the identification accuracy was (92.7±10.4)%. The calculated solution concentrations in the small phantom were higher by (4.6±2.6)% from the actual concentrations, and lower by (5.7±4.6)% in the large phantom.

CONCLUSION

SDCT can differentiate between calcium and iodine solutions in a phantom model and calculate their concentrations with good accuracy on a pixel by pixel analysis. Beam hardening effects had only a small impact on the results which depended very slightly on the phantom size or the solution location within the phantom.

CLINICAL RELEVANCE/APPLICATION

By the use of Spectral Detector CT, contrast agents in blood and tumors may be reliably differentiated from adjacent skeletal components, and their concentration can be accurately assessed.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jacob Sosna, MD - 2012 Honored Educator

RC225-06 Quantitative Imaging for PET-CT: Applications and Future Directions

Monday, Nov. 30 9:40AM - 10:10AM Location: S403B

Participants
Robert Jeraj, Madison, WI (*Abstract Co-Author*) Founder, AIQ Services
Tyler Bradshaw, Madison, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the role of PET/CT-based quantitative imaging in the clinical and research settings.

RC225-07 Quantitative Imaging for DCE-MRI: Applications and Future Directions

Monday, Nov. 30 10:25AM - 10:55AM Location: S403B

Participants
Yue Cao, PhD, Ann Arbor, MI (*Presenter*) Research Grant, Siemens AG; Speaker, Siemens AG

LEARNING OBJECTIVES

1) Describe the role of quantitative DCE MR imaging in the clinical and research settings.

RC225-08 Measuring Blood Velocity with Doppler-CT (part 1): Theoretical Aspects and Simulations

Monday, Nov. 30 10:55AM - 11:05AM Location: S403B

Participants
Johannes G. Korporaal, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Rainer Raupach, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Thomas G. Flohr, PhD, Forchheim, Germany (*Abstract Co-Author*) Employee, Siemens AG
Bernhard Schmidt, PhD, Forchheim, Germany (*Presenter*) Employee, Siemens AG

PURPOSE

Measuring blood velocity with computed tomography (CT) has been subject of numerous studies, most of which used the time-of-flight technique. With that method, data acquisition should be performed with a stationary table (sequence mode) and the clinical applicability and measurement accuracy are limited by the detector size. The purpose of this study is to introduce Doppler-CT as a new method of measuring blood velocity by describing the theory, simulating its expected behavior and deriving clinical acquisition strategies.

METHOD AND MATERIALS

In general, the speed v [m/s] of a wave with wavelength λ [m] and frequency f [1/s] is given by $v = f*\lambda$. When considering a straight vessel segment and assuming a linear increase in contrast enhancement after injecting an iodinated contrast agent, the blood velocity can be analogously calculated from the spatial [m/HU] and temporal [HU/s] contrast gradients within the vessel. In case the observer O (the scan plane of the CT scanner) and the source S (the human heart) are moving with respect to each other, i.e. during a spiral acquisition, the well-known Doppler-equations can be applied, e.g. $fO = fS(1 \pm v/c)$ [eq.1], with fO being the measured temporal gradient [HU/s] of the spiral scan, fS the temporal gradient [HU/s] produced by the heart, ±v the table speed and c the blood velocity. For table velocities of ±70cm/s and blood velocities of ±100cm/s, fO was simulated as fraction of fS, since the relative change in fO is independent of fS.

RESULTS

With a known direction of table movement, the direction of the blood flow can be qualitatively determined, since the relative gradient of fO is centrally symmetric. With increasing table speed and decreasing blood speed, the deviation of fO from fS increases, indicating better quantitative measurement accuracy. For equal image noise, low tube voltages and high iodine delivery rates will further improve the measurement sensitivity.

CONCLUSION

High table speed and low blood velocity are favorable for quantifying blood velocity with Doppler-CT. Implementation in clinical routine can be simple, e.g. with two (or more) sweeps of a dynamic scan mode with alternating scan direction (part 2) or with a bolus tracking scan followed by a CT angiography (part 3).

CLINICAL RELEVANCE/APPLICATION

Measuring blood velocity is no longer reserved for wide-detector CT-systems in sequence mode, but can also be performed with CT-systems with smaller detectors in spiral scan mode.

RC225-09 Quantification of Hepatic Tumor Viability in Multi-phase MDCT Images

Monday, Nov. 30 11:05AM - 11:15AM Location: S403B

Participants
Wenli Cai, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Anand K. Singh, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Yin Wu, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Gordon J. Harris, PhD, Boston, MA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc

PURPOSE

The purpose of this study was to develop a quantitative imaging biomarker, denoted as hepatic tumor viability (HTV), for quantification of viable and necrotic tumor volumes in addition to the size of liver and tumors in the assessment of tumor progression and treatment responses for patients with hepatocellular carcinoma (HCC) and metastasis.

METHOD AND MATERIALS

Based on the pattern analysis of time-intensity curve (TIC) in multi-phase MDCT images, we developed the automated HTV scheme for segmentation of liver and liver tumors, and classification of viable and necrotic tumor regions. To depict a TIC pattern, a group of TIC features was extracted including the peak CT value, the time to peak (TTP), the area under the curve (AUC), the AUC of wash-in/out, the max/average wash-in/out derivative, and a group of spatiotemporal textures: skewness, kurtosis, energy, and entropy. A K-mean cluster was applied to classify each voxels into four different types of materials: vessel, normal liver tissue, tumor tissue, and necrotic tissue. Liver, liver tumor and viable regions were segmented using the likelihood to each material. Forty (40) IV-contrast enhanced hepatic multi-phase MDCT cases with biopsy-confirmed HCC or metastases were used for evaluation of the proposed HTV biomarker. The MDCT imaging parameters settings were: 2.5-5 mm collimation, 1.25-2.5 mm reconstruction interval, 175 mA tube current, and 120 kVp tube voltage.

RESULTS

In reference to the liver and tumor segmentation by manual-contouring of two radiologists, the volumetric size of these 40 HCC or metastasis livers ranged from 1079.2 CC to 4652.3 CC, in which the tumor volume percentages ranged from 1.77% to 53.54%. The proposed HTV scheme achieved a liver volumetric difference of 3.27±2.58% and tumor percentage difference of 1.33±1.44%. Viable tumor volume showed significant better performance than RECIST and total tumor volume in prediction of treatment response in the case of overall and progression-free survival.

CONCLUSION

Our HTV biomarker can achieve accurate and reliable quantification results in segmentation of liver and liver tumors, classification of viable and necrotic tumor regions, and thus provides a better prediction of treatment response.

CLINICAL RELEVANCE/APPLICATION

Our HTV biomarker can provide an accurate and reliable tumor quantification for assessment of tumor progression and treatment response for HCC and liver metastasis.

RC225-10 Fully Automated Quantitative Analysis of Myocardial Perfusion in First-pass MR Images

Monday, Nov. 30 11:15AM - 11:25AM Location: S403B

Participants
Luan Jiang, PhD, Shanghai, China (*Presenter*) Nothing to Disclose
Shan Ling, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Jichao Yan, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Qiang Li, PhD, Shanghai, China (*Abstract Co-Author*) Patent agreement, General Electric Company Patent agreement, Hologic, Inc Patent agreement, Riverain Technologies, LLC Patent agreement, MEDIAN Technologies Patent agreement, Mitsubishi Corporation

PURPOSE

We are developing a fully automated scheme for quantitative analysis of myocardial perfusion in short-axis first-pass MR images.

METHOD AND MATERIALS

We obtained 8 short-axis myocardial perfusion MR scans from xxx Hospital in xxx with an xxx 1.5-T MR scanner. Each MR scan has 40 time frames with slice thickness 8 mm and in-plane resolution 1.37 mm × 1.37 mm. Our automated method consists of three steps, i.e., cardiac registration, myocardium segmentation, and empirical indexes quantification. Based on the region of interest (ROI) automatically identified from the image at the reference time phase with better contrast of left ventricle and myocardium, a multiscale affine transformation using Sobel gradient information and a non-rigid Demons registration using pseudo ground truth images were sequentially applied to correct the deformations caused by respiratory and cardiac motion. We then further used fuzzy c-means clustering method in the reference image and dynamic programming method in the maximum intensity projection image of all time phases to delineate, respectively, the endo- and epicardial boundaries of the myocardium. Finally, several empirical perfusion indexes (peak signal intensity, time to peak, and maximum upslope) were quantified from the time-intensity curves of segments of myocardium.

RESULTS

Dice index based on apical, midventricular, and basal slices was improved from 78.4% ± 12.5% to 85.9% ± 5.3% using cardiac registration, and Dice index of 82.2% ± 5.9% was achieved for myocardium segmentation. Subjective judgment showed that the empirical indexes were able to identify the ischemia in myocardium.

CONCLUSION

Our fully automated scheme for quantitative analysis of myocardial perfusion MR images would be useful for myocardium perfusion assessment and early diagnosis of myocardium with ischemia.

CLINICAL RELEVANCE/APPLICATION

Our CAD scheme could help the radiologists to quantitatively analyze myocardium perfusion and to improve the accuracy and efficiency for diagnosis of myocardium with ischemia.

Active Handout:Luan Jiang

http://abstract.rsna.org/uploads/2015/15016295/RC225-10.pdf

RC225-11 Laws Textures: A Potential MRI Surrogate Marker of Hepatic Fibrosis in a Murine Model

Monday, Nov. 30 11:25AM - 11:35AM Location: S403B

Participants
Baojun Li, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Hei Shun Yu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hernan Jara, PhD, Belmont, MA (*Abstract Co-Author*) Patent holder, qMRI algorithms Research Grant, General Electric Company Royalties, World Scientific Publishing Co
Jorge A. Soto, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stephan W. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the effect of disease progression on liver parenchymal Laws textures of ex vivo murine liver specimens imaged using 11.7 Tesla MRI. To compare Laws textures to other imaging-based surrogate markers (T2, PD, ADC, and degrees of inflammation).

METHOD AND MATERIALS

This animal study was IACUC approved. Seventeen male, C57BL/6 mice were divided into control (n=2) and experimental groups (n=15). The latter were fed a 3,5-dicarbethoxy-1, 4-dihydrocollidine (DDC) supplemented diet to induce hepatic fibrosis. Ex vivo liver specimens were imaged using an 11.7T MRI scanner, from which the parametric proton density (PD), T2, and ADC maps were generated from spin-echo pulsed field gradient and multi-echo spin-echo acquisitions. The PD maps were first preprocessed to eliminate the low-intensity histogram bias arisen from partial volume effect. The PD maps were further corrected by mean and standard deviation in order to minimize discrimination by overall graylevel variation, which is unrelated to liver parenchymal texture. Laws textures were extracted from the PD maps. Degrees of fibrosis and inflammation were assessed by an experienced pathologist (subjective scores) and digital image analysis (DIA, %Area Fibrosis). Scatterplot graphs comparing Laws texture, T2, PD, ADC, inflammation score to degrees of fibrosis were generated and correlation coefficients were calculated.

RESULTS

Hepatic fibrosis and Laws textures were strongly correlated with higher %Area Fibrosis associated with higher Laws textures ($r=0.89$, $p<0.001$). Strong correlation also existed between T2 and Laws textures ($r=0.85$, $p<0.01$). Moderate correlations were seen between %Area Fibrosis and PD ($r=0.65$), ADC ($r=0.67$), and Subjective Fibrosis Score ($r=0.51$). The Subjective Inflammation Score was poorly correlated with hepatic fibrosis ($r=0.20$). Without proposed corrections, there was only a moderate correlation between %Area Fibrosis and Laws textures ($r=0.70$).

CONCLUSION

Higher degree of hepatic fibrosis is associated with increased liver parenchymal Laws textures. Laws textures may be more accurate than PD, ADC, and subjective fibrosis and inflammation scores in assessing degrees of fibrosis. The proposed corrections are critical.

CLINICAL RELEVANCE/APPLICATION

Laws textures are potentially accurate surrogate marker for diagnosing and staging hepatic fibrosis.

Honored Educators

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Hernan Jara, PhD - 2014 Honored Educator
Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

RC225-12 Grading of Diffuse Liver Diseases Using Phase-Contrast-Imaging

Monday, Nov. 30 11:35AM - 11:45AM Location: S403B

Participants
Marco Armbruster, Munich, Germany (*Presenter*) Co-Founder of medical software company.
Blaz Zupanc, MA, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Emmanuel Brun, Grenoble, France (*Abstract Co-Author*) Nothing to Disclose
Alberto Mittone, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Wieland H. Sommer, MD, Munich, Germany (*Abstract Co-Author*) Founder, QMedify GmbH
Wolfgang Thasler, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Paola Coan, Grenoble, France (*Abstract Co-Author*) Nothing to Disclose

CONCLUSION

X-ray PCI allows grading of diffuse liver diseases, is correlated to histopathology and might be a valuable technique for non-invasive diagnosis and grading of liver fibrosis and steatosis.

Background

Diffuse liver pathologies like steatosis, fibrosis or cirrhosis are an increasing cause of morbidity and mortality worldwide. Liver biopsy is currently the gold standard for the diagnosis and monitoring of disease progression and is essential both for treatment decisions and the prognosis of patients. However, liver biopsy has non-negligible risks, is prone to sampling erros and cannot be used as a screening method.Therefore, the purpose of this study was a proof-of-concept that high resolution X-ray phase contrast imaging (PCI) in computer tomography mode is able to directly visualize pathological changes of the microstructure and that grading of diffuse liver diseases is feasible using PCI-CT.

Evaluation

Synchrotron-based PCI-CT volumetric imaging was performed for human, ex-vivo liver samples from 20 patients (male: 12, female: 8, age: 62+-12 yrs). Histopathological workup included hematoxylin-and-eosin-, elastica-van-Gieson-, and iron-straining. For PCI-CT, propagation based imaging technique was used with X-ray of 30 keV and a sample-to-detector distance of 11m. Images were acquired at a spatial resolution of 8 microns.All dataset were graded for the presence of fibrotic changes and the amount of fatty vacuoles. PCI-CT- and histopathological grading of fibrosis and steatosis was correlated using pearson's correlation-coefficient. Both fatty vacuoles, portal, and septal fibrougenous deposites were identifiable in PCI-CT. Visual grading of fibrosis and steatosis correlated moderatly but significantly to the histopathological assessment ($r=0.682$; $p<0.05$ for fibrosis; $r=0.764$; $p<0.05$ for steatosis).

Discussion

In this study we used X-ray PCI for a direct visualization of microstructural changes within the liver tissue of patients suffering from diffuse liver diseases. Detailed grading of fibrosis and steatosis was feasible. Due to the three-dimensionality of PCI datasets this technique has the potential to decrease interobserver variability and sampling errors in the grading of diffuse liver diseases.

RC225-13 Question and Answer

Monday, Nov. 30 11:45AM - 12:00PM Location: S403B

Participants

RC229

Rectal Carcinoma: Pre and Post Treatment Evaluation with MRI (An Interactive Session)

Monday, Nov. 30 8:30AM - 10:00AM Location: E353B

GI MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC229A Rectal Carcinoma: Setting the Stage, What the Clinician Needs to Know

Participants
Gina Brown, MD, MBBS, Sutton, United Kingdom, (gina.brown@rmh.nhs.uk) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the prognostic relevance of MRI in planning surgical treatment options. 2) MRI assessment for oncologic treatment decisions. 3) Future developments in treatment strategies based on MRI assessment and restaging after chemoradiotherapy.

Handout:Gina Brown

http://abstract.rsna.org/uploads/2015/15002789/RSNA2015_GinaBrownHandout.pdf

RC229B Pre Treatment Staging Standardized Reporting: Have you Checked the 'DISTANCE?'

Participants
Caroline Reinhold, MD, MSc, Montreal, QC, (caroline.reinhold@mcgill.ca) (*Presenter*) Consultant, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) To propose a MR imaging protocol for staging newly diagnosed rectal carcinoma.2) To understand the anatomy of the rectum and mesorectum as pertains to MRI staging.2) To propose a step-by-step approach for standardized MRI staging of pre-treatment rectal carcinoma using the mnemonic "DISTANCE".

ABSTRACT

In the Western Hemisphere, colorectal cancer is the third most common cancer in men after prostate and lung, and the second most common in women after breast cancer. One-third of colorectal cancers occur in the rectum. Survival rates for rectal cancer have improved in the past decade due to the combined effects of better staging, improved preoperative treatment strategies and total mesorectal excision (TME) surgery. Several studies have been published showing the ability of MRI to accurately stage rectal cancer and predict a negative circumferential resection margin. Moreover, advances in preoperative therapies require accurate preoperative MRI staging to select those patients who may benefit from chemoradiation prior to surgery. To accurately stratify patients according to the risk of local and distant failure, imaging takes on the same importance as tumor type and genetic susceptibility. However, rectal cancer evaluation by MRI continues to pose a challenge in non experts' hands. This presentation will present a mnemonic: "DISTANCE" to enable a systematic and standardized approach to the interpretation of MR imaging in newly diagnosed rectal cancers, thereby enabling all the clinically relevant features to be adequately assessed: DIS: for Distance from the Inferior part of the tumor to the transitional Skin, T: for T staging, A: for Anal complex, N: for Nodal staging, C: for Circumferential Resection Margin, E: for Extramural vascular invasion.

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Caroline Reinhold, MD, MSc - 2013 Honored Educator
Caroline Reinhold, MD, MSc - 2014 Honored Educator

RC229C Post Treatment Evaluation: What Criteria and Imaging Protocol Should I Use?

Participants
Stephanie Nougaret, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To highlight current management of rectal cancer including sphincter- and organ-sparing treatment options 2) To describe how pretreatment multi-parametric rectal MRI may serve as a predictive biomarker of subsequent tumor response to chemoradiation (CRT) 3) To propose a step-by-step approach for accurate interpretation of rectal MRI following CRT and to illustrate how the information gleaned from post CRT multi-parametric rectal MRI may influence treatment decisions.

ABSTRACT

Recent changes in the management of patients with locally advanced rectal cancer highlight the need for accurate assessment of tumor response to chemoradiation (CRT). In the past, CRT was followed by surgical resection in nearly all patients, irrespective of response to CRT. However, new data suggest that surgery may not be necessary in patients with complete response. MR imaging

has become an essential tool to enable the oncology team to make appropriate treatment decisions. MRI has so far relied on changes in morphology as a measurement for response. However, this evaluation is hampered by the difficulties in differentiating residual tumor from radiation-induced fibrosis. Recent studies have suggested that adding diffusion-weighted imaging (DWI) to conventional MRI can aid this differentiation and thus improve the prediction of response after neoadjuvant therapy.Thus, the learning objectives for this lecture are as follows:1) To learn about the value of multi-parametric rectal MRI prior to and following CRT for the prediction and subsequent assessment of response to CRT. To understand how rectal MR imaging finding are essential to making patient-centered treatment decisions.2) To become familiar with "DISTANCE" mnemonic and diagnostic clues which provide a systematic approach to the interpretation of rectal MRI images in patients with rectal cancer prior to treatment and following CRT.

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Stephanie Nougaret, MD - 2013 Honored Educator

MSCM22

Case-based Review of Magnetic Resonance (An Interactive Session)

Monday, Nov. 30 10:30AM - 12:00PM Location: S100AB

BR CH HN NR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
John R. Leyendecker, MD, Dallas, TX (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of MRI in diagnosing abnormalities of the breast. 2) Be familiar with the MRI appearance of select cardiothoracic abnormalities. 3) Effectively use MRI to diagnose disorders of the head and neck. 4) Distinguish between a variety of brain lesions based on MRI appearance.

ABSTRACT

This session will help attendees recognize and manage select, commonly encountered breast, cardiothoracic, head and neck, and brain abnormalities based on their MRI appearances using a case-based, interactive format.

Sub-Events

MSCM22A Breast MRI

Participants
Fiona J. Gilbert, MD, Cambridge, United Kingdom (*Presenter*) Medical Advisory Board, General Electric Company; Research Grant, GlaxoSmithKline plc; Research Grant, General Electric Company

LEARNING OBJECTIVES

View learning objectives under main course title.

MSCM22B Cardiothoracic MRI

Participants
Suhny Abbara, MD, Dallas, TX (*Presenter*) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

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Suhny Abbara, MD - 2014 Honored Educator

MSCM22C Head and Neck MRI

Participants
Daniel W. Williams III, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

MSCM22D Brain MRI

Participants
Mauricio Castillo, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the differential diagnosis and imaging features of intraventricular massses in children and adults. 2) Review the cerebral complications of treatment vascular malformations. 3) Review the differential diagnosis and imaging features of masses arising in the cerebello-pontine angle region. 4) Review the differential diagnosis of cerebral microbleeds.

SSC01

Cardiac (Nonischemic Cardiomyopathies)

Monday, Nov. 30 10:30AM - 12:00PM Location: S502AB

CA MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Konstantin Nikolaou, MD, Tuebingen, Germany (*Moderator*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Ella A. Kazerooni, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Vincent B. Ho, MD, MBA, Bethesda, MD (*Moderator*) In-kind support, General Electric Company

Sub-Events

SSC01-01 Myocardial Hyperintensity on T2-weighted MRI of Hypertrophic Cardiomyopathy: Distribution and Clinical Significance Related to Phenotypes

Monday, Nov. 30 10:30AM - 10:40AM Location: S502AB

Participants
Shogo Imai, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose
Yasuo Amano, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Fumi Yamada, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Kumiko Aita, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masaki Tachi, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Makoto Obara, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinichiro Kumita, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

T2-weighted magnetic resonance imaging (MRI) visualizes myocardial injuries that are different from late gadolinium enhancement (LGE). The aim of this study was to evaluate the distribution and clinical significance of myocardial hyperintensity on T2-weighted MRI (T2-high) in patients with two phenotypes of hypertrophic cardiomyopathy (HCM): asymmetrical septal HCM (ASH) and apical HCM (APH).

METHOD AND MATERIALS

Thirty-six ASH and 18 APH patients and their 864 myocardial segments based on the American Heart Association model were investigated using cardiac MRI. The two patient groups were age-matched. The distribution of T2-high was compared with that shown by LGE. The relationships between T2-high and the episode of unexpected syncope or nonsustained ventricular tachycardia and elevated troponin T levels were evaluated. In four patients with HCM, T2 values of the T2-high were quantitatively estimated with multi-echo spin-echo T2 mapping.

RESULTS

T2-high was observed in 18 segments (3.1%) in 13 ASH patients (36.1%) and in 12 segments (4.2%) in 8 APH patients (44.4%). One-third of T2-high was located outside LGE in ASH patients, and half of the T2-high was outside LGE in APH patients. The concordance of T2-high and LGE was moderate when analyzed on the per-patient basis ($k = 0.47$) and mild when analyzed on the per-segment basis ($k = 0.30$) in ASH. In APH, the concordance of T2-high and LGE was fair when analyzed on both the per-patient basis ($k = 0.05$) and per-segment basis ($k = 0.20$). In ASH patients, the presence of T2-high was significantly related to the episode of unexpected syncope ($P = 0.016$). T2-high had greater T2 values (mean, 61.1 ms) than the remote myocardium of HCM (mean, 47.3 ms) and the normal myocardium of 5 volunteers (mean, 47.4 ms).

CONCLUSION

T2-high reflects changes in myocardial water contents, which may be related to syncope associated with ASH. Because the T2-high is often localized outside the LGE area, T2-weighted MRI should be interpreted carefully in HCM.

CLINICAL RELEVANCE/APPLICATION

Myocardial hyperintensity on T2-weighted MRI, which may be related to syncope, should be investigated carefully in patients with hypertrophic cardiomyopathy.

SSC01-02 Comprehensive Cardiac Magnetic Resonance in Acute Myocarditis

Monday, Nov. 30 10:40AM - 10:50AM Location: S502AB

Participants
Julian A. Luetkens, Bonn, Germany (*Presenter*) Nothing to Disclose
Rami Homsi, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Alois Martin Sprinkart, MSc, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Jonas Doerner, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Darius Dabir, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel Kuetting, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Wolfgang Block, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Rene Andie, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Stehning, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV

Rolf Fimmers, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Juergen Gieseke, DSc, Bonn, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Daniel K. Thomas, MD, PhD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans H. Schild, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Claas P. Naehle, MD, Bonn, Germany (*Abstract Co-Author*) Consultant, Medtronic, Inc

PURPOSE

Cardiac magnetic resonance (MR) can visualize inflammatory tissue changes in acute myocarditis. Several quantitative image-derived parameters have been described to enhance the diagnostic value of cardiac MR, but no direct comparison of all these techniques is available.

METHOD AND MATERIALS

34 patients with suspected acute myocarditis and 50 control subjects underwent cardiac MR. Cardiac MR protocol included quantitative assessment of T1 relaxation times using modified Look-Locker inversion recovery (MOLLI) and shortened MOLLI (ShMOLLI) acquisition schemes, extracellular volume fraction (ECV), T2 relaxation times, and longitudinal strain. Established Lake-Louise Criteria (LLC) consisting of T2-weighted signal intensity ratio (T2 ratio), early gadolinium enhancement ratio (EGEr) and late gadolinium enhancement (LGE) were assessed. Receiver operating characteristics analysis was performed to compare diagnostic performance.

RESULTS

Areas under the curve of native T1 (MOLLI: 0.95; ShMOLLI: 0.92) and T2 relaxation times (0.92) were higher compared to those of other cardiac MR parameters (T2 ratio: 0.71, EGEr: 0.71, LGE: 0.87, LLC: 0.89, ECV MOLLI: 0.77, ECV ShMOLLI: 0.80, longitudinal strain: 0.83). Combined with LGE each native mapping technique outperformed the diagnostic performance of LCC ($P<0.01$ respectively). A combination of native parameters (T1, T2 and longitudinal strain) significantly increased the diagnostic performance of cardiac MR compared to LCC without the need of contrast media application (0.99 vs. 0.89; $P=0.002$).

CONCLUSION

In patients suspected of having acute myocarditis, diagnostic performance of cardiac MR can be improved by implementation of quantitative cardiac MR parameters. Especially native mapping techniques have the potential to replace current LCC.

CLINICAL RELEVANCE/APPLICATION

Based on these study findings, an update to the Lake-Louise criteria with respect to quantitative CMR parameters may become necessary.

SSC01-03 Myocardial T1-mapping and T1-derived Extracellular Volume Fraction (ECV) in Patients with Chronic HIV Infection

Monday, Nov. 30 10:50AM - 11:00AM Location: S502AB

Participants
Julian A. Luetkens, Bonn, Germany (*Presenter*) Nothing to Disclose
Jonas Doerner, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Christoph Boesecke, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Jan-Christian Wasmuth, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Carolynne Schwarze-Zander, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Juergen Rockstroh, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans H. Schild, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Claas P. Naehle, MD, Bonn, Germany (*Abstract Co-Author*) Consultant, Medtronic, Inc

PURPOSE

Chronic HIV infection is associated with an increased risk for cardiovascular disease. Diffuse myocardial pathologies may noninvasively be assessed by quantitative cardiac magnetic resonance (CMR) using myocardial T1 mapping, and T1-derived extracellular volume fraction (ECV).

METHOD AND MATERIALS

The institutional review committee approved the study and all subjects gave informed consent prior to CMR. Patients with chronic HIV infection undergoing combination antiretroviral therapy and healthy controls were included in this study. All patients had no medical history of cardiac disease and no cardiac risk factors. CMR protocol at 3 Tesla (Ingenia, Philips Healthcare, The Netherlands) included common SSFP sequences, T2 STIR imaging, late gadolinium enhancement imaging, and a pre- and 10 minutes post-contrast 3-3-5 MOLLI scheme for myocardial T1 mapping. Hematocrit-corrected ECV was derived from the pre- and post-contrast T1 maps.

RESULTS

27 patients with HIV infection (age 49.1 ± 9.5 years) and 18 controls (age 40.6 ± 15.6 years) underwent CMR. Pre-contrast global T1 relaxations times were significantly prolonged in HIV patients compared to healthy controls (1116.1 ± 57.0 ms vs. 1075.1 ± 65.5 ms; $P=.033$). Post-contrast T1 relaxation times were decreased (405.0 ± 50.5 ms vs. 455.7 ± 77.5 ms, $P=.007$). ECV was higher in the HIV group compared to controls (25.8 ± 3.5 % vs. 22.4 ± 5.1 %, $P=.015$). Left ventricular ejection fraction was lower in the HIV group (60.3 ± 6.6 % vs. 64.4 ± 5.4 %; $P=.038$).

CONCLUSION

This study revealed signs of subtle myocardial disease (i.e. cardiac fibrosis) in asymptomatic HIV using quantitative myocardial T1 mapping analysis. Preclinical detection of myocardial involvement in HIV infection appears feasible and may allow for early risk factor modification.

CLINICAL RELEVANCE/APPLICATION

Myocardial T1 mapping might serve as a potential screening parameter for beginning cardiovascular disease in the course of HIV-infection.

SSC01-04 Characteristics of Peak Systolic Longitudinal Strain Using Strain-encoded Magnetic Resonance in Patients with Hypertrophic Cardiomyopathy: Comparison with Healthy Subjects and Relationship with Late Gadolinium Enhancement and with Wall Thicknes

Monday, Nov. 30 11:00AM - 11:10AM Location: S502AB

Participants
Fumiko Kimura, MD, PhD, Hidaka-Shi, Japan (*Presenter*) Nothing to Disclose
Takatomo Nakajima, MD, Shinjuku-Ku, Japan (*Abstract Co-Author*) Nothing to Disclose
Masahiro Takahashi, MD, Hidaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshiko Hoshi, MD, Kumagaya, Japan (*Abstract Co-Author*) Nothing to Disclose
Shigetoshi Nishimura, MD, PhD, Hidaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Nael Osman, Baltimore, MD (*Abstract Co-Author*) CEO, Diagnosoft, Inc

PURPOSE

To clarify characteristics of peak systolic longitudinal strain (PSLS) using strain-encoded cardiac magnetic resonance (SENC) in patients with hypertrophic cardiomyopathy (HCM) with normal left ventricular ejection fraction (LVEF)

METHOD AND MATERIALS

We retrospectively assessed 31 patients with HCM with LVEF ≥ 55% (20 men, 11 women; mean age 62.6 ± 12.3 years; mean LVEF 68.7 ± 8.6%) who underwent MR evaluation of late gadolinium enhancement (LGE) and PSLS using a 1.5 T-system in 2 hospitals between August 2012 and December 2014. For reference, we assessed the PSLS of 9 healthy control subjects. We compared the average segmental PSLS and the variability of segmental PSLS using 16-segment models between the HCM and control groups and then, in patients with HCM, directly correlated PSLS with corresponding myocardial wall thickness and compared PSLS with the percentage of area with LGE. We defined LGE as signal intensity (SI) 6 or more standard deviations (SDs) above the mean SI of normal myocardium, defined the normal range of segmental PSLS as the average segmental LS ± 2 SD in controls, and used an expression of reduction of PSLS when the absolute value of PSLS was reduced more than 2 SD of that of controls.

RESULTS

The average segmental PSLS was significantly reduced (HCM, -14.8%; control, -19.5%; $P < 0.0001$) and significantly more inhomogeneous (SD of average PSLS: HCM, 6.2%; control, 3.3%; $P < 0.0001$) in the HCM group than controls. We identified LGE in 28 of 31 patients with HCM (90.3%) and 253 of 496 segments (51.0%). In HCM group, the PSLS correlated moderately with myocardial wall thickness ($R = 0.53$, $P < 0.0001$) and weakly with the percentage of area of LGE ($R = 0.30$, $P < 0.0001$). Defining the normal range of segmental PSLS as above, PSLS in the HCM group was reduced in segments with and without LGE (PSLS was reduced in 80 of 243 segments with no LGE).

CONCLUSION

The average PSLS was significantly reduced and inhomogeneous in those with HCM despite a normal LVEF. Segmental PSLS correlated moderately with wall thickness, and weak correlation with segmental LGE percentage was probably due to the presence of segments with reduced PSLS and no LGE.

CLINICAL RELEVANCE/APPLICATION

In patients with HCM and normal LVEF, peak systolic longitudinal strain was reduced and inhomogeneous compared to controls and reduced in thick myocardium and myocardium with and without LGE.

SSC01-05 Relationship between Myocardial Markers and Myocardial Fibrosis of Hypertrophic Cardiomyopathy: Accessed by 3.0T Cardiac Magnetic Resonance

Monday, Nov. 30 11:10AM - 11:20AM Location: S502AB

Participants
Huayan Xu, Chengdu, China (*Presenter*) Nothing to Disclose
Zhigang Yang SR, PhD,MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Yingkun Guo, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To quantitatively detect myocardial fibrosis of hypertrophic cardiomyopathy (HCM) by 3.0 T cardiac magnetic resonance(CMR) Late gadolinium enhancement (LGE) technology, and get the relationship of LGE and myocardial markers, to investigate whether HCM patients' elevated myocardial markers are associated with myocardial fibrosis.

METHOD AND MATERIALS

34 HCM patients and 20 healthy volunteers were enrolled in this research. HCM patients and 20 healthy volunteers were underwent 3.0 T Cardiac Magnetic Resonance scanning, including short axis cine sequences and LGE sequences. Left ventricular function was obtained on short axis cine sequence. LGE parameters, including total LGE rate, total LGE volume and total LGE mass were detected on LGE sequences by commercial available software(cmr42, Circle Cardiovascular Imaging Inc., Calgary, Canada) . Myocardial marker, including creatine kinase isoenzyme and troponin were detected. Independent sample t-test and Pearson correlation were used.

RESULTS

All myocardial markers of HCM patients were greater than clinical normal range. By LGE detection, LGE parameters of HCM group, including total LGE rate, total LGE volume and total LGE mass, were greater than normal control group (18.95±9.87 vs. 50.82±14.18; 8.50±4.50 vs.4.50±41.99; 9.00±4.80 vs.90.58±44.11, all $P<0.05$). Pearson correlation has been proved that creatine kinase isoenzyme of HCM patients were positively correlated to LGE rate and LGE volume ($r=0.759$, $P=0.000$; $r=0.448$, $P=0.008$). Troponin of HCM patients were also positively correlated to LGE rate and LGE volume ($r=0.647$, $P=0.000$; $r=0.578$, $P=0.000$).

CONCLUSION

Myocardial fibrosis of Hypertrophic Cardiomyopathy was quantitatively accessed by 3.0 T cardiac magnetic resonance late

gadolinium enhancement technologies. Creatine kinase isoenzyme and troponin of HCM patients were positively correlated to LGE. Myocardial fibrosis may induce myocardial markers in the myocardial cells releasing, which affect the myocardial metabolic function further and induced heart function damage eventually.

CLINICAL RELEVANCE/APPLICATION

CMR-LGE is a well-established tool for the assessment of myocarium fibrosis in patients with HCM.Creatine kinase isoenzyme and troponin of HCM patients were positively correlated to LGE. Myocardial fibrosis may induce myocardial markers in the myocardial cells releasing, which affect the myocardial metabolic function further and induced heart function damage eventually.

SSC01-06 Magnetic Resonance Feature Tracking Derived Myocardial Strain Parameters: The Discriminative Power of Right Ventricular Strain Analysis in the Diagnosis of Acute Myocarditis

Monday, Nov. 30 11:20AM - 11:30AM Location: S502AB

Participants
Bettina Baessler, MD, Cologne, Germany (*Presenter*) Nothing to Disclose
Guido Michels, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank Schaarschmidt, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Anastasia Dick, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
David C. Maintz, MD, Koln, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander C. Bunck, Koln, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic value of cardiac magnetic resonance (CMR) feature tracking (FT) derived strain-analysis of the left and right ventricle in patients with CMR-proven acute myocarditis (ACM).

METHOD AND MATERIALS

CMR cine data of 34 patients with clinically suspected ACM and confirmation of diagnosis by CMR according to the Lake Louise criteria were retrospectively analyzed. 20 age-matched healthy volunteers (HV) served as a control. Analysis of global longitudinal, circumferential (circ.) and radial strain and strain rate (SR) of both ventricles was performed in one long-axis and three short-axis slices using a dedicated FT-software (TomTec). Statistical analysis was conducted using independent t-test, one-way ANOVA with tukey-type comparisons, multiple and multinominal logistic regression analyses, and ROC-analyses.

RESULTS

ACM patients showed significantly reduced LV longitudinal strain (-12.7 ± 1.1 vs. -16.8 ± 1.3 %, p = .022) and LV circ. strain (-22.9 ± 1.0 vs. -27.8 ± 1.0 %, p = .001) compared to HV. Conversely, they showed improved basal RV circ. SR (-0.70 ± 0.04 vs. -0.47 ± 0.07 s-1, p = .008). In a multiple logistic regression model, LV circ. strain and RV basal circ. SR proved to be the best independent predictors of ACM with an AUC of 0.87 in ROC-analysis. In ACM patients with preserved LV ejection fraction (LV-EF), RV basal circ. SR (-0.76 ± 0.05 vs. -0.47 ± 0.07 s-1, p = .005) was significantly increased compared to HV while LV strain parameters showed no significant differences between both groups. In multinominal logistic regression analysis, again LV circ. strain and RV basal circ. SR proved to be the best independent predictors of ACM when LV-EF is preserved with an AUC of 0.82 in ROC-analysis.

CONCLUSION

A combination of LV circ. strain and RV basal circ. SR is the best predictor for the presence of ACM, even in patients with preserved EF. Concurrently, the RV basal circ. SR appears to be particularly sensitive to alterations caused by ACM hinting at a potentially compensatory mechanism of basal RV hyperkinesia. Taken together, our results point to a discriminative power of RV strain analysis in the CMR-based diagnosis of ACM.

CLINICAL RELEVANCE/APPLICATION

ACM represents one of the most frequent causes of sudden cardiac death in young patients. Therefore, an improvement of the currently still challenging noninvasive diagnosis of ACM is highly desirable.

SSC01-07 Quantification of Myocardial Fibrosis by LGE, Pre- / Post-contrast T1 and ECV in Patients with Hypertrophic Cardiomyopathy Referenced to Normal Appearing Myocardium and Healthy Volunteers

Monday, Nov. 30 11:30AM - 11:40AM Location: S502AB

Participants
Maxim Avanesov, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
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Gunnar K. Lund, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Quantification of myocardial fibrosis by pre- and post-contrast T1, ECV as well as LGE in patients with hypertrophic cardiomyopathy (HCM) referenced to normal appearing myocardium and to normal values of healthy volunteers.

SSC02

Cardiac (Viability and Ischemia)

Monday, Nov. 30 10:30AM - 12:00PM Location: S504AB

CA CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Jadranka Stojanovska, MD, MS, Northville, MI (*Moderator*) Nothing to Disclose
Hajime Sakuma, MD, Tsu, Japan (*Moderator*) Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Bayer AG; Departmental Research Grant, Guerbet SA; Departmental Research Grant, DAIICHI SANKYO Group; Departmental Research Grant, FUJIFILM Holdings Corporation; Departmental Research Grant, Nihon Medi-Physics Co, Ltd
Jacobo Kirsch, MD, Weston, FL (*Moderator*) Nothing to Disclose

Sub-Events

SSC02-01 Can Native T1 Mapping Distinguish between Infarct Area and Area-at-Risk in Patients between Acute ST-elevation Myocardial Infarction?

Monday, Nov. 30 10:30AM - 10:40AM Location: S504AB

Participants
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PURPOSE

Cardiac Magnetic Resonance (CMR) has been established as the reference standard for in vivo identification and assessment of myocardial damage in acute myocardial infarction (AMI). Conventional CMR approach required a combined evaluation of myocardial edema and necrosis by using respectively T2-weighted sequences and late gadolinium enhanced (LGE) imaging. However the standard acquisition protocol for AMI is time-consuming (about 40-50 minutes), poorly tolerated by patients in inadequate clinical conditions and needs of the administration of contrast agent.Novel T1 mapping technique offers a pixel-by-pixel calculation of tissue T1 relaxation time determined by water content and cellularity. Our purpose was to investigate the capability of native T1 mapping to differentiate infarcted area, healthy myocardium and area-at-risk using conventional CMR sequences as reference in patients with AMI.

METHOD AND MATERIALS

Twenty consecutive patients performed CMR within the first 7 days following STEMI. CMR protocol included MOLLI, STIR T2w and cineMR sequences. IR-TSE T1w images were acquired for LGE after gadobenate dimeglumine (Gd-BOPTA, Bracco) administration. MOLLI images were analyzed with a dedicated software (Cvi42, Circle) by placing four ROIs within necrotic areas (LGE area, excluding microvascular obstruction area), area-at-risk (hyperintense area on STIR images without LGE) and in the remote myocardium. Acquisition time of each sequence was measured. Results are expressed on mean±SD and compared with Student's t test.

RESULTS

The mean T1 native value of all patients (age 54±9yrs, 68% male) was 1317±66ms in the necrotic area (LGE+/MVO-),1149±57ms in the area-at-risk (LGE-/STIR+) and 952±76ms in remote myocardium (LGE-/STIR-). Significant differences were found in the comparison of t1 values between all regions ($p<0.01$ for all). Infarct size was 25±12% of left ventricular mass. Acquisition time of CMR protocol including only localizer, native MOLLI sequence and cineMR was 22.4±8.7min; acquisition time of standard CMR protocol (including localizer,STIR,cineMR and LGE) was 45.4±9.5min; $p<0.01$.

CONCLUSION

Native T1 mapping may reliably distinguish between necrotic area and area-at-risk after AMI.

CLINICAL RELEVANCE/APPLICATION

Native T1 mapping might offer a complete assessment of myocardial injury after AMI in shorter time and without contrast injection compared to conventional CMR approach.

SSC02-02 Subendocardium and Subepicardium Myocardial Blood Flow, Comparison in Normal and Ischemic Territories? A Dynamic CT Perfusion Study

Monday, Nov. 30 10:40AM - 10:50AM Location: S504AB

Participants
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Atsushi K. Kono, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Dynamic CT myocardial perfusion (CTP) uses a consecutive series of acquisitions in which the distribution of the contrast media over the myocardium is measured. By measuring time-attenuation curves and the arterial input function, the myocardial blood flow (MBF) can be computed. The examination is performed in a pharmacological hyperemic state.The subendocardium is known to be more susceptible for ischemia due to the wavefront phenomenon. One of the advantages of CTP compared with other modalities is the high spatial resolution, allowing for distinguishing the subendocardium and subepicardium. In this study the subendocardial and subepicardial perfusion are investigated for normal and ischemic territories, defined by invasive fractional flow reserve (FFR).

METHOD AND MATERIALS

For this study 43 patients, 94 vessels territories were analyzed. Short axis slices of MBF were reconstructed from dynamic CTP. Blinded to the invasive FFR outcomes the MBF was measured in the subendocardium and subepicardium within the suspected perfusion defect. Ischemic and normal territories were defined by invasive FFR, applying a threshold of ≤0.80 for ischemic territories.

RESULTS

Of the 94 vessels 48 were ischemic with an invasive FFR ≤0.80. The mean subendocardium MBF was 67 ±30 in the ischemic and 88 ±38 ml/100ml/min in the normal territories. Compared with a subepicardium MBF of 80 ±22 in the ischemic and 92 ±29 ml/100ml/min in normal territories (figure 1). The area under the receiver operator curve for MBF as a diagnostic determinant for ischemia was larger for the subendocardium (0.71) compared with subepicardium (0.63).

CONCLUSION

Dynamic CT perfusion allows for measurement of the MBF in the subendocardium and subepicardium. The subendocardium is more susceptible for ischemia and MBF measurements in that region perform better for the detection of hemodynamically significant coronary artery disease.

CLINICAL RELEVANCE/APPLICATION

The susceptibility of the subendocardium for ischemia could be utilized by dynamic CT myocardial perfusion.

SSC02-03 Myocardium: Dynamic CT Perfusion Imaging: A Comparison to Coronary Angiography/FFR and to MR First Pass Perfusion Imaging

Monday, Nov. 30 10:50AM - 11:00AM Location: S504AB

Participants
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Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the diagnostic accuracy of dynamic computed tomographic (CTP) perfusion imaging of the myocardium for the detection of hemodynamically relevant coronary artery stenosis compared with the accuracy of coronary angiography and fractional flow reserve (FFR) measurement and with MR first pass perfusion imaging of the myocardium.

METHOD AND MATERIALS

This study was approved by the institutional review board and the Federal Radiation Safety Council (Bundesamt für Strahlenschutz). All patients provided written informed consent. Thirty-two consecutive patients in adenosine stress conditions underwent dynamic CT perfusion imaging (14 consecutive data sets) performed by using a 256-section scanner with an 8-cm detector and without table movement. Myocardial blood flow (MBF) was determined quantitatively. Results were compared with those of coronary angiography and FFR measurement by using a receiver operating characteristic (ROC) analysis. In addition results were compared to MR first pass perfusion imaging under adenosine and at rest. For evaluation of MR perfusion imaging the myocardial perfusion reserve index was calculated derived from the ratio of the parameter upslope determined under the stress and the rest conditions. In addition, threshold values based on the Youden index and sensitivity and specificity were calculated.

RESULTS

The comparison of CTP with the invasive reference method coronary angiography and FFR showed an area under the ROC curve, a sensitivity, and a specificity of 0.86, 75.9% (95% CI: 56.5%, 89.7%), and 100% (95% CI: 94.6%, 100%) for the quantitative parameter MBF.The thresholds determined by using the Youden index was 1.64 mL/g/min. The comparison to MR perfusion imaging showed an area under the ROC curve, a sensitivity and a specificity of 0.90, 83.3 % (95% CI: 63.5%, 92.7%), 86.6 % (95% CI: 70.2 %, 93.2 %).

CONCLUSION

Dynamic CT perfusion imaging of the myocardium using the quantitative parameter MBF shows a similar diagnostic accuracy, when

compared to the invasive reference methods coronary angiography and FFR and when compared to MR first pass perfusion imaging of the myocardium.

CLINICAL RELEVANCE/APPLICATION

Dynamic CT Perfusion imaging shows a high diagnostic accuracy and may be used in addition to CTA in order to improve the specificity and/or the positive predictive value in patients with a high pretest probability.

SSC02-04 Diffusion Weighted Images: New Application in the Evaluation of Myocardial Infarction and Microvascular Obstruction

Monday, Nov. 30 11:00AM - 11:10AM Location: S504AB

Participants
Giulia Benedetti, Milan, Italy (*Presenter*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
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Mariangela Cava, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo G. Camici, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

CMR is one of the most accurate tool for myocardial damage evaluation after STEMI; LGE and STIR sequences are routinely used, even if STIR may suffer from some limitations. Aim of our study is to explore the potential role of Diffusion Weighted Imaging(DWI), in the detection of myocardial infarction and microvascular obstruction(MVO), in comparison with standard-reference sequences.

METHOD AND MATERIALS

STEMI patients underwent PCI and CMR within 5 days from the acute event with DWI(b= 0, 100, 300, 500), perfusion, LGE and STIR.Infarction walls involvement(apex, septal, anterior, lateral and inferior wall) and MVO presence were analyzed by two blinded observers; inter-observer reproducibility was assessed. DWI findings were compared to LGE as standard reference for the detection of the infarcted area, STIR for edema and perfusion for MVO. DWI sensitivity(Se) and specificity(Sp) in MVO detection were calculated; DWI-MVO was related with others CMR parameters.

RESULTS

51 pts were enrolled. Infarcted areas were hyperintense at DWI, and matched with hyperintensity at LGE and STIR, except for inferior and anterior walls infarctions, which couldn't be detected by axial DWI. Inter-observer reproducibilities for the detection of different walls infarctions were: septum k=0,75; apex k=0,90; lateral wall k=0,52.ADCmaps showed different intensity between normal and infarcted myocardium: ADCNormal Myocardium= 2.96 ± 0.78 x 10-3 mm2/sec, ADCInfarcted Myocardium = 4.75 ± 0.76 x 10-3 mm2/sec (p<0.001).Comparing DWI and LGE positive findings: septum 33vs34 pts; apex 35vs37; lateral wall 14vs13. Similarly, comparing DWI and STIR positive findings: septum 33vs38 pts; apex 35vs37; lateral wall 14vs14.31 pts had perfusion-MVO, 28 showed corresponding hypointensity within the hyperintensity at DWI (p=0.005), with good inter-observer reproducibility (k=0,71), Se=0,80 and Sp=0,70.Pts with DWI-MVO had higher LGE MVO% (Early-MVO%: 5.39 vs 1.62, p=0.011; Late-MVO% : 3.04 vs 0.54, p=0.019), larger and more edematous infarctions(LGE%: 38.36 vs 21.42, p<0.001; Oedema%: 44.57 vs 29.92, p<0.001).

CONCLUSION

ADC is a sensible technique in revealing the presence of myocardial infarction. DWI may also detect MVO, when more represented.

CLINICAL RELEVANCE/APPLICATION

DWI is a promising CMR tool in pts with acute STEMI. DWI may became an alternative to traditional STIR, when Diffusion Imaging reliability will be confirmed on larger groups.

SSC02-05 Inversion Time Dependence of the Accuracy of Late Gadolinium Enhancement Quantification Using T1 Map Based Synthetic Inversion Recovery Imaging

Monday, Nov. 30 11:10AM - 11:20AM Location: S504AB

Participants
Akos Varga-Szemes, MD, PhD, Charleston, SC (*Presenter*) Nothing to Disclose
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PURPOSE

To investigate the influence of inversion time (TI) on the accuracy of myocardial late gadolinium enhancement (LGE) quantification using synthetic inversion-recovery (IR) imaging.

METHOD AND MATERIALS

Thirty-eight patients with suspected myocardial infarction underwent 1.5T MR imaging. Twelve minutes after the administration of 0.1mmol/kg gadobenate-dimeglumine, conventional single-shot magnitude and phase-sensitive inversion-recovery (MagIR, PSIR) LGE imaging and fast myocardial T1-mapping were performed in a single short axis plane. Based on the T1 maps, synthetic magnitude (MagIRsy) and PSIR (PSIRsy) images were calculated in a TI range of -100 and +150ms relative to the most optimal TI (TI0) with 5ms increments, using an in-house developed application integrated in the Research Mass Software. LGE was quantified

using two binary methods: applying thresholds of 5 standard deviations (5SD) above the average signal of the normal myocardium, and using the lower threshold of the full width at half maximum (FWHM) of the signal of the infarcted myocardium. LGE area was compared within the TI range.

RESULTS

LGE was observed in 15 (39.4%) patients. LGE area quantified by 5SD thresholding in MagIRsy, PSIRsy (at TI0), and conventional MagIR, and PSIR techniques were 5.29±1.39, 4.44±1.35, 5.71±1.88, and 4.72±1.49cm2, respectively, while the same parameter with FWHM was 3.46±2.39, 3.10±1.18, 4.01±2.16, and 3.32±1.43cm2, respectively. LGE areas obtained by the synthetic and the conventional methods were in agreement at TI0. The 5SD method showed significantly larger infarct areas than FWHM ($P<0.05$) in both synthetic and conventional images. LGE area was essentially constant over the TI range in the PSIRsy images. The MagIRsy technique provided accurate LGE area at TIs beyond TI0, while the accuracy was compromised for TIs below TI0.

CONCLUSION

The accuracy of LGE area quantification using MagIRsy images is constant over a wide TI range above TI0, while the accuracy using PSIRsy images is constant over the entire clinically relevant TI range (250-400ms).

CLINICAL RELEVANCE/APPLICATION

Synthetic T1-based IR images are reliable for infarct quantification and may provide a benefit over conventional LGE methods by eliminating the operator dependence (i.e. selection of optimal TI).

SSC02-06 Improved Detectability of Myocardial Delayed-Enhancement Using a Subtraction Myocardial Computed Tomography

Monday, Nov. 30 11:20AM - 11:30AM Location: S504AB

Participants
Takayoshi Yamaguchi, Sapporo, Japan (*Presenter*) Nothing to Disclose
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PURPOSE

Subtraction coronary computed tomography (CT) angiography is effective for assessing calcified lesions in coronary arteries, enhancing visibilities of the enhanced coronaries. If this subtraction technique can be applied to delayed enhancement (DE) for assessing myocardial viability, the detectability of myocardial delayed enhancement might be improved. We propose the new subtraction technique, which removes coronary CTA images from DE CT images. The obtained images are similar to black blood delayed gadolinium enhancement images of magnetic resonance imaging (MRI). The purpose of this study is to evaluate the effectiveness of the subtraction myocardial CT (SMCT), compared with a myocardial MRI (MMRI).

METHOD AND MATERIALS

18 patients (mean age 62.6±14.7 years) with suspected coronary artery disease underwent DE imaging with a 320-slice CT and a 1.5-T MRI. SMCT images were obtained using dedicated software. We assessed DE transmurality per segment on a five-point scale (0 = 0%; 1 = 1- 25%; 2 = 26-50%; 3 = 51-75% and 4 = 76-100% transmurality), contrast-to-noise ratios (CNRs) in infarct and healthy myocardiums and left ventricular blood pools for MMRI, non-subtracted myocardial CT (NSMCT), and SMCT.

RESULTS

81/306 (26.5%) segments showed DE in MRI. Using MRI DE detection in the transmurality scores as the reference standard, the kappa value of SMCT was higher than that of NSCT (0.775 vs. 0.646). CNRs at myocardiums for MRI, NSMCT and SMCT were 31.7 ±18.2, 3.15 ±2.58, and 5.15 ±2.16, respectively, while CNRs based on the blood pool were 11.9 ±14.7, -0.85 ±1.77, and 36.0 ±11.4, respectively.

CONCLUSION

DE imaging using SMCT technique showed better CNR compared with NSMCT, and comparably reasonable detectability of DE with MMRI.

CLINICAL RELEVANCE/APPLICATION

Conventional delayed enhanced CT imaging of myocardial infarction suffers from low contrast, especially between the area of infarction and the blood pool. The SMCT technique would contribute to improve the detectability of myocardial DE.

SSC02-07 Development of Infarct and Edema Size in the Course of the First 6 Months after Acute Myocardial Infarction Measured by LGE- and T2w-CMR Imaging

Monday, Nov. 30 11:30AM - 11:40AM Location: S504AB

Participants
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Gunnar K. Lund, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to serially analyze the development of infarct and edema size over 6 months after first acute

myocardial infarction (AMI) using late gadolinium enhancement (LGE)- and T2-weighted (T2w)-CMR imaging, respectively.

METHOD AND MATERIALS

Consecutive baseline (BL) at 7 ±4.9 days and follow-up (FU) imaging at 1.2 ±0.3 months (FU1), 3.3 ±0.6 months (FU2) and 6.3 ±0.7 months (FU3) was performed on 25 patients with first-time AMI using a 1.5 Tesla MRI machine (Achieva, Philips). Short-axis LGE- and T2w-images of the entire left ventricle were acquired with a slice thickness of 8 mm and a gap of 2 mm. CMR studies were quantitatively evaluated by two experienced observers in respect to infarct and edema size using a threshold method with the dedicated HeAT-Software. Infarct and edema size were measured on LGE- und T2w-images as gram (g) of infarcted left ventricular myocardium. Statistical analysis was performed using GraphPad Prism 5 and Excel, Microsoft.

RESULTS

Mean size of infarcted myocardium was 26 ±21.9 gram (gr) at BL and decreased on FU1 and FU2 to 20.7 ±16.4 gram (P< 0.04) and 18.8 ±14.6 gram (P< 0.03), respectively. FU3 did not show further decline in infarct size. Infarction was present in all 25 patients on BL and FU imaging, whereas edema was present in 88% of the patients at BL, in 72% of patients on FU1, in 32% of patients on FU2 and only in 8% of patients on FU3. Mean myocardial edema was 41 ±28.3 gram at BL and decreased to 21 ±16.2 gram (P= 0.001) on FU1 and 13.7 ±13 gram (P= 0.005) on FU2, respectively. On FU3 edema was detected in two patients and measured 3.9 ±2 gram.

CONCLUSION

After first AMI a continuous decrease in the size of gadolinium enhancing infarcted area is observed during the first 3.3 ±0.6 months and remains constant afterwards, whereas main edema decrease occurs during the first 1.2 ±0.3 months. Nevertheless, in 32% of patients edema is still present after 3.3 ±0.6 months and can even persist in 8% after 6.3 ±0.7 months.

CLINICAL RELEVANCE/APPLICATION

Infarct healing, defined as edema resorption, mainly occurs between 6 weeks and 3 months after AMI. However, in 1/3 of patients edema still persists after 3 months indicating prolonged infarct healing.

SSC02-08 Serial Native T1 and T2 Mapping for Quantitative Monitoring of Myocardial Edema Resorption after Acute Myocardial Infarction

Monday, Nov. 30 11:40AM - 11:50AM Location: S504AB

Participants
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Kai Muellerleile, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
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Gunnar K. Lund, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Currently, myocardial edema monitoring after acute myocardial infarction (AMI) is based on visualization of the region with increased signal-intensity on T2-weighted (T2w) images. Native T1 and T2 mapping are promising novel cardiac magnetic resonance imaging (CMR) techniques to quantitatively assess edema. The purpose of the study was to evaluate resorption of myocardial edema following AMI by native T1 and T2 mapping.

RESULTS

Edema size continuously decreased from BL with 29.9%LV to 19.6%LV at FU1, to 8.6%LV at FU2 and to 5.6%LV at FU3 using T2w-CMR. An identical decrease of edema size was observed using native T2 and T1 mapping. T2 times decreased between BL from 83±8 ms to 76±7 ms at FU1 (P<0.05), but no further change was observed later with 73±7 ms at FU2 and 72±5 ms at FU3. The T2 times of remote normal myocardium were about 55±3 ms at all times and significantly lower compared to the edema zone. Native T1 time within the edema was with 1253±103 ms significantly increased compared to remote normal myocardium with 1018±43 ms and remained constantly high in the edema zone throughout all follow-ups.

CONCLUSION

Edema size continuously decreased within the following months after AMI, but was still present at low levels after 6 months. Additionally, quantitative mapping showed increased T2 and T1 values within the edema zone indicating prolonged presence of edema up to 6 months after AMI.

CLINICAL RELEVANCE/APPLICATION

T2 and T1 mapping may improve the ability to differentiate edematous myocardium over T2w techniques allowing a more precise determination of area at risk after AMI.

SSC02-09 Integrating Anatomical and Functional Assessment of Coronary Artery Disease Using Single-scan Stress Computed Tomography Perfusioin: A Comparison with Combined Invasive Coronary Angiography and Cardiac Magnetic Resonance Imaging

Monday, Nov. 30 11:50AM - 12:00PM Location: S504AB

Participants
Sung Min Ko, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

This study was aimed to determine the diagnostic performance of single-scan stress computed tomography perfusion (CTP) for

This study was aimed to determine the diagnostic performance of single-scan stress computed tomography perfusion (CTP) for identifying hemodynamically significant coronary artery disease (CAD).

METHOD AND MATERIALS

Twenty-nine (21 men, 63.9±9.1 years) patients with suspected or known CAD underwent single-scan CTP, stress perfusion cardiovascular magnetic resonance (SP-CMR), and invasive coronary angiography (ICA). Dual-source CT was performed as follows: 1) coronary calcium scan: non-enhanced, prospectively ECG-triggered scan; 2) single-scan CTP for coronary artery anatomy (coronary CT angiography, CCTA) and inducible myocardial perfusion (CTP): contrast-enhanced, retrospectively ECG-gated scan during adenosine infusion; 3) delayed scan: acquired 5 min after single-scan CTP using prospectively ECG-triggered scan. Diagnostic values of CCTA for detecting hemodynamically significant stenosis were assessed before and after CTP on a per-vessel basis compared with combined ICA and SP-CMR as reference standard. A coronary vessel was considered to be significantly stenosed if there was at least 1 segment with ≥ 50% lumen reduction

RESULTS

By ICA, 26 (90%) patients had 57 (66%) significantly stenotic vessels. By SP-CMR, perfusion defects were noted in 23 (79%) patients with 48 (55%) vessel territories. Ten (34%) patients had old myocardial infarction. Combined ICA/SP-CMR showed hemodynamically significant stenoses in 23 (79%) patients with 47 (54%) vessel territories. The performance of sing-scan CTP for detecting perfusion defects compared with SP-CMR on per-vessel (segment) basis was sensitivity, 88% (78%); specificity, 92% (84%); positive predictive value, 94% (76%); negative predictive value, 85% (86%). Compared to ICA/SP-CMR, per-vessel territory sensitivity, specificity, positive predictive value, and negative predictive value of CCTA were 75%, 93%, 96%, and 63%, respectively, those by using CTP were 86%, 92%, 94%, and 83%, respectively, and those by using single-scan CTP (CCTA and CTP) were 90%, 90%, 91%, and 88%, respectively. The area under the receiver operating characteristic curve increased from 0.79 to 0.90 (p=0.013) using single-scan CTP compared with CCTA.

CONCLUSION

Single-stress CTP allows for the detection of hemodynamically significant coronary stenosis.

CLINICAL RELEVANCE/APPLICATION

Single-stress CTP has the potential to become the preferred CT technique for identifying hemodynamically significant CAD at a single-examination.

SSC04

Gastrointestinal (Multimodality)

Monday, Nov. 30 10:30AM - 12:00PM Location: E451A

CT GI MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Alvin C. Silva, MD, Scottsdale, AZ (*Moderator*) Nothing to Disclose
Christine O. Menias, MD, Scottsdale, AZ (*Moderator*) Nothing to Disclose

Sub-Events

SSC04-01 The Incidental Splenic Lesion: Does It Need to be Worked Up?

Monday, Nov. 30 10:30AM - 10:40AM Location: E451A

Participants
Bettina Siewert, MD, Brookline, MA (*Presenter*) Nothing to Disclose
Noam Z. Millo, MD, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose
Kamaldeep Sahi, MD, BSc, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Robert G. Sheiman, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Robert A. Kane, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Olga R. Brook, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Maryellen R. Sun, MD, Boston, MA (*Abstract Co-Author*) Research Grant, Glaxo SmithKline plc

PURPOSE

The purpose of this study is to evaluate whether an incidentally noted splenic lesion on abdominal computed tomography (CT) requires further imaging work-up.

METHOD AND MATERIALS

In this HIPAA compliant retrospective study, we performed a search of our CT database for patients with splenic lesions who underwent imaging from 2002 to 2008. Online medical records were reviewed for a history of malignancy and the indication for the CT examination. Patients were devided into 3 groups: 1. patients with a history of malignancy, 2. patients without a history of malignancy and no systems related to the left upper quadrant, 3. patients without a history of maligancy, but constitutional symptoms such as weight loss or fever or pain related to the left upper quadrant and epigastrium. Final diagnosis of the etiology of the lesion was confirmed by surgery, image guided biopsy or clinical and/or imaging follow-up. A lesion was considered benign on follow-up if it was stable by imaging for 2 years and by clinical follow-up for 5 years.

RESULTS

Our search revealed 525 patients, 57 patients needed to be excluded due to insufficient follow-up data. 468 patients were included in this study (294 women, 174 men, mean age = 58 years, age range 21-97 years). 154 of 468 (32.9%) patients had a history of malignancy (group 1), 279 of 468 (59.6%) patients had no history of maligancy and no symptoms related to the left upper quadrant (group 2). 35 of 468 (7.4%) patients had no history of malignancy, but constitutional symptoms or symptoms related to the left upper quadrant (group 3). The number of malignant lesions was as follows: group 1: 43 of 154 (27.9%), group 2: 2 of 305 (0.7%), group 3: 6 of 35 (17.1%). Patients with malignant lesions in group 2 consisted of new diagnoses of lymphoma (n=1) with extensive lymphadenopathy as well as metastatic ovarian carcinoma (n=1). Patients with malignant lesions in group 3 were diagnosed with lymphoma (n=6).

CONCLUSION

In a patient with no history of malignancy, no fever, weight loss or pain in the left upper quadrant or epigastrium, the likelihood of malignancy is very rare (0.7%). Patients who are diagnosed with a malignancy in this group have other lesions that allow for this diagnosis to be made. Therefore in patients with no evidence of previous or newly diagnosed malignancy, follow-up of splenic lesions may not be indicated.

CLINICAL RELEVANCE/APPLICATION

Follow-up of incidentally noted splenic lesions may not be indicated.

SSC04-02 CT Signs Predictive of Internal Hernia or Volvulus after Roux-en-Y Gastric Bypass in a Consecutive Surgical Cohort

Monday, Nov. 30 10:40AM - 10:50AM Location: E451A

Participants
Jennifer Y. Lee, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Peter S. Wang, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Susan L. Summerton, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Mindy M. Horrow, MD, Philadelphia, PA (*Abstract Co-Author*) Spouse, Director, Merck & Co, Inc

PURPOSE

To evaluate CT predictors of small bowel volvulus/internal hernia (VIH) after Roux-en-Y gastric bypass surgery (RYGB) in a consecutive, heterogeneous surgical cohort

METHOD AND MATERIALS

100 consecutive RYGB patients with abdominal pain and preoperative CT of abdomen/pelvis were retrospectively reviewed in consensus by 2 radiologists blinded to surgical outcomes for two 1º signs of VIH: mesenteric swirl and shift of jejunal anastomosis and 7 2º signs: dilated, ischemic or clustered small bowel; mesenteric edema; stretching of mesenteric vessels; SMA/SMV vascular narrowing; and mesenteric adenopathy. Alternative diagnoses, (related and unrelated to RYGB) and negative studies were tallied. Results included SEN, SPEC, PPV and NPV for VIH. Stepwise logistic regression analysis determined predictors of VIH amongst the 9 CT signs.

RESULTS

Patient age: 41 ± 12.6 (range 22-68) years), 85 females. 1 day (range 0-10) between CT and operation. Surgical results: 33 VIH (21 due to mesenteric defect and 12 to an adhesive band), 28 other diagnoses (intussusception, small bowel obstruction, adhesions) and 18 non-RYGB related diagnoses (acute cholecystitis, other hernias, cecal and sigmoid volvulus, perforated duodenal ulcer, ruptured ovarian cyst, appendicitis, omental infarct, PID). and 21 had no pathology. CT was 97% SEN, 78% SPEC for diagnosis of VIH with, NPV = 98%, PPV = 68 %. Presence of volvulus alone or IH alone on CT had numerically lower predictive value for surgical VIH than presence of either one: corresponding C-statistics 0.82, 0.75, 0.87. Of 9 predictors of VIH, only mesenteric swirl (odd ratio [95%CI] 7.46 (2.5-22.2) and vascular narrowing (12.0[2.3-62.5]) predicted VIH (p<.0001, C-statistic 0.843). Review of single FN showed subtle mesenteric swirl and 15 FPs showed 4 SBO and 1 adhesion all requiring surgery and 10 negative cases in which swirls were overcalled and other findings were minimal. CT correctly identified 83% of non-RYGB related operative diagnoses (missed 2 cholecystitis and 1 leaking ovarian cyst).

CONCLUSION

Mesenteric swirl and vascular narrowing on CT predict surgical VIH. FP cases occurred because SBO 2° adhesions may appear similar to VIH and simple adhesions can cause appearance of a mesenteric swirl.

CLINICAL RELEVANCE/APPLICATION

CT can predict volvulus/internal hernia after RYGB amongst a cohort of all cases taken to surgery for abdominal pain.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Mindy M. Horrow, MD - 2013 Honored Educator

SSC04-03 An Assessment of Clinical History Quality and Its Effect on Acute Abdominal CT Diagnostic Accuracy

Monday, Nov. 30 10:50AM - 11:00AM Location: E451A

Participants
Wilfred Dang, BS, Ottawa, ON (*Presenter*) Nothing to Disclose
Pawel Stefanski, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Ania Z. Kielar, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Arash Jaberi, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Mohamed A. el-Khodary, FRCR, PhD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Christian B. Van Der Pol, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Angel Y. Fu, BSC, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Matthew D. McInnes, MD, FRCPC, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT interpretation is integral in the management of emergency department (ER) patients. The clinical history provided on the ER CT requisition is variable in quality but often guides CT interpretation. The aim of this study is to evaluate the effect of CT requisition history quality on acute abdominal CT diagnostic accuracy and determine if more patient information would aid in study interpretation.

METHOD AND MATERIALS

335 abdominal CT scans at a tertiary care ER between September and October 2012 was retrospectively reviewed. The following data was collected: a) clinical history provided on CT requisition, b) lab work-up ordered prior to CT request, c) impression by ER CT radiologist, d) final disposition diagnosis by ER physician, and e) microbiology, surgical or pathology results.The quality of the clinical histories collected were evaluated by two blinded staff radiologists and two radiology residents. A 5-point Likert scale based on 4 categories of history criteria was used (presenting complaint, past medical history or symptom evolution, objective laboratory or prior examination results and differential diagnosis based on clinical evaluation).A composite CT diagnosis was created through: 1) Blinded double reading by two radiologists in consensus; 2) Patient laboratory data ordered by ER physician; 3) Surgical or pathology confirmation; 4) Follow-up imaging confirming CT diagnosis. This combined composite was compared to the original CT diagnosis from the CT report.

RESULTS

14.9% (50/335) of ER CT diagnoses did not correlate with the final composite CT diagnosis. The usage of patient information (e.g. lab work, reports) in addition to CT requisition clinical history changed the radiological diagnosis for 8.0% (27/335) of cases. 8.4% (28/335) of cases had misleading history that could have led to interpretation error. No statistically significant correlation (P=0.589) was found between graded quality of the clinical history provided and CT diagnosis accuracy.

CONCLUSION

CT clinical history quality does not correlate with CT diagnosis accuracy. However, a misleading history could alter CT case interpretation. Increased access to ancillary patient information can improve interpretation accuracy.

CLINICAL RELEVANCE/APPLICATION

The results of our study could lead to greater live-access in electronic medical systems of more patient information and of increased quality for ER radiologists to improve interpretation accuracy.

SSC04-04 Body Packing: Which Modality to Choose in the Initial Evaluation? A Comparative Study of X-ray versus CT

Monday, Nov. 30 11:00AM - 11:10AM Location: E451A

Participants
Robin F. Gohmann, MD, Aachen, Germany (*Presenter*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Sebastian Reinartz, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to evaluate the diagnostic performance of plain film and CT in the detection of internally concealed drugs, frequently referred to as body packing.

METHOD AND MATERIALS

The study was approved by the local ethics committee and performed retrospectively. Between July 2009 and June 2013, 142 consecutive X-ray (n=98) and CT (n=44) examinations on medically asymptomatic suspects where included (107 men, 25 females, mean age 35±8).

RESULTS

In a total of 40 cases (40 %) authorities ascertained intracorporally concealed drugs with a prevalence of 35 % in the group examined with X-ray and 14 % in the group examined with CT. In 85 % of those cases heroin was found.The rate of radiologically detected cases of body packing in either modality (X-ray: 79 %, CT: 82 %) did not vary statistically significantly (p>0.05). Both the NPV of X-ray (83 %) and CT (94 %) as well as the PPV of X-ray (68 %) and CT (40 %) were statistically equivalent (p>0.05).

CONCLUSION

As body packing is not limited to a single substance or mode of packaging and therefore presents with differing imaging characteristics, diagnostic performance of X-ray and CT may vary. Because CT und X-ray were statistically equivalent in our cohort, and body packing sometimes can be invisible on plain film and other times is very easily picked up we emphasise a stepwise approach with a careful interpretation of the CT-scout view and to only secondarily proceed to CT.

CLINICAL RELEVANCE/APPLICATION

Hard ray CT-scout view in body packing should be viewed as a diagnostic image with the potential of rendering the planed CT of the abomen not necessary in selected cases.

SSC04-05 Pelvic Artifacts in Material Decomposition Images from Dual Energy CT: A Phantom and Patient Study

Monday, Nov. 30 11:10AM - 11:20AM Location: E451A

Participants
Sebastian Winklhofer, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Jack Lambert, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Yuxin Sun, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Zhen J. Wang, MD, Hillsborough, CA (*Abstract Co-Author*) Nothing to Disclose
Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;

PURPOSE

Aim of the study was to describe the frequency, appearance and severity of pelvic beam hardening artifacts on material decomposition images from rapid-kV switching Dual-Energy Computed Tomography (rsDECT).

METHOD AND MATERIALS

Monochromatic (70keV, 52keV, 120keV) and material decomposition images (iodine(-water), water(-iodine)) reconstructed from pelvic rsDECT scans of 41 patients (22 male, mean age 57±6 years, range 22-86 years) were retrospectively evaluated. We qualitatively analyzed the presence, type (hyperdense vs. hypodense) and severity of artifacts and the diagnostic capability of anatomic details (5-point scales). Quantitative measurements included CT numbers, iodine and water concentrations, grayscale values (GY), and standard deviations (SD) of the artifact-affected regions, compared with corresponding unaffected reference tissue. A pelvic phantom was constructed and scanned to validate the presence of artifacts. Wilcoxon signed-rank and paired t-tests were used to compare results between the different image reconstructions.

RESULTS

Beam hardening artifacts were seen in all 41 patients in all datasets. The median artifact severity score was higher in water(-iodine) and iodine(-water) images (3, each) compared to 70keV (1), 52keV (2), and 120keV (1) (P<0.001, each). The diagnostic capability for pelvic organ depiction was lower (P<0.001) in water(-iodine) and iodine(-water) images compared to monochromatic images. Higher SD values of CT number, concentrations, and GY value were revealed for areas affected by artifacts compared to reference tissues in all data sets (each P<0.001). Similar results were seen in the phantom study.

CONCLUSION

Beam hardening artifacts are prevalent in pelvic material decomposition rsDECT images, show inverted high and low signal and should not be misinterpreted as disease in the pelvis.

CLINICAL RELEVANCE/APPLICATION

It is important for the radiologist to know that the accuracy of pelvic material decomposition images might be impaired by artifacts

and that the diagnosis of frequently seen pathologies such as urinary bladder cancer or wall thickening, intravesicular calculi, enlargement of the prostate gland or ovarian cancer might be impeded.

SSC04-06 The Clinical Value of MR Gadolinium Colonic Transit Test in Patients with Constipation

Monday, Nov. 30 11:20AM - 11:30AM Location: E451A

Participants
Dan Liang, Guangzhou, China (*Presenter*) Nothing to Disclose
Wuteng Cao, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Mingyue Luo, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhiyang Zhou, PhD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To establish a new and non-invasive methodology of MR gadolinium transmission test and assess its clinical feasibility by comparing with conventional X-ray barium transmission test.

METHOD AND MATERIALS

According to Rome III clinical diagnostic criteria, eight patients,1 male, 7 female, aged15-48 with a mean of 34.3,with a history of functional constipation from 1 to 10 years, with a mean of 5.4 years were chosen to underwent both traditional barium X-ray and MR gadolinium colonic transit test at the same time. 20 barium tablets and 5 gadolinium grains were taken orally at the same time by each patient, then rechecked after 24h, 48h, 72h to count the residual barium tablet and gadolinium markers in X-ray and MRI respectively. The results, advantages and disadvantages of the two methods were compared.

RESULTS

All of the eight patients successfully underwent both X-ray and MR colonic transit tests. X-ray transmission test showed 5 cases residual barium strip markers ≥20% (4 tablets) after 48h,3 cases ≥20% (4 tablets) after 72h; MR transmission test showed 5 cases residual gadolinium markers ≥20% (1 grain) after 24h,3 cases ≥20% (1 grain) after 48h. The residual barium tablet markers ≥20% (4 tablets) after 72h in X-ray test was set as a positive standard of slow colonic transit. All 3 positive patients in X-ray test showed residual gadolinium markers ≥20% (1 grain) after 48h in MR colonic transit tests; All 5 negative patients in X-ray test showed no residual gadolinium grain after 48h in MR tests.

CONCLUSION

MR transmission test can clearly demonstrate the location and quantify the remaining markers in the colon with fast scan sequences. The exact location of the residual markers can be observed by using 2D combined with 3D technology. MR has no ionizing radiation which is very important for multiple follow-ups. Our preliminary results indicate that it is feasible to consider the residual marker≥20% (1 grain) in the colon after 48h as the diagnostic criteria of slow transit constipation time by MRI.

CLINICAL RELEVANCE/APPLICATION

It is expected that MR gadolinium transmission test to replace the X-ray colon transmission test due to its accurate positioning and without radiation.

SSC04-07 Quantification of Inflammation with Ultrasound Molecular Imaging Following Automated Imaging Fusion with CT/MRI: A Pilot Study in a Porcine Model of Acute Ileitis

Monday, Nov. 30 11:30AM - 11:40AM Location: E451A

Participants
Huaijun Wang, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose
Stephen A. Felt, DVM, MPH, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Ismayil Guracar, Mountain View, CA (*Abstract Co-Author*) Employee, Siemens AG
Poonam Gwalani, MS, Mountain View, CA (*Abstract Co-Author*) Nothing to Disclose
Juergen K. Willmann, MD, Stanford, CA (*Abstract Co-Author*) Research Consultant, Bracco Group; Research Consultant, Triple Ring Technologies, Inc; Research Grant, Siemens AG; Research Grant, Bracco Group; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company

PURPOSE

Most patients with inflammatory bowel disease (IBD) undergo anatomical CT and MR imaging to assess the location and extent of inflammation as part of their routine clinical workup; however, both techniques are limited in terms of quantification of inflammation which is critically needed for proper patient management. Molecular imaging including ultrasound molecular imaging using targeted contrast agents is currently explored to quantify inflammation in IBD at the molecular level. However, localizing the inflamed bowel segment and imaging the entire bowel with ultrasound can be time consuming. The purpose of this study was to explore feasibility of real-time image fusion of CT and MRI data sets with ultrasound molecular imaging in an acute terminal ileitis model in pigs.

METHOD AND MATERIALS

An acute terminal ileitis model was established in 3 female pigs by intraluminal exposure of a segment of terminal ileum with 2,4,6-trinitrobenzene sulfonic acid (TNBS in ethanol). All pigs were imaged at 48 h after induction of acute ileitis. Pigs were either imaged with a clinical CT (Zeego, Siemens) or MR (Discovery MR750w; GE) enterography protocol and data sets were uploaded onto a clinical ultrasound machine (Acuson S3000; Siemens). Using an anatomical landmark-based approach, inflamed bowel segments were localized in real-time on subsequent ultrasound molecular imaging of the bowel using eSie Fusion auto registration software (Siemens). Inflammation of the bowel wall was quantified using dual P- and E-selectin-targeted ultrasound molecular imaging and compared with histology.

RESULTS

Real-time image fusion was successful in all 3 animals. Using anatomical CT and MR road mapping, the inflamed bowel segment could be identified quickly and inflammation of the bowel segment could be assessed within 10 minutes. Selectin-targeted ultrasound molecular imaging signal correlated well with the grade of inflammation on histology.

CONCLUSION

Automatic fusion of volumetric CT and MRI datasets with ultrasound imaging in real time is feasible and allows rapid anatomical localization of inflamed bowel segments for further quantification of inflammation using ultrasound molecular imaging.

CLINICAL RELEVANCE/APPLICATION

Anatomical road mapping by fusing volumetric CT or MRI data sets with ultrasound in real time improves the work flow of ultrasound molecular imaging for grading inflammation in IBD.

SSC04-08 CT after Pancreaticoduodenectomy with Portal Vein and/or Superior Mesenteric Vein Reconstruction: Review of Current Surgical Techniques and Associated Post Surgical Imaging Findings

Monday, Nov. 30 11:40AM - 11:50AM Location: E451A

Participants
Karen B. Bleich, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Ammar Javed, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio Bagante, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher L. Wolfgang, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Elliot K. Fishman, MD, Owings Mills, MD (*Abstract Co-Author*) Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

PURPOSE

To review the current range of PV-SMV reconstruction procedures that may be performed in conjunction with pancreaticoduodenectomy, and to establish patterns of imaging findings associated with these vascular procedures in order to more accurately distinguish post-surgical findings from recurrent malignancy, both of which can demonstrate venous attenuation and perivenous induration.

METHOD AND MATERIALS

We reviewed our database of patients who underwent PV-SMV reconstruction from 2004-2014 and identified patients who met the following criteria: 1. CT available within 60 days following surgery, 2. pathologic R0 or R1 resection. We restricted our analysis to cases with recent post-operative CT and complete surgical resection because recurrent malignancy is highly unusual in the immediate post-operative period in patients for whom a complete surgical resection has been achieved; therefore the observed CT findings could be attributed to post-surgical changes rather than to recurrent or residual disease. 71 patients in the database met the inclusion criteria. Two radiologists and two surgeons reviewed the CTs and the operative notes. The configuration and caliber of the post-reconstruction portal vein and SMV (referred to as the PV-SMV complex) were analyzed, and the perivenous tissue was characterized. The findings were correlated with the details of the type of venous reconstruction.

RESULTS

There are four patterns of the PV-SMV complex following reconstruction: concentric smooth narrowing, eccentric/irregular narrowing or defect, thrombosis, and changes in venous configuration without significant caliber change. There are two patterns of the perivenous tissue: soft tissue density thickening, and a range of low attenuation induration/inflammation/fluid. The post-operative imaging findings can be correlated with the type of venous reconstruction performed. Some of the post-operative imaging appearances overlap with findings considered suspicious for recurrent malignancy.

CONCLUSION

There are specific patterns of imaging findings after portal venous reconstruction. In some cases, the normal post-surgical findings mimic recurrent disease. Knowledge of the expected post-surgical appearances may allow for more accurate interpretation of follow-up CT.

CLINICAL RELEVANCE/APPLICATION

Recognition of the patterns of the PV-SMV complex after pancreaticoduodenectomy with venous reconstruction may prevent erroneous diagnosis of recurrent/residual disease.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Elliot K. Fishman, MD - 2012 Honored Educator
Elliot K. Fishman, MD - 2014 Honored Educator

SSC04-09 Evaluation of Splenic Stiffness in Patients of Extrahepatic Portal Vein Obstruction Using Shear Wave Elastography: Comparison with Intra-Operative Portal Pressure

Monday, Nov. 30 11:50AM - 12:00PM Location: E451A

Participants
Madhusudhan Kumble Seetharama, MD, FRCR, New Delhi, India (*Presenter*) Nothing to Disclose
Raju Sharma, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Ragini Kilambi, MS, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Peush Sahni, MBBS, MS, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Sujoy Pal, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Nihar R. Dash, MS, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Arun K. Gupta, MBBS, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare splenic stiffness (SS) measured by shear wave elastography (SWE) in patients of extrahepatic portal vein obstruction

To compare splenic stiffness (SS) measured by shear wave elastography (SWE) in patients of extrahepatic portal vein obstruction (EHPVO) with intra-operative portal system pressures (PP)

METHOD AND MATERIALS

21 patients (14 males; 7 females) of mean age 20.4 years (range: 13 - 34 years) with clinical and sonographic diagnosis of EHPVO were included in this prospective study after obtaining approval from institute ethics committee. Endoscopy for esophageal varices was done in all patients. Splenic stiffness was measured using shear wave elastography (SWE) on Aixplorer Supersonic Imagine ultrasonography scanner. Three values were taken three different region of interests drawn at different areas of spleen avoiding major vessels and mean was calculated. Intra-operative PP was measured from an omental vein in all these patients during proximal spleno-renal shunt surgery. The PP was compared and correlated with SS along with other parameters. A p-value of < 0.05 was considered significant.

RESULTS

The mean SS was 46.04 ± 8.0 kPa and the mean PP was 33.29 ± 4.1 mm of Hg. Although there was negative correlation between PP and SS (Pearson correlation coefficient: minus 0.119), this was not statistically significant (p=0.607). There was no significant correlation between grades of esophageal varices (EV) and SS (p=0.375) and between EV and PP (0.06). PP also did not show significant difference between patients with and without portal biliopathy (p=0.14).

CONCLUSION

There was no significant correlation between SS and PSP, EV grading and PSP, and EV grading and SS. Thus SS measured by SWE may not help in predicting gastrointestinal bleed in patients of EHPVO.

CLINICAL RELEVANCE/APPLICATION

Assessment of splenic stiffness by SWE is a simple technique giving absolute values of stiffness in kilopascals. Although, SS should indirectly reflect portal pressure, we did not find this in our study. The results of our study indicate that simple measurement of SS may not be sufficient to predict portal pressure and thus variceal bleeding.

SSC07

ISP: Musculoskeletal (Cartilage: Mechanics, Quantitative MRI and Repair)

Monday, Nov. 30 10:30AM - 12:00PM Location: E450B

MK BQ MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Daniel B. Nissman, MD, MPH, Raleigh, NC (*Moderator*) Royalties, John Wiley & Sons, Inc
Michael P. Recht, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSC07-01 Musculoskeletal Keynote Speaker: Cartilage: Understanding Quantitative Evaluation through Structure and Biomechanics

Monday, Nov. 30 10:30AM - 10:50AM Location: E450B

Participants
Michael P. Recht, MD, New York, NY (*Presenter*) Nothing to Disclose

SSC07-03 Weight Loss Is Associated with Slower Cartilage Degeneration Over 48 Months in Obese and Overweight Subjects: Data from the Osteoarthritis Initiative

Monday, Nov. 30 10:50AM - 11:00AM Location: E450B

Participants
Alexandra S. Gersing, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Martin Solka, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Gabby B. Joseph, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Benedikt J. Schwaiger, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Ursula R. Heilmeier, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Georg Feuerriegel, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
John Mbapte Wamba, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Charles E. McCulloch, San Francisco, CA (*Abstract Co-Author*) Instructor, F. Hoffmann-La Roche Ltd Expert Witness, Mallinckrodt plc Consultant, Mallinckrodt plc
Michael C. Nevitt, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Link, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Research funded, General Electric Company; Research funded, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

PURPOSE

To investigate the association of different degrees of weight loss with progression of knee cartilage degeneration in overweight and obese subjects.

METHOD AND MATERIALS

In this study, 290 subjects (age 61.7±9.1y; 171 females) with a BMI>25kg/m2 from the Osteoarthritis Initiative (OAI) with risk factors for OA or radiographically mild to moderate OA were included. Subjects with weight loss were categorized into groups with a large (≥10%, n=36) or moderate amount of weight loss (5-10%, n=109) over 48 months, and were frequency matched to a group with stable weight (BMI change <3%, n=145). Changes of focal cartilage defects assessed with 3T MRI cartilage WORMS (Whole-Organ Magnetic Resonance Imaging Score) and T2 maps of the right knee for five cartilage compartments (patella, medial and lateral femur, medial and lateral tibia) including laminar and texture analysis, were analyzed using multivariate regression models adjusting for age, sex, baseline BMI and KL.

RESULTS

Overall cartilage WORMS showed significantly less progression in both weight loss groups compared to the stable weight group (5-10% weight loss, P=0.035; >10% weight loss, P<0.0001) over 48 months and changes were associated with changes of BMI (r=0.31, P=0.02). Subjects with >10% weight loss showed significantly less T2 value increase in the bone layer averaged over all compartments compared with stable weight subjects (mean diff. 1.0msec [95%CI 1.3, 0.6] P=0.01), suggesting slower cartilage deterioration, yet no significant change in T2 was found between 5-10% weight loss and stable weight group. In the medial compartment of the >10% weight loss group, overall T2 and cartilage WORMS changes were significantly less (P<0.0001, for each) and homogeneity was increased (P=0.004), compared to the group with stable weight.

CONCLUSION

While changes in cartilage defects were significantly associated with the amount of weight loss in all subjects, only subjects with >10% weight loss showed significantly reduced cartilage deterioration measured with T2. Our data show evidence that weight loss has a protective effect against cartilage degeneration and that a larger amount of weight loss is more beneficial.

CLINICAL RELEVANCE/APPLICATION

MR-based knee cartilage T2 measurements and semiquantitative grading allow monitoring of the protective effect of weight loss on joint health and are useful to determine which amount of weight loss is most beneficial in overweight and obese patients.

SSC07-04 The TEFR Field Study: Results of Continuous Biochemical and Morphological Cartilage Analysis of Hindfoot, Ankle, and Knee Joints in Course of a 4,500 km Ultramarathon Race throughout Whole Europe Using T2*-mapping on a Mobile MRI Truck Trailer

Monday, Nov. 30 11:00AM - 11:10AM Location: E450B

Awards
RSNA Country Presents Travel Award

Participants
Uwe H. Schuetz, MD, Ulm, Germany (*Presenter*) Nothing to Disclose
Christian Billich, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Jutta Ellermann, MD, PhD, Minneapolis, MN (*Abstract Co-Author*) Nothing to Disclose
Martin Ehrhardt, MD, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel Schoss, MD, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Brix, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Siegfried Trattnig, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Sabine Goed, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Antje Reiner, MD, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Meinrad J. Beer, MD, Wuerzburg, Germany (*Abstract Co-Author*) Research Consultant, Shire plc

PURPOSE

We took advantage of the possibility for a continuous, mobile MR surveillance of cartilage integrity during a transcontinental ultramarathon over 4,486 km. Biochemical changes, thickness and focal lesions of the cartilage of knee, ankle, and hindfoot joints as well as muscle mass and respective relationships were presented.

METHOD AND MATERIALS

MRI data were acquired with a mobile 1.5T scanner travelling with 44 participants of the TransEurope FootRace (TEFR) for 64 days. Repeated follow-up scans were obtained using a T2* GRE-, a TIRM-, and a fat-saturated PD-sequence. T2* values were obtained from inline reconstructed T2* maps by using a pixelwise, monoexponential nonnegative least squares fit analysis. Statistical analyses regarding cartilage T2* and thickness changes and influencing factors were done on the finishers of the race.

RESULTS

With exception of the patellar joint, nearly all cartilage segments showed a significant initial mean T2* signal increase within the first 1500km run: ankle 25.6%, subtalar joint 20.9%, midtarsal joint 26.3%, femorotibial Joint (FTJ) 25.1 to 44.0%. Interestingly, an unexpected secondary T2* decrease was observed in ankle (-30.6%) and hindfoot joints (-28.5% and -16.0%), but not in the FTJ. A significant loss of cartilage thickness was detected in the FTJ, but not in the other joints. A side dependent, positive relationship between muscle volumes of the thigh and cartilage T2* at baseline could be found in the FTJ. Osteochondral lesions were detected, however all were already present at baseline and showed no changes throughout TEFR. Reasons for stopping the race were not associated with joint problems.

CONCLUSION

After initial significant intrachondral matrix changes, a subsequent T2* value recovery indicates the ability of the cartilage matrix to regenerate under ongoing running burden in ankle and hindfoot joints. In contrast, for the FTJ no T2* signal recovery could be observed accompanied by loss of cartilage thickness. No new lesions were observed during TEFR. Asymmetry of cartilage T2* behavior is in line with the hypothesis of the "breaking" limb and demonstrates leg-preference even in well-trained ultra-runners.

CLINICAL RELEVANCE/APPLICATION

The capability of most parts of human cartilage to recover in the presence of extreme physical stress has not been shown previously indicating a high regenerative potential of human joint cartilage.

SSC07-05 The Evaluation of Clinical Reliability and Speed of a Triple-echo Steady-state T2 Mapping for in Vivo Evaluation of Articular Cartilage in Comparison to Multi-echo Spin-echo Sequence

Monday, Nov. 30 11:10AM - 11:20AM Location: E450B

Participants
Vladimir Juras, BMedSc, PhD, Vienna, Austria (*Presenter*) Nothing to Disclose
Klaus Bohndorf, MD, Augsburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Claudia Kronnerwetter, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
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Stefan Zbyn, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Siegfried Trattnig, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the clinical relevance of T2 relaxation times, measured by 3D triple-echo steady-state (3D-TESS), in knee articular cartilage compared to conventional multi-echo spin-echo T2-mapping.

METHOD AND MATERIALS

Thirteen volunteers and ten patients with focal cartilage lesions were included in the study. All subjects underwent 3-Tesla MRI consisting of a multi-echo multi-slice spin echo sequence (CPMG) as a reference method for T2 mapping, and 3D TESS with the exact same geometry settings, but variable acquisition times: standard (TESSs 4:35 min) and quick (TESSq 2:05 min). T2 values were compared in six different regions in the femoral and tibial cartilage using a paired t-test and the Pearson correlation coefficient (r).

RESULTS

The mean quantitative T2 values measured by CPMG (mean: 46±9ms) in volunteers were significantly higher compared to those measured with TESS (mean: 31±5ms) in all regions. Both methods performed similarly in patients, but CPMG provided a slightly higher difference between lesions and native cartilage (CPMG: 90ms?61ms [31%],p=0.0125; TESS 32ms?24ms [24%],p=0.0839)..

CONCLUSION

This work compared a newly developed 3D-TESS sequence with a CPMG method to evaluate T2-mapping of human articular

cartilage. 3D-TESS provided results comparable to CMPG with a substantially shorter acquisition time. This novel sequence may replace the conventional approach with CMPG

CLINICAL RELEVANCE/APPLICATION

3D-TESS T2 mapping provides clinically comparable results to CPMG in shorter scan-time Cartilage loading studies might benefit from high temporal resolution of 3D-TESS. 3D-TESS T2 values are able to differentiate between healthy and damaged cartilage

SSC07-06 A Comprehensive 7 Tesla Hip Cartilage Protocol Including Morphological and Quantitative MRI Techniques and Its Application in Patients after Acetabular Autologous Chondrocyte Transplantation

Monday, Nov. 30 11:20AM - 11:30AM Location: E450B

Participants
Andrea Lazik, MD, Essen, Germany (*Presenter*) Nothing to Disclose
Oliver Kraff, MSc, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konrad Koersmeier, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Christina Geis, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Harald H. Quick, PhD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Jens M. Theysohn, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate morphological and quantitative 7 Tesla MRI techniques for hip cartilage imaging in patients with acetabular cartilage lesions, treated by autologous chondrocyte transplantation (ACT).

METHOD AND MATERIALS

Hips of 11 healthy volunteers were examined to establish a 7T hip cartilage protocol including high-resolution DESS (0.7mm3 isotropic), T1 VIBE (0.4x0.4x0.8mm3) and PDw sequences (sagittal and coronal) for morphological imaging, multi-contrast sequences (5 echoes) for T2- and T2*-mapping and a dual flip angle technique for T1-mapping prior to and after contrast agent administration following a dGEMRIC-protocol. Accurate and reproducible scan-rescan conditions were monitored with a fast B1-mapping technique (DREAM). After reviewing image quality by means of acetabular and femoral cartilage delineation (4-point scale, 4 being best) and comparing relaxation times in correlating regions (Pearson's correlation) this protocol was applied in 9 patients treated by ACT. Here, over-all image quality, delineation of the cartilage transplants and their relaxation times were compared to 3T MRI.

RESULTS

Volunteer study: The delineation of acetabular and femoral cartilage was excellent in T2- (3.2±0.9) and T2*-maps (3.2±0.4). Gadolinium improved cartilage delineation in T1-maps (2.9±0.8 vs. 1.7±0.6) as well as in T1 VIBE (3.3±0.6 vs. 2.2±0.9). T1-, T2- and T2*-relaxation times showed a high correlation in unenhanced and contrast-enhanced sequences (all $p<0.001$) in volunteers with mean values of 931ms (T1 enhanced), 43ms (T2) and 15ms (T2*).Patient study: Compared to 3T, image quality at 7T was clearly superior in sagittal PDw, T1 VIBE, DESS and T1-mapping with enhanced delineation of the transplants. Mean relaxation times of the cartilage transplants were reduced at 7T comparted to 3T for T1 (537 vs. 757ms), T2 (42 vs. 45ms) and T2* (11 vs. 14ms).

CONCLUSION

A comprehensive hip cartilage protocol after contrast agent administration was established at 7T MRI, including morphological sequences as well as T1-mapping for dGEMRIC, T2- and T2*-mapping. The application of this protocol in patients after ACT showed predominantly superior image quality with better evaluation of the cartilage transplants compared to 3T.

CLINICAL RELEVANCE/APPLICATION

7 Tesla can help to noninvasively follow up patients after acetabular cartilage transplantation, as imaging of the thin and spherical shaped hip cartilage remains challenging at lower field strengths.

SSC07-07 Quantitative T2* Analysis of Articular Cartilage of the Tibiotalar Joint in Professional Soccer Players and Healthy Individuals at 3T MRI

Monday, Nov. 30 11:30AM - 11:40AM Location: E450B

Participants
Marc Regier, Hamburg, Germany (*Presenter*) Nothing to Disclose
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Azien Laqmani, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Chressen C. Remus, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael G. Kaul, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To quantitatively evaluate the tibiotalar cartilage of professional soccer players by T2* relaxation measurements in comparison to age-matched healthy volunteers.

METHOD AND MATERIALS

Using a 3T MRI system both ankles of 20 elite professional soccer players from the highest european level and 20 age-matched healthy individuals were investigated. After resting in supine position for 30 minutes, all individuals were examined appliying multiplanar T1w and Pdw sequences. For quantitative measurements a 3D T2* (24 echoes ranging from 4.6-52.9ms; image resolution 0.5x2x2mm) sequence was performed in sagittal orientation. Using a dedicated software tool (ImageJ) data were postprocessed and quantitative maps were generated. The articular cartilage was subdivided into 6 areas and regions-of-interest (ROI) were manually placed in all zones of the tibial and talar cartilage. For statistical workup Pearson product-moment correlation coefficients and confidence intervals were calculated.

RESULTS

In professional soccer players the T2* values were significantly higher in all tibial and talar compartments than those in healthy participants (mean, 21.36ms vs. 16.44ms; p<0.001). This difference was most evident in the posterior zones of the tibiotalar cartilage. In the athletes, there was a trend towards higher T2* values at the anterior medial compartments of the articular cartilage, however, compared to the healthy control group this was not statistically significant (p,0.08).

CONCLUSION

Based on these initial results, T2* values of the tibiotalar joint seem to be elevated in professional soccer players compared to an age-matched control group indicating cartilage degeneration. T2* measurements might potentially serve as a quantitative noninvasive tool for the detection of articular cartilage lesions at early stage.

CLINICAL RELEVANCE/APPLICATION

Quantitative MR imaging of tibiotalar articular cartilage using T2* measurements could serve as a complementary tool for early detection of subtle cartilage defects and further investigation should be encouraged.

SSC07-08 MRI-T2 Mapping Assessment after Treatment of Knee Osteoarthritis with Mesenchymal Stem Cells at One Year Follow-up

Monday, Nov. 30 11:40AM - 11:50AM Location: E450B

Participants
Joan C. Vilanova, MD, PhD, Girona, Spain (*Presenter*) Nothing to Disclose
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Lluis Orozco, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Robert Soler, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Anna Munar, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To confirm the feasibility of osteoarthritis treatment with mesenchymal stem cells (MSCs) in humans, and to demonstrate its efficacy on MRI and clinical outcome on a larger population with osteoarthritis of the knee

METHOD AND MATERIALS

Fifty patients with clinical and radiologic diagnosis of osteoarthritis of the knee (graded according to the ICRS (International Cartilage Repair Society) were treated with autologous MSCs by intrarticular injection. Clinical outcomes were followed for 1 year (including pain, disability, and quality of life). Cartilage assessment was performed using MRI T2-mapping at 88 pre-determined anatomical regions previous to treatment at 12 months after treatment; by determining the T2 relaxation values (RV) in each region of the knee. Inter, intraobserver and equipment errors were calculated for reproducibility, and for the statistical analysis to determine significant differences on T2 RV's before and after treatment. Statistical analysis was performed by Students t-test or by one-way analysis of variance (ANOVA) and the corresponding non-parametric tests

RESULTS

The mean T2 RV's (ms) previous to treatment (mean±SD) (60.3±6.1) was significantly higher than at 12 months (53.1±6.2) (p<0.04). A positive correlation was identified between the baseline mean average T2 RV's and the mean final average (ms) improvement T2 RV's score (r=0.38; p<0.05). T2 RV's decreased in 37 of 50 patients, 10 remained the same and 3 worsened between 7 and 10%. The median pain reduction was 60% for daily activities and 63% for sport activities. A good positive correlation was observed between the amount of clinical improvement and the initial score (r=0.49), (P<0.001)

CONCLUSION

Non-invasive technique MRI T2-mapping is a valuable tool to assess the follow up of cartilage after MSC therapy for knee osteoarthritis

CLINICAL RELEVANCE/APPLICATION

Stem cell therapy could be an effective, feasible and safe treatment for knee osteoarthritis; and MRI T2-mapping can be a useful imaging biomarker tool to correlate and assess the clinical outcome

SSC07-09 Prevalent Partial and Full-thickness Focal Cartilage Defects Predict Cartilage Damage Progression in the Same Subregion and Development of Incident Cartilage Damage in the Same Tibiofemoral Compartment: The MOST Study

Monday, Nov. 30 11:50AM - 12:00PM Location: E450B

Participants
Ali Guermazi, MD, PhD, Boston, MA (*Presenter*) President, Boston Imaging Core Lab, LLC; Research Consultant, Merck KgaA; Research Consultant, Sanofi-Aventis Group; Research Consultant, TissueGene, Inc; Research Consultant, OrthoTrophic; Research Consultant, AstraZeneca PLC
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David T. Felson, MD, MPH, Boston, MA (*Abstract Co-Author*) Consultant, Zimmer Holdings, Inc

PURPOSE

To assess if depth of focal cartilage damage affects the risk of incidence and progression of cartilage loss in the tibiofemoral joint (TFJ).

METHOD AND MATERIALS

Persons with or at high risk of knee OA with MRI readings at baseline and 30-month were included. Semiquantitative MRI analysis was done using the Whole Organ MRI Score (WORMS) for cartilage damage, meniscal damage and extrusion, bone marrow lesions (BMLs), effusion and synovitis. Baseline focal cartilage damage was defined as grade 2 (partial-thickness) or grade 2.5 (full-thickness). In a subregion-based analysis, we assessed the risk of cartilage loss over 30 months comparing subregions of TFJ with baseline cartilage grade 2.5 vs grade 2. In the compartment-based analysis, we included only knees with a solitary grade 2 or 2.5 lesion at baseline and all other subregions in the same compartment having no cartilage damage. We estimated the risk of incident cartilage loss (grade≥2) in any non-damaged subregions for compartments with baseline full-thickness and partial thickness defects. In addition knees or compartments with grade 2 and 2.5 cartilage damage at baseline were compared to those without. Logistic regression was used to account for correlations among multiple subregions/compartments within a knee.

RESULTS

927 subregions (683 knees) were included in the subregion-based analysis. Risk of cartilage damage progression for grade 2.5 lesions compared to grade 2 lesions were comparable. However, compared to subregions with no cartilage damage, subregions with grade 2 or 2.5 cartilage defects had higher risk for cartilage loss (aOR 8.2, 95%CI 6.7-10.0). 374 compartments were included in the compartment-based analysis. There was no significant difference in regard to risk of incident damage between compartments that had grade 2 and grade 2.5 cartilage defects at baseline. However, compared to compartments with no baseline cartilage damage, those with grade 2 or 2.5 cartilage defects in a subregion had higher risk for incident cartilage damage in other subregions at follow-up (aOR 1.7, 95%CI 1.2-2.5).

CONCLUSION

Prevalent focal cartilage defects are a risk factor for local cartilage damage progression in the same subregion and increase risk for development of incident cartilage damage in the same TFJ compartment regardless of defect depth.

CLINICAL RELEVANCE/APPLICATION

Even small superficial cartilage lesions are relevant for cartilage damage progression.

Honored Educators

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Ali Guermazi, MD, PhD - 2012 Honored Educator

SSC08

Neuroradiology (Traumatic Brain Injury)

Monday, Nov. 30 10:30AM - 12:00PM Location: N226

NR MR ER

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Pratik Mukherjee, MD, PhD, San Francisco, CA (*Moderator*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company;
Michael M. Zeineh, PhD, MD, Stanford, CA (*Moderator*) Research funded, General Electric Company

Sub-Events

SSC08-01 The Association between Football Exposure, Position, and Concussion History on White Matter Integrity

Monday, Nov. 30 10:30AM - 10:40AM Location: N226

Participants
Allen A. Champagne, BS,BA, Chapel Hill, NC (*Presenter*) Nothing to Disclose
Michael D. Clark, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Feng Shi, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
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Kevin Guskiewicz, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Diffusion tensor imaging has emerged as an important tool for quantitative analysis of white matter (WM) integrity following sport-related concussion. The primary purpose of this project was to investigate the variances in WM integrity in retired college and professional football athletes based on concussion history, duration of playing career, and playing position.

METHOD AND MATERIALS

32 former college and 31 former professional players were matched on age, concussion history, and playing position. All subjects were cognitively normal for age on a battery of neuropsychological tests. MRI scans were obtained and all diffusion-weighted images were analyzed using Tract Based Spatial Statistics. Our primary outcomes were fractional anisotropy (FA) and mean diffusivity (MD). A permuted, voxel-wise 3x2 ANOVA was performed on the WM skeleton to investigate the main and interaction effects of three fixed variables on WM integrity. These variables were concussion history (3+ vs. 0-1), football exposure (College vs. Professional), and playing position (Speed vs. Non-speed). Threshold-free cluster enhancement was used to identify clusters of significantly different FA or MD and post-hoc univariate analyses were used to determine the direction of interaction effects. Our a priori α was set at 0.05 after correction for multiple comparisons.

RESULTS

Three clusters in the forceps minor and genu of the corpus callosum were identified as having significant differences in FA for the concussion by position interaction. Post-hoc analysis of the peak voxels within each of the three clusters revealed consistently lower FA for non-speed players with 3+ concussions as compared to those with 0-1 concussions (Cohen's d: 0.89, 0.95, and 1.29; $P<0.05$). No other main effects or interaction effects were observed for FA or MD.

CONCLUSION

Our results suggest a history of multiple concussions is associated with lower FA in former non-speed position players compared to speed players, particularly in frontal white matter tracts. Additionally, we did not observe main or interaction effects of football exposure, suggesting that without concussive injuries, added football exposure does not account for variances in FA or MD. A limitation of these results is the lack of a control group without history of football participation.

CLINICAL RELEVANCE/APPLICATION

Multiple concussions and playing a non-speed position are associated with lower FA in frontal white matter tracts.

SSC08-02 Reduced Cerebral Blood Flow Detected after Clinical Recovery in Acute Sports-related Concussion

Monday, Nov. 30 10:40AM - 10:50AM Location: N226

Participants
Yang Wang, MD, Milwaukee, WI (*Presenter*) Research Grant, Siemens AG; Research Grant, General Electric Company
Lindsay D. Nelson, PhD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Ashley A. LaRoche, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Adam Y. Pfaller, BS, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Andrew S. Nencka, PhD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Michael A. McCrea, PhD, Milwaukee, WI (*Abstract Co-Author*) Research Grant, General Electric Company

PURPOSE

Sport-related concussion (SRC) is a major health problem, affecting millions of people each year. While the clinical effects of SRC (e.g., symptoms and impairments in neuropsychological functioning) typically resolve within several days, increasing evidence suggests persistent neurophysiological abnormalities beyond the point of clinical recovery after injury. This study was aimed to evaluate cerebral blood flow (CBF) changes in acute SRC, as measured using advanced arterial spin labeling (ASL) MRI.

METHOD AND MATERIALS

We compared CBF maps assessed using 3D pCASL (pseudo continues ASL) MRI in 18 concussed football players (age 17.8 ± 1.5 years) obtained within 24 hours and at 8 days after injury, in comparison to a control group of 19 matched non-concussed football players at the same interval. Clinical assessments including the Sport Concussion Assessment Tool 3 (SCAT3) and Standardized Assessment of Concussion (SAC) were obtained at each time point.

RESULTS

While the control group did not show any changes in CBF between the two time points, concussed athletes demonstrated a significant decrease in CBF at 8 days relative to 24 hours ($p<0.01$, FWE corrected). Moreover, scores on the clinical symptom (SCAT3) and cognitive (SAC) measures demonstrated significant impairment (versus pre-season baseline levels) at 24 hours (SCAT $p < 0.0001$, SAC $p < 0.01$) but returned to baseline levels at 8 days.

CONCLUSION

Our preliminary results suggest that advanced ASL MRI method might be useful for detecting and tracking the longitudinal course of underlying neurophysiological recovery from concussive injury.

CLINICAL RELEVANCE/APPLICATION

Abnormal CBF was found using 3D pCASL MRI in acute concussed patients even after clinical recovery, which might have important implication for clinical decisions on return-to-play after concussion.

SSC08-03 Abnormal Radial Diffusivity Predicts Worse Cognitive Function One Year Following Concussion (Mild Traumatic Brain Injury)

Monday, Nov. 30 10:50AM - 11:00AM Location: N226

Participants
Sara B. Rosenbaum, MD, Bronx, NY (*Presenter*) Nothing to Disclose
Namhee Kim, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Margo Kahn, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Hannah Scholl, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Jennifer Provataris, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Craig A. Branch, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Michael L. Lipton, MD, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Abnormally low FA is related to worse cognitive outcomes in concussion (mild traumatic brain injury; mTBI). Some studies demonstrate that diffusion perpendicular to the principal direction of the diffusion tensor, or radial diffusivity (RD), may largely drive changes in FA, reflecting more severe transaxonal pathology such as axotomy. The purpose of this study is to examine the relationship between regional abnormalities of RD within 2 weeks of mTBI and cognitive function 1 year later.

METHOD AND MATERIALS

31 uncomplicated mTBI subjects were recruited from a local emergency center. 3T DTI was performed within 2 weeks of injury, and cognition was tested at 1 year post-injury. Voxelwise assessment was used to identify clusters of voxels demonstrating abnormally high RD ($p(\text{individual voxel})<0.05$, $p(\text{cluster size corrected for multiplicity})<0.01$) in each subject by comparing each subject to a cohort of 40 healthy controls. Each subject was then classified according to presence or absence of abnormally high RD within the following regions: left frontal, right frontal, left temporal, right temporal and corpus callosum. T-tests were used to compare cognitive outcomes between subjects with or without abnormally high RD in each region.

RESULTS

Subjects with abnormally high RD in the left temporal and right temporal lobe performed worse on tasks of executive function at 1 year ($t(18)=-2.607$, $p=0.018$ and $t(18)=-2.495$, $p=0.023$, respectively). There were no significant differences in cognitive function between those with and without abnormally high RD in the frontal lobes or corpus callosum.

CONCLUSION

Abnormally high RD in the temporal lobes within two weeks of injury is significantly associated with worse executive function 1 year following uncomplicated mTBI. RD, a putative imaging correlate for transaxonal injury, may reflect more severe early axonal or myelin pathology, which heralds persistent deficits in mTBI patients.

CLINICAL RELEVANCE/APPLICATION

These preliminary findings suggest that RD might provide an early imaging biomarker for worse long-term outcomes in mTBI, to guide patient management and inform treatment trials.

SSC08-04 Diffusion Tensor MRI Reveals Gender-based Risk for Traumatic Brain Injury in Soccer Players

Monday, Nov. 30 11:00AM - 11:10AM Location: N226

Participants
Eva Catenaccio, BA, Bronx, NY (*Presenter*) Nothing to Disclose
Roman Fleysher, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
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Walter Stewart, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Michael L. Lipton, MD, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Female athletes are thought to be at increased risk for sports-related mild traumatic brain injury (mTBI) and worse mTBI outcomes, relative to males. Heading in soccer represents a source of repetitive subconcussive head impacts. Previous research shows that heading exposure above a threshold of approximately 1000 headers/year is associated with microstructural brain damage (lower fractional anisotropy; FA) detectable on diffusion tensor imaging (DTI). This study assesses the role of gender as a predictor of mTBI-associated changes in white matter in a cohort of amateur soccer players.

METHOD AND MATERIALS

Forty-one females and 41 age- and educated-matched males (ages 18-52) were drawn from an ongoing longitudinal study of mTBI in amateur soccer players. Number of prior concussions and frequency of heading in the prior 12 months was quantified. Subjects underwent 3.0T DTI. After registration to the Johns Hopkins University template, we analyzed the results with a voxelwise general linear model with 3 predictors of interest: (1) gender to assess baseline gender differences in FA, (2) reported heading to assess heading-related declines in FA and (3) a term representing the interaction of gender and heading to assess for gender-dependent sensitivity to heading. Nuisance covariates for the analysis included age, education, and number of prior concussions. Significance was determined by a statistical threshold of $p<0.01$ and a cluster size of 100 voxels.

RESULTS

The analysis revealed regions showing statistically significant effects from all 3 predictors of interest in the bilateral corona radiata and right frontal lobe white matter, in which (1) women had lower baseline FA, (2) where both genders showed heading-related declines in FA and (3) where there was a differential gender-based sensitivity to heading-related changes in FA.

CONCLUSION

Our finding of significant overlapping changes in white matter abnormalities may indicate that baseline sexual dimorphisms in brain microstructure are the basis for a gender-specific response to repetitive trauma. Future work should focus on associating these imaging findings with gender-specific clinical outcomes.

CLINICAL RELEVANCE/APPLICATION

Gender-based vulnerability of amateur athletes to TBI pathology, revealed through DTI, may provide new bases for the development and implementation of preventive interventions.

SSC08-05 Quantitative Assessment of Optic Nerve Injury Longitudinally Using Manganese-enhanced MRI

Monday, Nov. 30 11:10AM - 11:20AM Location: N226

Participants
Jun Yang JR, BA, Kunming, China (*Presenter*) Nothing to Disclose
Yingying Ding, MD, Kunming, China (*Abstract Co-Author*) Nothing to Disclose
Chengde Liao, MD, Kunming, China (*Abstract Co-Author*) Nothing to Disclose
qing q. Li, Kunming, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate manganese (Mn2+)-enhanced MRI(MEMRI) in a longitudinal quantitative study of rat optic nerve injury.

METHOD AND MATERIALS

Forty Sprague Dawley rats were divided into 3 group: Group A / with manganese-enhanced MRI (n=15), Group B / with retrograde labeled fluoro-gold and pathology (n=15), and control group C (n=10). Group A and B were underwent left optic nerve crush (ONC) at 2mm back to the eyeball. Using fluoro-gold from superior colliculus and lateral geniculate nucleus to retrograde label RGCs was performed before ONC 7days. A total of 3 mL of 90 nmol $MnCl_2$ was unilaterally injected into the vitreous body 24h before MRI. MEMRI (group A) and retinal ganglia cells (RGCs) count (group B) were performed at 3, 7 and 14 day-post-lesion (dpl). Each 5 rats in group C were underwent the same process as group A and B respectively, but no ONC. The contrast-to-noise ratio (CNR) of retina and optic nerve, the results of RGCs count were compared between groups at different time points.

RESULTS

In the control groups, the intact visual pathway, from the retina to the contralateral superior colliculus, was visualized by MEMRI. The overall impression of ONC group at the different time point (3, 7, 14dpl) after the injury was that Mn2+ enhancement was seen in the retina and ON proximal to the lesion site. No Mn2+ enhancement was observed distal to the lesion site at 3, 7 and 14 dpl. The Mn2+ enhanced signal was reduced from 3dpl to 14dpl in the ON proximal to the lesion site. In the ONC group at 3dpl, there was an increased Mn2+ signal in the ON proximal to the lesion site compared to that seen in the control group ($P<0.05$), while no signal was detected distal to the ONC. At 7 and 14dpl, the Mn2+-enhanced signal was decreased significantly in the ON proximal to the crush site, compared to the signal observed at 3dpl ($P<0.05$). The RGCs drop rate was 6.84%, 45.31%, and 72.36% at 3dpl, 7dpl and 14dpl, respectively. The apoptosis of RGCs was most obvious after ONC at 14dpl.

CONCLUSION

MEMRI in the rat optic injury has a certain value in vivo experimental research, it can be used to observe the structure and function changes of optic nerve after injury. It is possible to detect the severity of the optic nerve by MEMRI examination.

CLINICAL RELEVANCE/APPLICATION

It is possible to use MEMRI to monitor the severity of the optic nerve injury in human by injecting mico-$MnCl_2$ in the future.

SSC08-06 'Black Dipole' or 'White Dipole': Using Susceptibility Phase Image to Differentiate Cerebral Microbleed from Intracranial Calcification

Monday, Nov. 30 11:20AM - 11:30AM Location: N226

Participants

Ying Jeng, MD, New Taipei City, Taiwan (*Presenter*) Nothing to Disclose
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David Y. Chen, MD, New Taipei City, Taiwan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of the study was to evaluate the role of susceptibility phase image in differentiation of cerebral microbleed (CMB) from intracranial calcification.

METHOD AND MATERIALS

The study was conducted upon 21 patients who received both brain CT and MRI within 3 days after acute infarct. MRI was performed in a 3T scanner, with susceptibility weighted angiography (SWAN) and susceptibility phase image generated from SWAN. Lesions that were 1) black, 2) round or ovoid, 3) less than 5 mm in SWAN were included. Two radiologists independently categorized each lesion, based on the SWAN phase image, into six axial patterns (1: total black, 2: total white 3: black with white core, 4: white with black core, 5: heterogenous black, 6: heterogenous white) and two coronal patterns (1: black dipole, 2: white dipole). Agreement of phase pattern was determined, including kappa statistics. Each lesion was interpreted as CMB or calcification based on coronal (pattern1 as CMB; 2 as calcification) and axial (pattern 1,3,5 as CMB; 2,4,6 as calcification) phase image respectively. In all the cases, CT was used as the gold standard for the presence/absence of calcification.

RESULTS

A total of 141 lesions were included. 60, 15, 17, 5, 32, 12 lesions were classified into axial phase pattern 1, 2, 3, 4, 5, 6, respectively, while 97 and 44 lesions into coronal phase pattern 1 and 2, respectively. The interobserver agreement was perfect ($\kappa = 1$) in coronal pattern, while moderate (κ=0.73; 95% CI, 0.65-0.81) in axial pattern. CT confirmed 97 lesions as CMBs and 44 as calcifications. The sensitivity and specificity for detecting calcification were 91.8% and 54.6% for axial phase image and 99.0% and 93.2% for coronal phase image. Among lesions < 2mm, the sensitivity and specificity for detecting calcification increased to 97.3% and 80.0% for axial phase image, while 88.3% and 47.1% among lesions > 2mm.

CONCLUSION

Coronal phase image better demonstrated the susceptibility property of the paramagnetic CMBs as black dipoles, which expanded along the direction of the main magnetic field, and the diamagnetic calcifications as white dipoles, with higher diagnostic accuracy than axial phase image.

CLINICAL RELEVANCE/APPLICATION

The ability of susceptibility phase image to differentiate cerebral microbleed from calcification in MRI study is gaining clinical importance, especially in patients with cerebrovascular disease.

SSC08-07 Correlation between Optic Nerve Sheath Diameter Measured Using Computed Tomography and Marshall's Scale in Adult Patients with Acute Traumatic Brain Injury

Monday, Nov. 30 11:30AM - 11:40AM Location: N226

Participants
Haider N. Al-Tameemi, MBBCh,MD, Al-Najaf, Iraq (*Presenter*) Nothing to Disclose
Sattar R. Al-Esawi, MBChB, PhD, Najaf, Iraq (*Abstract Co-Author*) Nothing to Disclose
Ali Alyassari, Al-Dywania, Iraq (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the correlation between ONSD measurements using CT scan with the severity of TBI according to Marshall's scoring system.

METHOD AND MATERIALS

A cross-sectional analytic study was conducted on 60 adult patients (52 males, 8 females) with acute TBI referred by the neurosurgeon for brain CT examination over period of 8 months between February 2014 and September 2014. Children (<18 years), patients with orbital pathology and orbital trauma were excluded. After initial general evaluation of brain CT images, the score of TBI was assessed according to Marshal's scale (I to VI). The transverse ONSD of both right and left sides was then manually measured on axial CT image at 3mm distance behind eye globe. Statistical analysis was done using scientific package of social statistics (SPSS) with the correlation was considered significant if P value less than 0.05. The Institutional Ethical Review Committee approved the study.

RESULTS

The means of all, right-sided and left-sided ONSD were 4.695mm, 4.606mm and 4.785mm respectively. There was statistically significant and a strongly positive linear correlation (p value <0.001, r = 0.662) between the mean of ONSD measured by CT scan and Marshall's score. When the ONSD measurements of the right and left sides were analyzed separately, the correlation was also significant and strongly positive (p value <0.001, r= 0.504 for the right side and p value <0.001, r = 0.699 for the left side).ONSD showed weakly negative and statistically not significant correlation (p value= 0.571, r = - 0.075) with the duration between onset of the trauma and time of CT examination There was no significant difference between mean ONSD measurements when correlated with the laterality of TBI, age or gender (p values 0.392 0.328 and 0.462 respectively)..

CONCLUSION

ONSD measured on CT scan is strongly correlated with the severity of TBI as assessed by Marshall's scale. Because Marshall's scale has prognostic implication, ONSD may also have a prognostic value during assessment of patients with TBI.

CLINICAL RELEVANCE/APPLICATION

Measurement of ONSD using CT scan is correlated with higher scores of Marshall's classification of acute TBI and may be an indirect indicator of raised ICP. It is recommended to be included in the routine evaluation of patients with acute TBI.

SSC08-08 Cortical Thickness Analysis in Patients with Mild Traumatic Brain Injury

Monday, Nov. 30 11:40AM - 11:50AM Location: N226

Participants
Yadi Li, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Xiuyuan Wang, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Thomas Thesen, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sohae Chung, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Yvonne W. Lui, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Joanne Rispoli, MD, New York, NY (*Presenter*) Nothing to Disclose

PURPOSE

It is known that brain atrophy can occur after traumatic brain injury (TBI) including changes in cross-sectional and longitudinal cortical thickness which have been documented in moderate to severe TBI patients. Alterations in cortical thickness after mild traumatic brain injury (mTBI) have not been previously examined. The purpose of this study is to investigate longitudinal changes in cortical thickness in mTBI patients from average 22 days to 1 year after injury and compare to controls.

METHOD AND MATERIALS

Sixteen patients with mTBI and 16 matched control subjects were enrolled. Longitudinal and cross-sectional cortical thickness group analysis was performed on T1WI-3D-MPRAGE images obtained at 3.0Tesla using Freesurfer. A statistical threshold of $p<0.001$ was used following which clusterwise correction for multiple comparisons was applied. Z-score analyses were also done to assess individual differences in cortical thickness at both time-points.

RESULTS

The longitudinal analysis of mTBI subjects yielded a decrease in cortical thickness over the 1st year in the following areas: superior temporal gyrus, precentral gyrus, precuneus, etc. on the left; calcarine sulcus, parieto-occipital sulcus, inferior parietal lobule, middle occipital gyrus, etc. on the right. There was increased cortical thickness in the right temporal pole. The cross-sectional analysis showed greater cortical thickness in the mTBI group compared with normal controls at the 1st scanning in precentral gyrus, postcentral gyrus, supramarginal gyrus, paracentral gyrus, etc. bilaterally; superior temporal gyrus, middle temporal gyrus on the right; inferior temporal gyrus on the left. Right superior parietal gyrus demonstrated decrease in cortical thickness. None of these differences survive clusterwise multiple comparisons correction. Comparing to controls, Z-score analysis showed scattered differences in cortical thickness across individual patients at both 1st and 2nd scanning without definite consistent pattern.

CONCLUSION

The uncorrected pilot data suggest areas with predominantly decrease in cortical thickness of patients in the first year after mTBI; however, at the 1st scanning there is a trend towards areas of greater cortical thickness compared with controls. This could be due to a transient conformational change in regional thickness such as evolving gliosis or edema. There is, however, no clear pattern of cortical thickness change observed after multiple comparisons correction. Groupwise analysis insensitivity to morphometric alterations in this cohort may be due to heterogeneity of injury as is supported by variable differences seen after Z-score analysis.

CLINICAL RELEVANCE/APPLICATION

Cortical thickness analysis is helpful in detecting sutle morphometric changes of brain trauma.

SSC08-09 Small Traumatic Subarachnoid Hemorrhages: Is Routine ICU Admission Necessary?

Monday, Nov. 30 11:50AM - 12:00PM Location: N226

Participants
Paul J. Albertine, MD, Washington, DC (*Presenter*) Nothing to Disclose
Samuel Borofsky, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Derek Brown, MS, Washington, AR (*Abstract Co-Author*) Nothing to Disclose
Smita Patel, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Woojin Lee, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Anthony Caputy, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
M. Reza Taheri, MD, PhD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Traumatic subarachnoid hemorrhages (tSAH) are a common type of intracranial hemorrhage that occurs in the setting of acute traumatic brain injury (TBI). It is estimated that more than 1.5 million Americans suffer from a TBI per year resulting in over 300,000 hospital admissions and an estimated financial cost of 17 billion dollars. In our current clinical setting, any form of intracranial hemorrhage requires both neurological consultation and mandatory observation in an intensive care unit for close neurological monitoring. It has been suggested that the clinical impact of these small subarachnoid hemorrhages may be minimal; however, few studies exist that compare the size of a subarachnoid hemorrhage with patient outcome and rates of medical and neurological decline.

METHOD AND MATERIALS

This retrospective cohort study is based on 63 patients evaluated between 2011-2014 who presented to a Level I trauma center emergency room for acute traumatic injuries that were found to have tSAH on CT examination. Results were obtained through medical records and imaging results. Blood volumes of the subarachnoid hemorrhages were evaluated using Fisher, Modified Fisher and Claassen classification systems. Data gathered on the hospital course included several neurological and medical complications that have been associated with tSAH. Information regarding patient outcomes was based chart review.

RESULTS

Of the 63 total patients, 33 (52%) patients had low-grade tSAH which were classified as Fisher grade ≤ 2 , 40(63%) Modified Fisher grade ≤ 2, and 41(65%) Claassen grade ≤ 2. None of these patients with low-grade tSAH demonstrated neurological decline, medical decline, or seizures while they were hospitalized (all findings are significantly lower [$p<.05$] when compared to the patients

with higher grade tSAH). Patients with low grade tSAH had significantly shorter stays in the ICU ($p<.05$) and better clinical outcome based on GOS compared to the other patients ($p<.01$).

CONCLUSION

In this study, none of the patients with small low-grade tSAH demonstrated neurological decline, seizures, or medical decline during their hospitalization. All of these patients spent significantly less time in the intensive care unit and had good clinical outcomes.

CLINICAL RELEVANCE/APPLICATION

Patients with small low-grade tSAH rarely experience medical decline, neurological decline or seizures as a result of their injuries and may not necessitate intensive care unit admission.

BRS-MOA

Breast Monday Poster Discussions

Monday, Nov. 30 12:15PM - 12:45PM Location: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants
Dipti Gupta, MD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

BR228-SD-MOA2 Differential Upgrade Rates for Non-Definitive Image-Guided Core Needle Breast Biopsies Based on BI-RADS Features

Station #2

Participants
Alison R. Gegios, Madison, WI (*Presenter*) Nothing to Disclose
Mai A. Elezaby, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Wendy B. Demartini, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Jennifer R. Cox, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Celina Montemayor, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. Burnside, MD, MPH, Madison, WI (*Abstract Co-Author*) Stockholder, NeuWave Medical Inc
Heather Neuman, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Finn Kuusisto, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
John Hampton, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Non-definitive image-guided breast biopsies typically require repeat sampling by surgical excision for potential upgrade to malignancy. The American College of Radiology (ACR) defines and requires tracking of repeat sampling categories of atypia/radial scar (ARS), discordant (D), and insufficient (I). Identifying lesions with low likelihoods of upgrade to safely avoid surgery is a priority, but there are little data about lesions and outcomes according to ACR non-definitive categories. We assessed the frequency of mammographic features and associated rates of upgrade by category.

METHOD AND MATERIALS

From our database of 2808 consecutive image-guided core needle breast biopsies performed from 1/1/2006-12/31/2011, classified prospectively by a multidisciplinary team as concordant/definitive or non-definitive (ARS, D or I), we identified all non-definitive biopsies with mammographic correlates. BI-RADS imaging features of non-definitive cases were categorized retrospectively by one of three fellowship trained breast imaging radiologists blinded to core biopsy and surgical outcome. Surgical results or tumor registry match served as reference standard for upgrade to malignancy. We calculated frequencies of imaging features and pathology outcomes stratified by ARS, D, and I categories. We compared upgrade rates based on mammographic features, using exact chi-square tests.

RESULTS

A total of 130 biopsies meeting study criteria were classified as non-definitive (ARS, D or I). Overall, the upgrade rate was 16.2%. The majority of ARS biopsies had imaging feature calcifications (71.4%), while masses were most common for discordant (50.0%) and insufficient (88.2%) biopsies. The upgrade rate was significantly higher for masses (26.0%) than for calcifications (10.5%; p-value = 0.04).

CONCLUSION

Among ACR categories for non-definitive breast biopsies, upgrade rates differ based on mammographic features. The upgrade rate is higher for masses than for calcifications, which should be considered as shared decision-making to avoid surgical excision increases in practice.

CLINICAL RELEVANCE/APPLICATION

Upgrade rates for ACR non-definitive biopsies differ based on mammographic features, which should be considered as shared decision-making to avoid surgical excision increases in practice.

BR229-SD-MOA3 Dual-energy Contrast Enhanced Spectral Mammography. One Step beyond BI-RADS Score, by Adding the Power of Iodinated Contrast Media

Station #3

Participants
Athanasios N. Chalazonitis, MD, MPH, Athens, Greece (*Presenter*) Nothing to Disclose
Alexandra Tsigginou, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Christina Gkali, MD, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Eleni Feida, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Aris Giannos, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Constantine Dimitrakakis, MD, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess how Dual-energy Contrast Enhanced Spectral Mammography (CESM) can add value to BI-RADS (ACR) probability of malignancy classification.

METHOD AND MATERIALS

216 women, aged from 26 to 85 years, with mammographic findings primarily assessed as BIRADS II to V, underwent CESM examination. Ten of these had bilateral findings, so we examined 226 lesions in total. Lesion evaluation was based on contrast enhancement intensity strength, categorized as -1, 0, 1 or 2. We examined the presumption that the sum of the numerical value of BIRADS and CESM enhancement score as a value, can be predictive of malignancy. Thus, a sum of ≤ 4 was assumed to predict benign lesions and a sum of >4 considered to favor a malignant diagnosis. All lesions were biopsied and pathology reports were compared to imaging assessment.

RESULTS

Pathology reports confirmed 98 malignant and 128 benign lesions. There was an excellent correlation between proven breast malignancy and moderate or intense lesion contrast enhancement (92/98 lesions). The sum of BIRADS and CESM enhancement score conferred an accuracy in breast cancer diagnosis of 85.4% and a specificity rate of 80.47%, much higher than the corresponding values of diagnostic mammography (73.89% and 59.37%) and of the CESM enhancement mode alone (80.97% and 71.31%). Sensitivity rates of mammography, CESM and their sum were similar, namely 92.85%, 93.87% and 91.83%, respectively.

CONCLUSION

A new "malignancy potential predictive" score empowering the credibility of digital mammography BIRADS score and the value of lesion's strength enhancement in Dual-energy CEDM, increases the accuracy of digital mammography.

CLINICAL RELEVANCE/APPLICATION

Our proposed score may improve clinical decision making in breast cancer diagnosis. Furthermore breast biopsies in lesions with no enhancement or very low enhancement (type 0 or -1, according to our recommendation) can be avoided.

BR230-SD-MOA4 Decreasing Rates of Atypia with Digital Breast Tomosynthesis

Station #4

Participants
Madhavi Raghu, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Melissa A. Durand, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, Hologic, Inc
Liva Andrejeva-Wright, MD, Wallingford, CT (*Abstract Co-Author*) Nothing to Disclose
Jaime L. Geisel, MD, New Haven, CT (*Abstract Co-Author*) Consultant, QView Medical, Inc; Consultant, Siemens AG
Regina J. Hooley, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Brigid Killelea, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Liane E. Philpotts, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Atypical Ductal Hyperplasia (ADH) is a lesion which often generates additional procedures and treatments for the patient, contributing to the "overdiagnosis" phenomenon associated with mammography. The purpose of this study was to assess the prevalence and upgrade rates of ADH before and after the implementation of tomosynthesis.

METHOD AND MATERIALS

A retrospective review of the breast imaging database at a tertiary academic cancer hospital was performed to identify all cases of ADH on biopsy 12 months prior to (2D: 6/1/2010-6/1/2011) and three consecutive years following the implementation of tomosynthesis (3D1:1/1/2012-12/31/2012; 3D2:1/1/2013-12/31/2013 and 3D3:1/1/2014-12/31/2014). The pathology obtained at core needle biopsy was compared with the pathology obtained at surgical excision. Those cases upgraded to cancer were identified.

RESULTS

In the 2D group, 287 total biopsies were performed of which 18 (6.2%; 18/287) cases were diagnosed as ADH. None of the 18 cases were upgraded to malignancy at surgery. In the tomosynthesis group a total of 257, 358 and 321 biopsies (3D1, 3D2, 3D3, respectively), were performed resulting in 20 (6.2%), 20 (5.6%) and 15 (4.7%) cases of ADH, representing a nonsignificant (p=0.4) but 24% decrease in the prevalence of ADH from 2D to 3D3. A majority of the lesions (2D:16/18 (89%), 3D1:16/20 (80%), 3D2:16/20 (80%), 3D3:11/15 (73%)) were described as calcifications. Only one lesion in period 3D1 was upgraded to DCIS. This occurred in a patient with fine calcifications extending over a 4 cm area of the breast. None of the lesions in groups 3D2 and 3D3 were upgraded to malignancy at surgery.

CONCLUSION

Following the implementation of tomosynthesis, there was a trend to a decline in the percentage of atypias diagnosed, with a low upgrade rate of 1.8% (1/55). If the trend continues, it will result in fewer patients receiving a diagnosis of ADH and thereby avoiding surgical excisions.

CLINICAL RELEVANCE/APPLICATION

Diagnostic work-up with tomosynthesis has resulted in a trend of decreasing rate of atypias, reducing the number of additional procedures for patients.

BR231-SD-MOA5 Prediction of Pathologic Response Following Neoadjuvant Breast Cancer Chemotherapy: A Model Based on Diffusion-weighted Imaging, Contrast-enhanced MR Imaging and Tumour Phenotype

Station #5

Participants
Gorane Santamaria, MD, PhD, Barcelona, Spain (*Presenter*) Nothing to Disclose
Xavier Bargallo, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Blanca Farrus, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Xavier Caparros, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Pedro Luis Fernandez, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

Jose Rios, MSc, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Martin Velasco, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the relevance of diffusion imaging, contrast-enhanced MRI and cancer subtype to predict pathologic response to neoadjuvant chemotherapy in patients with breast cancer.

METHOD AND MATERIALS

From November 2009 to December 2014, all consecutive patients with histopathologically confirmed breast cancer undergoing neoadjuvant chemotherapy were enrolled. One hundred and eleven patients (mean age, 54.6; range, 27-84) underwent breast MRI, including diffusion sequence and contrast-enhanced MRI before and after neoadjuvant treatment. MRI interpretation included presence of enhancement in the last post-contrast sequence. The apparent diffusion coefficient (ADC) values were obtained using two different methods of region of interest (ROI) placement. The ADC ratio (mean post-treatment ADC/mean pretreatment ADC) was calculated in all cases. Tumours were characterised by immunohistochemical phenotype into three subtypes: human epidermal growth factor receptor 2 (HER2) positive (n=51), estrogen receptor positive/HER2 negative (n=40) and triple negative (n=20). Pathologic complete response (pCR) was defined as the absence of any residual type of invasive cancer or ductal carcinoma in situ (DCIS). Multivariate regression analysis and receiver operating characteristic analysis were performed.

RESULTS

For the total group, the pCR was 19% (21/111). The highest pCR was observed in the triple-negative (6/20 patients, 30%) and the HER2 positive (12/51 patients, 23.5%) subtypes. The ADC ratio increased significantly when pCR was achieved (1.440, 1.743 and 1.788 in presence of residual invasive cancer, residual DCIS and pCR, respectively; $p<0.001$). No significant differences in the ADC values obtained by single or multiple ROI placement were observed. Presence of late enhancement on the post-treatment MRI was significantly associated with residual tumour (area under the curve [AUC] 0.84; CI 95% 0.75-0.94). When the tumour subtype, ADC ratio and late enhancement were included in the model to predict the pathologic response, the AUC amounted to 0.92 (CI 95% 0.86-0.97).

CONCLUSION

Triple-negative or HER2 positive breast tumours showing high ADC ratios and absence of late enhancement after neoadjuvant chemotherapy are more likely to show pCR.

CLINICAL RELEVANCE/APPLICATION

Breast MRI including contrast-enhanced and diffusion imaging help predict pCR after neoadjuvant chemotherapy and is highly recommended in certain tumour phenotypes.

BR232-SD-MOA6 No Significant Difference in Time-To-Treatment of Newly Diagnosed Breast Cancer Patients Regardless of Whether Pre-Treatment MRI Performed or Whether a New Lesion was Found on MRI

Station #6

Participants
Brian Pogatchnik, MD, Minneapolis, MN (*Presenter*) Nothing to Disclose
Jessica E. Kuehn-Hajder, MD, Crystal, MN (*Abstract Co-Author*) Nothing to Disclose
Tim H. Emory, MD, Saint Paul, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The use of pre-treatment breast MRI in newly diagnosed breast cancer has been criticized because it has been reported to delay treatment. The purpose of our study was to measure the period between the diagnosis of breast cancer and the time of surgery in newly diagnosed patients, and look for differences between those that underwent pre-treatment MRI versus those that did not, all at a single institution.

METHOD AND MATERIALS

A retrospective analysis was performed using the medical records of all women with newly diagnosed breast cancer from 2009-12 at our institution. Included patients had their tissue diagnosis, surgery, and possible pre-treatment MRI performed entirely at our institution. We excluded non-surgical candidates and those that recieved neoadjuvant therapy. We recorded timing of initial tissue biopsy to surgery, type of surgery, pre-treatment MRI results, resultant biopsy data, and patient age.

RESULTS

Of the 189 qualifying patients,109 (58%) had pre-treatment MRI. Time-to-treatment was not significantly different (34.7 days with MRI vs 35.2 days without MRI, $p=0.832$), nor was it different if additional findings suspicious for malignancy were detected by MRI (37.2 days with new findings vs 33.0 days without new findings, $p=0.169$). In the MRI patient group, 45 of 109 (41%) had a new lesion found, 32 were biopsied, and 14 of 32 were cancerous for a 13% new cancer detection rate, and a PPV3 of 44%.There was an increased rate of mastectomy among those with a second lesion that was malignant vs benign (60% vs 19%, $p=0.008$). There was no difference in overall mastectomy rates (29% with MRI vs 24% without MRI, $p=0.391$). Women who received preoperative breast MRI were an average of 10 years younger than those who did not ($p<0.0001$).

CONCLUSION

Pre-treatment MRI did not delay surgery in patients with newly diagnosed breast cancer. No significant difference in mastectomy rate was seen overall in the MRI group, but it was greater in the 13% of patients with additional cancer found by MRI. Patients receiving pre-treatment MRI at our institution were 10 years younger than those who did not.

CLINICAL RELEVANCE/APPLICATION

Individualized treatment for newly diagnosed breast cancer often involves consultation with various specialists and additional testing. In our setting, when additional testing utilized preoperative breast MRI, it didn't delay surgery, yet it found additional cancer important for treatment planning.

BR117-ED- Metastatic Disease to the Breast: Common Findings in an Uncommon Clinical Entity

MOA7

Station #7

Participants
Rachel L. Delfanti, MD, San Diego, CA (*Presenter*) Nothing to Disclose
Haydee Ojeda-Fournier, MD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Metastatic cancer to the breast is uncommon. Given recent Center for Disease Control reports of more patients living with metastatic disease for longer than 5 years, it is possible that the incidence of metastasis to the breast could increase. We searched a single institution reporting system and identified 11 metastasis to the breast between 2008 to 2014. The imaging modalities, morphologic features of the lesions and the patient clinical history were reviewed. At the end of this educational exhibit the learner will: 1. Understand the importance of metastatic disease to the breast, 2. Be able to identify the imaging features of metastatic cancer to the breast. 3. Be able to explain to both the clinician and the patient the significance of such findings.

TABLE OF CONTENTS/OUTLINE

Introduction; Historical perspective; Definitions: primary breast cancer v. metastatic breast cancer to the breast v. regional breast cancer metastasis; Review the incidence, evaluation, and diagnosis of metastasis to the breast; Significance of metastatic disease to the breast; Literature review of metastatic disease to the breast significance; Imaging work up; Illustrate the imaging finding of metastasis to the breast with multimodatily breast imaging; Algorithm for the management of metastatic disease to the breast; Test yourself with image and multiple choice questions.

BR198-ED-MOA8 BRCA Positive Patients Undergoing Annual MRI Screening: Is there an Added Benefit to Continuing Annual Mammography?

Station #8

Participants
Brenna A. Chalmers, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Mary W. Yamashita, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Lingyun Ji, MS, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Duveen Sturgeon, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Sandy C. Lee, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Susan Groshen, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Lauren Alonzo, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Linda Hovanessian-Larsen, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. To review current screening recommendations for patients considered to be at high risk for developing breast cancer.2. To be familiar with the genetic mutations that incur an increased breast cancer risk, including more recently discovered mutations such as ATM gene, which causes radiosensitivity leading to increased cancer susceptibility.3. To assess the benefit, if any, of continued annual mammography in addition to MRI in BRCA patients through illustrative case examples and retrospective analysis of data collected from our institution.

TABLE OF CONTENTS/OUTLINE

A. Summarize data from prior multicenter studies which showed MRI has a higher sensitivity than mammography in high risk patients.B. Review the current recommendations for breast cancer screening in high risk patients.C. Describe the genetic mutations that incur an increased risk of breast cancer.D. Present data from our institution of 38 BRCA 1/2 patients diagnosed with breast cancer from 2012 to 2013, including age at diagnosis, clinical presentation, type and size of cancer, and imaging modality(s) that showed cancer.E. Provide illustrative case examples with comparison of mammogram and MRI findings in BRCA 1/2 patients, specifically focusing on any added diagnostic information gained from mammogram over MRI.

NRS-MOA

Neuroradiology Monday Poster Discussions

Monday, Nov. 30 12:15PM - 12:45PM Location: NR Community, Learning Center

NR

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Pratik Mukherjee, MD, PhD, San Francisco, CA (*Moderator*) Research Grant, General Electric Company; Medical Adivisory Board, General Electric Company;

Sub-Events

NR319-SD-MOA1 Left Hemisphere Dominance of fMRI Resting State Connectivity between the Pre-SMA and Language Areas in Right-Handed Persons

Station #1

Participants
William Lou, BS, New York, NY (*Presenter*) Nothing to Disclose
Kyung K. Peck, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Nicole Petrovich Brennan, BA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Mehrnaz Jenabi, MS, Great Neck, NY (*Abstract Co-Author*) Nothing to Disclose
Andrei I. Holodny, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study utilizes a seed-based approach to assess strength and laterality of resting state functional connectivity between the pre-SMA and language areas.

METHOD AND MATERIALS

Anatomical and resting state data for 30 right-handed healthy subjects were downloaded from the 1000 Functional Connectomes Database. Images were aligned, pre-processed, and converted to Talairach space using AFNI. A symmetric pre-supplemental motor area (pre-SMA) region of interest (ROI) was drawn in each subject for seed analysis; pre-SMA boundaries were defined by the vertical anterior commissure line (posterior), vertical line drawn from the genu of the corpus callosum (anterior), cingulate gyrus (inferior), and brain surface (superior). For each subject, voxel-wise Z-score maps of the entire brain were generated by correlating the average time-course signal in the pre-SMA ROI with that of each brain voxel. Z-score maps were averaged and a single T-score map was created, which represented correlation strength between brain voxel and the pre-SMA as a function of T-scores. Laterality indices [LI = (L-R)/(L+R)] using threshold-dependent voxel activation counts in left and right hemispheres were defined as significant when |LI| is greater than or equal to 0.2.

RESULTS

The pre-SMA had statistically significant resting state functional connectivity with language areas bilaterally, but connectivity strength was consistently greater in the left hemisphere. Among language areas, statistical significance ($T>2.46$; $p<0.01$) was seen in Broca's (L8.1, R7.2), Wernicke's (L6.5, R5.9), middle frontal (L7.1, R6.5), supramarginal (L7.6, R6.6), and angular (L6.7, R5.7) regions. Voxel activation was consistently left lateralized at higher T-score ranges; at $T>8$, Broca LI=0.33, Wernicke LI=0.36, left middle frontal LI=0.30, supramarginal LI=0.51, and angular LI=0.20.

CONCLUSION

The pre-SMA has resting state functional connectivity with brain language areas, with strongest connectivity to the left Broca's area in right-handed persons. Pre-SMA functional connectivity to language areas is consistently left-lateralized in right-handed persons.

CLINICAL RELEVANCE/APPLICATION

When evaluating neurosurgical candidacy, pre-SMA resting state connectivity may be able to inform language localization and laterality task-free, thus eliminating the most problematic step experienced in paradigm-driven fMRI.

NR320-SD-MOA2 Low Dose FDG Brain PET/CT Imaging to Monitor Deep Brain Simulation: A Methodology Demonstration in Patients with Alzheimer's Disease

Station #2

Participants
Jun Zhang, PhD, Columbus, OH (*Presenter*) Nothing to Disclose
Douglas W. Scharre, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Ali Rezai, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To demonstrate the methodology and feasibility of utilizing low dose brain FDG PET/CT in the management and response monitoring of deep brain simulation (DBS) in patients with Alzheimer's Disease (AD).

METHOD AND MATERIALS

Low dose (167±15 MBq) FDG brain PET/CT of 3 Alzheimer patients was performed on a time-of-flight system (Gemini TF 64, Philips

Healthcare) at 4 time points: 1) before DBS surgery, 2) after surgery with DBS off, 3) after surgery with DBS on, and 4) 19 months post-surgery. 15min brain PET was acquired in 55 minutes post FDG i.v. and reconstructed as 2mm in 128x128. Quantitative assessment of regional brain metabolism was performed using MIMSoftware (MIM Software Inc., Cleveland, OH). 43 normal 18F-FDG PET brain data sets were used as the standard comparison set. Statistical z-scores were calculated on a voxel-by-voxel basis for patient PET to identify metabolic regional variations and examine the cerebral hypo-metabolism characteristics in AD. Z-scores differences between restaging PETs and staging PET were calculated, co-registered to presurgical 3T MRI and displayed in 3D stereotactic surface projection (SSP).

RESULTS

Low dose FDG Brain PET obtained in all subjects showed desired image quality. Quantitative z-score mapping clearly identified hyper- and hypo-metabolic regions of the brain and patterns of brain metabolism changes by comparing patient PET with healthy group. Areas of statistically significant z-scores differences were extracted and highlighted with color-coded overlays to remove distracting areas that are subtle or not large enough to be considered statistically. Through z-score SSP, areas of decreased FDG tracer uptake as well as increased tracer accumulation (reduced hypometabolism) in patients after therapy were identified. The majority of areas with reduced hypometabolism concentrated in Brodmann areas 9, 10, 11 and orbitofrontal cortex regions.

CONCLUSION

Low dose FDG Brain PET is feasible to serve as a noninvasive, quantitative imaging methodology to monitor response to DBS therapy and enable a neuro metabolic insight into induced changes. The developed quantitative methodologies appear promising for the quantitative evaluation of response to therapy and potentially individual prognosis in AD patients.

CLINICAL RELEVANCE/APPLICATION

Low dose FDG Brain PET was shown to be a feasible, reproducible and quantitative imaging methodology to assess changes in brain metabolism after deep brain stimulation.

NR321-SD-MOA3 Reproducibility of GABA Measurements from MR Spectroscopy using MEGA-PRESS; The Effect of Different Voxel Placement and Increased Scanning Time

Station #3

Participants
Maiken Kirkegaard Brix, Bergen, Norway (*Presenter*) Nothing to Disclose
Lars Ersland, PhD, Bergen, Norway (*Abstract Co-Author*) Stockholder, NordicNeuroLab AS Board member, NordicNeuroLab AS Consultant, NordicNeuroLab AS
Mona K. Beyer, MD, PhD, Oslo, Norway (*Abstract Co-Author*) Nothing to Disclose
Kenneth Hugdahl, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Gerard Dwyer, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Renate Gruner, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
John C. Evans, Cardiff, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ralph Noeske, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander R. Craven, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The MEGA-PRESS MRS sequence for measurement of GABA in the human brain has become increasingly popular in examining conditions such as epilepsy, depression, schizophrenia etc. The present study addresses ongoing questions of reproducibility, focusing on optimizing the number of repetitions for two locations in the human brain.

METHOD AND MATERIALS

Two 20 minute long MEGA-PRESS acquisitions were performed: one from a 21ml volume in the mid anterior cingulate cortex (ACC) and one from a 12 ml volume in the left Broca's area in 21 healthy male volunteers (age 32.3 years ± 6.5(SD)). All subjects were scanned twice with identical protocols, one week apart. Subjects abstained from caffeine, alcohol, nicotine, chocolate, exercise and sex for the twelve hours prior to each examination. Data were acquired on a 3T GE Discovery 750 scanner with a 32-channel head coil. Each location (with randomized order) was examined with a MEGA-PRESS sequence (TE=68ms, TR=1800ms) for 328 repetitions..Spectroscopy data were partitioned into shorter sections, numerically equivalent to scans of progressively increasing duration, and compared between sessions. Data were preprocessed using in-house software, and quantified with LCModel version 6.3-1H; additional quality control prompted rejection of ACC data from two subjects.

RESULTS

In both regions, increasing the number of repetitions showed notable improvements in between-session reproducibility up to 218 repetitions. Further increases resulted in only modest gains, and actually decreased reliability beyond 262 repetitions (16 minutes), particularly in the ACC. This is likely the result of cumulative subject motion towards the end of the long scan. Best reproducibility for GABA in the ACC was coefficient-of-variation (CV) 10.4% (218 scans), compared with 4.7% in Broca's area (328 scans, vs 5.6% at 218 scans). Measurement of Glx (glutamate + glutamine) proved more reliable, with a CV of 6.0% in the ACC (246 scans) and 3.2% in Broca's area (246 scans).

CONCLUSION

Based on these findings, we can recommend an optimal number of repetitions between 220 and 256 (13-15 minutes) for MEGA-PRESS in either of these regions. We also suggest an upper bound on scan times, of 16 minutes.

CLINICAL RELEVANCE/APPLICATION

Establishing reliability of measurements while minimizing acquisition times is crucial for effective clinical application of quantitive MR spectroscopy.

NR322-SD-MOA4 Perimedullary Spinal Vein Enlargement Sign: Added Value for Differentiation between Intradural-Extramedullary and Intramedullary Tumors at MR Imaging

Station #4

Participants
Tao Gong, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Guangbin Wang, MD, Jinan, China (*Presenter*) Nothing to Disclose
Li Yang, MD, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine sensitivity and the specificity of the perimedullary spinal vein enlargement sign at MR Imaging in helping distinguish intramedullary tumors from intradural-extramedullar tumors.

METHOD AND MATERIALS

This study was approved by the ethics committee, for the retrospective nature, informed consent was waived, included a total of 124 consecutive patients (age range, 2-77 years; mean age, 46±8 years) with spinal intradural tumors: 112 tumors located in intramedullary (mean age, 45±7 years) and 12 extramedullary(mean age, 47±15 years), with histopathologic confirmation. The perimedullary venous enlargement sign around the tumor was evaluated at conventional T2 weighted MR Imaging and contrast enhanced MR Imaging sequence. Two readers independently assessed the venous enlargement sign, which were described and indicated as extramedullary-intradural tumors, both diagnostic sensitivity, specificity, accuracy and intra- and inter-observer agreement for the sign were calculated.

RESULTS

The spinal perimedullary venous enlargement sigh was easier to find out at the contrast enhanced MR images than T2 weighted images. Reader 1 found one of 12 intramedullary tumors, thirty-five of 112 extramedullary-intradural tumors demonstrated the venous dilation sign, in which schwannoma accounted for 25(69%), meningioma 6(17%), teratoma 4(11%), ependymoma 1(4%). Thirty-two venous enlargement sign were found by reader 2, which were all found out around extramedullary-intradural tumors, schwannoma accounted for 24(75%), meningioma 4 (12%), teratoma 4(12%). The sensitivity, specitivity and accuracy of the venous dilation sign for differentiating extramedullary-intradural tumors from intramedullary tumors were 31.4%, 91.7% and 61.9% by reader 1; 28.5%, 100%, and 60.2% by reader 2. Intraobserver agreement ($\kappa = 1$) and interobserver agreement ($\kappa = 0.946$) were excellent.

CONCLUSION

The perimedullary spinal vein enlargement sign has high specificity for extramedullary-intradural tumors, and is useful for spinal intradural tumors to differentiate extramedullary(especially schwannoma)from intramedullary.

CLINICAL RELEVANCE/APPLICATION

The presence of the perimedullary vein enlargement sign around the intradural spinal tumors at the T2 weighted images and contrast enhanced MR images was highly predictive for the presence of extramedullary tumors, especially of myoschwannoma.The sign is useful to differentiate extramedullary from intramedullary.

NR323-SD-MOA5 Large (≥3cm) Thyroid Nodule with Benign Cytology: Can Thyroid Imaging Reporting and Data System be Helpful in Predicting False Negative Cytology?

Station #5

Participants
Sejin Nam, MD, Incheon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jin Young Kwak, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hee Jung Moon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Hyun Yoon, MD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun-Kyung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the false negative rate of fine needle aspiration (FNA) of large thyroid nodule and validate the usefulness of Thyroid Imaging Reporting and Data System (TIRADS) in predicting false negative cytology for large thyroid nodule with benign cytology.

METHOD AND MATERIALS

From January 2010 to August 2014, 632 thyroid nodules with more than 3cm size (mean size, 40.0±9.1mm; range, 30-100mm) and subsequent benign cytology on US-FNA were included. Reviewing clinical features, false negative rate of cytology was evaluated. US features of internal composition, echogenicity, margin, calcifications, shape were evaluated, and thyroid nodules were classified according to TIRADS. TIRADS category 3 included nodules without any suspicious features of solidity, hypoechogenicity or marked hypoechogenicity, microlobulated or irregular margins, microcalcifications, and taller-than-wide shape. Category 4a, 4b, 4c, and 5 included nodules with one, two, three or four, or five suspicious US features. The malignancy risk was calculated. US feature associated with malignancy for these lesions were analyzed.

RESULTS

Of the 632 lesions, 26 lesions (4.1%) were malignancy and 606 (95.9%) were benign, suggesting 4.1% of false negative rate of FNA cytology. Of the 26 malignant lesions, the final pathology consisted mainly of follicular carcinoma minimally invasive (15 of 26) and follicular variant of papillary carcinoma (9 of 26). One case was a conventional papillary carcinoma and another one case was a malignant lymphoma. The malignancy risks of categories 3, 4a, 4b, and 4c nodules were 1.3%, 5.1%, 11.2%, and 11.8%, respectively. In the 164 nodules with surgery, the malignancy risks of category 3, 4a, 4b, and 4c nodules were 5.1%, 20.8%, 29.0%, and 50.0%.

CONCLUSION

Large thyroid nodule with benign cytology results had relatively high false negative risk of 4.1% and TIRADS was helpful in

predicting false negative cytology for these lesions. If the large thyroid nodule with benign cytology has any suspicious US feature, it should be considered as image-cytology discordance and additional work up such as core biopsy or surgery should be recommended.

CLINICAL RELEVANCE/APPLICATION

If the large (≥3cm) thyroid nodule with benign cytology has any suspicious US feature, additional work up such as core biopsy or surgery should be recommended.

NR324-SD-MOA6 Stent-Based Thrombectomy versus Intravenous Tissue Plasminogen Activator in Acute Ischaemic Stroke - A Systematic Review and Meta-Analysis

Station #6

Participants
Reuben Grech, MD, FRCR, Msida, Malta (*Presenter*) Nothing to Disclose
Mark Schembri, Msida, Malta (*Abstract Co-Author*) Nothing to Disclose
John Thornton, Dublin, Ireland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To date only a few studies have compared the effectiveness and functional outcomes of stent retrievers versus intravenous thrombolysis in acute ischaemic stoke. Our aim was to identify and collate all the available data and to assess for statistical differences in patient outcomes between the two treatments.

METHOD AND MATERIALS

We performed a systematic review and meta-analysis of studies with a randomized controlled design which utilised stentrievers and intravenous thrombolysis in acute ischaemic stroke.

RESULTS

Seven randomised controlled studies published or presented between 2013 and 2015 were identified. The first three studies namely IMS-III, MR RESCUE and SYNTHESIS Expansion utilised a stent-based device in less than 15% of cases. Conversely only second generation devices were utilised in the four RCTs (MR CLEAN, ESCAPE, EXTEND-IA and SWIFT PRIME) that followed. Because of excessive sub-group heterogeneity, only the last four trials were included in our meta-analysis.46.6% of patients treated with stentrievers achieved an independent functional outcome (mRS<2) at 90 days compared with 26.1% of those treated with intravenous thrombolysis with an odds ratio of 2.50 (p=0.00).A lower mortality rate was observed with stentrievers (14.7%) compared to intravenous thrombolysis (19.3%). Stentrievers were also associated with a lower risk of symptomatic intracranial haemorrhage. The differences in functional outcomes and safety profiles were statistically significant.

CONCLUSION

Stentrievers can achieve a high rate of recanalisation and functional independence in acute ischaemic stroke and have a relatively good safety profile. Our meta-analysis demonstrates a clear benefit of an intra-arterial mechanical approach versus standard treatment.

CLINICAL RELEVANCE/APPLICATION

'Our meta-analysis demonstrates a clear benefit of an intra-arterial mechanical approach versus standard treatment in acute ischaemic stroke '

NR325-SD-MOA7 Qualitative Comparison of 7 Tesla and 3 Tesla MRI in Drug Resistant Epilepsy

Station #7

Participants
David R. Pettersson, MD, Portland, OR (*Presenter*) Nothing to Disclose
Bronwyn E. Hamilton, MD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Gonzalo A. Romero, MD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Justin Meuse, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
William Rooney, PhD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Neil Roundy, Springfield, OR (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare 7 Tesla (7T) and 3 Tesla (3T) MRI in evaluation of patients with drug resistant epilepsy (DRE).

METHOD AND MATERIALS

Between March and July 2013, 10 patients with DRE were imaged using both 3T (Siemens Tim Trio) and 7T (Siemens Magnetom) MRI scanners, including isotropic (1 mm² or smaller) T1 MPRAGE and T2 weighted imaging. Two neuroradiologists graded each scan for normal tissue contrast, technical artifacts, motion artifacts, and lesion conspicuity, using a 4-point scale. A specific diagnosis was made if possible. Blinded independent reviews and unblinded consensus reviews were performed. References standards for potential epileptogenic lesions consisted of surgical pathology when available or consensus judgment of a multidisciplinary epilepsy team after review of relevant clinical data.

RESULTS

Ten subjects (mean age 28; age range 11-46) were included. Consensus review found 7/10 subjects had lesions on MRI including 3 focal cortical dysplasias (FCD), 2 mesial temporal sclerosis (MTS), and 2 encephaloceles; the remaining 3 subjects had inconclusive MRI scans. Surgical pathology confirmed 2 MTS and 1 FCD. For the remaining 4/7 subjects with lesions identified on research MRI scans, EEG, clinical history, and non-research imaging studies corroborated the diagnoses. Independent blinded reviews found normal tissue contrast was improved significantly (p<0.001), and technical artifacts worsened significantly (p<0.05) on 7T MRI compared to 3T. Independent review scores of lesion conspicuity of FCDs were improved in all 3 cases (figure 1) (p=0.064). Consensus review scores of lesion conspicuity of the 2 skull base encephaloceles was greatly decreased on 7T MRI, relating to

artifactual signal drop-out around the skull base ($p<0.001$).

CONCLUSION

Significantly improved tissue contrast was found at 7T MRI and likely contributed to the improved conspicuity of FCDs seen in 3 of the 10 subjects. Significantly worse technical artifacts were seen on the 7T scans, including signal drop-out around the skull base. Larger investigations of 7T MRI are needed to characterize the diagnostic accuracy of 7T MRI in evaluation of each of the several known epilepsy-related pathologies.

CLINICAL RELEVANCE/APPLICATION

7T MRI may outperform 3T MRI in identification and delineation of FCDs in patients with epilepsy. Signal drop-out around the skull base is a shortcoming of 7T MRI.

BRS-MOB

Breast Monday Poster Discussions

Monday, Nov. 30 12:45PM - 1:15PM Location: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants
Dipti Gupta, MD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

BR234-SD-MOB2 BI-RADS 5th Edition Breast Density Classification: Comparison of Radiologist and Automated System

Station #2

Participants
Delia M. Keating, MD, New York, NY (*Presenter*) Nothing to Disclose
Donna D. D'Alessio, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Kimberly N. Feigin, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

BI-RADS 5th edition includes a revised approach to breast density categorization that considers not only estimation of percentage volume of fibroglandular tissue but also subjective assessment of tissue distribution to better reflect potential to obscure a lesion. Our study compares radiologists' scores of breast density to those of an automated breast density system that considers percent volume density combined with texture and dispersion pattern of breast tissue, in a clinical setting

METHOD AND MATERIALS

Following IRB approval, we performed a HIPAA-compliant retrospective review of imaging reports of 401 bilateral and unilateral digital screening mammograms performed from January 2015 to March 2015 and compared BI-RADS mammographic density scores assigned by one of 13 radiologists who specialize in breast imaging to those assigned by a fully automated breast density system (VuCOMP, M-Vu Breast Density 2.1). Statistical analysis was performed with kappa statistic and Pearson chi- square test.

RESULTS

Of 401 asymptomatic patients who presented for bilateral or unilateral mammography, there was agreement of breast density scores in 241 (60%) yielding a kappa of 0.43, $p < .001$. The automated system underreported breast density: radiologists scored a, b, c, d in 13 ,31 ,45, 11% and automated system 20, 40, 30 , 9%, respectively. Pearson chi- square ($9, N = 401$) = 357.57, $p < .001$.

CONCLUSION

An automated breast density system that considers percent volume density as well as distribution of tissue, and that uses an algorithm that incorporates experts' scores to create category thresholds to align with BI-RADS 5th edition modifications may underreport breast density. Biases between radiologist scoring in a nonclinical, investigative setting and scoring in a clinical setting may contribute to these differences.

CLINICAL RELEVANCE/APPLICATION

Automated breast density software intends to lower subjectivity of density scores; however,compared to radiologists' scores the evaluated system underreports breast density in a clinical setting.

BR235-SD-MOB3 Screen Detected Breast Cancer Conspicuity on Digital Breast Tomosynthesis versus Digital Mammography

Station #3

Participants
Katrina Korhonen, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, Siemens AG
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Speaker, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Siemens AG
Samantha P. Zuckerman, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Marie Synnestvedt, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Elizabeth McDonald, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate breast cancer conspicuity on the digital mammography (DM) versus digital breast tomosynthesis (DBT) acquisitions of combination DBT/DM screening to determine whether detected cancers are better seen on DM or DBT.

METHOD AND MATERIALS

After IRB approval, 201 cases of screen detected cancers from over 3 years of DBT/DM screening were reviewed by two fellowship-trained breast imagers. Cancer conspicuity was assessed using a numerical scale ranging from not seen (0) to clearly seen (5). 4 cases were excluded due to incomplete images/reader omission leaving 197 for analysis. Conspicuity grades were averaged between readers and differences between DBT and DM were assessed by Wilcoxon signed rank test. Associations of conspicuity score were also compared with patient age and breast density. For single variable analysis, density was grouped into "high" and "low" (BIRADs 1 and 2 vs 3 and 4). Multivariable linear regression was performed to identify independent predictors of conspicuity. Analyses were conducted using JMP software, v12 (SAS Institute Inc., Cary, NC).

RESULTS

Cancers were significantly better seen on DBT (mean 4.2) than DM (mean 3.7) (p=<0.0001). Cancers were also significantly better seen on CC vs MLO view of both DBT (mean CC 4.2, mean MLO 3.9, p=0.012) and DM (mean CC 3.6, mean MLO 3.3, p=0.0459), noting that 9 cancers were not included on the CC field of view. On DM, increased density was associated with decreased conspicuity (mean 3.3 high and 4.0 low density, p=0.0013), even when controlling for age (p=0.0001). Conspicuity on DBT also decreased with increasing density (4.1 high and 4.3 low density), but this was not significant (p=0.08).

CONCLUSION

Cancers were more conspicuous on DBT than DM and seen better on the CC view of both studies. Additionally, increased density is significantly associated with decreased cancer conspicuity in DM but not in DBT.

CLINICAL RELEVANCE/APPLICATION

Screen detected cancers on DBT and DM may be better seen on the CC view with overall conspicuity decreasing as breast density increases.

BR236-SD-MOB4 Impact of 2D Reconstructed Mammograms on Patient Dose in the Clinical Practice of Tomosynthesis

Station #4

Participants
Bruno Barufaldi, BSC, MSc, Sao Carlos, Brazil (*Abstract Co-Author*) Nothing to Disclose
Samantha P. Zuckerman, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Marie Synnestvedt, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Speaker, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Siemens AG
Homero Schiabel, PhD, Sao Carlos, Brazil (*Abstract Co-Author*) Nothing to Disclose
Andrew D. Maidment, PhD, Philadelphia, PA (*Presenter*) Research support, Hologic, Inc; Research support, Barco nv; Spouse, Employee, Real-Time Radiography, Inc; Spouse, Stockholder, Real-Time Radiography, Inc
Mitchell D. Schnall, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the impact on radiation dose of 2D reconstructed mammograms (C-View; Hologic Inc., Bedford, MA) in combination with digital breast tomosynthesis (DBT) in clinical practice.

METHOD AND MATERIALS

In 2014-15 our clinical practice, consisting of four Selenia Dimensions (Hologic Inc.), transitioned from "Combo" imaging to "TomoHD". In Combo mode, both 2D and 3D x-ray images are taken during the same breast compression. In TomoHD mode, no 2D image is acquired; rather, synthesized 2D mammograms are generated from the 3D images. We studied the impact of this change on radiation dose. The study includes 3936 images of 991 women from two 13-day periods in 2014 and 2015. The average glandular dose (AGD) was extracted by automated custom software. The software tracks radiation dose in terms of approximately 60 data elements including patient age, breast thickness, x-ray spectrum, room, procedure identifier, and view position.

RESULTS

Various factors affect the radiation dose, including compressed breast thickness, breast density, and radiographic technique. Over the considered time period in 2014, 485 Combo studies were performed (average age 55.3y), with an average AGD per view of 4.28 mGy (1.95 mGy 2D; 2.33 mGy 3D). In the matching period in 2015, 506 TomoHD studies were conducted (average age 54.6y), with an average AGD of 2.42 mGy. This represents a 43% dose reduction. These data also suggest that a practice changing from 2D digital mammography to TomoHD DBT imaging would see approximately a 24% increase in patient dose.

CONCLUSION

The implementation of TomoHD DBT, in which synthetic mammograms replace radiographically acquired mammograms, resulted in a 43% reduction in radiation dose in our patient population.

CLINICAL RELEVANCE/APPLICATION

Institutions transitioning from Combo to TomoHD should expect about a 40% reduction in dose, while those changing from digital mammography to TomoHD DBT should expect about a 25% increase in dose.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Mitchell D. Schnall, MD, PhD - 2013 Honored Educator

BR238-SD-MOB6 Breast Cancer Recurrence in Patients With and Without Adjuvant Radiation Therapy

Station #6

Participants
Wade C. Hedegard, MD, Rochester, NY (*Presenter*) Nothing to Disclose
Andrea L. Arieno, BS, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Renee Morgan, RT, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To review time between original cancer diagnosis and recurrent breast cancer diagnosis in patients treated with breast conserving surgery with and without adjuvant radiation therapy.

METHOD AND MATERIALS

A retrospective, single-institution medical record review was performed of 9,005 breast cancers diagnosed at a community breast center from 2000-2013. We specifically evaluated 4,796 patients with 4,822 cancers treated with breast conserving surgery who developed an ipsilateral breast cancer recurrence. Charts were reviewed for patient demographics, clinical presentation for both primary and recurrent tumor, histopathology for both primary and recurrent tumor, time interval between the two diagnoses, tumor size for primary tumor, margin status for primary tumor, receptor status for primary tumor, and surgical treatment for recurrent tumor.

RESULTS

Of 4,796 patients with 4,822 cancers treated with breast conserving surgery, 171 (3.5%) had recurrent tumor diagnosed. 29% (50/171) of the recurrences were not originally treated with adjuvant radiation therapy. Average time interval between original diagnosis and recurrence was 3.86 years. 14 presented with calcifications, 34 mass, 1 mass with calcification and 1 palpable thickening, of which 16 were of non-invasive pathology and 34 were of invasive pathology. 71% (121/171) of the recurrences were treated with adjuvant radiation therapy. Average time interval between original diagnosis and recurrence was 5.75 years. 38 presented with calcifications, 72 mass, 2 MRI, 1 nipple change, 1 palpable thickening and 1 complicated seroma, of which 31 were non-invasive and 90 were invasive.

CONCLUSION

Recurrence in patients treated without radiation was on an average of 2 years earlier than those treated with radiation (3.86 v. 5.75 years, respectively).

CLINICAL RELEVANCE/APPLICATION

Adherence to a more stringent imaging surveillance protocol is essential in patients treated without adjuvant radiation.

BR136-ED-MOB7 Benign to Malignant Spectrum of Architectural Distortions on Digital Breast Tomosynthesis

Station #7

Awards
Certificate of Merit

Participants
Jennifer Young, MD, MPH, Los Angeles, CA (*Presenter*) Nothing to Disclose
Melissa M. Joines, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

With the advent of digital breast tomosynthesis (DBT), architectural distortions appear to be encountered more frequently as they are more easily visualized without overlying breast parenchyma obscuring features. After reviewing this presentation, participants will be able to:-Understand the role of DBT and reconstructed 2D images in identifying occult architectural distortions.-Identify architectural distortions on DBT and reconstructed 2D images.-Describe the histopathologic characteristics of various types of lesions that can present as architectural distortions.-Understand the management of the various types of lesions presenting as architectural distortions.

TABLE OF CONTENTS/OUTLINE

-Review and benefits of DBT-Review and benefits of synthetically reconstructed 2D images-Synthetically reconstructed 2D images vs conventional 2D images and pitfalls-Detection of architectural distortion on DBT-Review of lesions presenting as architectural distortions-including imaging (mammograms, DBT, reconstructed 2D images, and ultrasound), management, histopathology, and teaching points Post-procedural change Reduction mammoplasty Fat necrosis Radial scar Non-calcified ductal carcinoma in situ Invasive ductal carcinoma Invasive lobular carcinoma

MSMI23

Molecular Imaging Symposium: Oncologic MI Applications

Monday, Nov. 30 1:30PM - 3:00PM Location: S405AB

GU MI MR OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Moderator*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc
Umar Mahmood, MD, PhD, Charlestown, MA (*Moderator*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;

LEARNING OBJECTIVES

1) To understand the role of molecular imaging in cancer therapy. 2) To understand the impact that new molecular imaging agents could have on drug development. 3) To understand the barriers facing the development of new molecular imaging agents.

ABSTRACT

Molecular Imaging is expanding in many new directions. Most research is being performed for PET and SPECT agents. However, optical and MRI agents are also being developed. Molecular Imaging can play a role in accelerating the development and approval of new cancer therapeutics by quantifying the impact drugs have in early Phase studies and by selecting the most appropriate patients for trials. Molecular Imaging agents can be useful in determining the utility and mechanism of actions of drugs that are already approved and may provide insights to oncologists regarding the best treatment combinations for individual patients. Molecular Imaging methods have already expanded our knowledge of cancer behavior and this will ultimately lead to new forms of the therapy that will one day cure this dreaded disease.

Sub-Events

MSMI23A Overview of MI in Oncology

Participants
Peter L. Choyke, MD, Rockville, MD, (pchoyke@nih.gov) (*Presenter*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc

LEARNING OBJECTIVES

1) To understand the broad spectrum of activities in molecular imaging including PET, SPECT, optical and MRI. 2) To understand the potential impact of Molecular Imaging on cancer treatment.

ABSTRACT

Molecular Imaging is expanding at a rapid rate. This overview will provide a panoramic view of the field of Molecular Imaging and major trends that are emerging among the different modalities, PET, SPECT, optical, ultrasound and MRI that constitute molecular imaging.

MSMI23B Hyperpolarized MRI of Prostate Cancer

Participants
Daniel B. Vigneron, PhD, San Francisco, CA (*Presenter*) Research Grant, General Electric Company

LEARNING OBJECTIVES

View learning objectives under main course title.

MSMI23C Radiogenomics

Participants
Michael D. Kuo, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss the principles behind radgiogenomics and to highlight areas of clinical application and future development.

ABSTRACT

MSMI23D Somatastatin Receptor Imaging

Participants
Ronald C. Walker, MD, Nashville, TN, (ronald.walker@vanderbilt.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the advantages of 68Ga-somatostatin PET/CT over 111In-DTPA-octreotide imaging. 2) Detect patients likely to benefit from peptide receptor radiotherapy (PRRT).

ABSTRACT

68Ga-labeled somatostatin analogs (DOTATATE, DOTATOC and DOTANOC) PET/CT imaging provides higher resolution scans than 111In-DTPA-octreotide with less radiation, comparable cost, and imaging completion within 2 hours vs. 2-3 days. 68Ga-somatostatin analogs have a higher impact on care than 111In-DTPA-octreotide, including superior ability to identify patients likely to benefit from PRRT. This activity will provide results from the literature and the author's experience to illustrate the advantages of 68Ga-based PET/CT imaging of neuroendocrine tumors.

Active Handout:Ronald Clark Walker

http://abstract.rsna.org/uploads/2015/15003715/MSMI23D.pdf

MSMI23E Multimodal MI in Oncology

Participants
Umar Mahmood, MD, PhD, Charlestown, MA (*Presenter*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;

LEARNING OBJECTIVES

1) To understand strengths of various imaging modalities for specific target/disease assessment.

ABSTRACT

Each imaging modality has a set of characteristics that helps define optimal use. These constraints include sensitivity, depth of imaging, integration time for signal, and radiation dose, among other factors. Understanding when each modality can be used and when combining the relative strengths of differerent modalities can be synergistic allows greater molecular information to be acquired.

SSE01

Breast Imaging (MR Response to Tx)

Monday, Nov. 30 3:00PM - 4:00PM Location: Arie Crown Theater

BR MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Nola M. Hylton, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose
Constance D. Lehman, MD, PhD, Seattle, WA (*Moderator*) Research Consultant, General Electric Company;

Sub-Events

SSE01-01 DCE-MRI Early Predict Pathological Complete Response to Neoadjuvant Chemotherapy in Resectable Primary Breast Cancer

Monday, Nov. 30 3:00PM - 3:10PM Location: Arie Crown Theater

Participants
Ying-Shi Sun, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yanling Li, MD, Beijing, China (*Presenter*) Nothing to Disclose
Xiaoting Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Kun Cao, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To establish a predictive model using dynamic enhanced MRI multi-parameters for early predicting pathological complete response (pCR) to neoadjuvant chemotherapy (NAC) in breast cancer.

METHOD AND MATERIALS

In this prospective cohort study, 170 breast cancer patients treated with NAC were enrolled and were randomly grouped into training sample (136 patients) and revalidation sample (34 patients). DCE-MRI parameters achieved before the start of the NAC and at the end of the first cycle of NAC were screened to establish the predictive model by using multivariate logistic regression model according to pCR status. Receiver operating characteristic curves were conducted to assess the predictive capability. The association between MRI-predicted pCR status and survival outcomes was estimated by using the Kaplan-Meier method.

RESULTS

Multivariate analysis showed ΔAreamax, ΔI and ΔSlopemax were independent predictors for pCR, OR were 0.939(95%CI, 0.915 to 0.964), and 0.966(95%CI, 0.947 to 0.986), respectively. A predictive model was established "Y=-0.089*ΔAreamax - 0.022*ΔSlopemax", a cut-off point of 2.8 was determined. The AUC for training and revalidation sample were 0.908 (95%CI, 0.844 to 0.972) and 0.884 (95%CI, 0.772 to 0.998), respectively. MRI-predicted pCR status showed significant association with DFS (P=0.045), nearly significant association with RFS (P=0.086) and no significant association with OS (P=0.23).

CONCLUSION

The multi-parameter MRI model can be potentially used for early predicting pCR status and especially be used for accurately finding out patients not achieving pCR. MRI-predicted pCR status achieved at an early stage of NAC allows regimen refinement before definitive surgical treatment.

CLINICAL RELEVANCE/APPLICATION

This is the first time that a prospective study has constructed a multi-parameter MRI model for early predicting pCR to neoadjuvant chemotherapy in breast cancer patients. The pCR status achieved at an early stage of NAC before surgical resection allows in time regimen alteration and give an opportunity to refine treatment plans before definitive surgical treatment. This might also serve as an early indicator for predicting comparative effectiveness in clinical trials.

SSE01-02 Multiparametric Breast Magnetic Resonance Imaging (MRI) in Patients Eligible for Neoadjuvant Chemotherapy (NAC): Can We Predict Tumor Response According to Baseline Features?

Monday, Nov. 30 3:10PM - 3:20PM Location: Arie Crown Theater

Participants
Marta Maria Panzeri, Milan, Italy (*Presenter*) Nothing to Disclose
Francesco Ballati, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Claudio Losio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

NAC is the standard treatment of locally advanced breast cancer, but only a minority of the patients obtain a complete pathologic complete response (pCR), which correlates with prognosis. Identification of potential responders could avoid ineffective toxic treatment and delay in surgery. Breast MRI is considered the best technique for monitoring NAC, but there is no consensus on its predictive role. We evaluated the potential role of morphological, dynamic and functional tumor features, assessed with baseline MRI, as markers of tumor response to NAC.

METHOD AND MATERIALS

Seventy-two patients with histopathologically proven locally advanced breast cancer underwent baseline MRI (1.5T) before starting

NAC. T2 TSE sequences, diffusion-weighted imaging (DWI) and dynamic gadolinium-enhanced studies were performed. Morphological parameters included tumor size, morphology, presence or absence of pseudocapsule, oedema, rim enhancement, necrosis and vascular map. T2 signal intensity and Apparent Diffusion Coefficient (ADC) obtained from DWI were assessed. Dynamic parameters included kinetic curve patterns and contrast enhancement data (Maximum relative enhancement, Wash-in and wash-out rates, brevity of enhancement [BOE]). Final response to NAC was histopathologically defined. Univariate and multivariate analysis using logistic binary regression were performed.

RESULTS

All women completed NAC and 40% achieved a pCR. At univariate analysis, presence of peritumoral oedema was significantly associated with pCR [OR 3.33 (IC95%: 1.13-9.82), p=0.029]. Chemosensitive tumors showed higher mean ADC values [OR 1.03 (IC95%: 1.01-1.07), p=0.032]. BOE was higher in patients who achieved pCR [OR 1.08 (IC95%: 1.01-1.14), p=0.015]. At multivariate analysis, BOE [OR 1.08 (IC95%: 1.01-1.16), p=0.025] and mean ADC values [OR 1.03 (IC95%: 1.01-1.07), p=0.049] were significantly associated with pCR.

CONCLUSION

Some tumor features at baseline MRI are reflective of growth patterns and aggressiveness, influencing the response to NAC in different ways. BOE and ADC seem the strongest predictors of responsiveness.

CLINICAL RELEVANCE/APPLICATION

Quantitative DWI and Brevity of enhancement assessed with baseline Breast MRI can potentially predict chemosensitivity to NAC.

SSE01-03 Tumor Heterogeneity Patterns on DCE-MRI Parametric Response Maps May Augment Early Assessment of Neoadjuvant Chemotherapy in Locally Advanced Breast Cancer: A Pilot Study of ACRIN 6657/I-SPY 1

Monday, Nov. 30 3:20PM - 3:30PM Location: Arie Crown Theater

Participants
Jia Wu, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, Siemens AG
Andrew Oustimov, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Lauren Pantalone, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Ning Yu, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Yangming Ou, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Mark A. Rosen, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Angela DeMichele, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Christos Davatzikos, Philadelphia, PA (*Abstract Co-Author*) Shareholder, Gliomics LLC
Despina Kontos, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

PURPOSE

To investigate the performance of tumor heterogeneity metrics derived from parametric response mapping (PRM), in their capacity to predict early pathologic complete response (pCR) to neoadjuvant chemotherapy (NAC) in women with locally advanced breast cancer, based on longitudinal assessment of dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI).

METHOD AND MATERIALS

A subset 27 patients from ACRIN 6657/I-SPY 1 TRIAL were retrospectively analyzed. Four kinetic features (i.e., signal enhancement ratio, peak enhancement, wash-in and wash-out slope) were computed separately from DCE-MRI acquired before chemotherapy and at the first post treatment visit. For each feature, voxel-wise measures of variation during chemotherapy were assessed via PRM, and the degree of spatial heterogeneity for these voxel-level variations were quantified by selected statistical texture-based indices. The resulting heterogeneity-based PRM-index was compared with current standard measures in predicting pCR using logistic regression, where each model was also adjusted for age and tumor subtype. Performance was assessed via receiver operating characteristic (ROC) analysis.

RESULTS

After adjusting for patient's age and tumor subtype (ER/PR+, Her2+, TN), the heterogeneity-based PRM-index outperformed all current standard measures (AUC = 0.93 (95% CI: 0.83 - 1.00), PRM-index p-value = 0.08), including the "hot spot" signal enhancement ratio (SER) (AUC = 0.87 (95% CI: 0.71 - 1.00), SER p-value = 0.76), tumor longest diameter (LD) (AUC = 0.89 (95% CI: 0.67 - 1.00), LD p-value = 0.13), and tumor volume (AUC = 0.87 (95% CI: 0.71 - 1.00), volume p-value = 0.34). A similar trend was observed for unadjusted models, although classification performance was generally lower across all models.

CONCLUSION

Our study provides preliminary evidence that metrics of spatial tumor heterogeneity are valuable in revealing patterns of early tumor response to breast NAC, and could augment pCR prediction based on standard MRI measures, age and tumor subtype.

CLINICAL RELEVANCE/APPLICATION

Patterns of quantitative tumor heterogeneity analysis based on voxel-level DCE-MRI kinetic feature changes may augment early prediction of tumor pathologic response to breast neoadjuvant chemotherapy.

SSE01-04 Texture Analysis of Magnetic Resonance Images Predicts Ultimate Residual Cancer Burden (RCB) Scores in Patients Undergoing Neoadjuvant Chemotherapy for Breast Cancer

Monday, Nov. 30 3:30PM - 3:40PM Location: Arie Crown Theater

Participants
Shelley Waugh, PhD, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sarah J. Vinnicombe, MRCP, FRCR, Dundee, United Kingdom (*Presenter*) Nothing to Disclose
Colin Purdie, MBChB,PhD, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Richard A. Lerski, PhD, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

Marilyn Johnston, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrew Evans, MRCP, FRCR, Dundee, United Kingdom (*Abstract Co-Author*) Research Grant, SuperSonic Imagine Speakers Bureau, SuperSonic imagine
Alastair Thompson, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether lesion heterogeneity, as measured using texture analysis on Magnetic Resonance Imaging (MRI), is associated with residual cancer burden in patients receiving neoadjuvant chemotherapy (NAC) for primary breast cancer.

METHOD AND MATERIALS

IRB approval was waived for this retrospective study of anonymised data. T2-weighted images (voxel size: 1.1 mm3) from 61 consecutive patients undergoing a total of 6 cycles of anthracycline based NAC. All patients underwent baseline (pre-NAC) and interim (post 3-cycles of NAC) MRI examinations on a 32-channel 3.0T MRI scanner (Trio; Siemens, Erlangen) using a 7 element open breast biopsy coil. Texture analysis was performed using MaZda (University of Lodz, Poland) with manually placed regions of interest within the lesion on one slice matched between each imaging time-point. Lesion heterogeneity was assessed using the entropy feature as derived from the co-occurrence matrix.Final pathological response on the resected cancer was assessed using the Residual Cancer Burden (RCB), (calculated from tumour bed dimensions, cellularity and axillary node burden.

RESULTS

Patients who ultimately achieved a pathological complete response (pCR; RCB-0) or who had minimal residual disease (RCB-I) demonstrated a greater reduction in lesion heterogeneity between baseline and interim examinations compared with those who ultimately went on to have moderate (RCB-II) or extensive (RCB-III) disease at surgical resection (Figure 1). Average reduction in entropy values between baseline and interim examinations were as follows: pCR:20.0%, RCB-I:10.6%, RCB-II:6.8% and RCB-III: 3.4%.Differences in entropy change were highly significant ($p<0.001$; Mann-Whitney U) between the good responders (pCR and RCB-I) and the poor responders (RCB-II and RCB-III).

CONCLUSION

Changes in lesion T2 heterogeneity between baseline and interim MR examinations, as measured using texture analysis of T2-weighted images, can predict residual cancer burden after NAC for breast cancer.

CLINICAL RELEVANCE/APPLICATION

Changes in lesion T2 heterogeneity on MR imaging between baseline and 3 cycles of NAC are strongly associated with ultimate pathologic response and could therefore facilitate timely surgical planning.

SSE01-05 Higher Background Parenchymal Enhancement at Preoperative MRI: Association with Poor Prognosis in Breast Cancer Patients Treated with Neoadjuvant Chemotherapy

Monday, Nov. 30 3:40PM - 3:50PM Location: Arie Crown Theater

Participants
Ji Soo Choi, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Sook Ko, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Boo-Kyung Han, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Young Ko, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ga Ram Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively investigate whether background parenchymal enhancement(BPE) of the contralateral breast at preoperative dynamic contrast material-enhanced magnetic resonance imaging(DCE-MRI) are associated with therapy outcome in patients with unilateral invasive breast cancer after neoadjuvant chemotherapy(NAC).

METHOD AND MATERIALS

The institutional review board approved this retrospective study. Between 2009 and 2011, 170 women with unilateral invasive breast cancers had undergone NAC, and pre- and post-treatment DCE-MRI before curative breast surgery. Among these, 93 women (43 premenopausal women who performed pretreatment MRI between day 7 and 20 of the menstrual cycle, 50 postmenopausal women) were finally included in this study. MRI features (BPE grade [minimal, mild, moderate, severe] of contralateral breast, size and number of lesions, lesion kinetics, and the percent change of lesion size between pre- and post-treatment MRI) and clinicopathologic features (age, menopausal status, clinical tumor and nodal stages, pathologic response to NAC, tumor size, nuclear grade, immunohistochemical subtype, presence of lymphovascular invasion, and adjuvant therapy) were analyzed. Patients were grouped according to BPE grade (high [moderate or severe], low [minimal or mild]) of contralateral breast. A Cox regression model was used to determine the association between MRI features and disease-free survival after controlling for clinicopathologic variables.

RESULTS

Median follow-up was 46 months. There were 23 recurrent cases(2 ipsilateral breast, 6 regional, 15 distant). Multivariate analysis showed that high BPE of contralateral breast at pretreatment DCE-MRI(hazard ratio [HR]=4.242, P=0.005), lower change of lesion size between pre- and post-treatment MRI(HR=1.024, P=0.002), presence of lymphovascular invasion(HR=10.194, P<0.001), and triple negative cancer(HR=4.820, P=0.006),were independent factors associated with poor disease-free survival.

CONCLUSION

BPE of contralateral breast is significantly associated with long-term outcome of patients with unilateral invasive breast cancer who had undergone NAC. This study suggests that higher BPE at pretreatment DCE-MRI may have potential as a predictor for relatively poor outcome in breast cancer patients who undergo NAC.

CLINICAL RELEVANCE/APPLICATION

Higher BPE at pretreatment DCE-MRI may have potential as a predictor for relatively poor outcome in breast cancer patients who undergo NAC

SSE01-06 Baseline DCE-MRI and PET-CT as a Predictor of Pathologic Response in Patients Treated with Neodjuvant Chemotherapy (NAC) for Locally Advanced Breast Cancer

Monday, Nov. 30 3:50PM - 4:00PM Location: Arie Crown Theater

Participants
Loic Colleter, MD, Paris, France (*Presenter*) Nothing to Disclose
Emmanuelle Cauderlier, Caen, France (*Abstract Co-Author*) Nothing to Disclose
Marine Bricout, MD, Angers, France (*Abstract Co-Author*) Nothing to Disclose
Constance de Margerie-Mellon, Paris, France (*Abstract Co-Author*) Travel support, Guerbet SA
Marion Chapellier, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Marcela Albiter, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Eric De Kerviler, MD, Paris, France (*Abstract Co-Author*) Research Consultant, Galil Medical Ltd; Speaker, Guerbet SA
Cedric M. De Bazelaire, MD, PhD, Paris, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate DCE-MRI analysis and PET-CT at baseline for prediction of pathological response to neoadjuvant chemotherapy (NAC) in patients with locally advanced breast cancer.

METHOD AND MATERIALS

88 patients with locally advanced breast cancer treated with NAC followed in DCE-MRI at 1.5T and PET-CT were included in this retrospectively study. Perfusion parameters (Ktrans, Kep, Ve) and SUVmax were measured at baseline of the NAC. Imaging datas were compared with tumoral and nodal pathologic response and histopathological tumor characteristics (SBR, Ki67, Hormonal Receptors (HR), HER2, and p53).

RESULTS

Response were observed in 54 patients (61%) and non-response in 34 patients. Low Ve and high SUVmax were significatively associated with tumoral response to NAC (Ve, t-test, p = 0,0035 ; SUVmax, t-test, p = 0,0265). Other perfusion parameters were not significatively associated to pathological response. Low Ve and high SUVmax were significantly associated with histopathological agressivity markers (SBR III, Ki67 > 15%, negative HR, p53 muted). Only low Ve was associated with nodal response (t-test, p = 0,048).

CONCLUSION

Ve and SUVmax before NAC were associated with tumoral response and histopathological aggressivity markers.

CLINICAL RELEVANCE/APPLICATION

Ve and SUVmax before NAC can predict tumoral response and histopathological aggressivity markers.

SSE09

Gastrointestinal (Liver Functional Imaging)

Monday, Nov. 30 3:00PM - 4:00PM Location: E451A

GI MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Claude B. Sirlin, MD, San Diego, CA (*Moderator*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;
Aliya Qayyum, MBBS, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSE09-01 MR Elastography in Combination with MRI Proton Density Fat Fraction for Prediction of Advanced Hepatic Fibrosis in Adults with Non-Alcoholic Fatty Liver Disease

Monday, Nov. 30 3:00PM - 3:10PM Location: E451A

Participants
Paul Manning, MSc, La Jolla, CA (*Presenter*) Nothing to Disclose
Kang Wang, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Jonathan C. Hooker, BS, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
William Haufe, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Tanya Wolfson, MS, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Anthony Gamst, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Michael S. Middleton, MD, PhD, San Diego, CA (*Abstract Co-Author*) Consultant, Allergan, Inc Institutional research contract, Bayer AG Institutional research contract, sanofi-aventis Group Institutional research contract, Isis Pharmaceuticals, Inc Institutional research contract, Johnson & Johnson Institutional research contract, Synageva BioPharma Corporation Institutional research contract, Takeda Pharmaceutical Company Limited Stockholder, General Electric Company Stockholder, Pfizer Inc Institutional research contract, Pfizer Inc
Richard L. Ehman, MD, Rochester, MN (*Abstract Co-Author*) CEO, Resoundant, Inc; Stockholder, Resoundant, Inc; Research Grant, Resoundant, Inc
Rohit Loomba, MD, MSc, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Claude B. Sirlin, MD, San Diego, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;

PURPOSE

To determine in adults with non-alcoholic fatty liver disease (NAFLD), whether the combination of magnitude MRI (M-MRI)-estimated proton density fat fraction (PDFF) with MR elastography (MRE)-estimated liver stiffness improves the prediction of advanced fibrosis compared to MRE-estimated liver stiffness alone.

METHOD AND MATERIALS

This retrospective analysis included 123 adults with confirmed NAFLD (49 men, mean age 52 yrs, range 19-76 yrs) who underwent M-MRI and MRE within 90 days of liver biopsy. Biopsies were scored based on NASH CRN criteria; 46%, 27%, 14%, 9% and 4% of adults had stage 0, 1, 2, 3, and 4 fibrosis, respectively. Fibrosis stages 3-4 were considered to be advanced fibrosis. PDFF was estimated by M-MRI performed with low flip angle to avoid T1 weighting, and with six nominally in- and out-of-phase echoes to correct for T2*. Stiffness was estimated by each of two MRE methods (3D 40Hz, 3D 60Hz). Logistic regression was performed for each MRE method alone, and for each MRE method in combination with PDFF, to predict advanced fibrosis. AUROCs were calculated for each logistic regression model and compared pairwise using chi-squared tests.

RESULTS

For 3D MRE 40Hz and 3D MRE 60Hz, AUROCs (95% CI) for predicting advanced fibrosis with MRE alone were 0.960 (0.907, 1) and 0.948 (0.881, 1), respectively. AUROCs (95% CI) for predicting advanced fibrosis with MRE in combination with PDFF for these two methods were 0.970 (0.920, 1) and 0.962 (0.906, 1), respectively. Each of these AUROCs was significantly greater than the corresponding AUROC achieved with MRE alone (p-values 0.007 and 0.012).

CONCLUSION

In adults with NAFLD, M-MRI estimated PDFF combined with MRE-estimated liver stiffness provided a small but statistically significant improvement for predicting advanced fibrosis compared to MRE alone.

CLINICAL RELEVANCE/APPLICATION

Estimation of both hepatic PDFF and liver stiffness in a single MR examination may improve prediction of advanced fibrosis in adults with NAFLD, but further study is needed to confirm the results.

SSE09-02 Liver Hemodynamics Quantification with DCE-MRI for Hepatic Reserve Function Assessment in Patients with Post-hepatitic Liver Cirrhosis (PHLC)

Monday, Nov. 30 3:10PM - 3:20PM Location: E451A

Participants
Lan Zhang, Zhengzhou, China (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the value of (dynamic contrast-enhanced magnetic resonance imaging, DCE-MRI)for hepatic reserve function assessment in patients with Post-hepatitic liver cirrhosis (PHLC)

METHOD AND MATERIALS

Ten normal subjects, ten mild PHLC patients (Child-Pugh score 5-6)and ten moderate PHLC patients(Child-Pugh score 7-9)were prospectively enrolled and underwent DCE-MRI before clinical treatment. All data were calculated with Exchange Model fitting Pharmacokinetic curve and various parameters were measured, including volume transfer constant of the contrast agent(Ktrans), Reverse reflux rate constant(Kep), Volume fraction of EES(Ve), full perfusion (FP), hepatic arterial perfusion index(HPI), blood volume(BV),blood flow(BF) mean transit time(MTT). All data was assessed with ANOVA and LSD test was used to compare the differences between each two groups. $P < 0.05$ was considered statistically significant.

RESULTS

Compared with normal liver, increases of HPI and FP were found significant in mild PHLC group($p<0.05$), as well as in moderate PHLC group($p<0.01$). MTT was constant between normal group and mild PHLC group, but increased in moderate PHLC group($p<0.05$). BF was found no significant difference between normal and mild PHLC group, but decreased in moderate PHLC group($p<0.05$). BV was found no statistical difference between each two groups of three groups. Compared with normal group, Ktrans,Kep and Ve were found no significant in mild PHLC group ($p>0.05$), only Ve increased in moderate PHLC group ($p<0.05$).

CONCLUSION

The quantified DCE-MRI parameters, such as HPI, FP, MTT and Ve could be helpful to evaluate hepatic reserve function of PHLC.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI suggests that it could be used as an important index for the degree of PHLC and hepatic reserve function assessment.

SSE09-03 Biliary Tract Enhancement during the Hepatobiliary Phase in Gadoxetic Acid-enhanced MRI: Correlation with Non-invasive Biomarker Associated with Liver Function and Fibrosis

Monday, Nov. 30 3:20PM - 3:30PM Location: E451A

Participants
Yoshifumi Noda, MD, Gifu, Japan (*Presenter*) Nothing to Disclose
Satoshi Goshima, MD, PhD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Haruo Watanabe, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Kawada, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Nobuyuki Kawai, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiromi Ono, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Masayuki Kanematsu, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Kyongtae T. Bae, MD, PhD, Pittsburgh, PA (*Abstract Co-Author*) Patent agreement, Medtronic, Inc; Consultant, Otsuka Holdings Co, Ltd

PURPOSE

To evaluate the correlation between the magnetic resonance (MR) imaging measurements and non-invasive biomarker associated with liver function and fibrosis in gadoxetic acid-enhanced MR imaging.

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board and written informed consent was waived. One hundred thirty nine consecutive patients (89 men and 50 women, age range 33-87 years, mean age 67 years ± 12.6 [standard deviation]) with suspected a liver disease or liver tumor underwent gadoxetic acid-enhanced MR imaging. Patients were classified into two groups according to the model for end-stage liver disease (MELD) score: MELD group A, MELD sore ≤ 10 (n = 129); MELD group B, MELD sore > 10 (n = 10). We calculated the following liver function indices: the biliary tract structure-to-muscle signal intensity ratio (SIR), relative enhancement of the liver and, liver-to-spleen ratio. MR imaging measurements and Child-Pugh score or MELD score were then compared.

RESULTS

Multiple regression analysis showed that SIR of common bile duct and cystic duct were the most significantly correlated with Child-Pugh score ($P < 0.0001$) and MELD score ($P = 0.0017$), respectively. The sensitivity, specificity, and area under the receiver-operating-characteristic curve for the detection of patients with Child-Pugh class B or C, and MELD group B were 74%, 88%, and 0.86 with the SIR of common bile duct and 100%, 87%, and 0.94 with the SIR of cystic duct, respectively.

CONCLUSION

The SIRs of cystic duct and common bile duct can be a non-invasive and valuable imaging biomarker for the estimation of liver function.

CLINICAL RELEVANCE/APPLICATION

Our study demonstrated the SIRs of cystic duct and common bile duct possibly correlate with non-invasive biomarker associated with liver function and fibrosis. This index may be an important quantitative biomarker for the evaluation of liver function and fibrosis.

SSE09-04 Multidisciplinary Evaluation of Congestive Hepatopathy after Fontan Procedure - Preliminary Results

Monday, Nov. 30 3:30PM - 3:40PM Location: E451A

Participants
Natally d. Horvat, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Rocha Manoel, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Hilton M. Leao Filho, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Nana Ikari, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Aline Chagas, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Denise Vezozzo, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Joao Rafael T. Vicentini, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Brunna Oliveira, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Angelica Binotto, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Flair J. Carrilho, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Mariana P. Pacheco, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To analyze the frequency of hepatopathy in a group of patients submitted to Fontan Procedure (FP) at our Hospital.

METHOD AND MATERIALS

In this cross-sectional study, 15 patients from our Hospital Cardiology department were evaluated from august 2014 to december 2014. Inclusion criteria were age above 18 years old and at least 5 years after FP. These patients were submitted to laboratorial tests and to different imaging techniques of the liver: 1) CT with iodinated contraste media (ICM), 2) MRI with hepatobiliary contrast, 3) ultrasound (US) and 4) liver ultrasound elastography (Fibroscan® and ARFI). Three patients did not undergo CT because of history of allergic reaction to ICM.

RESULTS

Patients' mean age was 9 years (range 2 - 15) at the time of the final FP and 24 years (range 18 - 31) at the time of this study. No patients had clinical signs of liver disease or laboratorial findings indicating other hepatic disorders. Radiological features of hepatopathy were found in 14 (93%) patients at US, in 7 patients (73%) at CT and in all 15(100%) patients at MRI with overall agreement of 94%. Hepatic nodules were detected in 2 patients at US. Among the 12 patients that underwent CT, 3 presented hepatic nodules (25%), with a total of 12 nodules with mean size of 1.2 cm (range 1.1 - 2.2 cm). All nodules were hypervascular on arterial phase and were also characterized on MRI. Hepatic nodules were detected in 4 patients at MRI (27%) with a total of 13 nodules with mean size of 1.3 cm (range 1.1 - 2.2 cm). All nodules presented isosignal on T1WI, one was hypointense on T2WI, none presented diffusion restriction and all nodules were hypervascular in the arterial and hepatobiliary phases, except one that was hypovascular in these phases. Small hypervascular foci in the hepatobiliary phase MRI was seen in 11 patients (75%). All patients presented increasing liver stiffness at Fibroscan®, mean 20.0 kPa (range 6.7 - 24.0 kPa) and at ARFI, mean 1.96 (range 0.82 - 3.93).

CONCLUSION

Hepatic complications are frequent in patients who underwent FP including hepatic fibrosis, cirrhosis and hepatic nodules.

CLINICAL RELEVANCE/APPLICATION

A proper evaluation in patients submitted to FP is important to allow early recognition and treatment of liver complications. Hepatic nodules have been observed in FP patients but the nature of these nodules remains uncertain, although there are reports of malignancy.

SSE09-05 Measuring Hepatic Functional Reserve Using T1 Mapping with Gadoxetic Acid Enhanced 3T MR Imaging: A Preliminary Study Comparing 99mTc GSA Scintigraphy with Indocyanine Green (ICG) Retention

Monday, Nov. 30 3:40PM - 3:50PM Location: E451A

Participants
Tomohiro Namimoto, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masataka Nakagawa, Kumamoto, Japan (*Presenter*) Nothing to Disclose
Kie Shimizu, kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masafumi Kidoh, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Seitaro Oda, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Nakaura Takeshi, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Daisuke Utsunomiya, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

To test whether T1 mapping of liver parenchyma on gadoxetic acid (Gd-EOB-DTPA) enhanced 3T MRI correlates with the parameters of Technetium-99m galactosyl serum albumin (99mTc-GSA) scintigraphy and indocyanine green (ICG) retention for the measurementof liver functional reserve.

METHOD AND MATERIALS

Sixty-six patients (43 HCC, 18 metastasis, 5 CCC) awaiting liver resection or TACE were included in this retrospective study. T1 relaxation times of the liver post-contrast enhancement images were measured using Look-Locker sequences 20 minutes after Gd-EOB-DTPA administration. For 99mTc-GSA scintigraphy, the blood clearance index HH15 and LHL15 was recorded. ICG retention at 15 min was also recorded. Statistical analysis involved Kruskal-Wallis test and Pearson correlation.

RESULTS

The T1 relaxation times for Gd-EOB-DTPA-enhanced MRI showed significant differences between patients with normal hepatic function ($p < 0.01$) or mild hepatic functional damage ($p < 0.05$) and modelate hepatic functional damage defined by HH15. The T1 relaxation times for Gd-EOB-DTPA-enhanced MRI showed a constant increase from normal hepatic function to severe hepatic functional damage (normal, 313 ± 43ms; mild, 349 ± 89 ms; moderate, 489 ± 143 ms; severe, 491 ± 11 ms). Regression analysis showed a correlation between T1 relaxation times for Gd-EOB-DTPA enhanced MRI and other liver functional parameters (T1 versus HH15, $R2=0.38$; T1 versus LHL 15, $R2=0.30$; T1 versus ICG clearance $R2=0.57$; HH15 versus ICG clearance $R2=0.48$; LHL 15 versus ICG clearance $R2=0.45$).

CONCLUSION

The T1 relaxation time for Gd-EOB-DTPA enhanced MRI has the potential to serve as a representative of MRI-based liver functional

reserve. It is strongly correlated with ICG clearance and moderately correlated HH15/LHL15 with 99mTc-GSA.

CLINICAL RELEVANCE/APPLICATION

The T1 relaxation time for Gd-EOB-DTPA enhanced MRI has the potential to serve as a representative of MRI-based liver functional reserve.

SSE09-06 Visual Assessment of Graft Dysfunction in Liver Transplant Recipients Using Gadoxetic Acid-enhanced MRI

Monday, Nov. 30 3:50PM - 4:00PM Location: E451A

Participants
Nina Bastati, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Andreas G. Wibmer, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Dietmar Tamandl, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Jacqueline C. Hodge, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Henrik Einspieler, Vienna, Austria (*Presenter*) Nothing to Disclose
Sarah Poetter-Lang, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Ahmed Ba-Ssalamah, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether a qualitative visual scoring system, using specific features of gadoxetic acid-enhanced MRI, could be applied to estimate liver graft (OLT) function and survival probability.

METHOD AND MATERIALS

85 patients, 31 females (36.5%) and 54 males (63.5%) with a median age of 54.6 years were examined on a 3 Tesla MR. All patients received a bolus injection of 0.025 mmol/kg body weight of gadoxetic acid at 1 mL/sec. Dynamic imaging was subsequently performed, including a 20 minute hepatobiliary phase (HBP). Two readers independently analyzed the unenhanced and HBP-enhanced MR images qualitatively. The degree of contrast parenchymal enhancement, i.e, enhancement quality score EnQS) (0-2) and biliary CM excretion i, e. excretion quality score (ExQS) (0-4) as well as the persistence of signal intensity (SI) in the portal vein, the so-called 'portal vein sign (PVs) quality score (PVsQS) (0-1) on the HBP were assessed. A quantitative measurement on the unenhanced and HBP-enhanced MR images was performed, as well, to measure the relative liver parenchymal enhancement (RLE) at 20 minutes (i.e.HBP). The probabilities of graft survival were calculated by Kaplan-Meier survival estimates and Cox proportional hazard regression models with Firth's correction.

RESULTS

The inter-reader agreement for the qualitative assessment of EnQS, ExQS, PVsQS according to the suggested scale was almost perfect (k: 0.81). Univariate survival analysis showed that the EnQS, ExQS, and PVsQS were independently associated with the probability of graft survival, respectively.

CONCLUSION

Qualitative assessment using PVsQS, EnQS, and ExQS on gadoxetic acid enhanced-MRI allows us to estimate the graft survival probability after OLT.

CLINICAL RELEVANCE/APPLICATION

Gadoxetic acid-enhanced MRI can be used as a non-invasive imaging biomarker to predict the liver graft survival probability.

SSE10

ISP: Genitourinary (GU Intervention)

Monday, Nov. 30 3:00PM - 4:00PM Location: E351

GU CT IR MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Douglas S. Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose
Cary L. Siegel, MD, Saint Louis, MO (*Moderator*) Nothing to Disclose

Sub-Events

SSE10-01 Genitourinary Keynote Speaker: Renal Tumor Ablation-Current Status and Future Directions

Monday, Nov. 30 3:00PM - 3:10PM Location: E351

Participants
Ronald J. Zagoria, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

SSE10-02 Real-time MR-guided Renal Cryoablation: Technical Feasibility, Complications and Outcomes

Monday, Nov. 30 3:10PM - 3:20PM Location: E351

Participants
Georgia Tsoumakidou, MD, Strasbourg, France (*Presenter*) Nothing to Disclose
Herve Lang, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Guillaume Koch, MD,MSc, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Julien Garnon, MD, Strasbourg, France (*Abstract Co-Author*) Proctor, Galil Medical Ltd
Xavier Buy, MD, Bordeaux, France (*Abstract Co-Author*) Proctor, Galil Medical Ltd
Afshin Gangi, MD, PhD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

At present, major improvements in device development, as well as modern special designed MR-suites (with MR-compatible life support and anesthesia equipment) have made the performance of MR-guided percutaneous procedures not only feasible, but also attractive. We retrospectively reviewed our single institution experience with percutaneous MR-guided cryoablation of renal tumours for technical feasibility, complications and outcomes (oncologic, renal function).

METHOD AND MATERIALS

Between April 2009 and March 2015, 68 patients underwent percutaneous MR-guided renal cryoablation. All procedures were performed in an MR-interventional unit, using a 1.5T large bore, supra-conductive system. Real-time BEAT IRTTT (3-simultaneous-plane sequence) and high-resolution T2-Blade/HASTE sequences were used for probe positioning and ice-ball monitoring.

RESULTS

A total of 79 lesions in 68 patients were treated. Four patients were excluded because of less than 3 month follow-up. Twenty-one patients had a history of renal cancer (15 and 2 treated with total and partial nephrectomy, respectively, 4 with cryoablation). Mean maximal tumour diameter was 22mm (min 5, max 42). Biopsy results were available in 61 patients.Procedure related data (time, number-type of cryoprobes, ice ball size) were collected. Two freeze-thaw cycles were systematically performed. Hydrodissection was used in 37 patients.All procedures were technically successful. Local recurrent tumour was identified in six patients during the first six months of imaging follow-up. The local primary tumour control rate was 92%. One patient developed a late local recurrence at 3 years follow-up. Five out of six early and the late recurrence were treated percutaneously. Peri-operative major complication rate was 4.6% (one active bleeding necessitating embolization, one asymptomatic subcapsular hematoma, and one urothelial damage treated with ureteric catheter insertion). There was no procedural related death. Mean follow-up was 18 (3-70) months.

CONCLUSION

Percutaneous renal cryoablation can be performed with high technical and clinical success under MR-guidance. The real-time probe placement, high soft tissue contrast, multi-planar imaging, and the lack of ionizing radiation are some of the advantages of MR vs the CT-guidance.

CLINICAL RELEVANCE/APPLICATION

Percutaneous cryoablation of T1a renal tumours can be perfromed safely and with high tecnical sucesss under MR-guidance.

SSE10-03 Single Institution Review of Percutaneous Cryoablation in the Horseshoe Kidney: An Initial Experience

Monday, Nov. 30 3:20PM - 3:30PM Location: E351

Participants
Junjian Huang, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Thomas D. Atwell, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Anil N. Kurup, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Stephen Boorjian, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Robert Thompson, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

Grant D. Schmit, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To present the initial case series of percutaneous cryoablation of tumors in a horseshoe kidney.

METHOD AND MATERIALS

This is a single center retrospective review of 5 consecutive patients with a renal mass in a horseshoe kidney treated with percutaneous image-guided cryoablation from June of 2006 to August of 2013. Patient and tumor characteristics were extracted from the electronic medical record. Oncologic outcomes were defined using standardized criteria.

RESULTS

Average age of patient was 59 years old(4M, 1F), tumor size was 3cm(±1cm), and serum creatinine was 1.1±0.4. Of the 5 patients, 4 patients had biopsy proven clear cell renal cell carcinoma, and 1 patient had biopsy proven carcinoid. Technical success was achieved in all patients. The median follow-up duration is 19 months. There were no major complications. Transient elevation of creatinine, not requiring dialysis, occurred following treatment in one patient which has since normalized to baseline. A single patient had inguinal nerve pain that resolved within 3 months. Mean creatinine at follow-up was 1.1±0.3. All patients remain free of local tumor progression. Two patients expired 46 months and 24 months after ablation due to unrelated disease.

CONCLUSION

There is a paucity of data with regard to the safety, efficacy, and long term outcome of percutaneous cryoablation in the horseshoe kidney. From our initial series it seems that cryoablation is relatively safe in the treatment of small renal tumors, without impact on renal function. This is the first reported series of cryoablation in the horseshoe kidney and, in select patients, may present an alternative to surgical management.

CLINICAL RELEVANCE/APPLICATION

Percutaneous cryoablation represents an alternative treatment modality in patients with a small renal mass on a horseshoe kidney.

SSE10-04 Placement of Essure Tubal Occlusion Coils by Fluoroscopy; An Option when Hysteroscopic Placement Fails

Monday, Nov. 30 3:30PM - 3:40PM Location: E351

Participants
Amy S. Thurmond, MD, Portland, OR (*Presenter*) Nothing to Disclose

PURPOSE

Nonsurgical tubal occlusion by Essure coils was FDA (Food and Drug Administration) approved in 2002 for hysteroscopic placement by gynecologists. Occasionally hysteroscopic placement of one or both coils is not possible--or the coil perforates or is expelled from the tube. Fluoroscopic fallopian tube catheterization has been used since 1987 as a nonsurgical method for unblocking proximal tubal occlusion in women with infertility. The feasability of fluoroscopic fallopian tube catheterization for placement of Essure coils was explored.

METHOD AND MATERIALS

Women were referred by their gynecologists because of complications after hysteroscopic placement of the Essure device. No pre-medication, sedation, or anesthesia was given. Commercially available equipment was used to perform hysterosalpingogram, fallopian tube catheterization, and Essure placement. Equipment consisted of a 9 Fr balloon catheter for use in the cervix and uterus (Cook Medical), a 5 Fr catheter and 0.035 inch diameter hydrophilic guidewire for use in the fallopian tube (Cook Medical), and the Essure device and delivery system (Bayer Pharmaceutical).

RESULTS

Twelve women had attempt at fluoroscopic Essure placement in 14 tubes. Procedure was successful in 12/14 tubes (86%), including 5 tubes where hysteroscopic placement had failed, 2 tubes where hysteroscopic placement resulted in perforation, 3 tubes in which device was expelled after hysteroscopic placement, and 2 tubes with hydrosalpinx. Fluoroscopic placement failed in 2 tubes, in one because of severe tubal spasm which was also the reason for hysteroscopic failure, and in one tube (in which device had been expelled) because of pain during the procedure attributed to severe endometriosis.There were no complications.Six women have had post-procedure confirmation hysterosalpingograms required by the FDA and all 6 tubes with devices placed fluoroscopically were occluded (100%).

CONCLUSION

Ten of 12 high risk women (83%) who had failed Essure placement by hysteroscopy on one or both sides had subsequent successful fluosocopic procedures allowing them to rely on the Essure devices for tubal occlusion. Twelve of 14 tubes (86%) were amenable to fluoroscopic placement of the Essure device.

CLINICAL RELEVANCE/APPLICATION

Ten of 12 women (83%) who would have been considered Essure failures and referred for tubal ligation, were converted to Essure successes by fluoroscopic placement of the device.

SSE10-05 Percutaneous Embolization of Varicocele By Steel and Platinum Coils

Monday, Nov. 30 3:40PM - 3:50PM Location: E351

Participants
Syed Muhammad Faiq, MBBS, Karachi, Pakistan (*Presenter*) Nothing to Disclose
Khair Muhammad, MBBS, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose
Waseem A. Mirza, MBBS, Karachi, Pakistan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The goal of this study was to present our experience with percutaneous treatment of male varicocele in view of procedural, clinical aspects in adult population.

METHOD AND MATERIALS

45 male with clinical moderate to severe varicocele associated with scrotal swelling with "bag of worms" or discomfort in testes, such as heaviness or dull pain after standing all day, referred from urology outpatient department to Radiology Department, where Doppler ultrasound was done which confirms the grade and patient underwent percutaneous varicocele embolization with coil.

RESULTS

The procedural success rate for spermatic vein occlusion was 93%. Follow-up, achieved of every patient after 6 month in urology outpatient department. Forty two patients (93%) reported disappearance of varicocele and as well as pain relief. In two patients percutaneous embolization procedure failed due to internal jugular vein approach and congenital venous abnormality. None of patients reported a reappearance of their varicocele. No significant complications occurred in 42 patients except pain in two patients and hematoma in two patients at femoral punctured site: none had any 6 months sequelae

CONCLUSION

Percutaneous embolization of varicocele carried out as outpatient procedure under local anesthesia and is more beneficial to patient in comparison to surgery. It has high procedural success rates, less recurrence rate, when performed by experience interventional radiologist. We believed primary therapy for varicocele treatment should be embolization if we compared various risk factors associated with surgery.

CLINICAL RELEVANCE/APPLICATION

Procedural and clinical success in elimination of varicocele by steel or platinum coils with low rate of failure and reappearance up to 6 month. High failure rate was seen in our study through internal jugular vein approach for venous access. We believed primary therapy for varicocele treatment should be embolization if we compared various risk factors associated with surgery.

SSE10-06 Hysterosalpingo-foam Sonography (HyFoSy): A Prospective Observational Cohort Study of an Innovative, Radiation Free, Safe and Effective, Non(Embryo) Toxic Technique, to Visualize Tubal Patency in an Outpatient / Office Setting

Monday, Nov. 30 3:50PM - 4:00PM Location: E351

Participants
Anurag Singh, MBBS,MD, Sharjah, United Arab Emirates (*Presenter*) Nothing to Disclose
Tejashree Singh, Dubai, United Arab Emirates (*Abstract Co-Author*) Nothing to Disclose
Kiran C. Patil JR, MD, Jalgaon, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study was conducted to evaluate the efficacy and safety of HyFoSy as a first step routine office procedure for tubal patency testing.

METHOD AND MATERIALS

A prospective observational cohort study was conducted in a medical center from 26/11/2014 - 4/4/2015. 46 patients with subfertility were examined. The mean age of patients was 31 years. The mean duration of subfertility was 2.2 years. The patients were asked to report for the test, on days 7-9 of their menstrual cycle. All patients were at low risk for tubal disease and had no history of tubal surgery. A non(embryo) toxic foam was created by rigorously mixing 10 ml hydroxymethylcellulose glycerol gel (88.25% water) with 10 ml purified water to give a mixture containing 94.10% water in a 20 ml syringe, and was introduced into the uterine cavity with the help of a disposable 5F single balloon catheter. This foam had low viscosity and was sufficiently stable to show echogenicity for at least 5 minutes. Tubal patency was determined by transvaginal ultrasound demonstration of echogenic dispersion of foam through the Fallopian tubes and the peritoneal spillage. The tubal contour, length and relation of spill with respect to ipsilateral ovary, were also noted. The pain score was calculated. No precautions with regard to pregnancy were advised.

RESULTS

In 45/46 (98%) patients (except 1 case of cervical stenosis), a successful procedure was performed. In these cases, there was no further need for a hysterosalpingogram (HSG). 42 patients (94%) had bilateral patent tubes and 3 patients (6%) had unilateral patent tubes. Only 1 patient (1/45; 2%) had mild vasovagal discomfort during the procedure that resolved spontaneously. The average pain score was 2.2. All procedures were uneventful and no serious side-effects were observed. Furthermore, in 10 patients (22%) conception occurred within a median of 3 months after the procedure. Review of literature found our results comparable with other similar studies.

CONCLUSION

Thus, HyFoSy is a successful, less painful and radiatian free technique, easily performed in an office setting as a first step test for tubal patency.Comparison with other tubal patency tests was done as per the literature evaluation and our old experiences. It showed excellent findings in favor of HyFoSy.

CLINICAL RELEVANCE/APPLICATION

HyFoSy is a radiation free, less painful, non(embryo) toxic, effective alternative to HSG and definitely has a potential to be the new generation patient friendly first step office test for tubal patency.

SSE11

Genitourinary (Renal Stone Imaging)

Monday, Nov. 30 3:00PM - 4:00PM Location: E353B

CT GU MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Naoki Takahashi, MD, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

SSE11-01 In Vitro Imaging of Kidney Stones in Pig Kidneys Using Ultra-short Echo-time (UTE) MRI

Monday, Nov. 30 3:00PM - 3:10PM Location: E353B

Participants
El-Sayed H. Ibrahim, PhD, MSc, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Robert A. Pooley, PhD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Joseph G. Cernigliaro, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Mellena D. Bridges, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
Jamie G. Giesbrandt, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose
James C. Williams, PhD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
William E. Haley, MD, Jacksonville, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Ultra-short echo-time (UTE) MRI provides echo times (TE) in the range of tens of microseconds, which allows for effective imaging of tissues that have rapid signal decay, e.g., kidney stones. In this study, we investigate the imaging performance of UTE MRI for stones embedded within their usual milieu, the kidney, thus mimicking the in vivo situation.

METHOD AND MATERIALS

24 kidney stones passed/extracted from patients were obtained. The stones represented 8 different types (confirmed by micro CT): calcium oxalate monohydrate (COM), calcium oxalate dehydrate (COD), brushite, apatite, uric acid (UA), struvite, cystine, and mixed-composition. Each stone type was represented by 3 stones in a range of sizes: small (2-3 mm), medium (4-6 mm), and large (7-10 mm). A total of 8 pig kidneys, purchased from a local meat store, were used in the experiments. Using small cuts, three stones (large, medium, and small) of the same type were inserted into each kidney, each into a different calyx (Fig 1a). The kidneys were arranged in a small plastic container filled with water and covered with a sealed lid (Fig 1b), and then imaged on a Siemens 3T MRI scanner using an 18-channel body surface coil and an optimized 3D UTE pulse sequence.

RESULTS

All stones were successfully visualized. The resulting images clearly showed the stones' shapes with high resolution (Fig 1c). Although efforts were made to expunge air bubbles throughout the pre-scan process, air gaps still existed inside some of the kidneys, which resulted in some artifacts. Using the body surface coil and large FOV did not adversely affect stone visualization, which is promising for future in vivo imaging.

CONCLUSION

This study confirms the potential of MRI for in vitro imaging of stones in kidneys using the body surface coil, which is one step closer to in vivo imaging than phantom experiments with head or knee coils. If successful for true in vivo imaging, the UTE technique could serve as an alternative to CT for imaging patients for whom minimization of radiation exposure is desirable. The sequence could be also added to abdominal MRI protocols for comprehensive evaluation of the genitourinary system.

CLINICAL RELEVANCE/APPLICATION

Although CT is the modality of choice for imaging kidney stones, UTE MRI may provide an effective alternative when there are concerns about radiation exposure.

SSE11-02 Low-dose Abdominal Computed Tomography for Urinary Stone Disease - Impact of Additional Spectral Shaping on Image Quality and Dosage

Monday, Nov. 30 3:10PM - 3:20PM Location: E353B

Participants
Patricia Dewes, MD, Frankfurt, Germany (*Presenter*) Nothing to Disclose
Claudia Frellesen, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Jan-Erik Scholtz, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Sebastian Fischer, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Ralf W. Bauer, MD, Frankfurt, Germany (*Abstract Co-Author*) Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Boris Schulz, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate a novel tin filter based abdominal CT technique for urolithiasis in terms of image quality and radiation exposure.

METHOD AND MATERIALS

130 consecutive patients with suspected urolithiasis underwent non-enhanced CT in our department with various techniques: 48 patients were examined with a novel tin filtration (150kV Sn) method (group 1) on a third-generation dual-source-CT, 33 patients were examined with automated kV-selection (80-140kV) based on the scout view with the same CT-device (group 2) and 49 patients were examined on a second-generation dual-source-CT (group 3) also with automated kV-selection (80-140kV) based on the scout view. Automated exposure control was active in all groups. Image quality was subjectively evaluated on a 5-point-likert-scale by two radiologists and interobserver agreement as well as signal-to-noise-ratio (SNR) was calculated. Dose-Length-Product (DLP) and volume based CT weighted Dose Index (CTDIvol) were used to analyze radiation exposure.

RESULTS

Image quality was rated in favour for the tin filter protocol with an excellent interobserver agreement (ICC=0.86-0.91). SNR was significantly better in group 1 and 2 compared to second-generation DSCT ($p<0.001$). On third-generation dual-source CT, there was no significant difference in SNR between the 150 kV Sn and the CAREkV protocol ($p=0.5$). DLP of group 1 was significantly lower in comparison to group 2 and 3 by 23% and 27% (93 vs. 122 vs. 127mGycm; $p<0.002$). CTDIvol of group 1 was significant lower compared to group 2 (-36%) and 3 (-32%) (1.95 vs. 3.09 vs. 2.87 mGy; $p<0.001$).

CONCLUSION

Additional shaping of a 150kV spectrum by a tin filter substantially lowers patient exposure while improving image quality on abdominal Computed Tomography for urinary stone disease.

CLINICAL RELEVANCE/APPLICATION

The novel tin filtered technique reduces radiation exposure and improves image quality in comparison to standard low- dose abdominal CT, thus serving to benefit the patient.

SSE11-03 Predictive Value of Low Dose and Dual-Energy CT for Successful Stone Disintegration in Shock Wave Lithotripsy: An in-Vitro Study

Monday, Nov. 30 3:20PM - 3:30PM Location: E353B

Participants
Sebastian Winklhofer, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Largo Remo, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Christian Fankhauser, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Cedric Poyet, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Pirmin Wolfsgruber, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Tullio Sulser, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Hatem Alkadhi, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Paul Stolzmann, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Shock wave lithotripsy (SWL) represents the golden treatment for urinary stone disease. Failure of stone disintegration results in repeated treatments or alternative procedures, thereby not only increasing medical costs. The ability to predict successful SWL will improve the selection of patients suitable for SWL. This study investigates single energy computed tomography (SECT) and dual-energy computed tomography (DECT) to predict numbers of shock waves to stone disintegration in an in-vitro setting.

METHOD AND MATERIALS

A total of 33 human urinary calculi (10 uric acid, 8 hydroxyapatite, 6 calcium oxalate monohydrate, 5 cysteine, 3 struvite, 1 brushite stones, mean size 6±3 mm) were scanned using a 128-slice DECT machine (Somatom Force, Siemens Healthcare, Forchheim, Germany) with single- (120kVp) and dual-energy settings (80/150, 100/150kVp) resulting in 6 different SECT and DECT data sets. Calculi were disintegrated using an electromagnetic Dornier DL50 lithotrypter (Dornier MedTech, Wessling, Germany) over a 2-mm mesh until succesful disintegration.

RESULTS

All stones were successfully disintegrated by applying a median of 72 shock waves (interquartile range 343). Regarding logistic regression analysis, CT numbers significantly ($p<0.01$) predicted fewer or more than median shock waves to successful disintegration and differed among data sets ($p<0.05$), both adjusted for stone composition ($p<0.001$) and size ($p<0.001$). Correlation coefficients ranged from rho=0.36 to 0.68 with best correlation for CT numbers and shock waves at 80 kVp ($p<0.001$).

CONCLUSION

Lower CT numbers are significantly associated with fewer shockwaves needed which is independent of stone composition and size. Optimal prediction of SWL success may be fascilated on the basis low-dose CT data which is paralleled by a low radiation dose.

CLINICAL RELEVANCE/APPLICATION

Being able to predict the success of shock wave lithotripsy with low-dose computed tomography would be helpful to determine the optimal management in patients with urinary calculi.

SSE11-04 Feasibility of Split-filter Dual-energy CT for in-Vitro Differentiation of Urinary Stones by Using Dose-neutral (Compared with Single-energy CT) Protocol

Monday, Nov. 30 3:30PM - 3:40PM Location: E353B

Participants
Anushri Parakh, MBBS,MD, Basel, Switzerland (*Presenter*) Nothing to Disclose
Daniel Boll, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Andre Euler, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Caroline Zahringer, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Fabian Morsbach, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Daniel Mueller, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Geraldine Stadelmann, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Sebastian T. Schindera, MD, Basel, Switzerland (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Ulrich GmbH & Co KG; Research Grant, Bayer AG

PURPOSE

The study aimed to examine the efficacy of a novel split-filter (using gold and tin filters) single-source dual-energy CT (sf-DECT) in characterizing renal stones as compared to second-generation dual-source dual-energy CT (ds-DECT) in intermediate-sized phantoms using vendor-suggested and dose-neutral (to single-energy CT) protocols.

METHOD AND MATERIALS

Urinary stones (n=65, size: 2.1-6.4mm) of known chemical composition (15 calcium, 15 struvite, 15 cystine and 20 urate) were embedded in a custom-made kidney model and placed in a 30-cm cylindrical water-containing phantom simulating a medium-sized patient. Scans with vendor-recommended and dose-neutral protocols were performed on ds-DECT (SOMATOM Definition Flash, Siemens; protocol A (vendor-suggested) tube A, 100kVp, 210 reference mAs; tube B, Sn140kVp, 162 reference mAs; protocol B (dose-neutral) tube A, 100kVp, 65 reference mAs; tube B, Sn140kVp, 50 reference mAs) and sf-DECT (SOMATOM Definition Edge, Siemens; protocol C (vendor-suggested) AuSn 120kVp, 640 reference mAs; protocol D (dose-neutral) AuSn 120kVp, 235 reference mAs). Stones were assessed by a dedicated post-processing software. Positive (PPV) and negative (NPV) predictive values were calculated. A comparison of radiation doses between both dual-energy techniques was made using CTDIvol parameter.

RESULTS

The CTDIvol (in mGy) for protocols A to D measured 13.7, 4.3, 11.2 and 4.4 respectively. Presence of all stones was detected by the four protocols. The PPV of protocols A-D to characterize urate stones were 95.2, 95.2, 94.1 and 58.6 and for non-urate stones were 100, 100, 93.6 and 96.9, respectively. For clinically significant stones (>4 mm), the PPV for characterizing urate or non-urate stones (100 for both) by protocols A and B was not affected. For the same stone size, PPV of protocols C vs. D were 100 vs 76.9 for urate and 96.4 vs. 96.0 for non urate stones. Dose-neutral sf-DECT was particularly inferior to ds-DECT in characterizing urate stones and stones which were less than 4 mm.

CONCLUSION

While dose-optimization is feasible in differentiation of urate from non-urate stones by ds-DECT for smaller stones, it is accurate for sf-DECT if they are greater than 4 mm in size.

CLINICAL RELEVANCE/APPLICATION

Sf-DECT is a promising new tool for dual-energy evaluation with a benefit of reduced radiation dose as compared to second-generation dual-energy technique.

SSE11-05 Virtual Non-enhanced Images Generated from Spectral CT: Determinants of Detection of Urinary Calculi in the Renal Collecting System

Monday, Nov. 30 3:40PM - 3:50PM Location: E353B

Participants
Yan Chen, Zhengzhou, China (*Presenter*) Nothing to Disclose
Peijie Lv, MMed, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jianbo Gao, MD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine which features of urinary calculi are associated with their detection on VNE images generated from Spectral computed tomograpic(CT) urography.

METHOD AND MATERIALS

This retrospective study was approved by the insititutional ethics committee with waiver of informer consent.A total of53 patients were examined with true nonenhanced (TNE) CT and Spectral CT urography in the excretory phase. Thecontrast medium was virtually removed from excretory-phase images by using material suppressed iodine(MSI),water-based (WB) and calcium-based (CaB) material decomposition (MD) analysis in the spectral imaging viewer.Thesensitivity regarding the detection of calculi on these three groups and the subjective scoring were determined byusing true non-enhanced (TNE) images as the reference standard , and interrater agreement was evaluated byusing the Cohen k test.By using logistic regression, the influences of image noise, attenuation, and stone size, as well as attenuation of the contrast medium, on the stone detection rate were assessed on VNE images.

RESULTS

169 stones were detected on the TNE images;149 stones were identified on CaB images (sensitivity,88.2%),145 stoneson WB images(sensitivity, 85.7%),whlie 160 stones on MSI images(sensitivity,94.6%) with significant difference.Compared with the TNE images,the relatively lower subjective scoring of the VNE images (P>0.05) and higher SNR,CNR(P<0.05)were identified. Size (long-axis diameter and short-axis diameter), and attenuation of the calculi,except for the image noise were significantly associated with the detection rate on VNE images (P<0.05). As thresholdvalues on CaB, WB, MSI images, size larger than 2.68 mm , 3.01mm , 2.03mm,maximum attenuation of the calculigreater than 223 HU, 312HU and 203HU respectively were found.

CONCLUSION

After virtual elimination of contrast medium with material decomposition and MSI, large and high-attenuation calculi can be detected with high reliability.

CLINICAL RELEVANCE/APPLICATION

VNE images generated at excretory-phase Spectral CT can depict calculi larger than 2.03mm in the presence ofcontrast medium; however, small and hypoattenuating calculi may be missed.

SSE11-06 Improved Differentiation between Uric Acid and Non-uric Acid Renal Stones Using DECT Monoenergetic Imaging

Monday, Nov. 30 3:50PM - 4:00PM Location: E353B

Participants
Fabio Lombardo, MD, Verona, Italy (*Presenter*) Nothing to Disclose
Matteo Bonatti, MD, Bolzano, Italy (*Abstract Co-Author*) Nothing to Disclose
Giulia A. Zamboni, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Federica Ferro, Bolzano, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Pozzi Mucelli, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Giampietro Bonatti, Bolzano, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate monoenergetic attenuation values of renal stones for discriminating between uric acid and non-uric acid stones.

METHOD AND MATERIALS

IRB-approved retrospective study; need for informed consent was waived. We included in our study 37 patients (23M, 14F; mean age 54y) who underwent CT for symptomatic urolithiasis on our second-generation dual-source scanner. We performed a 120kV single-energy low-dose acquisition of the whole abdomen followed by one or more 100/140kV dual-energy acquisitions limited to the regions in which one or more stones were detected. All patients subsequently underwent stone extraction or they spontaneously expelled the stone within 1 month from the examination; all the obtained stones were analyzed by means of infrared spectroscopy and classified, according to their prevalent composition, as uric acid or non-uric acid stones. When patients had >1 stone, their composition was considered the same for all the stones. Stones largest diameter was noted. One radiologist in training evaluated by means of a round ROI the monoenergetic attenuation values of the stones from 40 to 190 kV. 40/190kV monoenergetic attenuation ratios were calculated. A qualitative analysis on the monoenergetic curves was also performed.

RESULTS

75 stones were detected in 37 patients; 36 stones were located in the urinary calices, 13 in the renal pelvis, 25 in the ureters and 1 in the urinary bladder. Mean diameter was 6.1 mm (range 2-28 mm). At spectroscopy, 16/75 stones were prevalently composed by uric acid and 59/75 by cysteine or calcium oxalates/phosphates. Mean 40/190kV monoenergetic attenuation ratios were 0.82 for uric-acid stones (range 0.30-1.34) and 3.82 for non-uric acid stones (range 2.18-7.35)($p<0.0001$). All uric-acid stones were correctly characterized using a cut-off of 1.5. Qualitative analysis of monoenergetic curves showed a different and easily recognizable shape both for uric acid and non-uric acid stones.

CONCLUSION

40/190 kV attenuation ratios accurately differentiate uric acid from non-uric acid stones. Furthermore, qualitative analysis of monoenergetic curves can be an easy method to rapidly assess stone composition.

CLINICAL RELEVANCE/APPLICATION

40/190 kV monoenergetic attenuation ratio accurately predicts renal stone composition, even in small calculi, leading to a more accurate treatment planning.

SSE14

Musculoskeletal (Foot and Ankle)

Monday, Nov. 30 3:00PM - 4:00PM Location: E450B

MK MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Cree M. Gaskin, MD, Keswick, VA (*Moderator*) Author with royalties, Oxford University Press; Author with royalties, Thieme Medical Publishers, Inc; ;
Kathryn J. Stevens, MD, Menlo Park, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSE14-01 Frondiform Ligament, Sinus Tarsi Bursa and Fluid about the Extensor Digitorum Longus Tendon: MRI Evaluation with Cadaveric Correlation

Monday, Nov. 30 3:00PM - 3:10PM Location: E450B

Participants
Ignacio Rossi, Buenos Aires, Argentina (*Presenter*) Nothing to Disclose
Zehava S. Rosenberg, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Chimere Mba-Jonas, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jonathan S. Zember, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Jenny T. Bencardino, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe the association between fluid in the sinus tarsi and fluid about the extensor digitorum longus tendon (EDL) based on MRI and cadaveric studies. The frondiform ligament (FL, also called stem of inferior extensor retinaculum) exits the sinus tarsi to form a sling around the EDL. The sinus tarsi bursa extends between the inferior extensor retinaculum and the dorsolateral talar neck and may communicate with the EDL sheath. We hypothesize that fluid can advance from the sinus tarsi, via the frondiform ligament or sinus tarsi bursa, and surround the EDL, simulating tenosynovitis.

METHOD AND MATERIALS

Patient's MRI studies: All ankle MRIs with key phrases "extensor digitorum longus tenosynovitis" and "sinus tarsi ganglion" as well as 100 consecutive ankle MRIs were retrospectively reviewed. All cases with history of EDL or anterior ankle pathology were excluded. Cadavers: 2 fresh frozen cadaveric ankle specimen underwent MRI after injection, under ultrasound guidance, of saline solution into EDL tendon sheath and of Gadolinium solution into the sinus tarsi fat.

RESULTS

Patients' MRI studies: Review of 258 MRIs revealed 31 cases (11 males, 20 female, age range 29-83, mean age 54), with sinus tarsi fluid, (15 encapsulated fluid sinus tarsi bursae, 16 non-encapsulated fluid), extending along FL toward EDL. In 30 cases (97%), fluid exited sinus tarsi, along FL, only partially surrounding the EDL. In 1 case fluid encircled the EDL. Most common associated findings included ligamentous injury (n= 10), posterior tibial tendon dysfunction (PTTD) (n = 9), flat-foot (n=6), osteoarthrosis (n= 4). Cadavers: There was no MR evidence of communication between the EDL tendon sheath, FL or sinus tarsi after saline injection into the tendon sheath. Contrast was noted to exit the sinus tarsi dorsally, along FL, up to the EDL (n=1) and near EDL (n=1) on MRI images obtained after sinus tarsi injection.

CONCLUSION

Fluid within the sinus tarsi can advance via the FL or sinus tarsi bursa and partially or completely surround the EDL. This phenomenon, often seen with ligament injury or PTTD, should not be mistaken for tenosynovitis of EDL.

CLINICAL RELEVANCE/APPLICATION

Learning point: Before making the diagnosis of EDL tenosynovitis, the radiologist should ensure that the fluid is not originating from the sinus tarsi and extending along the FL or sinus tarsi bursa, to simulate tenosynovitis.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Zehava S. Rosenberg, MD - 2014 Honored Educator
Jenny T. Bencardino, MD - 2014 Honored Educator

SSE14-02 Early Findings of Charcot Arthropathy on MR Imaging

Monday, Nov. 30 3:10PM - 3:20PM Location: E450B

Participants
Lodewijk J. van Holsbeeck, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc
Noam Belkind, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Viviane Khoury, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

Paula Gangopadhyay, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively identify early ligamentous, tendinous, and osseous injuries predictive of joint deformity characteristic of Charcot arthropathy.

METHOD AND MATERIALS

The MR imaging reports database was searched for the word "Charcot"; the resultant patient list was reviewed for the following inclusion criteria: 1) documented early Charcot arthropathy by clinical exam; or 2) follow-up imaging showing evolution into classic Charcot arthropathy. From the imaging perspective, only feet were included that had at least two MRI studies, with one study antedating the onset of clinical or imaging evidence of neuropathic deformity. Images were reviewed by a musculoskeletal radiologist with 20 years of experience in consensus with a musculoskeletal fellow for location of Charcot, as well as marrow, articular, ligamentous, tendinous and soft tissue findings on the initial MR exam. Findings on follow-up were documented.

RESULTS

Thirteen feet in twelve patients were identified with MR imaging preceding Charcot arthropathy. Six of the neuropathic changes were located at the Lisfranc joint, three at the Chopart joint, one at the metatarsophalangeal joints, and two at a combination of these joints. Findings that preceded the Charcot changes included subchondral bone marrow edema in 10/13, subchondral fracture in 3/13, tear of a supporting ligament in 8/13, and tendinopathy in 3/13. Interestingly, of the 7 patients with eventual Charcot arthropathy at the Lisfranc joint, none had Lisfranc ligament tears on earlier MRI imaging. In general, the pattern of bone marrow edema and ligamentous/tendinous tears demonstrated on early MRI studies predicted the location of eventual Charcot arthropathy.

CONCLUSION

Paying close attention to subchondral and subtle ligamentous findings in diabetic feet can help detect neuropathic changes early, at a stage when these injuries are still manageable conservatively.

CLINICAL RELEVANCE/APPLICATION

Identification of initial ligamentous injuries preceding Charcot arthropathy in the diabetic population could assist surgeons in early intervention and prevention of late deformity.

SSE14-03 Accessory Anterolateral Talar Facet in Symptomatic and Asymptomatic Populations: Prevalence and Relevant Associated Findings on Ankle MRI

Monday, Nov. 30 3:20PM - 3:30PM Location: E450B

Participants
Ustun Aydingoz, MD, Ankara, Turkey (*Presenter*) Speaker, AbbVie Inc; Spouse, Stockholder, Edita Medical Writing Editing Ltd; Spouse, Employee, Edita Medical Writing Editing Ltd;
O. Melih Topcuoglu, MD, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose
Aysegul Gormez, MD, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose
Tijen Cankurtaran, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose
Elif D. Topcuoglu, MD, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose
Fatma Bilge Ergen, MD, Ankara, Turkey (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the prevalence of and relevant findings associated with the accessory anterolateral talar facet (AALTF), which has been reportedly implicated in talocalcaneal impingement under certain conditions, on ankle MRI in symptomatic and asymptomatic persons.

METHOD AND MATERIALS

This is a case-control study with institutional review board approval. Two observers independently reviewed routine 1.5-T or 3-T MRI (that included --but was not limited to-- sagittal T1W and fat-suppressed T2W sequences) of 110 symptomatic ankles (61 right, 49 left) in 100 consecutive patients (54 females, 46 males; age range, 16-79 years [mean, 41.5]) and limited (sagittal T1W and fat-suppressed T2W sequences) 1.5-T MRI of 104 age-, gender-, and side-matched ankles in 104 asymptomatic volunteers for the presence of AALTF (Figure). Exclusion criteria for both symptomatic and asymptomatic groups included history of acute or chronic fracture and/or operation at the ankle, and the presence of a neoplastic bone or soft tissue mass at the ankle. In the asymptomatic group, an additional exclusion criterion was the presence of any injury (including sprain) to the ankle in the last 30 days. Calcaneal cortical thickness, and talar or calcaneal fibrocystic and/or edema-like bone marrow changes at the critical angle of Gissane were noted.

RESULTS

There was no statistically significant difference between the symptomatic and asymptomatic populations with respect to age (mean and distribution), gender, and ankle side. AALTF was present in 36 symptomatic (32.7%) versus 27 asymptomatic (26.0%) ankles (P=0.297). Interobserver agreement was very good (kappa=0.851, 95% CI=0.772-0.929) for the detection of AALTF. Subjacent talar bone marrow edema-like change was significantly more frequent in persons with AALTF (P<0.0001), while chronic reactive osseous changes at Gissane angle were not (P>0.05).

CONCLUSION

Higher prevalence of AALTF on MRI in symptomatic versus asymptomatic ankles is notstatistically significant. AALTF may be associated with subjacent talar bone marrow edema-likechange.

CLINICAL RELEVANCE/APPLICATION

Accessory anterolateral talar facet, which has been reported to have a role in talocalcaneal impingement, is identified on MRI in one quarter of asymptomatic persons and may be associated with subjacent bone marrow edema-like change in both symptomatic and asymptomatic populations.

SSE14-04 Association of Superior Peroneal Retinaculum Abnormalities with Lateral Ankle Ligament Injuries

Monday, Nov. 30 3:30PM - 3:40PM Location: E450B

Participants
Connie Y. Chang, MD, Boston, MA (*Presenter*) Nothing to Disclose
Ambrose J. Huang, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Corey M. Gill, BS,BA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Frank J. Simeone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Miriam A. Bredella, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Martin Torriani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Inversion stress ankle sprain with injury to the lateral collateral ankle ligament complex is one of the most common sports injuries. The superior peroneal retinaculum has a close anatomic relationship to the lateral collateral ankle ligament complex, and chronic inversion stress also leads to laxity and injury of the superior peroneal retinaculum. Therefore, we sought to evaluate whether there is an association between ankle lateral collateral ligament complex injuries and superior peroneal retinaculum injury.

METHOD AND MATERIALS

Our study was IRB approved and complied with HIPAA guidelines. One hundred consecutive ankle MRI cases were obtained from July to September in 2013 and were evaluated for anterior talofibular ligament (ATFL), calcaneofibular ligament (CFL), posterior talofibular ligament (PTFL), superior peroneal retinaculum (SPR) sprain and tear by two independent readers. If the SPR was torn, peroneus longus (PL) and peroneus brevis (PB) tendons were also evaluated for subluxation. Chi-squared test was used to evaluate for correlation between abnormalities of these structures. Interobserver agreement was also calculated.

RESULTS

Of the 100 cases, 1 was excluded because of prior lateral ankle ligament reconstruction surgery, and 2 were excluded because of motion leading to poor image quality. Of the 97 remaining cases, the mean age was 50 ± 16 (18-90) years, and there were 35 males and 62 females. Inter-reader agreement was very good for all categories. Among the 97 cases, 69 (71%) had an abnormal ATFL, 62 (64%) had an abnormal ATFL and CFL; 28 (29%) had an abnormal ATFL, CFL, and PTFL; and 47 (48%) had an abnormal SPR. There were three SPR sprains with normal lateral collateral ankle ligaments. All other SPR injuries occurred in the setting of both ATFL and CFL injuries; there were no SPR injuries occurring with isolated ATFL injuries. There was a statistically significant correlation between ATFL and SPR abnormalities ($P = 0.0001$), ATFL/CFL and SPR abnormalities ($P < 0.0001$), and ATFL/CFL/PTFL and SPR abnormalities ($P = 0.0003$).

CONCLUSION

Lateral collateral ankle ligament injuries have a statistically significant correlation with superior peroneal retinaculum injuries.

CLINICAL RELEVANCE/APPLICATION

The SPR are common and should be closely evaluated in the setting of lateral collateral ligament complex injuries.

SSE14-05 Bone Bruise vs. Non-displaced Fracture at MRI: A Novel Grading System to Guide Reporting and Predict Return to Play

Monday, Nov. 30 3:40PM - 3:50PM Location: E450B

Participants
Blake Bowden, Philadelphia, PA (*Presenter*) Nothing to Disclose
Adam C. Zoga, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Peter F. DeLuca, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Johannes B. Roedl, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
James M. McCrossin, MS, Voorhees, NJ (*Abstract Co-Author*) Nothing to Disclose
Sandra Rutigliano, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc

PURPOSE

MRI is the standard of care imaging modality for suspected radiographically occult fracture from direct trauma. To date, MR criteria for bone contusion vs. fracture are not well established. We sought to generate an algorithm using MR to grade traumatic nondisplaced osseous injury in a cohort of athletes with trauma by correlating specific MR findings and imaging patterns with clinical scenarios and return to play (RTP).

METHOD AND MATERIALS

20 MR exams of the lower extremity (1.5T, extremity coil, 16 initial, 4 follow-up) in 15 professional hockey players with direct trauma and normal radiographs were reviewed by 2 MSK radiologists blinded to additional clinical information. Bone marrow edema (BME) was graded as 1=patchy/ill defined, 2=focal and mild, 3=focal and intense, 4=intense throughout bone. Marrow replacement on T1 weighted sequences was observed along with small and large regions of linear or curvilinear hypointensity. Presence and number of cortical breeches were observed as well as microtrabecular disruption, soft tissue contusion and hematoma. Locations of osseous injury were categorized as weight-bearing or not, and subenthesial or not.

RESULTS

MRIs included 9 foot, 6 ankle and 1 proximal tibia. Mean interval from injury to MR was 0.8 days and mean interval to follow-up MR was 10.3 days. Mean RTP for athletes with any linear hypointensity on MR was 10.8 days vs.7.5 days for those without (α=.267 unpaired t-test) and there was no difference in RTP for small vs large or curvilinear hypointensities. Mean RTP for athletes with T1 marrow replacement and grade 3 marrow edema in a weight-bearing location on MRI was 13.5 days vs. 4.2 days those without (α=.040). Subenthesial lesions had a slightly longer RTP without statistical significance. 6 subjects had CT and all were observed as normal. No cortical breeches were observed. 3/4(75%) subjects with grade 1 BME had a RTP within 2 days. Soft tissue edema and hematoma did not correlate with RTP.

CONCLUSION

The MRI constellation of T1 marrow replacement, grade 3 BME and weight-bearing location correlates with a longer return to play than other MRI findings including linear hypointensities and microtrabecular disruption, and can be reported as nondisplaced fracture.

CLINICAL RELEVANCE/APPLICATION

With non-displaced traumatic osseous injury, MRI should be interpreted as non-displaced fracture when focal intense subcortical bone marrow edema is accompanied by T1 marrow replacement.

SSE14-06 Association of Tarsal Tunnel Disease with Medial Hindfoot Coalitions

Monday, Nov. 30 3:50PM - 4:00PM Location: E450B

Participants
Catherine N. Petchprapa, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Zehava S. Rosenberg, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jenny T. Bencardino, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ignacio Rossi, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Erin FitzGerald, MD, Bronx, NY (*Presenter*) Nothing to Disclose

PURPOSE

Medial hindfoot coalitions, particularly posterior extra-articular and overlap coalitions, may have large medial and posteromedial osseous excrescences which extend into and produce, in conjunction with flat foot deformity, stretching and mass effect on the tarsal tunnel. Resection of the coalition without addressing pathology of these soft tissue structures can result in surgical failure and continued disability to the patient. Yet, to the best of our knowledge, there is scant information about this topic in the literature. We hypothesize that soft tissue disease in the tarsal tunnel is a frequent phenomenon, in the setting of hindfoot coalitions.

METHOD AND MATERIALS

A search of our ankle MRI data base revealed 88 cases with medial hindfoot coalitions. All cases were independently and retrospectively reviewed by 2 musculoskeletal radiologists for the presence of neuritis, manifested by focally increased nerve caliber and signal, of the posterior tibial nerve and its medial and lateral plantar branches. The posterior tibial (PT), flexor hallucis longus (FHL) and flexor digitorum longus (FDL) were assessed for the presence of tendinosis, tenosynovitis and partial tearing.

RESULTS

The final cohort included 68 cases of medial hindfoot (middle, posterior extra-articular and overlap) coalition (37 men, 31 women, average age 40, range 72-8). Neuritis of the posterior tibial nerve and its branches (n= 18, 26%) was more commonly noted in the medial plantar nerve. Entrapment of FHL by osseous coalition-related posteromedial excrescences was seen in 14 cases (21%). Other tendon disorders such as flattening and stretching against sharp bony edges, tendinosis, partial tearing and tenosynovitis were noted in the FHL (n=30, 44%) and FDL (n=22, 32%). PT tendinosis and tearing was less common (n= 9, 13%).

CONCLUSION

Medial hindfoot coalitions are commonly associated with tarsal tunnel soft tissue abnormalities affecting the posterior tibial nerve and its branches, the FHL tendon and less commonly FDL and PT tendons.

CLINICAL RELEVANCE/APPLICATION

The radiologist should alert the referring physician for the presence of tarsal tunnel abnormalities in the presence of medial hindfoot coalition since these can guide surgical treatment and outcome.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Zehava S. Rosenberg, MD - 2014 Honored Educator
Jenny T. Bencardino, MD - 2014 Honored Educator

SSE15

ISP: Musculoskeletal (MR Evaluation of Nerves)

Monday, Nov. 30 3:00PM - 4:00PM Location: E451B

MK MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Gustav Andreisek, MD, Zurich, Switzerland (*Moderator*) Grant, Holcim Ltd; Grant, Siemens AG; Speaker, Mepha Pharma AG; Speaker, Guerbet SA; Travel support, Guerbet SA; Consultant, Otsuka Holdings Co, Ltd; Travel support, Otsuka Holdings Co, Ltd; Institutional Research Grant, Bayer AG; Institutional Research Grant, Guerbet AG; Institutional research collaboration, Siemens AG; Institutional research collaboration, Koninklijke Philips NV; Speaker, General Electric Company; Speaker, Koninklijke Philips NV; Speaker, Siemens AG; ;
Anne Cotten, MD, Lille, France (*Moderator*) Nothing to Disclose

Sub-Events

SSE15-01 Musculoskeletal Keynote Speaker: MRI Evaluation of Nerves-Application and Implementation

Monday, Nov. 30 3:00PM - 3:20PM Location: E451B

Participants
Sandip Biswal, MD, Stanford, CA (*Presenter*) Co-founder, SiteOne Therapeutics Inc; Research Grant, General Electric Company; Stockholder, Atreus Pharmaceuticals Corporation

ABSTRACT

MR imaging of the peripheral nerves and brachial/lumbosacral plexi has become an important tool in the evaluation and workup of the chronic pain patient. High-quality imaging of these structures is now consistently possible due to technical improvements in field strength, coil, and pulse sequence technology. This imaging approach is able to highlight inflammatory (e.g. neuritis) and physical (e.g. impingement, mass lesions) changes in the nerves. We will review the technical requirements for imaging the peripheral nervous system, discuss the imaging findings nerve injury/inflammation and provide examples of normal and pathologic cases.

SSE15-03 MR Neurographic Orthopantomogram: Ultra-short Echo-time (UTE) Imaging of Mandibular Bone and Teeth Complemented with High-resolution Morphological and Functional MR Neurography

Monday, Nov. 30 3:20PM - 3:30PM Location: E451B

Participants
Andrei Manoliu, MD,PhD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Micheal Ho, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Evelyn Dappa, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel Nanz, PhD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Andreas Boss, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Gustav Andreisek, MD, Zurich, Switzerland (*Abstract Co-Author*) Grant, Holcim Ltd; Grant, Siemens AG; Speaker, Mepha Pharma AG; Speaker, Guerbet SA; Travel support, Guerbet SA; Consultant, Otsuka Holdings Co, Ltd; Travel support, Otsuka Holdings Co, Ltd; Institutional Research Grant, Bayer AG; Institutional Research Grant, Guerbet AG; Institutional research collaboration, Siemens AG; Institutional research collaboration, Koninklijke Philips NV; Speaker, General Electric Company; Speaker, Koninklijke Philips NV; Speaker, Siemens AG; ;
Felix P. Kuhn, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Panoramical radiographs or cone-beam CT images are the current standard-of-care to assess teeth, mandibular, and mandibular canal pathologies, but do not allow assessment of the mandibular nerve itself nor of its branches. Most recent MR technologies allow cortical bone imaging as well as dedicated MR neurography of the peripheral nerves. We propose a technique for "MR neurographic orthopantomograms" exploting UTE imaging of bone and teeth complemented with high-resolution morphological and functional MR neurography.

METHOD AND MATERIALS

IRB approved study in 10 healthy volunteers. The whole mandibles were imaged at 3.0T (Skyra, Siemens Healthcare) using a 64-channel head coil with isotropic spatial resolution (0.9x0.9x0.9mm) for subsequent multi-planar reformatting. Bone images were acquired using a 3D UTE PETRA sequence (echo time, 0.07ms; acquisition time, 4:56min). Morphological nerve imaging was accomplished with a 3D PSIF sequence with diffusion-based suppression of small blood vessel signals (4:16min) and with a 3D SPACE STIR sequence (9:23 min). Functional MR neurography was accomplished using a new accelerated diffusion tensor imaging technique (2D RESOLVE multiband prototype sequence = diffusion-weighted and readout-segmented echo planar imaging with blipped CAIPIRINHA and simultaneous two-slice acquisitions) (9:34min). Qualitative and quantitative image analysis was performed.

RESULTS

Image acquisition and subsequent post-processing into 'MR neurographic orthopantomogram' by overlay of morphological and functional images were feasible in all 10 volunteers without artifacts. All teeth, mandibular bones and mandibular nerves were assessable and normal. Fiber tractography with quantitative evaluation of physiological diffusion properties of mandibular nerves yielded the following mean±SD values: FA, 0.43±0.05; mean diffusivity (mm2/s), 0.0043 ±0.0003; radial diffusivity, 0.0034±0.0002, and axial diffusivity, 0.0021±0.0001.

CONCLUSION

The proposed technique of 'MR neurographic orthopantomogram' exploting UTE imaging complemented with high-resolution

The proposed technique of MR neurographic orthopantomogram exploiting STIR imaging complemented with high resolution morphological and functional MR neurography was feasible and allowed comprehensive assessment of teeth, bones and nerves.

CLINICAL RELEVANCE/APPLICATION

'MR neurographic orthopantomograms' may allow to assess various mandibular pathologies in a single examination and provide quantitative information on the integrity of the nervous microarchitecture.

SSE15-04 Clinical Impact of Brachial Plexus MRI Neurography on Diagnosis and Treatment

Monday, Nov. 30 3:30PM - 3:40PM Location: E451B

Participants
Stephen Fisher, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Christine Manthuruthil, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Jonathan Cheng, MD, FACS, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Avneesh Chhabra, MD, Dallas, TX (*Abstract Co-Author*) Research Consultant, Siemens AG; Consultant, ICON plc

PURPOSE

The use of MR neurography (MRN) is widely accepted as useful and accurate for the evaluation of traumatic, inflammatory and infectious pathologies of the brachial plexus. However, little exists documenting the effect on diagnosis, treatment, and outcomes. Brachial plexus lesions are often difficult to diagnose and treat, many times requiring electromyography (EMG), which is limited due to deep location of nerves. Physicians frequently face management challenges in terms of whether patients should undergo surgery, pursue further workup, treat neuropathy conservatively, or institute treatment for diagnoses unrelated to neuropathy. Currently, the added value of MRN of the brachial plexus in addition to clinical standard of care including EMG results is unknown. We hypothesize that brachial plexus MRN significantly impacts diagnostic thinking and therapeutic management.

METHOD AND MATERIALS

All consecutive brachial plexus MRN examinations performed at 1.5T using a uniform protocol at our institution between 6/1/2013 and 10/31/2014 were examined retrospectively. Relevant clinical data were collected. Effects on the pre-imaging clinical diagnosis and therapeutic management were classified as no change, mild change, or substantial change. A separate disease etiology, significant and previously unknown incidental findings, or marked deviation from expected degree of severity were classified as substantial changes. Changes in management from conservative to surgical and vice versa were classified as substantial.

RESULTS

Of 122 consecutive studies, substantial alteration of the pre-imaging clinical impression was found in 30 cases (24.6%). The therapeutic management was likewise affected substantially in 27 cases (22.1%).

CONCLUSION

No consecutive series of brachial plexus MRN findings this large has been reported. We show that this examination can significantly impact diagnostic evaluation and clinical treatment of patients with upper extremity neurologic lesions.

CLINICAL RELEVANCE/APPLICATION

MRN significantly alters diagnosis and treatment in patients with suspected brachial plexopathies.

SSE15-05 MR Neurography (MRN) of the Long Thoracic Nerve: Retrospective Review of Clinical Findings and Imaging Results at Our Institution over 5 Years

Monday, Nov. 30 3:40PM - 3:50PM Location: E451B

Participants
Swati Deshmukh, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Laura M. Fayad, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Shivani Ahlawat, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively review high-resolution MRNs of the long thoracic nerve in patients with clinical suspicion of long thoracic neuropathy performed at our institution over the past 5 years.

METHOD AND MATERIALS

IRB approval was obtained. A keyword search for 'long thoracic nerve' was performed to identify MRN studies performed at our institution for evaluation of the long thoracic nerve. Clinical presentation, electrodiagnostic studies and MRNs of 18 subjects (mean age, 38±13 years; 22%(4/18) female) were reviewed. MRN consisted of cervical spine (3D T2W, TE/TR=1000/97, 1mm slice thickness), brachial plexus (bilateral sagittal STIR; TE/TR/IR=3400/18/220, slice thickness 3mm) and chest (axial STIR; TE/TR/IR=4000/18/220, 4mm slice thickness), coronal T2FS(TE/TR=4940/49, 5mm slice thickness), axial T1W (TE/TR=800/12, 3mm slice thickness)) imaging. One observer reviewed MRNs for long thoracic nerve signal intensity on T1 and STIR, size, course, architectural distortion, presence or of mass, and secondary findings including serratus anterior, trapezius and rhomboid muscle denervation and scapular winging. C-spine disease (presence and degree of C4-5, C5-6, C6-7, C7-T1 central and foraminal stenosis) and brachial plexus pathology were also recorded. Descriptive statistics were reported.

RESULTS

Clinical indications included trauma (n=4), hereditary neuropathy (n=1), pain (n=7), winged scapula (n=5), Parsonage Turner syndrome (n=1) and mass (n=1). The long thoracic was not confidently identified in all exams in the anterior scalene triangle, retroclavicular space or lateral chest wall. In 3/18, electrodiagnostic studies showed evidence of denervation in the serratus anterior muscle while MRN revealed denervation in the serratus anterior (44%(8/18)), trapezius (22%(4/18)) and rhomboid (5% (1/18)) muscles. In 5%(1/18) subjects, there was denervation in both trapezius and serratus muscles. In 5%(1/18), an osteochondroma simulated a winged scapula and in 2/18(10%) MRN showed scapular winging. Concomitant C-spine disease (22% (4/18)) and brachial plexus pathology (22%(4/18)) were also detected.

CONCLUSION

Despite high resolution MRN, the long thoracic nerve is not confidently identified, though secondary signs including denervation are detected and add to EMG findings.

CLINICAL RELEVANCE/APPLICATION

MRN can serve as an adjunct clinical tool to electrodiagnostic testing for the evaluation of secondary signs of long thoracic neuropathy.

SSE15-06 Diffusion Weighted Imaging(DWI) and Neurography(DWN) of Human Lumbar Nerve Roots: Quantitative and Morphological Assessments of Nerve Roots Compression in Lumbar

Monday, Nov. 30 3:50PM - 4:00PM Location: E451B

Participants
Qingwei Song, MD, Dalian, China (*Presenter*) Nothing to Disclose
Meiyu Sun, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Li Na Zhang, MD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Bin Xu, BA, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Ailian Liu, MD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Ziheng Zhang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the application of DWI in the assessment of lumbosacral nerve root ganlias compression in lumbar intervertebral disc herniation through structural visualization, morphological analysis and the computed quantitative ADC values.

METHOD AND MATERIALS

This prospective study was approved by our Institutional Review Board and the written informed consent of each attendee was obtained. 30 lumbar intervertebral disc herniation:patients:(mean age=49.9 years, range=17-78 years; 20 male: 10 female) , with low back pain and confirmation from the conventional MR imaging were recruited. The original DW images and the reconstructed 3D maximum intensity projection (MIP) images of the L4/L5 and L5/S1 lumbosacral nerve ganglions were :blindly reviewed by two experienced radiologists. The morphologic parameters, i.e. nerve ganglions length, midpoint width and areas, of L4/L5 and L5/S1 were measured from the 3D MIP images and the ADC values of nerve ganglions were measured from the ADC maps generated by workstation, Functool 4.4. All the measured values of the compressed nerve roots and ganglions were statistically compared with the contralateral using t-test.

RESULTS

The high performance of DWI on showing the lumbosacral nerve roots, dorsal ganglions, and especially the postganglionic nerves of L4/L5 and L5/S1 assured the assessment of the interrelation between the nerve roots and the herniated intervertebral disc. No significant difference was observed from the values of the two sides of the L4 nerve ganglions' length, midpoint width, area and ADC for L3/L4 herniation. However, for L5/S1 hernidation, the length and area of the compressed nerve ganglions of L5 and S1 were significantly bigger than the contralateral ($t=10.39$, $p<0.05$), and the ADC values of L5 and S1 were significantly higher than the contralateral ($t=13.06$,$P<0.05$).:

CONCLUSION

DWI can clearly display the lumbosacral nerves roots and ganglions. The qualitative morphological analysis through 3D MIP reconstruction and the quantitative measurements of the ADC value of nerves ganglions were substantially contributed to the evaluation of the compression of nerve roots and ganglions for the patients with lumbar intervertebral disc herniation.

CLINICAL RELEVANCE/APPLICATION

DWI should be in the setting of the scanning protocol for the diagnosis of the nerve roots and ganglions disorders

SSE19

Neuroradiology (Epilepsy)

Monday, Nov. 30 3:00PM - 4:00PM Location: N230

NR CT MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Steven M. Stufflebeam, MD, Charlestown, MA (*Moderator*) Nothing to Disclose
Roland R. Lee, MD, San Diego, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSE19-01 A Novel Electrocorticography Grid Using Conductive Nanoparticles in a Polymer Thick Film on an Organic Substrate Improves CT and MR Imaging

Monday, Nov. 30 3:00PM - 3:10PM Location: N230

Participants
Emad Ahmadi, MD, Boston, MA (*Presenter*) Nothing to Disclose
Husam A. Katnani, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Laleh Daftaribesheli, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Qiang Gu, PhD, Jefferson, AZ (*Abstract Co-Author*) Nothing to Disclose
Reza Atefi, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Martin Y. Villeneuve, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Emad N. Eskandar, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Research support, General Electric Company Stockholder, General Electric Company
Alexandra J. Golby, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rajiv Gupta, PhD, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Giorgio Bonmassar, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Conventional electrocorticography (ECoG) grids produce extensive metal artifacts at CT and MR imaging. This study compares CT and MR artifacts from conventional ECoG grids with those from a grid developed by deposition of conductive nanoparticles in polymer thick film on an organic substrate (PTFOS).

METHOD AND MATERIALS

We compared the induced artifacts between the newly developed PTFOS grid and the conventional ECoG grids at CT and MR imaging. All imaging was performed on a cadaveric human head specimen. We then asked two neuroradiologists to score the quality of CT and MR images in the cases of the head sample with no grid, with conventional grids, and with PTFOS grids. The functioning of the PTFOS for cortical recording and stimulation was tested in mice. We used electron microscopy to study the microstructural changes of PTFOS after long-term implantation in mice. We also studied changes in electrical properties of the PTFOS after long-term submersion in a saline bath.

RESULTS

The PTFOS grid produced no appreciable artifacts in CT and MR images, and the image quality reported by neuroradiologists was significantly higher for the PTFOS compared to conventional grids ($P<0.05$). Cortical recording and stimulation was successfully done in mice using PTFOS. PTFOS pieces showed no appreciable microstructural changes after long-term implantation in mice. After long-term submersion in the saline bath, the impedance of the PTFOS traces did not change ($P>0.05$) and remained within the range of 150-300Ω which is favorable for cortical recording and stimulation.

CONCLUSION

PTFOS grids are an attractive alternative to conventional grids as they show no appreciable artifacts at CT and MR imaging, and remain stable after long-term in-vivo implantation.

CLINICAL RELEVANCE/APPLICATION

Diagnosis of surgical complications of electrocorticography grids implantation is largely dependent on CT and MR imaging. The newly developed PTFOS grid demonstrated excellent image quality both at CT and MR imaging, which can facilitate diagnosis of post-operative complications.

SSE19-02 A Novel Electrocorticography Grid Using Conductive Nanoparticles in a Polymer Thick Film on an Organic Substrate Causesless MRI Heating Compared to Conventional Grids

Monday, Nov. 30 3:10PM - 3:20PM Location: N230

Participants
Emad Ahmadi, MD, Boston, MA (*Presenter*) Nothing to Disclose
Reza Atefi, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Martin Y. Villeneuve, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Research support, General Electric Company Stockholder, General Electric Company
Alexandra J. Golby, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rajiv Gupta, PhD, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Giorgio Bonmassar, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Conventional electrocorticography (ECoG) grids might cause significant heating during MR imaging. This study compares MRI heating, at a 3T scanner, caused by a conventional ECoG grid with that caused by a grid developed by deposition of conductive nanoparticles in polymer thick film on an organic substrate (PTFOS).

METHOD AND MATERIALS

A 64-contact electrocorticography grid was developed in a PTFOS construct via deposition of silver and carbon nanoparticles on denaturized collagen. We placed the developed PTFOS grid over a head phantom and measured the temperature changes around the grid during 30 minutes of MRI at a 3T scanner. The phantom had MRI heating properties similar to human tissues. Temperature was measured using eight optical sensors placed within the phantom. For comparison purposes, we also studied temperature changes during MR imaging in the cases of the head phantom with no grid and with a conventional platinum grid.

RESULTS

The maximal temperature increase among the eight sensors during 30 minutes of MR images was 4, 11, and 4.5 degrees Celsius for the cases of the phantom without any grid, with the platinum grid, and with the PTFOS grid, respectively (Figure 1).

CONCLUSION

Conventional platinum grids might cause considerable heating during MR imaging, while the newly developed PTFOS grid causes minial, if any, heating during MR imaging.

CLINICAL RELEVANCE/APPLICATION

Diagnosis of surgical complications of electrocorticography grids implantation is largely dependent on MR imaging. Our results raise the concern that conventional electrocorticography grids might not be safe for MR imaging at the field strength of 3T, because they might cause considerable MRI heating. On the other hand, the newly developed PTFOS grid showed favorable MRI heating profile at the field strength of 3T.

SSE19-03 Language Reorganization in Temporal Lobe Epilepsy - A Task Based fMRI Connectome Study

Monday, Nov. 30 3:20PM - 3:30PM Location: N230

Participants
Gregor Kasprian, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Christian Widmann, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Karl-Heinz Nenning, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Ekaterina Pataraia, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Georg Langs, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Christoph Baumgartner, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Thomas Czech, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Daniela Prayer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Atypical language representations are frequently seen in left hemispheric temporal lobe epilepsy (lTLE) patients. fMRI based language connectome analysis allows to study neuronal networks, linked to language function. The aim of this study was to visualize the (re-) organization of the language connectome (LC) in a cohort of lTLE patients.

METHOD AND MATERIALS

The functional LC was calculated on the basis of functional MRI data (3 Tesla, TE=35ms, TR=3000ms, slice thickness: 4mm, 32 slices, 96x96 matrix, 2.4x2.4x4mm, 100 dynamics, verb generation task, FreeSurfer, FSL). The LC of 8 patients with non lesional lTLE (median age 35) and 12 lTLE patients with hippocampal sclerosis (HS) (median age 42) were compared to a reference LC based on 13 healthy controls (median age 38). Variations in the functional connectome analysis were quantified using the network-based statistics (NBS) approach.

RESULTS

The language connectome of non lesional lTLE patients and HS patients showed a significantly increased interhemispheric connectivity ($p<0.001$), compared to healthy controls (Figure). A stronger ipsilateral connectivity of the default mode network was found in controls. Non lesional lTLE and HS patients showed an increased node degree in the Broca region.

CONCLUSION

The task-based language connectome of lTLE patients shows widespread alterations (Figure). Recruitment of interhemispheric connections may be related to functional language network reorganization due to structural alterations of the left temporal lobe and/or seizure activity.

CLINICAL RELEVANCE/APPLICATION

Task-based NBS analysis offers a new perspective in understanding the lesion induced reorganization of language function in the human brain. These results will impact the preoperative evaluation of individual lTLE patients and may reduce the incidence of postoperative language deficits.

SSE19-04 Ultra High Field MR-microscopy for Diagnosis of Hippocampal Sclerosis in Patients with Mesial Temporal Lobe Epilepsy

Monday, Nov. 30 3:30PM - 3:40PM Location: N230

Participants
Clarissa Gillmann, PhD, Erlangen, Germany (*Presenter*) Nothing to Disclose
Roland Coras, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Karl Roessler, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Arnd Dorfler, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose

Michael Uder, MD, Erlangen, Germany (*Abstract Co-Author*) Speakers Bureau, Bracco Group; Speakers Bureau, Siemens AG; Research Grant, Siemens AG;
Ingmar Blumcke, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Tobias Baeuerle, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate ultra high field MR-microscopy for the discrimination of sclerotic and non-sclerotic hippocampi (HC) in patients with mesial temporal lobe epilepsy (mTLE).

METHOD AND MATERIALS

Resected HC of 11 patients diagnosed with mTLE were scanned on a preclinical 7T MRI (ClinScan, Bruker). Morphologic images (T2w, resolution: 42x42x300 µm) were acquired. Diffusion tensor imaging was performed and voxel based maps of T1-, T2- and T2*-times were calculated for each HC. On morphologic images, the pyramid cell layer (PCL) was segmented on 10 consecutive slices. The segmentation mask was transferred to the respective parameter maps. Depending on the neuropathologic diagnosis, HC were classified sclerotic (n=9) or non-sclerotic (n=2). The parameters PCL volume, T1-, T2- and T2*-times, apparent diffusion coefficient (ADC), fractional anisotropy (FA) and trace of the diffusion tensor (TW) were inserted into a multiparametric analysis and parameter-probability curves were adjusted using GNU R's logistic response model.

RESULTS

On morphologic images, a narrowing of the PCL for the sclerotic as compared to the non-sclerotic HC is discernible (Fig. 1a). The median parameter values were determined in the PCL for sclerotic/non-sclerotic HC including PCL volume (8/11 mm3), T1 time (736/1094 ms), T2 time (85/129 ms), T2* time (42/41 ms), ADC (593/228 µm2/s), FA (0.495/0.476 a.u.), TW (495/384 mm2/s). As a result of the multiparametric analysis, T1 time is the most significant predictor of sclerosis (p=0.026), followed by T2 time (p=0.072) and PCL volume (p=0.097). The respective parameter-probability curves are shown in Fig. 1b. HC with T1 times below 750 ms have a probability higher than 90 % of being sclerotic.

CONCLUSION

Ultra high field MR-microscopy revealed distinct characteristics in morphology and significantly different T1 times in the PCL of sclerotic and non-sclerotic HC. Time-adapted imaging protocols might be translated for clinical application on ultra high field systems.

CLINICAL RELEVANCE/APPLICATION

Non-invasive diagnosis of hippocampal sclerosis to preoperatively evaluate the patients' benefit of hippocampus resection using ultra high field MR-microscopy.

SSE19-05 Clinical Comparison of Three Methods for Analysis of SPECT Imaging of Epilepsy

Monday, Nov. 30 3:40PM - 3:50PM Location: N230

Participants
Zaiyang Long, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Benjamin H. Brinkmann, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Michael K. O'Connor, PhD, Rochester, MN (*Abstract Co-Author*) Royalties, Gamma Medica, Inc

PURPOSE

Ictal-interictal SPECT with co-registration to MRI provides a valuable non-invasive method to localize the seizure onset zone in focal epilepsy. Currently both statistical parametric mapping (SPM)-based methods and conventional subtraction methods (e.g. SISCOM) are employed, with SPM methods providing the context of normal physiological variation. However, SPM-based methods require specialized tools and are more complex to use. Commercial software packages that are more easily integrated into the clinical practice are becoming available. The current study compares SISCOM, an SPM-based method, and a commercial package MIMneuro (MIM Software), which uses both cluster analysis and statistical differences in co-registered images.

METHOD AND MATERIALS

We retrospectively reviewed the records of 366 patients who underwent ictal/interictal Tc99m-ECD SPECT scans. We identified 25 with surgical resection and postoperative follow up for at least one year. Surgical outcomes were scored by ILAE criteria (Range 1-5: 1=seizure freedom and 5=seizures continue or increase). Hyperperfusion and hypoperfusion SPECT images co-registered with MRI images were analyzed using SISCOM, SPM and MIMneuro. Correlation between SPECT localization and resected tissue was scored on a 1-5 scale (1=localization closely matches resection, 5=no match to resection location) and correlated with the patient's ILAE score.

RESULTS

Using optimized parameters, the resection overlap of images analyzed by MIMneuro showed a significant correlation with ILAE score ($R2=0.76$, $p<0.001$). SPM also showed a significant correlation with ILAE score ($R2=0.51$, $p<0.05$), whereas SISCOM did not show a significant correlation with ILAE score ($R2=0.19$). Summed ILAE score for all patients were 57, while summed MIMneuro, SPM and SISCOM scores were 57, 66 and 69, respectively. On a standard Windows 7 workstation (Intel Core i5-4300U CPU and 8GB of RAM), processing time per patient took less than 2 min with MIM Neuro, and took 10-15 min with SPM.

CONCLUSION

MIMneuro and SPM SPECT localizations showed better predictive value for surgical outcome compared to SISCOM. MIMneuro took less computation time than SPM, potentially providing further benefit to the clinical workflow.

CLINICAL RELEVANCE/APPLICATION

SPM and commercial MIMneuro package provide powerful tools for analyzing SPECT images for epilepsy evaluation. MIMneuro with optimized parameters can further reduce analysis time and improve localization.

SSE19-06 Stereotactic Laser Ablation for Temporal Lobe Epilepsy: MRI Findings Predictive of Seizure Freedom Outcome

Monday, Nov. 30 3:50PM - 4:00PM Location: N230

Participants
Bruno P. Soares, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Amit M. Saindane, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jon Willie, MD,PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Daniel Drane, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Deqiang Qiu, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Robert E. Gross, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MRI-guided stereotactic laser ablation is currently being used for amygdalohippocampotomy in mesial temporal lobe epilepsy (MTLE). The technique aims to eliminate seizures while minimizing adverse cognitive effects of open resection procedures. The purpose of this study is to establish pre- and postprocedural MRI findings that predict seizure freedom outcome with laser amygdalohippocampotomy.

METHOD AND MATERIALS

This retrospective study included 24 patients with diagnosis of MTLE who were treated with amygdalohippocampotomy and for which 12-month seizure freedom outcome data was available. Two neuroradiologists experienced in epilepsy imaging evaluated the MRI exams. On baseline exams, T2 signal intensity and volume of mesial temporal lobe regions were rated utilizing coronal oblique images. On periprocedural exams, extent of ablation of each region was rated utilizing postcontrast coronal oblique 3D T1 MPRAGE images. The patients were followed-up at 12 months after ablation and classified according to the Engel scale as seizure free / almost free or not improved. MRI findings were correlated with seizure freedom outcome by employing Fisher's exact test and Chi-square test.

RESULTS

16 patients fulfilled imaging criteria for mesial temporal sclerosis (MTS). Among these patients, 10/16 (62.5%) were seizure free 12 months after ablation. Three out of 8 patients without MRI diagnosis of MTS were free of seizures arising from the side of ablation at follow-up, while 5 of them were not improved. Among patients with MTS diagnosis, there was a significant correlation between the extent of amygdala ablation - in addition to the hippocampus - and favorable seizure freedom outcome ($p = 0.032$). 9/11 patients with 50% or greater ablation of the amygdala were seizure free after 12 months, compared to 1/5 patients in which the amygdala was less than 50% ablated.

CONCLUSION

MRI diagnosis of MTS predicts improved seizure freedom outcomes in patients treated with laser amygdalohippocampotomy. In these patients, our data suggests that seizure freedom outcome is improved by greater extent of ablation of the amygdala, in addition of the hippocampus. Larger sample sizes are required to better predict outcome in non-MTS patients.

CLINICAL RELEVANCE/APPLICATION

Precise knowledge of the extent and location of the ablation zone is crucial to predict seizure freedom and cognitive effects of stereotactic laser amygdalohippocampotomy in MTLE.

SSE20

ISP: Pediatrics (Neuroradiology)

Monday, Nov. 30 3:00PM - 4:00PM Location: S102AB

NR MR PD

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Ashok Panigrahy, MD, Pittsburgh, PA (*Moderator*) Nothing to Disclose
Susan Palasis, MD, Atlanta, GA (*Moderator*) Nothing to Disclose

Sub-Events

SSE20-01 Pediatrics Keynote Speaker: Studying the Pediatric Connectome

Monday, Nov. 30 3:00PM - 3:10PM Location: S102AB

Participants
Michael J. Paldino, MD, Houston, TX (*Presenter*) Nothing to Disclose

SSE20-02 Post-treatment Diffusion Tensor Imaging to Evaluate Response to Total Body Hypothermia in Neonates with Hypoxic-ischemic Encephalopathy

Monday, Nov. 30 3:10PM - 3:20PM Location: S102AB

Participants
Laura Scarciolla, MD, Massafra, Italy (*Presenter*) Nothing to Disclose
Carlo Cosimo Quattrocchi, MD, PhD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Thomas Joseph Re, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stefania Galassi, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Lorenzo Figa Talamanca, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonio Napolitano, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Calbi, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Bruno Bernardi, MD, Bologna, Italy (*Abstract Co-Author*) Nothing to Disclose
Bruno Beomonte Zobel, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Daniela Longo, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

to test the efficacy of ADC and FA for the evaluation of treatment response in newborns with moderate and severe hypoxic-ischemic encephalopathy (HIE) treated with total-body hypothermia.

METHOD AND MATERIALS

27 newborns with clinical criteria of moderate-severe HIE (17 treated with total body therapeutic hypothermia, 10 nontreated) and 10 healthy neonates were studied with MR imaging and DTI. Ten treated neonates and healthy neonates underwent a follow-up brain MRI and DTI at 6 months of life. All data were acquired on a 3-T Skyra (Siemens, Erlagen, Germany). Conventional MRI imaging included: axial T1 TSE (slice thickness = 2 mm, TR=550 ms, TE 6,7 ms, matrix size = 416x512), sagittal T1 TIRM (slice thickness = 3 mm, TR=2690 ms, TE 8,5 ms, matrix size = 256x256), axial and coronal T2 TSE (slice thickness = 2 mm, TR=10320 ms, TE 122 ms, matrix size= 348x384). DTI acquisition was performed by a single-shot echo-planar sequence, one volume not diffusion-weighted (b0), and bipolar diffusion gradients (b = 800 s/mm2) applied in 30 directions. On ADC and FA maps, basal ganglia and thalamus ROIs were designed. Preprocessing of the raw DTI data was performed using FSL software. Diffusion toolkit along with TrackVis (trackvis.org) were used to reconstruct and visualize tractography pathways respectively.

RESULTS

Conventional MR imaging was normal in 11 (65%) treated neonates and in 3 (30%) nontreated neonates. All treated neonates presented lower FA values in all tracks, in BG and in Thalamus ROI ($p<0.01$) comparing to healthy newborns but higher FA values ($p<10-5$) comparing to nontreated neonates. ADC values were higher in BG and in all white matter fibers ($p<10-4$) comparing to nontreated neonates. At 6 months follow-up MR, the treated neonates FA and ADC values were closer to normal.

CONCLUSION

FA and ADC may more accurately reflect true microstructure characteristics of brain immediately after therapeutic hypothermia and at 6-months follow-up than does conventional MRI. DTI data for nontreated neonates at 6 months would be required to confirm our results.

CLINICAL RELEVANCE/APPLICATION

As DTI metrics reflect a different aspect of brain microstructure than conventional MRI, they may provide a more accurate tool for diagnosing and following neonates with poor neurodevelopment due to HIE.

SSE20-03 Increased Gray Matter Volume of Emotional Circuits in Children without Direct Parental Care

Monday, Nov. 30 3:20PM - 3:30PM Location: S102AB

Participants
Yuan Xiao, Chengdu, China (*Presenter*) Nothing to Disclose
Lili Yang, Wenzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhihan Yan, Wenzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yuchuan Fu, Wenzhou, China (*Abstract Co-Author*) Nothing to Disclose

Meimei Du, Wenzhou, China (*Abstract Co-Author*) Nothing to Disclose
Su Lui, MD, Chendu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

With the economic boom, hundreds of millions of laborers are migrating away from their children to pursue a better job. This international parental migration has resulted in millions of left-behind children (LBC) and has raised widespread concern. However, it is still unclear where and how the brain is affected in these children who lack parental care. Therefore, we aimed to explore the gray matter volume alteration in LBC in relative to those with parental care.

METHOD AND MATERIALS

This study was IRB approved and written informed consent was obtained from guardians. Thirty-eight LBC (age=9.6±1.8yrs, 21boys) and 30 comparison children (age=10.0±1.95yrs, 19boys) were included and performed a 3.0T MR scan. The LBC is defined as children who living with the absence of both of their biological parents for a period over six months. Image preprocessing and statistical analyses were performed with optimized voxel-based morphometry in SPM8. IQ of all participants was measured to quantify cognitive function.

RESULTS

Compared to controls, LBC showed significantly greater gray matter volume in bilateral fusiform gyri, bilateral parahippocampus, right superior parietal lobe, right thalamus, right superior occipital gyrus, left cuneus, right superior temporal gyrus, right superior medial frontal gyrus, left postcentral gyrus, left middle occipital gyrus and left putaman ($p<0.05$, FDR corrected). The mean value of IQ scores in LBC was not significantly different from that in controls. Furthermore, gray matter volume in bilateral parahypocampus gyri in LBC was negatively correlated with IQ score ($p<0.05$).

CONCLUSION

This study provided the first empirical evidence of larger gray matter volumes, especially in emotional circuits in LBC than children living with their parents, suggesting the parental care affects the brain development. Since the larger gray matter volume may reflect insufficient pruning and mature of brain, the negative correlation between the gray matter volume and IQ scores suggest that growing without parental care may delay the development of brain.

CLINICAL RELEVANCE/APPLICATION

To our knowledge, this study provides the first empirical evidence of larger gray matter volumes in emotional circuits in LBC, suggesting that parental care affects brain development. From a public health perspective, the study highlighted the importance of parental care in children and indicated early intervention and stimulation are needed to LBC.

SSE20-04 Age-dependent Signal Density of Diffusion Kurtosis Imaging (DKI) of Healthy Volunteers' Brains at Left-right Hemispheric Level Analyses

Monday, Nov. 30 3:30PM - 3:40PM Location: S102AB

Participants
Mamiko Koshiba, PhD, Iruma-gun, Japan (*Presenter*) Nothing to Disclose
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Hayato Sakurai, MD , Moroyama, Japan (*Abstract Co-Author*) Nothing to Disclose
Tsuyoshi Sasaki, RT, Moroyama, Japan (*Abstract Co-Author*) Nothing to Disclose
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Naomi Hotta, Moroyama, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuuki Minamikawa, Moroyama, Japan (*Abstract Co-Author*) Nothing to Disclose
Mamoru Niitsu, MD, Saitama, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Kunikata, Iruma-Gun, Japan (*Abstract Co-Author*) Nothing to Disclose
Hideo Yamanouchi, Iruma-Gun, Japan (*Abstract Co-Author*) Nothing to Disclose

Background

For approaches to DKI application in neuropediatrics without any risky sedation, the lower resolution data of an infant's smaller brain raise a question whether 122significantly useful or not. As the preliminary evaluation, we are attempting to examine macroscopic DKI quantitative analyses in the data of our own medical staff volunteers if the linear regression would be visualized as previously reported age-dependency (2014).

Discussion

In the scatter diagrams with DKI signal density as a dependent variable and age as an explanatory variable, age-dependent increasing of DKI density was generally revealed repeatedly in both left and right hemispheres in the 2nd to 4th slices (e.g. square correlation coefficient (R2) = 0.52) but not in either cerebellums (R2 = 0.069) or eye balls (R2 = 0.023) imaged in the 1st slice.

Conclusion

DKI hemispheric density quantification in adult was preliminarily confirmed as a practical simple approach to diagnose neuronal development. This macroscopic comprehension using DKI is expected possibly contributable to Neuropediatrics by MRI without sedation under lower resolution.

SSE20-05 Repeatability of Graph-Theoretical Metrics Derived from Resting-State fMRI in Pediatric Patients with Epilepsy

Monday, Nov. 30 3:40PM - 3:50PM Location: S102AB

Participants
Michael J. Paldino, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Wei Zhang, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Zili David Chu, PhD, Houston, TX (*Presenter*) Nothing to Disclose

PURPOSE

To measure the test-retest repeatability of metrics that quantify network architecture in the brain derived from resting-state fMRI in a cohort of pediatric epilepsy patients.

METHOD AND MATERIALS

This IRB approved study identified patients with: 1. epilepsy; 2. brain MRI at 3 Tesla; 3. two identical resting state fMRI acquisitions performed in the same examination.Resting-state time series were co-registered to a T1-weighted structural image. Network nodes were defined by subdivision of whole brain gray matter into 400 (coarse parcellation) or 800 (fine parcellation) volumes of interest. The strength of an edge (connection) between two nodes was defined as the absolute value of the correlation between their BOLD time series.For each weighted connection matrix, correlation coefficients were thresholded over a range of values (0.7 to 0.98). The following topological properties were calculated for each graph: clustering coefficient, transitivity, modularity, characteristic path length, smallworldness, and global efficiency.A potential difference between observations was assessed using the Wilcoxon signed-rank test. For each parameter, we calculated: 1. Mean coefficient of variation (CoV). 2. Pearson Coefficient; 3. ICC; 4. Repeatability coefficient; 5. Ninety-five percent confidence limits (95%CL) for change.

RESULTS

12 patients were included (4-21 yrs). There was no significant difference between observations for any metric. Maximal test-retest estimates for each metric are presented in Table 1. ICC for modularity, transitivity and clustering was consistent across thresholds (Fig 1). By contrast, ICC for characteristic path length, smallworldness and global efficiency peaked over a narrow range of threshold. Modularity, path length and smallworldness were the most repeatable measures.

CONCLUSION

These findings demonstrate the test-retest repeatability of network metrics in a cohort of pediatric epilepsy patients. Change in an individual patient greater than the repeatability coefficient or 95%CL for change is unlikely to be related to intrinsic variability of the method.

CLINICAL RELEVANCE/APPLICATION

NA

SSE20-06 Identifying Medicated-naïve Boys with ADHD using Cortical Thickness via a Multivariate Pattern Analysis

Monday, Nov. 30 3:50PM - 4:00PM Location: S102AB

Participants
Qi Liu, Chengdu, China (*Presenter*) Nothing to Disclose
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Ming Zhou, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
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Ying Chen, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Lanting Guo, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
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Xiaoqi Huang, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Despite previous studies have reported structural and functional deficits in Attention-deficit/hyperactivity disorder (ADHD) children, it's still a challenge to translate the neuroanatomic abnormalities to clinical practice. Studies focus on adults with ADHD had shown the potential clinical value of support vector machine (SVM) in distinguishing patients with ADHD from healthy controls individually, but no study has explored its usage in unmedicated children with ADHD. As ADHD has a higher prevalence in males, our study sought to use cortical thickness (CT) to distinguish the medicated-naive school-age ADHD boys from healthy controls via SVM.

METHOD AND MATERIALS

Forty drug-naïve ADHD boys (mean age: 10.1) and 40 healthy controls (mean age: 10.2) were recruited. The T1-weighted images were obtained by 3T MRI with SPGR sequence. The whole-brain analysis between two groups was performed via the Qdec surface-based group analysis tool in Freesurfer for CT with age as covariate (corrected by FDR $p<0.05$). We used PROBID software to investigate the diagnosis potential of CT of each hemisphere separately based on SVM using leave-one-out cross-validation approach. Then we examined their combined discriminative power for both hemisphere ($p<0.001$). We also drew Receiver Operating Characteristic (ROC) curves to assess the diagnosis accuracy power.

RESULTS

Compared to healthy group, ADHD boys showed significant reduction in cortical thickness of bilateral orbitofrontal, insula and lingual, right anterior and posterior cingulate, prefrontal, temporal and parietal cortex (Figure A), and left CT demonstrated obviously more significance in classification (sensitivity 80%, specificity 85%, accuracy 82.5%, $P \leq 0.001$, ROC area 0.841) (Figure B). The combined CT of both hemispheres didn't provide better result than left CT alone.

CONCLUSION

Our study demonstrated deficits in cortical thickness provides best solution for classification of medicated-naive ADHD boys with healthy controls. The fact that left hemisphere is more useful in classification showed the lateralization in brain neural pathology of ADHD.

CLINICAL RELEVANCE/APPLICATION

Classification approach based on cortical thickness may be a useful technique to distinguish the ADHD individuals from healthy controls.

SSE21

Physics (Nuclear Imaging)

Monday, Nov. 30 3:00PM - 4:00PM Location: S403A

MR NM PH

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Chien-Min Kao, PhD, Chicago, IL (*Moderator*) Stockholder, Walgreens Boots Alliance, Inc
Tinsu Pan, PhD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSE21-01 Algorithm-Enabled Reduction of Detector Crystals in Advanced PET System

Monday, Nov. 30 3:00PM - 3:10PM Location: S403A

Participants
Zheng Zhang, MA, BS, Chicago, IL (*Presenter*) Nothing to Disclose
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Buxin Chen, MSc, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
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Emil Y. Sidky, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Xiaochuan Pan, PhD, Chicago, IL (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, Toshiba Corporation;

PURPOSE

As detector crystals constitute a large portion of a modern PET system cost, it is of significance to design a PET scanner with a reduced number of detectors without sacrificing the image quality. In this study, we investigate algorithm-enabled PET systems design with a 50% reduction of detector crystals.

METHOD AND MATERIALS

We employ a digital PET scanner to collect IEC phantom data with initial total activity of 53 MBq. The phantom contains 6 spheres of 10, 13, 17, 22, 28, and 37 mm diameter. The activity in the smallest four spheres is 4 times the background and zero in the other two. We design a sparse PET configuration with 50% of crystals, which is to remove odd-numbered tiles in the odd-numbered rings, and even-numbered tiles in the even-numbered rings. We use an iterative algorithm based on Chambolle-Pock framework to solve a constrained-TV-minimization problem. We reconstruct images from full data by using the row-action maximum likelihood algorithm (RAMLA) as references. Scatter and random corrections are applied in the reconstruction. Images are evaluated by use of contrast of 4 hot spheres with the instruction in NEMA NU 2-2012.

RESULTS

Reconstructions with the new algorithm from both full and sparse data exhibit lower background noise compared to the RAMLA result. The contrast of a hot sphere of size 22 mm is 71.7%, 66.7%, and 68.5% in the full-data TV image, the sparse-data TV image, and the full-data RAMLA result, respectively. In the same order, the contrasts of the hot sphere of size 17 mm is 63.2%, 60.8%, and 59.0%; of the hot sphere of size 13 mm is 58.4%, 54.1%, and 47.3%; and of the hot sphere of size 10 mm is 32.1%, 20.6%, and 17.5%.

CONCLUSION

Advanced algorithms can reconstruct PET images from full data with quality improved over the RAMLA results in terms of contrast and background noise, and can yield images from data with 50% crystal reduction with potential practical utility.

CLINICAL RELEVANCE/APPLICATION

This work suggests that PET images of practical utility may be obtained by use of advanced algorithms from sparse-crystal data, which can be exploited for enabling crystal/cost reduction.

SSE21-02 Respiratory Motion Compensation for Simultaneous PET/MR Based on Measurements of Strongly Undersampled Radial MR Data

Monday, Nov. 30 3:10PM - 3:20PM Location: S403A

Awards
RSNA Country Presents Travel Award

Participants
Christopher M. Rank, MSc, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
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Andreas Wetscherek, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Marc Kachelriess, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Sebastian Sauppe, Heidelberg, Germany (*Presenter*) Nothing to Disclose

PURPOSE

We propose a new method for PET/MR respiratory motion compensation (MoCo), which employs strongly undersampled measured MR

We propose a new method for PET/MR respiratory motion compensation (MoCo), which employs strongly undersampled measured MR data. These MR measurements can be interlaced with clinical MR sequences and can be acquired with measurement times as short as 30 s per bed position.

METHOD AND MATERIALS

MR data covering the thorax and abdomen of free-breathing volunteers were acquired with a Siemens Biograph mMR system. We applied a 3D encoded radial stack-of-stars sequence with a golden angle radial spacing. Two highly undersampled datasets consisting of 300 and 600 spokes were created corresponding to acquisition times of 30 s and 60 s, respectively. Respiratory motion amplitudes were derived from measured k-space centers allowing for a retrospective gating into 20 overlapping motion phase bins with a width of 10%. For all volunteers, MoCo 4D MR images and corresponding motion vector fields were generated for both highly undersampled datasets using our newly-developed method for joint motion estimation and iterative image reconstruction. Subsequently, 4D PET volumes of the volunteers with four artificial hot lesions (10 mm diameter) in the lungs and the abdomen were simulated. 3D PET and MoCo 4D PET images based on the two sets of motion vector fields derived from MR were reconstructed and compared to a reference gated 4D reconstruction with ten-fold PET acquisition time.

RESULTS

Compared to the 3D PET reconstructions, MoCo 4D PET reconstructions could reduce image blurring for both MR acquisition times. Due to its large motion amplitude, one lesion showed a double structure in the 3D reconstruction which could not be seen in the MoCo 4D reconstructions. For quantitative evaluation, SUVmean values were measured for all lesions in the end-exhale motion phases. In comparison to the reference, deviations of SUVmean were 36.7%, 24.5%, 21.5% on average for the 3D, MoCo 4D (30 s) and MoCo 4D (60 s) reconstructions, respectively.

CONCLUSION

It was demonstrated that motion compensation of PET images based on measurements of strongly undersampled radial MR data acquired during normal respiration could outperform 3D PET reconstructions in terms of image quality and quantification.

CLINICAL RELEVANCE/APPLICATION

The proposed method could be potentially integrated into clinical PET/MR to improve PET image quality and quantification, thus, increasing the diagnostic value of PET/MR.

SSE21-03 The Automated Determination of Universal Image Quality Indices for PET Scanners

Monday, Nov. 30 3:20PM - 3:30PM Location: S403A

Participants
Yaniv Rotem, BSc, MSc, Nesher, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
John A. Kennedy, PhD, Haifa, Israel (*Presenter*) Nothing to Disclose

Background

Evaluation of PET image quality phantom tests routinely requires deliberation and subjective decision-making. Commonly-used metrics of PET image quality do not always reflect perceptual quality differences. An automated method of measuring the structural similarity index (SSIM) reflecting known characteristics of the human visual system (HVS) has been developed to aid in the fast, objective evaluation of such tests.

Evaluation

Monthly image quality tests were performed (n=26) using an American College of Radiology (ACR) approved PET phantom (Esser flangeless) in a time-of-flight PET/CT. Scans comprised approximately 123e6 prompt counts and 19e6 random counts. An in-house MATLAB code analyzed 9.81 mm thick transaxial slices through the hot cylinders by comparing them with a digital model adjusted to known hot-to-background ratios. Registration of the digital model was performed using correlation of the outer phantom edges, and then rotating the images to maximize SSIM. In additional trials, SSIM was determined for a misregistered phantom (by 13 mm between CTAC and PET) exhibiting attenuation correction artifacts and for a list mode acquisition divided into 16 virtual acquisitions incrementing the scan time by 30 s to total of 8 minutes. SSIM was compared to a non-HVS metric, mean square error (MSE). Ideally, higher SSIM or lower MSE indicate superior image quality.

Discussion

Over approximately a two-year period, SSIM was 0.748 ± 0.007 (mean ± S.D., n=26) on ACR-approved PET phantoms. All cold and hot features were evident but highest (0.764) and lowest (0.733) SSIM were the visually better and worse images respectively. For the 16 virtual acquisitions, SSIM increased (from 0.56 to 0.74) monotonically with scan time, a known determinant of image quality. The misregistered phantom was superior to the 90 s acquisition by visual assessment, which was reflected in the SSIM (0.68 vs. 0.65, respectively) but not in the MSE (0.072 vs 0.065).

Conclusion

Automated PET quality control using structural similarity to model the human visual system efficiently provides an objective index to reflect small perceptual quality differences among images and can be used to ensure diagnostic accuracy.

SSE21-04 Performance Evaluation of a Prone Dedicated Breast Ring PET Scanner Designed for Improved Visualization of Posterior Breast Tissue

Monday, Nov. 30 3:30PM - 3:40PM Location: S403A

Participants
Andrew Polemi, Charlottesville, VA (*Presenter*) Institutional research agreement, Hologic, Inc
Heather R. Peppard, MD, Charlottesville, VA (*Abstract Co-Author*) Consultant, Siemens AG; Research Grant, Hologic, Inc
Stan Majewski, MD, Morgantown, WV (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, ONCOVISION
Alexander Stolin, PhD, Morgantown, WV (*Abstract Co-Author*) Nothing to Disclose
Patrice K. Rehm, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Mark B. Williams, PhD, Charlottesville, VA (*Abstract Co-Author*) Institutional research agreement, Hologic, Inc.

PURPOSE

To report the design and performance of a novel dedicated breast ring positron emission tomography (BRPET) system measured using a modified NEMA NU4-2008 protocol.

METHOD AND MATERIALS

The BRPET scanner consists of a ring of 12 detector modules. Each detector consists of a pixelated LYSO crystal connected to a position sensitive photomultiplier tube using a fiber optic light guide. The detector ring is mounted below a modified Lorad prone breast biopsy table for pendant geometry imaging. The detector light guides extend from the photomultiplier tubes at an angle to permit closer crystal access to posterior breast tissue near the patient's chest wall. Performance metrics evaluated include spatial resolution, sensitivity, and noise equivalent count rate. These tests were adapted from the National Electrical Manufacturers Association (NEMA) NU4-2008 protocol. Two additional phantom tests were performed to assess the amount of posterior breast tissue that cannot be imaged by the scanner due to the thickness of the table.

RESULTS

Spatial resolutions of 1.8, 1.6, and 1.9 mm FWHM were measured at the center of the field of view in the axial, radial, and tangential directions, respectively. The peak absolute system sensitivity was 13.2% and scatter fraction of 25.4% using an energy window of 420 - 600 keV. The peak noise equivalent counting rate and peak true rates at 3.86 MBq were 0.75 kcps and 1.23 kcps, respectively. The scanner can image to within 6.25mm of the plane defined by the top surface of the table and has the capability to scan a total of 19 cm along the central axis of a pendant breast.

CONCLUSION

The BRPET system can produce high-resolution PET images at clinically relevant count rates. Compared to other prone breast PET systems it has superior coverage of the posterior breast.

CLINICAL RELEVANCE/APPLICATION

Novel dedicated breast ring PET scanner with high spatial resolution and better visualization of posterior breast tissue compared to current breast PET systems.

SSE21-05 A Hybrid Imaging Phantom for Quality Assurance and Research

Monday, Nov. 30 3:40PM - 3:50PM Location: S403A

Participants
Philipp Mann, MSc, Heidelberg, Germany (*Presenter*) Nothing to Disclose
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Peter Bachert, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To construct and test a phantom that mimics the human pelvis for quality assurance, research, and performance measurements in both PET/CT and PET/MR devices.

METHOD AND MATERIALS

The phantom is enclosed in a PMMA box that can be filled with different liquids and radioactive tracers to simulate background signal. Refillable inserts mimic bladder, thigh bones, and prostate (including eight separate cells which can be filled with dissolved metabolites and radioactive tracers). The inserts were produced using 3D printing based on CAD models or MRI data from healthy volunteers. Activity introduced into the bladder model yields realistic PET signals while the thigh bones can be filled with fat- or bone-equivalent materials to obtain different attenuating properties. Additionally, an insert for an endorectal RF coil allows to perform MR spectroscopy (MRS). The phantom was used to check co-registration: the center of mass of the signals obtained by CT or MR within a single cell of the prostate insert was calculated and compared to the corresponding signal obtained by PET. The phantom was also used for research projects including MRS (e.g., quantification of creatine, citrate, and choline) and PET studies comparing reconstructions of data obtained with PET/MR and PET/CT scanners. Since the phantom is available as 3D voxel phantom all experiments can be cross-checked by simulations.

RESULTS

The misalignment of the co-registration of data from the employed PET/CT and PET/MR were 0.57 ± 0.30 pixels and 0.57 ± 0.20 pixels, respectively. The MRS analysis showed that all ^{1}H MR resonances of metabolites in the model solutions can be resolved. Offline PET simulations agree well with the outcome of phantom measurements (SUVmean differences < 5 %). PET image distortions caused by false MR-based attenuation maps can be accurately reproduced using simulations based on the 3D voxel phantom.

CONCLUSION

The phantom is a flexible tool to study the performance of PET/CT and PET/MR systems. It can verify co-registration in a straightforward way. In addition, there is a variety of research applications, ranging from MR sequence testing to evaluations of new PET reconstruction algorithms.

CLINICAL RELEVANCE/APPLICATION

The phantom and its digital 3D version can help to improve quality assurance in clinical PET/CT and PET/MR scanners and offer simple approaches to test and evaluate new PET reconstruction algorithms.

SSE21-06 Statistical Methods to Verify Lesion Detection in Low Count Environments

Monday, Nov. 30 3:50PM - 4:00PM Location: S403A

Participants
Kenneth Nichols, PhD, New Hyde Park, NY (*Presenter*) Royalties, Syntermed, Inc;

Fritzgerald Leveque, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Palestro, MD, New Hyde Park, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

It can be helpful to quantify lesion-to-background contrast in resolving cases of questionable visual lesion detection. For low-count data this becomes problematic due to statistical uncertainty. This study was undertaken to determine whether curve fitting at potential lesion locations overcomes these difficulties.

METHOD AND MATERIALS

Algorithms were written in IDL to automatically identify likely locations of solid spheres and to sample neighboring uniform background volumes in multipurpose plastic and water phantoms used for routine SPECT quarterly quality assurance tests. Data were processed for 12 phantoms loaded with 370-925 MBq Tc-99m for acquisitions ranging from 11-27 seconds/projection for 64-128 projections. Each high-count acquisition was paired with low-count acquisitions for the same phantoms imaged for only 1 second/projection. Algorithms generated counts versus radii curves and counts versus angles curves, through which 3rd order polynomials were fit by minimizing $\chi 2$ variance. Similar plots were formed for 6 background volumes. Contrast was computed as (maximum-minimum)÷(maximum+minimum) for both raw counts and fitted curves. One physicist read all images and graded sphere detection confidence on a 5-point scale for each sphere. The Kolmogorov-Smirnov test determined whether continuous variables were normally distributed, based on which the t-test or Wilcoxon test determined significance of differences between means.

RESULTS

Total counts were significantly greater for high-count than low-count acquisitions (32±19 versus 3±2 Million counts, $p < 0.0001$). Fitted contrast agreed with visual scores with higher accuracy (ROC area) than raw contrast (85±3% versus 61±5%, $p<0.0001$), for both low counts (84±5% versus 67±7%, $p=0.001$) and high counts (88±4% versus 75±6%, $p=0.003$). Contrast was significantly different between high-count and low-count paired acquisitions for raw counts (41±23% versus 74±24%, $p < 0.0001$), but not for fitted contrast (37±32% versus 35±32%, $p = 0.27$). Raw contrast was correlated with total counts ($r = -0.51$, $p<0.0001$), but fitted contrast was not ($r = 0.02$, $p = 0.79$).

CONCLUSION

Compared to straightforward contrast measurement, curve fitting provided better agreement with visual assessment and more stable measurements that were independent of acquired counts.

CLINICAL RELEVANCE/APPLICATION

Our results suggest that radial count curve fitting may be useful to verify lesion detection in low count environments.

SSE23

Physics (MRI I-Image Quality, Evaluation)

Monday, Nov. 30 3:00PM - 4:00PM Location: S404AB

MR PH

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Seth A. Smith, PhD, Nashville, TN (*Moderator*) Nothing to Disclose

Sub-Events

SSE23-01 Multi-Centric, Inter- and Intra-Scanner Variability of Quantitative, Organ-specific Measures in Whole-Body MR Imaging

Monday, Nov. 30 3:00PM - 3:10PM Location: S404AB

Participants
Christopher L. Schlett, MD, MPH, Heidelberg, Germany (*Presenter*) Nothing to Disclose
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Christian R. Stroszczynski, MD, Regensburg, Germany (*Abstract Co-Author*) Nothing to Disclose
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Dagmar Hartung, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
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Holger Hetterich, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Katrin Amunts, Julich, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Gunther, Bremen, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank K. Wacker, MD, Hannover, Germany (*Abstract Co-Author*) Research Grant, Siemens AG Research Grant, Pro Medicus Limited
Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans-Ulrich Kauczor, MD, Heidelberg, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Bayer AG; Speakers Bureau, Boehringer Ingelheim GmbH; Speakers Bureau, Siemens AG; Speakers Bureau, Novartis AG; Speakers Bureau, GlaxoSmithKline plc ; Speakers Bureau, Almirall SA
Michael Forsting, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Norbert Hosten, MD, Greifswald, Germany (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Institutional research agreement, Bayer AG; Stockholder, Siemens AG
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Fabian Bamberg, MD, MPH, Munich, Germany (*Abstract Co-Author*) Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG; Research Grant, Bayer AG; Research Grant, Siemens AG;

PURPOSE

Whole-body MR imaging is increasingly being implemented in population-based cohorts and certain clinical settings. However, to quantify the variability introduced by the different scanners is essential to make conclusions about clinical and biological data, and relevant for internal and external validity. Thus, we determined the inter- and intra-scanner variability of seven different 3 Tesla MR systems representing four major vendors.

METHOD AND MATERIALS

Healthy volunteers underwent multi-centric, inter- and intra-scanner (n=30 and n=12, respectively) imaging with a predefined whole-body MR protocol (including neurological, cardiovascular, thoracoabdominal and musculoskeletal sequences). A set of quantitative organ-specific measures (n=20; e.g. volume of brain's gray/white matter, SNR in TOF of basal cerebral arteries, LV endsystolic/-diastolic volume, pulmonary trunk diameter, vertebral body height, cartilage thickness, SNR of the lung, liver diameter) were obtained in a blinded fashion. Reproducibility was determined using mean weighted relative differences and interclass correlation coefficients (ICC).

RESULTS

All volunteers (44±14 years, 50% females) successfully completed imaging except for two scans due to technical issues; thus, 100 whole-body exams were finally analysis. Mean scan time was 2:32 hrs and differed significantly across scanners (range: 1:59 to 3:12 hrs). A higher reproducibility of organ-specific MR-measurements was observed for intra- than for inter-scanner comparisons (mean ICC: 0.80±0.17 vs. 0.60±0.31, p=0.005, respectively). In the inter-scanner comparison, the mean relative differences ranged from 1.0% to 53.2%, with 45% of measurements demonstrating excellent reproducibility (ICC≥0.75). Conversely, in the intra-device comparison, the mean relative differences ranged from 0.1% to 15.6%, with 65% of measurements showing excellent reproducibility. There were no differences regarding intra- and inter-scanner reproducibility between individual organ systems (all p≥0.24).

CONCLUSION

In this study of seven different 3 Tesla MR systems, whole-body imaging-derived organ parameters showed good to excellent reproducibility, with less variability observed when using identical MR scanners.

CLINICAL RELEVANCE/APPLICATION

Whole-body MRI shows acceptable relative differences and high reproducibility for most organ-specific measurements, indicating internal validity and the potential for pooling data across different cohorts.

SSE23-02 Magnetic Resonance Elastography of the Brain: Assessment of Scan-rescan Reproducibility

Monday, Nov. 30 3:10PM - 3:20PM Location: S404AB

Participants
Hatim Chafi, BS, Baton Rouge, LA (*Abstract Co-Author*) Nothing to Disclose
Ryan N. Schurr, Baton Rouge, LA (*Abstract Co-Author*) Nothing to Disclose
Jianhua Lu, PhD, Baton Rouge, LA (*Abstract Co-Author*) Nothing to Disclose
Kevin B. McKlveen, Baton Rouge, LA (*Abstract Co-Author*) Nothing to Disclose
Owen Carmichael, PhD, Baton Rouge, LA (*Abstract Co-Author*) Nothing to Disclose
Guang Jia, PhD, Baton Rouge, LA (*Presenter*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic resonance elastography (MRE) has shown brain tumor to differ in stiffness in comparison to normal brain tissue.The purpose of this study was to measure the shear modulus of white and grey matter using MRE, and to assess scan-rescan reproducibility.

METHOD AND MATERIALS

MRE of the brain was performed in 10 healthy volunteers on a 3T MRI scanner using a 2D EPI MRE sequence. Shear waves were induced at frequencies of 60, 50, and 40 Hz, using an ergonomic flexible driver connected to a speaker system via a polyvinyl chloride tube. MRE phase data was acquired using a single slice and 8 temporal phases with axial T2-weighted images as reference. Motion encoding was performed in the through plane direction (Z). Elastograms were reconstructed using GE direct inversion post processing software. Each subject was repositioned and rescanned within the hour. Wilcoxon signed-rank test was used to compare white and grey matter shear modulus measurement at each driver frequency.

RESULTS

White matter shear modulus measurements at 60, 50, and 40 Hz were 3.9 ± 0.4 kPa, 3.8 ± 0.5 kPa, and 3.4 ± 0.3 kPa, respectively. 60, 50, and 40 Hz grey matter shear modulus measurements were 3.3 ± 0.5 kPa, 2.8 ± 0.5 kPa, and 2.2 ± 0.4 kPa, respectively. White matter shear modulus measurements were significantly higher than grey matter at all frequencies ($P < 0.001$). The within-subject coefficient of variation of white matter and grey matter shear modulus measurements for all frequencies ranged 3.74-4.10%, and 4.68-5.95%, respectively.

CONCLUSION

Our results show that brain tissue shear modulus increases with driver frequency which highlights the importance of standardizing MRE settings in order to facilitate cross-institutional comparison. Both white matter and grey matter shear modulus measurements exhibit high reproducibility, enabling MRE as a potential clinical quantitative imaging technique.

CLINICAL RELEVANCE/APPLICATION

MRE allows for the differentiation between the shear modulus of normal brain tissue and malignancy. This technique with high reproducibility has potential for differentiating radiation necrosis from tumor recurrence in the brain.

SSE23-03 Quantification of MRI Geometric Distortion for Radiation Treatment Planning Applications

Monday, Nov. 30 3:20PM - 3:30PM Location: S404AB

Participants
Chase C. Hansen, MBA, Lubbock, TX (*Abstract Co-Author*) Nothing to Disclose
Abdallah S. Mohamed, MD, MSc, Houston, TX (*Presenter*) Nothing to Disclose
Yao Ding, MS, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Clifton D. Fuller, MD, PhD, Houston, TX (*Abstract Co-Author*) In-kind support, General Electric Company; Research Grant, Elekta AB; ; ;
Steven Frank, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Joseph Weygand, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jihong Wang, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Uncertainties related to geometric distortion are a major obstacle for use of MRI in radiation treatment planning. The aim of this study is to quantify the geometric distortion in patient images by comparing their in treatment position's MRIs with the corresponding planning CT, using CT as the non-distorted gold standard.

METHOD AND MATERIALS

Twenty-one head and neck cancer patients were imaged with MRI as part of a prospective IRB approved study. All patients had their treatment planning CT done on the same day or within one week of the MRI. MR Images were acquired with a T2 SE sequence (1x1x2.5mm voxel size) in the same immobilization position as in the CT scans. MRI to CT rigid registration was then done and geometric distortion comparison was assessed by measuring the corresponding anatomical landmarks on both the MRI and the CT images by two observers. Several skin to skin (STS; 9 landmarks), bone to bone (BTB; 8 landmarks), and soft tissue (TTT; 3 landmarks) were measured at specific levels in horizontal and vertical planes of both scans.

RESULTS

The mean distortion for all landmark measurements in all scans was 1.6±1.7 mm. For each patient 10 measurements were done in the horizontal plane and 10 were done in the vertical plane. The measured geometric distortion were significantly lower in the horizontal axis compared to the vertical axis (1.4±0.05 vs. 1.7±0.05 mm, respectively, P=0.0002*). The magnitude of distortion was lower in the BTB landmarks compared to the STS landmarks (1.2±0.06 vs. 2.0±0.07 mm, P<0.0001*). Likewise, the magnitude of distortion was lower in the TTT landmarks compared to the STS landmarks (1.5±0.09 vs. 2.0±0.07 mm, P<0.0001*). BTB distortion measurements were insignificantly different from TTT (1.2±0.06 vs. 1.5±0.09 mm, P=0.9). The mean distortion measured by observer one was not significantly different compared to observer 2 (1.6±0.07 vs 1.6±0.13 mm, P=0.16)

CONCLUSION

MRI geometric distortions were quantified in radiotherapy planning applications with clinically insignificant error of less than 2 mm compared to the gold standard CT.

CLINICAL RELEVANCE/APPLICATION

After QA aganist gold standard CT for quatification of errors related to goemetric distortion, MRI aquired in treatment position with customized immobilization devices and intra-oral stent is potentially usable for radiotherapy planning purposes.

SSE23-04 Multi-diffusivity and Multi-orientation Reproducibility of Apparent Diffusion Coefficient Measurement

Monday, Nov. 30 3:30PM - 3:40PM Location: S404AB

Participants
Ruoyun Ma, West Lafayette, IN (*Presenter*) Nothing to Disclose
Chien-Lin Yeh, West Lafayatte, IN (*Abstract Co-Author*) Nothing to Disclose
Thomas L. Chenevert, PhD, Ann Arbor, MI (*Abstract Co-Author*) Consultant, Koninklijke Philips NV
Michael Boss, PhD, Boulder, CO (*Abstract Co-Author*) Nothing to Disclose
Chen Lin, PhD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Apparent Diffusion Coefficient (ADC) of diffusion weighted imaging (DWI) has been used clinically as a biomarker for various diseases. However, the most broadly used DWI approach, echo planer imaging (EPI) sequence, is vulnerable to artifacts and highly dependent on MRI scanner system. Our study aims at investigating accuracy of ADC measurements across platforms from one vendor and in different orientation of image acquisition in a wide range of diffusivity.

METHOD AND MATERIALS

An RSNA QIBA ADC phantom containing 13 20ml polypropylene scintillation vials filled with aqueous solutions of polyvinylpyrrolidone (PVP) was used for measurement, as shown in Fig. 1. DWI scans were conducted with the phantom at 0°C on 8 types of Siemens scanners (3T TIM Verio, 1.5T TIM Avanto, 1.5T TIM Symphony, 1.5T TIM Espress, 3T TIM Trio, 1.5T Aera, 3T Skyra and 3T Prisma) with head coils and identical acquisition protocol. Three orthogonal imaging orientations, i.e. axial, sagittal and coronal directions were tested with b-values of 0, 500, 1000 and 2000 s/mm2; TR=5000ms; TE=136ms; parallel acceleration factor (iPAT)=2; acquisition matrix 256×256; FOV 230×230 mm2; 5 slices crossing the vials, 4mm thickness. ADC measurement for each vial was performed with ROI analysis using ADC maps from scanner.

RESULTS

Measured ADC from 8 scanners in three orientations for 13 vials are shown in Fig.2. ADC bias error of vials filled with water with respect to the reported value at 0°C was 2.1% at 3T and 1.5% at 1.5T. Overall standard deviation of ADC in water-only vials was 1.71%. Multi-platform coefficients of variance (CV) of ADC from three orientations for 5 types of vials were listed in table 1, with measured ADC ranging from 200 to 1100 mm2/s. Variability in orientation does not have a significant influence (CV≤5) on acquired ADC values.

CONCLUSION

Reproducibility of iso-center ADC measurements on eight scanners from the single vendor was verified in a wide range of diffusivity. Orientation of the image did not have a significant effect on ADC measurement; but slightly increased variance was observed with lower diffusivity. The quality assurance procedure was tested to be feasible and applicable for other vendors.

CLINICAL RELEVANCE/APPLICATION

Reproducibility of ADC values across scanners and orientation is crucial for clinical diagnosis and treatment evaluation requiring repeated scans and multi-platform comparison.

SSE23-05 Multicenter Study of Reproducibility of Wide Range of ADC at 0 °C

Monday, Nov. 30 3:40PM - 3:50PM Location: S404AB

Participants
Michael Boss, PhD, Boulder, CO (*Presenter*) Nothing to Disclose
Thomas L. Chenevert, PhD, Ann Arbor, MI (*Abstract Co-Author*) Consultant, Koninklijke Philips NV
Edward F. Jackson, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Rajpaul Attariwala, MD, PhD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Amita Shukla-Dave, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Edson Amaro JR, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Mark S. Shiroishi, MD, Los Angeles, CA (*Abstract Co-Author*) Consultant, Guerbet SA; Research Grant, Toshiba Corporation;
Ona Wu, PhD, Charlestown, MA (*Abstract Co-Author*) Royalties, General Electric Company; Royalties, Olea Medical; License agreement, General Electric Company; License agreement, Olea Medical
Dariya Malyarenko, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
John Kirsch, PhD, Charlestown, MA (*Abstract Co-Author*) Employee, Siemens AG

PURPOSE

MR DWI measurands are potential quantitative imaging biomarkers. However, at this juncture, there is variability in quantification of

MR DWI measurands are potential quantitative imaging biomarkers. However, at this juncture, there is variability in quantification of DWI data. This variability can be due to hardware differences, pulse sequence implementation and acquisition parameter choices, and b-value selection. Our study aims to determine the intrinsic, scanner-induced variability of the apparent diffusion coefficient (ADC) across multiple sites, vendors, and field strengths.

METHOD AND MATERIALS

Multiple copies of a phantom developed by NIST and RSNA QIBA, using varying concentrations of polyvinylpyrrolidone (PVP) in aqueous solution to generate physiologically relevant apparent diffusion coefficient (ADC) values, were produced and distributed. These phantoms have been scanned at isocenter to evaluate hardware across multiple institutions and platforms using a 0 °C ice-water fill solution to eliminate variability in ADC introduced by temperature differences across scanners, as well as at ambient conditions. All sites used a standardized SS-EPI pulse sequence with b= 0, 500, 900 and 2000 mm²/s.

RESULTS

Initial results across 5 (out of an eventual 13) sites, 3 vendor platforms, and 2 field strengths indicate that the phantom provides a high degree of reproducibility and a wide range of ADC values. ADCs ranged from 0.12 (50% PVP by mass) up to 1.1 x 10^{-3} mm²/s (water) at 0 °C, with repeatability coefficients (RCs) of 1.7% or less for water vials across sites. RCs were below 6% for all but the lowest ADC components of the phantom at 0 °C. A wider range of ADC values was seen at 37 °C, from ~0.6 to ~3.0 x 10^{-3} mm²/s, but with larger measurement error.

CONCLUSION

Stable, well-characterized phantoms allow for understanding sources of inter-hardware and longitudinal bias and variability and for providing a robust quality control and site qualification platform for DWI acquisitions. Slightly higher ADCs exhibited by the outermost water vial, ~70 mm from the phantom center, may indicate spatially-dependent bias, possibly due to gradient non-linearity effects. The intrinsic variability across scanners when measuring ADC is low; however, significantly larger errors can be expected when measuring slow diffusion components.

CLINICAL RELEVANCE/APPLICATION

This work demonstrates the utility of the phantom for quality control purposes in a multicenter, multivendor study. It allows pulse sequence testing over a relevant physiological range of ADC values.

SSE23-06 Evaluation of Whole-body Ferrodetector Systems in Clinical MRI

Monday, Nov. 30 3:50PM - 4:00PM Location: S404AB

Participants
Felix V. Guettler, Jena, Germany (*Presenter*) Nothing to Disclose
Andreas Heinrich, Jena, Germany (*Abstract Co-Author*) Nothing to Disclose
Ulf K. Teichgraeber, MD, Jena, Germany (*Abstract Co-Author*) Research Consultant, W. L. Gore & Associates, Inc; Research Consultant, Siemens AG; Research Consultant, CeloNova BioSciences, Inc ; Research Consultant, General Electric Company;

PURPOSE

In the environment of a MRI, ferromagnetic objects can cause severe injuries. According to manufacturers whole-body ferrodetection ensures maximum patient safety and minimize risks for personnel and MRI equipment in clinical routine. This study aims to evaluate if a screener or an door guard system for ferromagnetic metals can increase patient safety and is reliably working in clinical practice.

METHOD AND MATERIALS

A highly sensitive screener for ferromagnetic objects (Ferroguard Screener, Metrasens, GB) as well as an door guard system (Ferroguard Guardian, Metrasens, GB) focusing larger ferromagnetic objects, were installed in the preparation room and at the doorway to an MRI room (Fig 1). Subsequently 400 patients were scanned with the screener as well as another 2500 patients with the door guard system. Patients examined with the screener were asked to turn around 360° in front of the system. Measurement time was documented for each first scanning process. All patients were regularly asked to remove all metal objects and inform the radiologist about any implants that might contain metal parts. In case of an alarm the patient was rescanned for a reproducible result, otherwise a false positive finding was documented. If the alarm was confirmed the patient was searched for ferrous materials and findings were documented, until no more alarm is given.

RESULTS

The screener system identified unknown ferrous objects in 2% of the cases. In two cases ferrous foreign bodies were found. The average measurement time for the screener was 80 sec (varying from 10 to 300 sec). The door guard system detected unknown ferrous objects in 0,3% of the cases. There were two false-positive alerts (non reproducible).

CONCLUSION

The number of ferrous object which are brought to the scanner room by accident, can be reduced with usage of a whole-body ferrodetection system. To avoid false alarms the door guard system requires a ferrous free environment and perfectly ferrous free clothing for the medical personnel. Ferrodetection can aid and complement, but not replace patient education and MRI safety training.

CLINICAL RELEVANCE/APPLICATION

The biggest risk of an MRI examination are the impact of ferromagnetic objects, that are unconciously brought into the magnetic room. Effective mechanisms are mandatory to avoid MR-accidents.

MSAS24

Hot Topics in MR Safety (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

Monday, Nov. 30 3:30PM - 5:00PM Location: S105AB

MR SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Kendra Huber, RT, BS, Castle Rock, CO (*Moderator*) Nothing to Disclose
Steven P. DeColle, Edmonton, AB (*Moderator*) Nothing to Disclose

Sub-Events

MSAS24A Safety of the Gadolinium Chelates

Participants
Val M. Runge, MD, Bern, Switzerland (*Presenter*) Research Grant, Siemens AG

LEARNING OBJECTIVES

1) List the minor adverse reactions that occur with Gd chelate administration, and their incidence. 2) Describe the known interactions of the weaker chelates with laboratory tests. 3) Formulate a strategy for contrast use in renal failure patients, considering the impact of NSF. 4) Describe the phenomenon of dentate hyper intensity, and its link to the weaker chelates. 5) Critique the available agents in terms of overall safety.

ABSTRACT

The gadolinium based MR contrast agents (GBCAs) consist of transition metal Gd ions (Gd3+) bound very tightly by chelating agents to form a stable complex (minimizing dissociation in vivo), mitigating the substantial natural toxicity of the free metal ion. MR contrast media, specifically the gadolinium chelates, are in general very safe and lack the nephrotoxicity associated with IV administration of the iodinated agents. Nausea, hives, and taste disturbance are the most frequent adverse reactions caused by GBCAs. All of the available GBCAs have the same incidence of these minor adverse reactions, which is substantially less than with the iodinated agents. It should be noted, however, that life-threatening anaphylactoid reactions - although extremely rare - can occur after IV injection of any contrast agent.The GBCAs can, however, be differentiated on the basis of chelate stability, with important implications for clinical use. Nephrogenic systemic fibrosis (NSF) is a serious late adverse reaction associated with exposure to GBCAs in patients with renal insufficiency. In this situation, release of free Gd3+ is more likely to occur due to the extended presence of GBCAs within the body. Due to the advent of NSF, administration of three agents (Omniscan, Optimark, and Magnevist) is now contraindicated in several clinical situations (by both the FDA and the EMA), including specifically chronic severe kidney disease.In the last year, administration of multiple doses of Omniscan, in patients with normal renal function, has also been shown to be associated with changes in the globus pallidus and dentate nucleus, raising further questions regarding this agent, the least stable of the GBCAs. Use of only the most stable agents (the macrocyclics) is strongly recommended (Dotarem, Gadovist, and ProHance), with marked preferential use of these agents in developed countries.

MSAS24B Performing MRI Exams on Patients with Implant Devices

Participants
William H. Faulkner JR, BS, RT, Ooltewah, TN (*Presenter*) Speakers Bureau, Bracco Group; Consultant, Bracco Group; Consultant, Medtronic, Inc ; Speaker, General Electric Company; Consultant, Metrasens Ltd; Consultant, Aspect Imaging; Speaker, Siemens AG;

LEARNING OBJECTIVES

1) List and define the 3 approved labels for implants and devices as it relates to MRI. 2) Name common safety issues as it relates to B0, B1 and time-varying gradient magnetic fields. 3) Describe the benefit of using B1+rms vs. SAR as it relates to heating of implants and devices. 4) Describe how static field relates to heating of implants and devices.

ABSTRACT

When performing an MR exam on patients with implants and devices there are many factors to consider as it relates to safety. One must first first positively identify the device and then determine the MR labeling and thus the conditions of use. The static (B0) magnetic field can produce torque and translational forces on ferromagnetic objects. Additionally Lenz forces may be encountered with conductive metals. The time-varying gradient magnetic fields have been shown to adversely affect some types of active devices. Radio frequency (B1) fields can result in significant heating and sever burns. It's important for those who are exposing patients to these powerful magnetic fields understand their effects.

SPSC30

Controversy Session: Gadolinium Contrast Agents and Adverse Effects: Too Much Attention or Too Little?

Tuesday, Dec. 1 7:15AM - 8:15AM Location: E451A

GU MR SQ

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Hero K. Hussain, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Emanuel Kanal, MD, Pittsburgh, PA (*Presenter*) Consultant, Boston Scientific Corporation; Consultant, Medtronic, Inc; Consultant, St. Jude Medical, Inc; Consultant, Bayer AG; Investigator, Bracco Group; Royalties, Guerbet SA;
Martin R. Prince, MD, PhD, New York, NY, (map2008@med.cornell.edu) (*Presenter*) Patent agreement, General Electric Company; Patent agreement, Hitachi, Ltd; Patent agreement, Siemens AG; Patent agreement, Toshiba Corporation; Patent agreement, Koninklijke Philips NV; Patent agreement, Nemoto Kyorindo Co, Ltd; Patent agreement, Bayer AG; Patent agreement, Lantheus Medical Imaging, Inc; Patent agreement, Bracco Group; Patent agreement, Medtronic, Inc; Patent agreement, Topspins, Inc; Stockholder, Topspins, Inc
Richard H. Cohan, MD, Ann Arbor, MI, (rcohan@umich.edu) (*Presenter*) Consultant, General Electric Company; ; ;
Matthew S. Davenport, MD, Cincinnati, OH, (matdaven@med.umich.edu) (*Presenter*) Book contract, Wolters Kluwer nv; Book contract, Reed Elsevier;

LEARNING OBJECTIVES

1) To discuss associations of gadolinium based contrast agents (GBCA) and Nephrogenic Systemic Fibrosis (NSF). 2) To review rates and types of acute adverse reactions in patients receiving GBCA, and to place those in perspective with respect to the risk of NSF. 3) To discuss several other potential safety factors about GBCA, and to compare and contrast incidence of new potential safety factors among the various CNS-approved GBCA. 4) To explain the current thinking regarding imaging patients with renal impairment, and to define renal function thresholds that might be useful for operationalizing imaging in this patient population.

ABSTRACT

To review associations of gadolinium based contrast agents (GBCA) and Nephrogenic Systemic Fibrosis (NSF), and discuss current practice patterns that led to almost complete elimination of NSF. Speaker: Martin Prince.To review rates and types of acute adverse reactions in patients receiving GBCA, discuss principles of premedication and treatment, and place the acute adverse reaction rate in perspective with respect to the risk of NSF. Speaker: Richard Cohan. To list and integrate several other potential safety factors about GBCA, other than NSF and acute allergic type, into the clinical decision making process about whether or not to administer GBCA, and to compare and contrast incidence of new potential safety factors among the various CNS-approved GBCA available today. Speaker: Emanuel Kanal. To explain the current thinking regarding imaging patients with renal impairment, to highlight the differences that exist between serum creatinine-based and eGFR-based screening, and to define the ranges of renal function thresholds for which caution might be advised to avoid potential harm that might result from the administration of iodinated and gadolinium-based contrast media. Speaker: Matthew Davenport.

URL

SPSH30

Hot Topic Session: Quantitative MR Biomarkers in the MSK System

Tuesday, Dec. 1 7:15AM - 8:15AM Location: E350

MK BQ MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Martin Torriani, MD, Boston, MA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss how MRI-based cartilage mapping techniques yield biomarkers of cartilage integrity, and discuss the technical requirements and current indications for clinical use of these methods. 2) To describe the emerging capabilities of high-resolution MR imaging to examine bone microarchitecture and its potential in providing biomarkers of bone strength. 3) To discuss potential applications of MR spectroscopy in musculoskeletal neoplasms and fat quantification of musculoskeletal tissues such as marrow and muscle.

ABSTRACT

There is strong incentive to increase the role of quantitative techniques in clinical musculoskeletal imaging, especially applications related to cartilage health, bone structure, tumor and metabolic imaging. This Hot Topic session will discuss clinical applications of biomarkers of cartilage integrity (T1rho, T2, T2* and dGEMRIC), bone structure by high-resolution MRI, and tissue metabolism (MR spectroscopy for tumor imaging, muscle and marrow fat content).

Sub-Events

SPSH30A T2, T2*, T1rho and dGEMRIC as Biomarkers of Cartilage Integrity

Participants
Thomas M. Link, MD, PhD, San Francisco, CA, (thomas.link@ucsf.edu) (*Presenter*) Research funded, General Electric Company; Research funded, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

LEARNING OBJECTIVES

1) To define how T2, T2*, T1rho and dGEMRIC quantitatively assess cartilage matrix composition. 2) To describe the requirements for applying these quantitative measurements to clinical imaging. 3) To critically assess previous clinical studies and list indications for using quantitative cartilage imaging biomarkers.

SPSH30B Bone Microarchitecture by MRI

Participants
Gregory Chang, MD, New York, NY (*Presenter*) Speaker, Siemens AG

LEARNING OBJECTIVES

1) To define bone microarchitecture and its contribution to bone strength and fracture risk. 2) To describe the technical requirements for MRI of bone microarchitecture, including hardware, pulse sequences, and image post-processing. 3) To provide an overview of clinical studies of MRI of bone microarchitecture.

SPSH30C MR Spectroscopy of the Musculoskeletal System

Participants
Martin Torriani, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To define how MR spectroscopy quantitatively measures tissue biochemistry. 2) To describe general guidelines for usage of MR spectroscopy in musculoskeletal clinical imaging, including technical factors, quantification/analysis and interpretation. 3) To assess the state-of-the-science in regards to the use of MR spectroscopy for musculoskeletal tissues.

RC303

Cardiac Series: Imaging of Coronary Artery Disease

Tuesday, Dec. 1 8:30AM - 12:00PM Location: S405AB

CA CT MR

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants
Arthur E. Stillman, MD, PhD, Atlanta, GA (*Moderator*) Nothing to Disclose
Robert M. Steiner, MD, Philadelphia, PA (*Moderator*) Consultant, Educational Symposia; Consultant, Johnson & Johnson
Suhny Abbara, MD, Dallas, TX (*Moderator*) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG

Sub-Events

RC303-01 MRI of Coronary Ischemia (Coronary MRA, Stress Perfusion)

Tuesday, Dec. 1 8:30AM - 9:10AM Location: S405AB

Participants
David A. Bluemke, MD, PhD, Bethesda, MD (*Presenter*) Research support, Siemens AG

LEARNING OBJECTIVES

1) Describe the role of CMR for evaluation of myocardial perfusion. 2) Describe the results of CMR for evaluation of myocardial ischemia. 3) Indicate potential uses and methods for coronary artery evaluation by CMR.

ABSTRACT

Cardiac MRI (CMR) is an established modality for evaluation of ischemic myocardial disease; appropriateness criteria increasingly recognize the role of CMR in this role. CMR has outstanding temporal resolution allowing for accurate representation of myocardial volumes and function. Excellent soft issue contrast for myocardial ischemia evaluation is achieved with the use of a gadolinium contrast agent. Stress perfusion CMR during adenosine infusion compares favorably to nuclear medicine methods but can additionally assess volumes and mass very accurately. Stress CMR is used in combination with late gadolinium enhancement (LGE) techniques to depict viable myocardium to improve the specificity of the method. Coronary artery imaging with CMR is best performed at 1.5 T and is useful to assess for anomalous coronary artery imaging and confirm perfusion results. This session will describe the techniques, indications, results and interpretation of CMR for evaluation of ischemic disease of the myocardium.

Active Handout:David A. Bluemke

http://abstract.rsna.org/uploads/2015/15003318/RC303-01 Bluemke RSNA coronary and stress CMR.pdf

RC303-02 Evaluation of Obstructive Coronary Artery Disease in Patients with Agatston Score More than 500: Comparison of Computed Tomographic Angiography and Magnetic Resonance Angiography

Tuesday, Dec. 1 9:10AM - 9:20AM Location: S405AB

Participants
Makoto Amanuma, MD, Takasaki, Japan (*Presenter*) Nothing to Disclose
Takeshi Kondo, Takasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Hideyuki Matsutani, Takasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Takako Sekine, Takasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoko Miyata, Saitama, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Shigehide Kuhara, MS, Otawara, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinichi Takase, Takasaki, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

One of the limitations of coronary computed tomographic angiography (CCTA) is poor diagnostic accuracy for segments with severe calcification. On the other hand, the effect of calcification is considered limited on coronary magnetic resonance angiography (CMRA). The purpose of this study was to compare clinical feasibility of CCTA and CMRA for evaluation of obstructive coronary artery disease in patients with severe calcification.

METHOD AND MATERIALS

Written informed consent was obtained from all patients. In 29 patients(72±12 years,M:F=21:8)with high grade calcification (Agatston score>500) CCTA and CMRA findings were compared with the ICA findings as a reference standard. A 320-row area detector CT system (Aquilion ONE/ViSION Edition, Toshiba) was used for CCTA and a 1.5T MR unit (Vantage Titan, Toshiba) was used to obtain CMRA. For CCTA prospective one or two-beat scanning targeted at mid diastole was performed with the cardiac phase for scanning set to R-R 75%. For CMRA non-contrast 3D steady-state gradient echo technique with ECG gating and respiratory navigation technique was used. The coronary arteries were divided to 7 proximal segments (#1-#3, #5-#7, #11) based on the AHA classification and evaluated. Luminal stenosis (>50%) was judged both on CCTA and CMRA by consensus of two experienced readers with the ICA findings as a reference standard.

RESULTS

The mean Agatston score of the 29 patients was 1763 (SD: 1092, Range: 502-4674, median: 1348). With non-assessable segments considered to be stenotic, the diagnostic accuracy of CCTA and CMRA was 76.6% and 83.6% on a per-segment basis. When non-assessable segments were considered to be an incorrect diagnosis, the diagnostic accuracy of CCTA and CMRA was 72.1% and

82.6%, showing no statistically significant difference. When evaluation was limited to the segments with severe calcification involving 50% or more of the vessel wall, accurately assessable segment was 49.1% on CCTA and 78.4% on CMRA, showing a statistically significant difference (p=0.0001).

CONCLUSION

CMRA provides a higher diagnostic accuracy than does CCTA in patients with severe calcification.

CLINICAL RELEVANCE/APPLICATION

Coronary MRA provides a high diagnostic accuracy and recommended for evaluation of obstructive coronary arterial disease in patients with severe calcification.

RC303-03 Rosuvastatin Effect on Coronary Atherosclerosis Plaques Evaluated by 64-detector CT in Patients with Stable Coronary Heart Disease and Hyperlipidemia

Tuesday, Dec. 1 9:20AM - 9:30AM Location: S405AB

Participants
Jian-Xing Qiu, MD, Beijing, China (*Presenter*) Nothing to Disclose
Xiaoying Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaochao Guo, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the coronary atherosclerosis plaque changes by 64-detector CT on the follow-up examination of the patients, who treated by rosuvastain, with stable coronary heart disease and hyperlipidemia.

METHOD AND MATERIALS

The study included 30 patients, (27 males and 3 females), with stable coronary heart disease (stable angina for more than one month) and hyperlipidemia (LDL-C≥130 mg/dl without treatment, LDL-C≥100 mg/dl with treatment). Every patient underwent 64-detector CT coronary angiography twice before and after 76 weeks treatment with Rosuvastatin 20 mg q.d. The initial CT angiography at least detected one or more soft plaques with lumen stenosis ≥25%. We detected 35 target plaques totally. The volume of target plaques, the maximum sectional area(MASA) of plaques, the mean CT value(MCTV),the stenosis degree caused by the target plaques were measured on the initial and the follow-up CT examinations using the semi-automatic atherosclerosis plaque analysis software. The paired-samples t test was used to analyze the measurements in SPSS 10.0.

RESULTS

After Resuvastatin treatment for 76 weeks, the volume of target plaques decreased significantly from 53.8±38.9 mm^3 to 41.5±27.4 mm^3(p=0.011)after Rosuvastatin treatment, the MASA of target plaques decreased from 7.56±3.86 mm^2 to 6.11±2.81 mm^2 (p=0.038). the MCTV of target plaques had nonsignificant decrease from 66.42±28.62 Hu to 60.99±39.18 Hu (p=0.687), the stenosis degree caused by the target plaques decreased significantly from 55% to 46%.

CONCLUSION

The measurement change of target plaques demonstrated by 64-detector CT coronary angiography for the patients with stable coronary heart disease and hyperlipidemia include a decrease of the plaque volume, the maximum sectional area, and the stenosis degree.

CLINICAL RELEVANCE/APPLICATION

The 64-detector CT coronary angiography could analyze the effect of Statin for coronary atherosclerosis plaque.

RC303-04 Late Gadolinium Enhancement

Tuesday, Dec. 1 9:30AM - 10:10AM Location: S405AB

Participants
Scott D. Flamm, MD, Cleveland, OH, (flamms@ccf.org) (*Presenter*) Medical Director, Precision Image Analysis, Inc; Board of Directors, Precision Image Analysis, Inc;

ABSTRACT

Learning Objectives:1. Understand the distinct advantages of late gadolinium enhancement imaging by cardiac MRI.2. Articulate the mechanisms responsible for the increased signal intensity in irreversibly damaged myocardium. 3. Recognize the clinical situations appropriate for cardiac MRI late gadolinium enhancement imaging. Abstract:CMR has the unique ability to evaluate several markers of myocardial viability that are of proven value. Reliable and accurate assessment of myocardial scar burden, coronary perfusion, and contractile reserve by CMR are all well established.Direct imaging of myocardial fibrosis has been possible for well over a decade using an inversion-recovery prepared T1-weighted sequence following the intravenous administration of a gadolinium-chelate (Gd). This CMR technique has been named "late gadolinium enhancement" (LGE) and demonstrates non-viable tissue as "hyperenhanced" or bright. Both interstitial and replacement fibrosis enhance similarly with LGE for reasons described below. The hyperenhancement of interstitial fibrosis is more commonly seen in infiltrative entities such as hypertrophic cardiomyopathy and amyloidosis, where the issue of viability is less prominent.The excellent spatial resolution and tissue characterization afforded by CMR makes it ideal for both: 1) quantification of significant areas of viable myocardium, and 2) defining discrete regions of non-viability. Accurate quantification of areas of scar and viable tissue is clearly important in predicting mortality as the benefits of revascularization rise steeply when the area of dysfunctional but viable myocardium reaches a critical size. Further, characterization of non-ischemic patterns of LGE allows differentiation of the breadth of non-ischemic cardiomyopathies, and quantification may similarly provide prognostic information.This presentation will review the LGE technique in its various forms, define evaluation of both ischemic and non-ischemic cardiomyopathies, and address where LGE fits within the diagnostic and prognostic pathways in patients with cardiovascular diseases.

RC303-05 Coronary CT Angiography and Perfusion/Scar Imaging

Tuesday, Dec. 1 10:20AM - 11:00AM Location: S405AB

Participants
U. Joseph Schoepf, MD, Charleston, SC, (schoepf@musc.edu) (*Presenter*) Research Grant, Bracco Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; ; ;

LEARNING OBJECTIVES

1) Identify suitable CT techniques for the comprehensive assessment of ischemic heart disease. 2) Discuss different CT approaches for evaluating myocardial perfusion. 3) Compare CT to other modalities for determining the hemodynamic significance of coronary artery stenosis.

ABSTRACT

Appropriate non-invasive evaluation of patients with suspected coronary artery disease (CAD) has traditionally rested on the two pillars of morphological assessment for coronary artery stenosis and functional evaluation for determining the downstream hemodynamic significance of lesions. This approach has been informed by the fundamental realization that morphological assessment of coronary artery stenoses rarely reflects the actual level of myocardial ischemia. Further, patient evaluation, prognostication, and management are more reliable and effective when functional and morphological assessments are used in concert.Due to recent advancements in CT technology, coronary CTA (cCTA) has become an integral part of the non-invasive diagnostic work-up for the anatomic evaluation of the coronary arteries of patients with suspected CAD. According to the current appropriate use criteria, cCTA is the method of choice for the exclusion of significant coronary artery stenosis in patients with low and intermediate CAD risk profiles. The diagnostic accuracy of cCTA has been demonstrated by its high sensitivity (96%) and specificity (86%). Furthermore, cCTA can provide global and regional functional evaluation if acquired with an ECG-synchronization technique. In addition to its role in assessing coronary morphology and left ventricular function, cCTA has been utilized in the evaluation of a third aspect in the diagnostic algorithm of ischemic heart disease - myocardial perfusion. As cCTA may provide diagnostic information for each of these three cornerstones of ischemic heart disease management, this emerging technology has the potential to become the stand-alone method for the evaluation of patients with suspected CAD with a single modality, and within a single imaging session.The purpose of this presentation is to review the growing body of evidence on the CT assessment of myocardial perfusion and provide a systematic overview of presently available techniques.

RC303-06 Reduced-Dose Dual-Source Coronary Computed Tomography Angiography (CCTA): Is Raw-Data-Based Iterative Reconstruction Able to Maintain the Diagnostic Confidence?

Tuesday, Dec. 1 11:00AM - 11:10AM Location: S405AB

Participants
Francois Pontana, MD, PhD, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Isabel A. Castellano, PhD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Tevfik F. Ismail, PhD,MRCP, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Natalie Gartland, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
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Edward Nicol, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate image quality and diagnostic confidence of a raw-data-based iterative reconstruction technique (SAFIRE) in reduced-dose CCTA images in comparison with standard-dose filtered back projection (FBP) images.

METHOD AND MATERIALS

107 consecutive patients (72 males; 35 females), referred for a CCTA were prospectively included using a dual source CT system in a high pitch (n=51) or a sequential prospective gating scanning mode (n=56) according to the heart rate (mean DLP value = 204.6 mGy.cm). From each acquisition 4 series of images were reconstructed: (a) standard-dose images, reconstructed with FBP considered as the reference standard (Group 1) and (b) 3 series of reduced-dose images, obtained with a prototype software which virtually increased the level of noise simulating a 30% dose reduction, and reconstructed with FBP (Group 2) and SAFIRE with a preset strength of 3 (Group 3) and 5 (Group 4). Two readers blindly evaluated each series for (a) objective noise and CNR ; (b) coronary border sharpness, lesion detection and (c) diagnostic confidence level using a 5-point scale.

RESULTS

In Group 2, there was a significant increase in the mean level of objective noise compared to Group 1 (36.8 ±6.7 vs 30.4 ±5.2; $p<0.0001$) and an impairment of the CNR (15.6 ±4.3 vs 18.7 ±4.5; $p<0.0001$), which hampered the detection of 9 plaques. In Group 3 and 4, despite the 30% dose reduction, all the lesions depicted in Group 1 were seen and SAFIRE restored or improved the objective image quality respectively: (a) mean noise= 31.1 ±5.4; $p=0.1$ and 22.3 ±4.2; $p<0.0001$, and (b) CNR= 18.5 ±5.0; $p=0.9$ and 25.8 ±7.0; $p<0.0001$. However the diagnostic confidence was altered when compared with Group 1 ($p<0.0001$), mainly rated as moderate with a blurred aspect of the coronary borders (81/107; 75.7% and 103/107; 96.3%)($p<0.0001$) and a significant number of artefactual non stenosing soft plaques described in vessels considered as normal in Group 1 (105/222; 47.3% and 194/222; 87.4%)($p<0.0001$).

CONCLUSION

Raw-data-based iterative reconstruction allowed significant image noise reduction but may be associated with blurring of the coronary luminal borders, which can decrease diagnostic confidence.

CLINICAL RELEVANCE/APPLICATION

When reporting reduced-dose CCTA with iterative reconstruction, blurred-border and false smooth plaque artifacts must be considered in diagnostic assessment and subsequent patient management.

RC303-07 Prognostic Value of CT Coronary Angiography in Asymptomatic Patients with Suspected Coronary Artery Disease. Meta-Analysis of Observational Studies

Tuesday, Dec. 1 11:10AM - 11:20AM Location: S405AB

Participants

Michele Fusaro, MD, Treviso, Italy (*Presenter*) Nothing to Disclose
Salvatore Cassese, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Massimiliano Fusaro, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Giovanni Balestriero, Treviso, Italy (*Abstract Co-Author*) Nothing to Disclose
Leonardo E. La Torre, MD, TREVISO, Italy (*Abstract Co-Author*) Nothing to Disclose
Giovanni Morana, MD, Tresiso, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the prognostic value of CCTA as a screening tool in asymptomatic patients with suspected coronary artery disease (CAD).

METHOD AND MATERIALS

A meta-analysis of observational coronary computed tomographic angiography (CCTA) imaging studies was conducted, by means of search in electronic scientific databases for studies investigating the use of CCTA in asymptomatic patients with suspected CAD. The endpoints were the incidence of acute coronary syndrome (ACS) requiring hospitalization, revascularization and cardiac death. Exclusion criteria were composite outcomes and duplicated data. Odds ratio (OR) with 95% confidence interval [CI 95%] was used as summary statistic.

RESULTS

A total of 7,931 asymptomatic patients from 6 studies received a CCTA for suspected CAD. The proportion of patients without CAD, with CAD<50% and with CAD>50% was 78%, 14% and 8%, respectively.After a median follow-up of 27.1 months [22.0-31.2], Patients without CAD did not show any of the endpoints. Compared to patients with CAD>50%, patients with CAD<50% showed a similar risk of ACS (0.16 [0.02-1.50]; P=0.11) but a lower risk of revascularization (0.04 [0.02-0.10]; P<0.001) and death (0.05 [0.01-0.44]; P=0.007).

CONCLUSION

Two-third of asymptomatic patients receiving CCTA for suspected CAD had no evidence of disease and no events at follow-up. The presence of CAD>50% significantly increases the risk of revascularization and death as compared to CAD<50%, although the percentage is quite low. Nevertheless, patients with CAD>50% have a risk of ACS comparable to those with CAD<50%.

CLINICAL RELEVANCE/APPLICATION

In asimptomatic patients there is not evidence of the utility of CCTA as a screening tool.

RC303-08 The Role of Imaging for Management of Coronary Artery Disease - State of the Evidence

Tuesday, Dec. 1 11:20AM - 12:00PM Location: S405AB

Participants
Leslee Shaw, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

RC305

Neuroradiology Series: Stroke

Tuesday, Dec. 1 8:30AM - 12:00PM Location: N230

NR CT MR ER

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.50

FDA Discussions may include off-label uses.

Participants
Howard A. Rowley, MD, Madison, WI, (hrowley@uwhealth.org) (*Moderator*) Research Consultant, Bracco Group; Research Consultant, Guerbet SA; Research Consultant, General Electric Company; Consultant, F. Hoffmann-La Roche Ltd; Consultant, W.L. Gore & Associates, Inc; Consultant, Lundbeck Group; ; ; ; ; ;
Albert J. Yoo, MD, Newton, MA (*Moderator*) Research Grant, Penumbra, Inc; Research Grant, Terumo Corporation; Research Consultant, Medtronic, Inc;

Sub-Events

RC305-01 Imaging for Stroke Triage: Where Do We Stand?

Tuesday, Dec. 1 8:30AM - 8:55AM Location: N230

Participants
Max Wintermark, MD, Lausanne, Switzerland, (max.wintermark@gmail.com) (*Presenter*) Advisory Board, General Electric Company;

LEARNING OBJECTIVES

1) We will review the most common neuroimaging modalities and treatment algorithms used in the evaluation of acute stroke patients.

ABSTRACT

Neuroimaging has become essential in the evaluation of the acute stroke patient. CT and MRI are used to confirm the diagnosis of acute stroke, exclude stroke mimics, and triage patients for intravenous t-PA and endovascular revascularization therapies. Advanced neuroimaging techniques, including CT-angiography, MR-angiography, CT-perfusion and MR-perfusion further inform acute stroke treatment decisions and are increasingly used in the acute setting. We will review the most common neuroimaging modalities and treatment algorithms used in the evaluation of acute stroke patients.

RC305-02 Feasibility Of Improving Detection Of Early Ischemic Infarction on Head CT Using Continuity-Based Correlative Enhancement.

Tuesday, Dec. 1 8:55AM - 9:05AM Location: N230

Participants
Aseem Sharma, MBBS, Saint Louis, MO (*Presenter*) Stockholder, General Electric Company; Consultant, BioMedical Systems; Co-Founder, Correlative Enhancement, LLC
Manu S. Goyal, MD, MSc, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Michelle M. Miller-Thomas, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Rashmi Jain, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
James D. McEachern, MD, Saskatoon, SK (*Abstract Co-Author*) Nothing to Disclose
Charles F. Hildebolt, DDS, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recognition of early signs of brain infarction may influence patient management, but can be difficult on head CT. Using custom software (patent pending) that manipulates images based on correlation between intensities of continuous pixels, we aimed to assess the feasibility of improving the detection of brain infarction with head CT images.

METHOD AND MATERIALS

35 head CT images through the region of proven infarction and 20 control images across brain tissue without infarction were post-processed using a custom software (patent pending). Three readers, evaluated the baseline and enhanced images in a masked manner, and marked the location of infarction whenever suspected, while using a 5-point scale to rate their confidence for the presence of infarction. In a separate session, readers rated the comparative ease-of-recognition of signs of infarction for baseline and enhanced images on a 7-point scale, while evaluating these images simultaneously along with the follow-up imaging indicating the infarct distribution. Infarct identification data were analyzed with jackknife, alternative, free-response receiver operating characteristic (JAFROC) weighted software. Comparative ease-of-recognition was assessed using the one-sided Wilcoxon signed rank test for differences > a value of 4.

RESULTS

For infarct localization, JAFROC analysis revealed figure-of-merit values of 0.56 and 0.67 for baseline and enhance images respectively (p=0.03). Corresponding values for infarct localization within 6 hours of symptom onset were 0.49 and 0.63 (p = 0.04). Comparative ease-of-recognition was significantly higher than the equivalent value of 4 for all three readers (p <0.01, 0.03, <0.01), tilted favorably towards the enhanced images.

CONCLUSION

Continuity-based correlative enhancement improves conspicuity and accurate detection of early changes of brain infarction on non-contrasted head CT.

CLINICAL RELEVANCE/APPLICATION

By improving diagnostic accuracy for detection of ischemic infarction on head CT, continuity-based correlative enhancement may help in making more informed decisions for management of stroke patients.

RC305-03 Diagnostic Accuracy of Whole-brain CT Perfusion in MRI-confirmed Infratentorial Infarctions

Tuesday, Dec. 1 9:05AM - 9:15AM Location: N230

Participants
Kolja M. Thierfelder, MD,MSc, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Christine Bollwein, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Birgit B. Ertl-Wagner, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Louisa von Baumgarten, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Wieland H. Sommer, MD, Munich, Germany (*Presenter*) Founder, QMedify GmbH
Andreas Straube, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recently introduced whole-brain CT perfusion (WB-CTP) allows for an evaluation of the posterior fossa, but data on WB-CTP in this region is limited. Our aim was to determine the diagnostic accuracy of WB-CTP for infratentorial infarctions and to identify factors influencing the detection rate.

METHOD AND MATERIALS

Out of a retrospective cohort of 1361 consecutive patients who underwent WB-CTP due to suspected stroke, we selected all patients with an MRI-confirmed infratentorial ischemic infarction. The study was designed as a case-control study with a ratio of cases to controls without infratentorial infarction of 1:3. Two blinded and experienced readers independently evaluated 4 different perfusion maps - Cerebral Blood Flow (CBF), Cerebral Blood Volume (CBV), Mean Transit Time (MTT), and Time to Drain (TTD) - for the presence and location of an infratentorial perfusion deficit.

RESULTS

Seventy subjects met the inclusion criteria for the patient group. The control group consisted of 210 patients. Overall, WB-CTP reached a sensitivity of 45.4% and a specificity of 93.1%. Infarctions of the cerebellum were detected in 20/38 (53%), while infarctions of the brain stem were detected in only 9/32 (28%) of the cases, $p < 0.05$. Among the different perfusion maps, TTD was the most sensitive (47.2%), followed by MTT (41.0%), CBF (39.2), and CBV (9.1%). With respect to specificity, CBV (98.1%) reached the highest value, followed by CBF (93.8%), TTD (92.9%), and MTT (89.2%). Mean final infarction volume (15.2ml) and diameter (27.1mm) of infarctions that were detected in WB-CTP were significantly larger than volume (5.4ml) and diameter (17.8mm) of infarctions that were not detected (each with $p < 0.001$).

CONCLUSION

Depending on infarction size and localization, whole-brain CT perfusion is able to detect around 45% of infratentorial infarctions with a specificity of around 90%.

CLINICAL RELEVANCE/APPLICATION

Whole-brain CT perfusion is able to detect around 45% of infratentorial infarctions and may be an important alternative in the case of suspected posterior circulation ischemia when MRI is not available.

RC305-04 Intracranial Vessel Imaging at 1.5 Tesla versus 3 Tesla versus 7 Tesla:A Comparison Trial

Tuesday, Dec. 1 9:15AM - 9:25AM Location: N230

Participants
Lale Umutlu, MD, Essen, Germany (*Presenter*) Consultant, Bayer AG
Oliver Kraff, MSc, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Anja Fischer, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan Maderwald, PhD, MSc, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Mark E. Ladd, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas C. Lauenstein, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Forsting, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Marc U. Schlamann, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The increase of the magnetic field strength is associated to an increase in SNR that can be transitioned into imaging at higher spatiotemporal resolution. With the successful implementation of 7T neuro MRI, the aim of this study was to investigate and intraindividually compare non-enhanced MR imaging of intracranial arteries and veins at 1.5 Tesla, 3 Tesla and 7 Tesla utilizing TOF-MRA and susceptibility-weighted imaging.

METHOD AND MATERIALS

10 healthy volunteers were each examined on a 1.5 T (Magnetom Aera, Siemens), a 3T (Magnetom Skyra, Siemens) and a 7T MR system (Magnetom 7T, Siemens) utilizing 32-channel head coils. TOF-MRA and SWI were optimized to achieve best spatial resolution for each field strength while preserving comparable acquisition times. All datasets were read by two radiologists utilizing a 5-point scale (5= excellent vessel delineation to 1= non-diagnostic). All TOF-MRA datasets were assessed for delineation of the intracranial arteries, subdivided into 8 segments (ICA, A1/2, M1,M2,M3,PCA, P1/2, basilar artery). SWI datasets were read for delineation of 14 different smaller and larger veins. Additionally, overall image quality, vessel sharpness, vessel to background contrast and image impairment due to artifacts was assessed. For statistical analysis, a Wilcoxon Rank Test was used.

RESULTS

With increasing magnetic field strength, all sequences could be obtained at higher spatial resolution at comparable acquisition

times, enabling improved vessel delineation. TOF-MRA at 7T enabled a significantly better delineation particularly of small peripheral vessel segments compared to 3T and 1.5T (mean M3 TOF7T=4.3; TOF3T=3.8; TOF1.5T=2.9). 7 Tesla SWI imaging demonstrated its superiority in the highly-detailed delineation of larger and smaller veins with statistical significance to lower field strengths (p=0.03) (e.g. average mean value larger veins: SWI7T =4.5, SWI3T =3.3, SWI1.5T =2.7). Overall image quality was rated comparably high for all three field strengths (7T=4.6; 3T=4.7; 1.5T=4.7).

CONCLUSION

Our results demonstrate the benefits of an increase of magnetic field strength from 1.5T to 7T, offering improved and highly-detailed delineation of the intracranial arterial and venous vasculature.

CLINICAL RELEVANCE/APPLICATION

The excellent delineation of non-enhanced vascular structures in 7T neuro MRI may lead to a more accurate diagnosis of vascular disease, such as aneurysms or cavernomas using 7T MRI.

RC305-05 High Resolution Intracranial Vessel Wall Imaging of Atherosclerotic Plaque Characteristics: Correlation with Patient Symptoms

Tuesday, Dec. 1 9:25AM - 9:35AM Location: N230

Participants
Aaron M. Rutman, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Chun Yuan, PhD, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; ;
William D. Hwang, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Niranjan Balu, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Thomas S. Hatsukami, MD, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
David Tirschwell, MD, MSc, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Adam de Havenon, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Mahmud Mossa-Basha, MD, Seattle, WA (*Abstract Co-Author*) Research support, General Electric Company

PURPOSE

High resolution intracranial vessel wall imaging (VWI) has recently gained attention for its ability to evaluate and differentiate various intracranial arteriopathies, including atherosclerosis (ICAD), inflammatory vasculopathy, arterial dissection, and reversible cerebral vasoconstriction syndrome. VWI also allows for atherosclerotic plaque characterization, depicting potential vulnerable plaque features. The aim was to compare the VWI plaque characteristics between symptomatic and asymptomatic intracranial atherosclerotic lesions using a multi-contrast VWI protocol.

METHOD AND MATERIALS

Cases of ICAD imaged with VWI were collected and retrospectively analyzed from our database between the dates 12/20/12-12/5/13. The imaging protocol included T2, T1 pre and post contrast, 3D T2 SPACE VWI and TOF MRA sequences. Symptomatic plaques were those upstream from an infarct within 6 months of VWI. Lesions with symptoms greater than 6 months prior were excluded. Each plaque was assessed for presence/absence of a fibrous cap, presence of fibrous cap thinning/disruption, cap:necrotic core ratio, and remodeling ratio (total vessel area of diseased segment)/(total vessel area of reference segment). Characteristics were compared by Fisher's exact test (fibrous cap presence, thinning/disruption) and unpaired t-test (cap:necrotic core ratio, remodeling ratio).

RESULTS

48 intracranial atherosclerotic plaques were included from 22 patients. Assessment for fibrous capsule was possible in 18/21 symptomatic and 25/27 asymptomatic plaques. 18/18 symptomatic and 11/25 asymptomatic lesions either did not have a visible fibrous cap, or had apparent disrupted luminal surface or thinning of a visible fibrous cap ($p<<0.01$). There was no significant difference in the cap:lipid core ratio or the remodeling ratio between symptomatic and asymptomatic lesions.

CONCLUSION

VWI allows for evaluation of ICAD characteristics which may indicate plaque vulnerability, and be associated with symptoms. These features might serve as biomarkers for assessing risk, as well as indicate culprit lesions. Our study shows a significantly increased likelihood of absent fibrous cap or fibrous cap rupture/thinning in the setting of symptoms.

CLINICAL RELEVANCE/APPLICATION

VWI of intracranial atherosclerotic plaque can demonstrate characteristics of vulnerable, symptom-associated plaque.

RC305-06 Potential Applications for Intracranial Vessel Wall Imaging

Tuesday, Dec. 1 9:35AM - 10:00AM Location: N230

Participants
David J. Mikulis, MD, Toronto, ON (*Presenter*) Stockholder, Thornhill Research Inc; Research Grant, General Electric Company;

LEARNING OBJECTIVES

1) Understand the issues concerning clinical implementation of intra-cranial vessel wall imaging. 2) Understand how vessel wall imaging can aid in differentiating vasculopathies that have similar angiographic appearances. 3) Understand pitfalls related to arterial wall image interpretation.

ABSTRACT

Modern high field MRI systems with increased multi-element coil design have enabled higher resolution by providing greater overall signal. This in turn has paved the way for imaging smaller parts including the walls of smaller and smaller vascular structures. For example, current technology is capable of generating 3D images with 0.4 x 0.4 x 0.4 mm isotropic voxels using 3T MRI. This has

enabled characterization of circle of Willis vessels out to secondary branches (A2,M2, and P2). Not only has analysis of vasculopathies with identical angiographic appearances been made possible thereby increasing specificity of diagnosis, it has also provided insight into disease pathophysiology. An example of this is the strong relationship found between ischemic stroke and gadolinium enhancing intra-cranial atherosclerotic plaques. The purpose of this presentation therefore is to summarize the current status of arterial wall imaging in clinical neuroradiology.

RC305-07 Update on Acute Stroke Intervention

Tuesday, Dec. 1 10:20AM - 10:45AM Location: N230

Participants
Colin P. Derdeyn, MD, Saint Louis, MO, (colin-derdeyn@uiowa.edu) (*Presenter*) Consultant, Terumo Corporation; Consultant, Penumbra, Inc; Consultant, Silk Road Medical; Stock options, Pulse Therapeutics, Inc; ;

LEARNING OBJECTIVES

1) Describe the current indications for endovascular stroke intervention. 2) Describe the available mechanical devices currently used in these cases.

ABSTRACT

The past 12 months have seen the publication of more positive pivotal clinical trials (n = 4) for the treatment of acute ischemic stroke than the last 20 years combined (n = 6). Endovascular stroke treatment (EVT) is now proven effective for a large subgroup of patients presenting with acute ischemic stroke. We will carefully review the data from the four recently published trials of endovascular treatment (EVT) for acute ischemic stroke: MR CLEAN (Multicenter Randomized Clinical Trial of Endovascular Treatment for Acute Ischemic Stroke in the Netherlands), ESCAPE (Endovascular Treatment for Small Core and Anterior Circulation Proximal Occlusion with Emphasis on Minimizing CT to Recanalization Times), and EXTEND-IA (Extending the Time for Thrombolysis on Emergency Neurological Deficits) and SWIFT PRIME (Solitaire With the Intention For Thrombectomy as Primary Endovascular Treatment for Acute Ischemic Stroke). We will examine the implications of these trials for current practice and future studies. In particular, we will focus on procedural details such as patient selection, devices, adjunctive therapies, treatment time windows and performance metrics.

Active Handout:Colin P. Derdeyn

http://abstract.rsna.org/uploads/2015/15000010/RC305-07 Stroke-2015-Powers-3020-35.pdf

RC305-08 Carotid Intraplaque Hemorrhage is Associated with Accelerated Progression in Patients with Acute Ischemic Stroke: A Prospective Multicenter-Study on Carotid Plaque Imaging in Patients with Acute Stroke

Tuesday, Dec. 1 10:45AM - 10:55AM Location: N230

Participants
Andreas Schindler, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Anna Bayer-Karpinska, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Tilman Obenhuber, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Florian Schwarz, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Clemens C. Cyran, MD, Munich, Germany (*Abstract Co-Author*) Research Grant, Bayer AG Research Grant, Novartis AG Speakers Bureau, Bayer AG
Tobias Saam, MD, Munich, Germany (*Abstract Co-Author*) Research Grant, Diamed Medizintechnik GmbH; Research Grant, Pfizer Inc
Andreas D. Helck, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
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Holger Poppert, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Dichgans, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively evaluate whether carotid plaque hemorrhage - as detected by high-resolution carotid plaque MRI - is associated with an accelerated progression rate of atherosclerosis.

METHOD AND MATERIALS

58 consecutive patients (76.3±9.8 years; 45 male) with acute ischemic stroke in the anterior circulation and non-stenosing carotid plaque in any carotid artery were included in the ongoing multi-center trial (which is also registered on ClinicalTrials.gov). Patients underwent MRI of both carotid arteries at baseline and at 12 months. Carotid plaques were characterized by the American Heart Association (AHA) classification system and plaque burden as well as components such as the lipid-rich/necrotic core, calcifications, and hemorrhage were identified and quantified. Annualized changes for each item were analyzed for both arteries combined on a patient basis for the whole cohort, as well as depending on the status of intra plaque hemorrhage (IPH) at baseline (IPH+ vs. IPH-). Unpaired t-test and one-sample t-test vs. 0 were performed.

RESULTS

A total of 14 patients had complicated AHA-LT6 plaques with IPH at baseline; no new IPH was detected at follow-up. During follow-up a total of four re-events occurred (all IPH+ at baseline). For all patients no significant changes in plaque burden or component size were measurable after one year, with a non-significant increase of mean wall area of 2.3%/year. IPH+ vs. IPH- subjects had a significantly higher progression of the normalized wall index (3.5% vs. 0.5%; $p<0.05$), and an accelerated progression of mean wall area (7.3% vs. 0.8%; P=n.s. for IPH+ vs. IPH-; P=0.037 for IPH+ vs. 0). No significant quantitative changes for all plaque components were measurable, although mean necrotic core area increased from 6.2 to 7.1 mm^2 in IPH+ patients (+16%) and remained unchanged in IPH- patients.

CONCLUSION

Intraplaque hemorrhage is associated with an accelerated atherosclerotic plaque progression rate in patients with acute ischemic stroke.

CLINICAL RELEVANCE/APPLICATION

This multi-center study provides further evidence that IPH is a good marker of plaque vulnerability; further studies are needed to test if patients with IPH could profit from more intensive therapy.

RC305-09 Dual-Energy Head CT Can Accurately Distinguish Intraparenchymal Hemorrhage from Calcification in Emergency Department Patients

Tuesday, Dec. 1 10:55AM - 11:05AM Location: N230

Participants
Laleh Daftaribesheli, MD, Boston, MA (*Presenter*) Nothing to Disclose
Ranliang Hu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Joseph Y. Young, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Markus Y. Wu, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Research support, General Electric Company Stockholder, General Electric Company
Rajiv Gupta, PhD, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stuart R. Pomerantz, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company

PURPOSE

Conventional head CT and MRI with gradient-echo susceptibility scanning are limited in their ability to distinguish hemorrhage from calcification, a critical distinction in the selection of stroke patients for IV-thrombolytic and endovascular therapies. Dual energy CT (DECT) scanning, however, may be able to better discriminate calcium from hemorrhage based on the differing proportions of X-ray attenuation of these materials at different scanning energies. The purpose of this study is to evaluate the ability of DECT for differentiation of calcification from acute hemorrhage.

METHOD AND MATERIALS

In this IRB approved study, all unenhanced DECT head exams performed in our emergency department in November and December 2014 were retrospectively reviewed. Patients with at least one focus of intra-parenchymal hyperdensity were included and material decomposition images were post-processed. Virtual non-calcium and calcium overlay images were reviewed for the presence of calcification versus hemorrhage. Relevant prior and follow-up imaging and clinical data were used to determine the reference standard.

RESULTS

Of 399 DECT head exams, 83 (21%) contained at least one intraparenchymal hyperdensity on the corresponding simulated single energy CT (SECT) image; 64/83 (77%) with reference standard proof of diagnosis were included. Mean age was 67 years; 39/64 (61%) were male. 68 distinct intraparenchymal hyperdense lesions were identified, of which 41/68 (60%) were calcification and 27/68 (40%) were hemorrhage. Sensitivity, specificity and accuracy of DECT for the detection of hemorrhage were 96% (CI 81-99%), 100% (CI 91-100%) and 99% (CI 90-100%), respectively. Seven of 27 (26%) of hemorrhages were incorrectly classified by SECT alone, compared to 1/27 (4%) for DECT.

CONCLUSION

DECT post-processed images can distinguish intraparenchymal hemorrhage from calcification rapidly and with very high accuracy in emergency department patients. Conventional gradient-echo MRI and CT scanning are unable to make this distinction accurately. This may have important implications for patient care, most notably in excluding stroke patients with intracranial hemorrhage from IV-thrombolytic and endovascular stroke therapies.

CLINICAL RELEVANCE/APPLICATION

Ability of DECT for differentiation of calcification from hemorrhage has important implications for patient care, most notably in excluding stroke patients with hemorrhage from IV-thrombolytic.

RC305-10 Favorable Outcomes Following Endovascular Treatment in Anterior Circulation Stroke Patients Defined Prospectively Using MRI and Clinical Criteria

Tuesday, Dec. 1 11:05AM - 11:15AM Location: N230

Participants
Ramon G. Gonzalez, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Thabele M. Leslie-Mazwi, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Pamela W. Schaefer, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Research support, General Electric Company Stockholder, General Electric Company
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Lee Schwamm, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Joshua A. Hirsch, MD, Boston, MA (*Abstract Co-Author*) Shareholder, Intratech Medical Ltd

PURPOSE

To evaluate the clinical efficacy of major anterior circulation stroke thrombectomy in patients prospectively classified by specific MRI and clinical criteria.

METHOD AND MATERIALS

72 patients with MCA or terminal ICA occlusion by CTA, followed by core infarct volume determination by MRI, underwent thrombectomy after meeting institutional criteria. 40 patients were prospectively classified as Likely to Benefit (LTB) using the following institutional criteria: DWI lesion volume <70ml, age < 80, stroke onset to procedure initiation < 6 hours and baseline mRS ≤1. Thirty two were prospectively classified as Uncertain to Benefit (UTB) if one or more of the clinical criteria were not met or if the DWI lesion was 70-100 ml. Outcomes were based on 90-day modified Rankin score (mRS). Favorable outcomes were defined as 90 day mRS of 0, 1 or 2.

RESULTS

Reperfusion (mTICI 2b or 3) and prospective categorization as LTB were strongly associated with favorable outcomes (p<0.001 and p<0.005, respectively). Successful reperfusion had a significant positive impact on the distribution of mRS scores of the LTB cohort (p<0.0001). Intervention resulted in successful reperfusion in 68% of the LTB patients and 75% of UTB patients (not significant). Favorable outcomes were obtained in 53% and 25% of LTB and UTB patients that were treated, respectively (p= 0.016; Fisher exact test). In considering the effect of successful intervention, favorable outcomes were observed in 74% of LTB patients that had successful reperfusion compared to 33% of successfully reperfused UTB patients (p=0.004; Fisher exact test).

CONCLUSION

Patients prospectively classified as Likely to Benefit based on MRI and clinical criteria have a high likelihood of favorable outcome after thrombectomy, particularly if reperfusion is successful.

CLINICAL RELEVANCE/APPLICATION

This work demonstrates how to achieve high levels of favorable outcomes in severe ischemic stroke patients by using imaging for selection of appropriate patients for endovascular therapy.

RC305-11 Body Temperature Fluctuations Modulate Infarct Expansion, Penumbral Rescue, and Clinical Outcome in Acute Ischemic Stroke Following Successful Endovascular Reperfusion: Impact of Subclinical Temperature Changes on Ischemic Progression

Tuesday, Dec. 1 11:15AM - 11:25AM Location: N230

Participants
Seena Dehkharghani, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Meredith Bowen, BA, Atlanta, GA (*Presenter*) Nothing to Disclose
Diogo C. Haussen, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Michael Frankel, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Adam B. Prater, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Andrey Lima, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Tyler Gleason, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Raul G. Nogueira, MD, Boston, MA (*Abstract Co-Author*) Consultant, Stryker Corporation Consultant, Medtronic, Inc Consultant, CoAxia, Inc

PURPOSE

The exquisite temperature sensitivity of neuronal substrate has been thoroughly expounded in past studies. The effect of systemic temperature changes on stroke progression, and its impact upon the fate of at-risk tissues remains unknown. We undertook the analysis of temperature fluctuations and their interaction with rescue of penumbral tissues in a cohort of successfully revascularized acute stroke patients, hypothesizing greater relative infarct expansion as a function of sub-clinical systemic temperature changes.

METHOD AND MATERIALS

129 patients with acute stroke presenting within 12 hours were culled from our prospective registry. CT perfusion was obtained, with perfusion analysis undertaken in a user- and vendor-independent processing environment (RAPID). Automated lesion segmentation and thresholding of CTP data produced core, penumbral, and mismatch volumes. Final infarct volumes (FIV) were measured from DWI, and relative infarct growth (FIV-core/mismatch) computed. Systemic temperatures were recovered from medical records for the duration of hospitalization (up to q15 minutes), with minima, maxima, and ranges collected. All patients underwent successful endovascular reperfusion (mTICI IIb/III). Kendall's tau correlation was prescribed to assess the association between temperature change from baseline and both relative infarct growth (RIG) and favorable clinical outcome (FCO) as 90d mRS<=2.

RESULTS

59 men and 70 women (age 63±14 yrs) with acute stroke (NIHSS median[IQR]=19[9]; time to groin puncture median[IQR]=330[301]) were examined. All patients exhibited an occlusive lesion of the anterior circulation (ICA/MCA) with successful reperfusion (mTICIIIb/III). Median core (rCBF), penumbral (Tmax), and FIV (median[IQR]) were 9.6cc[25], 131cc[125], and 21cc[37], respectively. Mean temperature minima=35.1°C and maxima=37.9°C. Correlational analysis demonstrated significant associations between temperature fluctuation from baseline and both RIG (P=0.01) and FCO (P<0.001).

CONCLUSION

The impact of sub-clinical temperature changes had not previously been reported as a driving factor in penumbral rescue, however the present findings suggest that neuronal fate may be affected by even minor temperature changes

CLINICAL RELEVANCE/APPLICATION

Sub-clinical temperature dysregulation may potentiate neuronal injury following acute ischemic stroke, compelling further investigation into the mechanistic relationship.

RC305-12 Impact of the Implementation of Thrombectomy with Stent Retrievers on the Frequency of Hemicraniectomy in Patients with Acute Ischemic Stroke

Tuesday, Dec. 1 11:25AM - 11:35AM Location: N230

Participants
Peter Sporns, MD, Munster, Germany (*Presenter*) Nothing to Disclose
Jens Minnerup, Munster, Germany (*Abstract Co-Author*) Nothing to Disclose
Tarek Zoubi, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose
Uta Hanning, MD, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose
Walter L. Heindel, MD, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose
Wolfram Schwindt, MD, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Niederstadt, MD, Munster, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The increasing use of endovascular treatments has led to higher recanalization rates and better clinical outcomes compared to intravenous thrombolysis alone. Stent retrievers represent the latest development for recanalization of large vessel occlusions. Decompressive hemicraniectomy has proved beneficial in patients suffering from rising intracranial pressure after malignant stroke. We investigated the effect of the implementation of stent retriever treatment on the frequency of hemicraniectomy as a surrogate marker for infarct size and thus for poor neurological outcome.

METHOD AND MATERIALS

Patients with acute ischemic stroke were retrospectively studied. We compared the frequency of hemicraniectomy following proximal artery occlusion of the internal carotid artery and middle cerebral artery main stem in the years before (2009 and 2010) and after (2012 and 2013) introducing stent retrievers.

RESULTS

Overall, 497 patients with proximal arterial occlusion were included in the study. Of 253 patients admitted in the years 2009 and 2010 44 (17.4 %) and of 244 patients admitted in 2012 and 2013 20 (8.2 %) received a hemicraniectomy. This decrease in the proportion of hemicraniectomies was statistically significant ($p<0.01$).

CONCLUSION

The findings in this study illustrate a significantly reduced rate of hemicraniectomies in patients with proximal artery occlusions after implementation of thrombectomy with stent retriever. Hereby we could show a significant reduction of malignant infarctions after thrombectomy with stent retriever.

CLINICAL RELEVANCE/APPLICATION

Stent retriever is a safe and effective device and improves clinical outcome.

RC305-13 Hallmarks of Pediatric Ischemic Stroke

Tuesday, Dec. 1 11:35AM - 12:00PM Location: N230

Participants
Arastoo Vossough, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define the epidemiological features and risk profiles of stroke in different pediatric patient populations. 2)Classify the types of pediatric stroke and features of vasculopathies leading to stroke. 3) Identify major mimickers of pediatric arterial ischemic stroke. 4) Specify current approved treatment options available for pediatric stroke 5) Identify recent and ongoing clinical trials in pediatric stroke.

RC308

Emergency Radiology Series: Current Imaging of the Acute Abdomen

Tuesday, Dec. 1 8:30AM - 12:00PM Location: N228

GI CT MR ER

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

Participants
Douglas S. Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose
Michael N. Patlas, MD,FRCPC, Hamilton, ON, (patlas@hhsc.ca) (*Moderator*) Nothing to Disclose
Hani H. Abujudeh, MD, MBA, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

RC308-01 CT and MR of Acute Appendicitis

Tuesday, Dec. 1 8:30AM - 8:55AM Location: N228

Participants
Perry J. Pickhardt, MD, Madison, WI (*Presenter*) Co-founder, VirtuoCTC, LLC; Stockholder, Cellectar Biosciences, Inc; Research Consultant, Bracco Group; Research Consultant, KIT ; Research Grant, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Assess the relative advantages and disadvantages for CT and MR imaging in the setting of suspected appendicitis. 2) Compare the diagnostic performance of CT and MR for both appendicitis and alternative conditions. 3) Describe the increasing use of MR for abdominal imaging in the ED setting.

ABSTRACT

N/A

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Perry J. Pickhardt, MD - 2014 Honored Educator

RC308-02 T1 Bright Appendix Sign is Helpful for the Diagnosis of Acute Appendicitis in Pregnant Women

Tuesday, Dec. 1 8:55AM - 9:05AM Location: N228

Participants
Ilah Shin, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Yong Eun Chung, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myeong-Jin Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic value of T1 bright appendix sign for the diagnosis of acute appendicitis in pregnant women

METHOD AND MATERIALS

This retrospective study included 125 pregnant women with suspected appendicitis who underwent MRI, including axial T2WI with/without fat saturation, coronal and sagittal T2WI, and 3D T1WI. Total of 22 patients were surgically confirmed as acute appendicitis. T1 bright appendix sign was defined as T1 high signal intensity (SI) material filling more than half length of appendix while this T1 high SI did not result from appendicolith on 3D T1WI. MR images were reviewed by two experienced radiologists in consensus and visibilities of the appendices were evaluated. The maximal diameter of visible appendix with presence or absence of T1 bright appendix sign was evaluated from MR. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of T1 bright appendix sign were calculated

RESULTS

In patients with acute appendicitis (n=22), appendix was visualized in all patients and the mean diameter of the appendix was 9.4 ± 2.7 mm (range, 6.0-14.6 mm). In patients with a normal appendix (n=103), appendix was not visualized in 14 patients (13.6%). The mean diameter of the visualized normal appendix was 5.0 ± 0.7 mm (range, 3.1-6.8 mm). Among patient without appendicitis, T1 bright appendix sign was seen in 40 patients (45%), whereas it was noted in only 1 patient with acute appendicitis (4.5%). Fourteen patients had borderline sized appendix (appendix diameter between 6 - 7 mm) and 4 out of 14 patients were diagnosed as appendicitis. Among them, T1 bright appendix sign was seen in 4 patients without appendicitis. The sensitivity, specificity, PPV and NPV of T1 bright appendix sign for the diagnosis of normal appendix were 45%, 96%, 98%, and 30% for all patients and 60%, 100%, 100%, and 50% for patients with borderline sized appendix

CONCLUSION

T1 bright appendix sign was a specific finding for the diagnosis of normal appendix in pregnant women suspected of acute appendicitis

CLINICAL RELEVANCE/APPLICATION

If T1 bright appendix sign is seen in pregnant women with suspected appendicitis, the probability of acute appendicitis might be low

RC308-03 Optimization of MR Protocols in Pregnant Women with Suspected Acute Appendicitis

Tuesday, Dec. 1 9:05AM - 9:15AM Location: N228

Participants
Ilah Shin, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Yong Eun Chung, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myeong-Jin Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the optimal MR protocols in pregnant women who were suspected of acute appendicitis

METHOD AND MATERIALS

This retrospective study included 125 pregnant women (mean IUP, 21.6; range, 16-30 weeks) with suspected appendicitis. MR images were reviewed by two experienced radiologists in consensus in 3 separate sessions. On session 1, axial single shot(SSH) T2WI, respiratory gated fat saturated T2WI, 3D T1 weighted images (set 1) were reviewed. In session 2 and 3, set 1 + coronal T2WI (set 2) and set 2 + sagittal T2WI were reviewed respectively. The visibility of appendix (1: not identified - 5: entirely visualized) and probability of appendicitis (1: not appendicitis - 5: definite appendicitis) were evaluated in each session. If diseases other than appendicitis were suspected, reviewers were asked to provide specific diagnosis with a 5-point scale confidence level. Visualization score and diagnostic performance were compared by ANOVA and chi-square test. Area under the curve (Az) value was compared with DeLong methods

RESULTS

Visualization scores of appendix was slightly increased in both set 2 (4.5±1.3) and set 3 (4.5±1.3) compared to set 1 (4.2±1.3) without statistical significance (ANOVA, P=0.214). There was no significant differences in confidence level among three groups, in both patients with appendicitis (4.9 in all sets, P>0.999) and without appendicitis (1.2 in all sets, P=0.914). Eighteen patients had been diagnosed to other diseases including ureter stone (1), obstruction (3), torsion (7), acute pyelonephritis (2), hemoperitoneum (2), colon cancer (2), and terminal ileitis (1). Sensitivity and accuracy were increased in set 2 (77.8%, 96.8%) and set 3 (83.3%, 97.6%) compared to set 1 (66.7%, 95.2%) for the diagnosis of other disease. Az value was significantly higher in set 3 (Az, 0.917) compared to both set 2 (Az, 0.889) and set 1 (Az, 0.833, $P < 0.05$)

CONCLUSION

Axial T2WI with/without fat saturation and 3D T1WI were sufficient for the diagnosis of acute appendicitis. However, additional coronal and sagittal SSH T2WI were required for the accurate diagnosis of disease other than appendicitis in pregnant women

CLINICAL RELEVANCE/APPLICATION

Although axial T2WI and 3D T1WI is sufficient for the diagnosis of appendicitis, coronal and sagittal T2WI might be needed for the accurate diagnosis of diseases other than acute appendicitis in pregnant women who are suspected of acute appendicitis

RC308-04 "Saving Time without Sabotaging Diagnosis"- The FAST MR Protocol for Evaluating Acute Appendicitis in the Emergency Setting

Tuesday, Dec. 1 9:15AM - 9:25AM Location: N228

Participants
Memoona Mian, MD, FRCR, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Ismail T. Ali, MBChB, MD, Vancouver, BC (*Presenter*) Nothing to Disclose
Teresa I. Liang, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Patrick D. McLaughlin, FFRRCSI, Cork, Ireland (*Abstract Co-Author*) Speaker, Siemens AG
Savvas Nicolaou, MD, Vancouver, BC (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Triona M. Walshe, FFR(RCSI), Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Silvia D. Chang, MD, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Acute appendicitis is a major concern especially in young females presenting to ER with right iliac fossa pain. Prompt diagnosis/exclusion has major implications in the urgent care setting. Due to concerns for radiation exposure with CT scan, MR is gaining popularity as the imaging of choice given the low yield of ultrasound in such cases. In this study, we assess the diagnostic performance of FAST MR protocol comprising T2 HASTE and DW imaging for investigating such patients in the Emergency department.

METHOD AND MATERIALS

50 patients (49 Females; mean age 25.4 +/-5.2 yrs) with MR imaging between July 2017 and March 2015 for possible acute appendicitis were reviewed. MR abdomen/pelvis performed on 1.5 T MR per departmental protocol included axial T1 gradient echo in-out of phase, transverse FSE T2 with fat sat/motion correction, axial/coronal T2 HASTE and axial DWI images. In a randomized blinded fashion, two independent radiologists with > 5 years' experience in acute imaging reviewed both protocols for presence/absence of acute appendicitis with interpretation confidence on a five point scale(5 : highly confident to 1: nondiagnostic).Mean acquisition and interpretation times for both protocols were calculated. Sensitivity, specificity and accuracy for the FAST protocol was calculated, using clinical disposition of the patient as gold standard.

RESULTS

Mean scan time for FAST and FULL protocol was calculated to be 21.1 min and 40.5 min respectively. Mean interpretation time for FAST protocol for reader one and two was 4.1+/-1.5 min and 4.5 +/- 1.4 min and for FULL protocol was 8.1+/-1.8 min and 7.1+/-1.4 min respectively. The appendix was not confidently identified in 3 scans which were considered negative for the purpose of this study given the absence of indirect signs of inflammation like fat standing, free fluid. Sensitivity, specificity and accuracy for the FAST protocol were calculated to be 100% each for reader one and 75%, 100% and 94% respectively for reader two.

CONCLUSION

The FAST MR protocol with high diagnostic accuracy in detecting/excluding appendicitis and significant reduction in scan/interpretation time can be a valuable tool for assessing patients with possible acute appendicitis in the ER setting.

CLINICAL RELEVANCE/APPLICATION

FAST MR protocol significantly reduces scan/read times without sabotaging diagnostic accuracy for evaluating acute appendicitis, thus is an efficient and cost-effective technique in the ER setting.

RC308-05 CT Angiography for Gastrointestinal Hemorrhage

Tuesday, Dec. 1 9:25AM - 9:50AM Location: N228

Participants
Jorge A. Soto, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review an appropriate algorithm for the evaluation of patients presenting with overt lower intestinal bleeding, with emphasis on CT angiography. 2) To describe the proper CT angiography technique for overt gastrointestinal bleeding. 3) Illustrate with multiple examples the CT angiographic findings of active gastrointestinal bleeding, as well as potential pitfalls in interpretation.

ABSTRACT

Overte gastrointestinal bleeding is a common and serious condition that may threaten a patient's life depending on the severity and duration of the event. Precise identification of the location, source and cause of bleeding are the primary objectives of the diagnostic evaluation. The diagnostic algorithm implemented in these acutely ill patients include various imaging modality options, as well as upper endoscopy and colonoscopy. For patients presenting with hematochezia, implementation of colonoscopy in the emergency setting poses multiple challenges, especially the inability to adequately cleanse the colon and poor visualization owing to the presence of intraluminal blood clots. Scintigraphy with technetium 99m-labeled red blood cells is highly sensitive but also has some limitations, such as imprecise localization of the source of bleeding. CT angiography offers logistical and diagnostic advantages in the detection of active hemorrhage. A three-phase examination (non-contrast, arterial and portal venous) is typically performed. Potential technical and interpretation pitfalls should be considered and will be explained. The information derived from CT angiography helps direct therapy and select the most appropriate hemostatic intervention (when necessary): endoscopic, angiographic, or surgical. Precise anatomic localization of the bleeding point also allows a targeted endovascular embolization. The high diagnostic performance of CT angiography makes this test a good alternative for the initial emergent evaluation of patients with acute lower intestinal bleeding.

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Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

RC308-06 The Association of the Hypovolemic Shock Complex and Patient Mortality in Patients with Acute Internal Hemorrhage of the Abdomen and Pelvis

Tuesday, Dec. 1 9:50AM - 10:00AM Location: N228

Awards
RSNA Country Presents Travel Award

Participants
Benjamin Fritz, MD, Freiburg, Germany (*Presenter*) Nothing to Disclose
Jan Fritz, MD, Baltimore, MD (*Abstract Co-Author*) Research Grant, Siemens AG; Research Consultant, Siemens AG; Speaker, Siemens AG
Philippe A. Dovi-Akue, MD, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Maximilian Russe, MD, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Mathias F. Langer, MD, PhD, Freiburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Elmar C. Kotter, MD, MSc, Freiburg, Germany (*Abstract Co-Author*) Editorial Advisory Board, Thieme Medical Publishers, Inc

PURPOSE

The hypovolemic shock complex (HSC) constitutes computed tomography (CT) signs that are believed to be related to hypovolemic shock; however, its association with patient prognosis is unclear. We, therefore, sought to determine the frequency of HSC signs in patients with acute internal hemorrhage of the abdomen and pelvis and their association with patient mortality.

METHOD AND MATERIALS

A retrospective search of our hospital database between 2012 and 2014 derived 197 patients with clear contrast-enhanced MDCT demonstration of acute internal hemorrhage of the abdomen and pelvis. Experienced observers evaluated the CT studies for 10 different radiological signs of HSC. The frequencies of HSC signs were correlated with death during hospitalization.

RESULTS

44/197 (22.3%) of the patients died. The mortality group showed an average of 3.0 HSC signs, whereas the survival group showed 1.1 ($p<0.001$). Mortality and survival groups showed differences of the frequency of hyperenhancing adrenal glands (70.5% (31/44) vs. 19.0% (29/153), $p<0.001$), halo sign (54.5% (24/44) vs. 32% (48/150), $p=0.01$), spleenic hypoperfusion (37.2% (16/43) vs. 4% (6/151), $p<0.0001$), altered renal enhancement (15.9% (7/44) vs. 3.3% (5/153), $p=0.033$), shock bowel (22.7% (10/44) vs. 3.3% (5/150), $p=0.005$), liver hypoperfusion (15.9% (7/44) vs. 3.3% (5/153), $p=0.004$), and hyperenhancement/edema of the gallbladder

(12.1% (4/33) vs. 0% (0/137), p=0.044). No significant differences existed for a flat IVC (59.1% (26/44) vs. 45.1% (69/153), p=0.103), small diameter aorta (9.5% (4/42) vs. 6.5% (10/153), p=0.516) and pancreatic hyperenhancement/edema (6.8% (3/44) vs. 0% (0/153), p=0.083). 10% (7/73) of patients with no signs of HSC died compared to 11% (5/44) with 1, 27% (9/33) with 2, 33% (8/24) with 3, 67% (4/6) with 4, 44% (4/9) with 5, 67% (2/3) with 6, 100% (2/2) with 7, 100% (2/2) with 8 and 100% (1/1) with 9 HSC signs.

CONCLUSION

HSC signs are common in patients with acute internal hemorrhage. Patient mortality significantly increases if 2 or more signs are present. While several signs are associated with increased mortality, inferior vena cava, aorta and pancreas signs have the weakest association.

CLINICAL RELEVANCE/APPLICATION

Timely MDCT diagnosis and reporting of the HSC can contribute to appropriate management of the acute patient care and prognosis.

RC308-07 Question and Answer

Tuesday, Dec. 1 10:00AM - 10:15AM Location: N228

Participants

RC308-08 Imaging of Bowel Ischemia

Tuesday, Dec. 1 10:15AM - 10:40AM Location: N228

Participants
Vincent M. Mellnick, MD, Saint Louis, MO, (mellnickv@mir.wustl.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To apply protocols for CT and MRI that are best for identifying and characterizing bowel ischemia. 2) To compare the underlying causes and imaging findings of bowel ischemia, including nonocclusive ischemia, arterial and venous occlusion, vasculitis, and obstruction. 3) To dfferentiate the CT and MRI findings of bowel ischemia due in various stages of chronicity. 4) To use this information to better detect bowel ischemia in clinical practice and recommend appropriate management.

ABSTRACT

N/A

RC308-09 CT for Acute Nontraumatic Abdominal Pain - Is Oral Contrast Really Required? Initial Conclusions

Tuesday, Dec. 1 10:40AM - 10:50AM Location: N228

Participants
Rivka Kessner, Tel Aviv, Israel (*Presenter*) Nothing to Disclose
Sophie Barnes, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Pinhas Halpern, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Vadim Makrin, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Arye Blachar, MD, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of abdominal CT performed with and without oral contrast, in patients presenting to the ED with acute nontraumatic abdominal pain.

METHOD AND MATERIALS

Our prospective study was conducted on a sample of adult patients presenting with nontraumatic abdominal pain to the ED of a large tertiary medical center. 250 patients with acute abdominal pain that underwent IV contrast-enhanced abdominal CT were enrolled over a 9-month period. 125 patients were recruited for the study group using convenience sampling, and underwent CT without oral contrast. A control group of 125 patients was recruited, matching the cohort groups' gender and age and underwent abdominal CT during the same week - with oral contrast material. Exclusion criteria were: pregnancy, history of IBD, recent abdominal operation, suspected renal colic, AAA rupture or intestinal obstruction. The exams were first reviewed by the senior attending radiologist to determine if an additional scan with oral contrast was required. Two senior radiologists then performed consensus reading to determine the significance of the lack of oral contrast administration. The reviewers also determined specific technical and imaging findings, including the presence of oral contrast in the pathological area and the influence of the technique on some radiological findings.

RESULTS

Each group consisted of 67 males and 58 females. The average age of the two groups was 46.9 years. The main diagnoses were appendicitis (20%), diverticulitis (8.4%), colitis (6.4%) and a normal CT exam (40.4%). There was no significant difference between the groups regarding the history of the patients and the technique of the studies. Among the 125 patients of the study group, no patient had to undergo additional scan in order to establish the correct diagnosis. In only 1 patient from each group (0.8%), contrast material was considered to be necessary. In 8 patients from the study group (6.4%) and 5 patients from the control group (4%) oral contrast was considered helpful.

CONCLUSION

Our study indicates that examination of patients with acute nontraumatic abdominal pain with CT scans without oral contrast material - are diagnostic and have comparable performance to scans performed after oral contrast administration.

CLINICAL RELEVANCE/APPLICATION

Our study indicates that patients presenting to the ED with acute nontraumatic abdominal pain, may be examined with CT without

oral contrast material.

RC308-10 Assessing the Prevalence and Clinical Relevance of Positive Abdominal and Pelvic CT Findings in Senior Patients Presenting to the Emergency Department.

Tuesday, Dec. 1 10:50AM - 11:00AM Location: N228

Participants
Abdullah Alabousi, MD, Hamilton, ON (*Abstract Co-Author*) Nothing to Disclose
Michael N. Patlas, MD,FRCPC, Hamilton, ON (*Abstract Co-Author*) Nothing to Disclose
Malek Meshki, MD, Hamilton, ON (*Presenter*) Nothing to Disclose
Sandra Monteiro, PhD, Hamilton, ON (*Abstract Co-Author*) Nothing to Disclose
Douglas S. Katz, MD, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospectively evaluate the prevalence and clinical relevance of positive abdominal and pelvic CT(A/P CT) findings for patients ages 65 and older, when compared with all other Emergency Department (ED) patients undergoing A/P CT during the same time period.

METHOD AND MATERIALS

An IRB-approved retrospective review of all adult patients who underwent an emergency 64-MDCT of the abdomen and pelvis for acute non-traumatic abdominal complaints over a two-year period at a single institution was performed. The prevalence and clinical relevance of positive CT findings was assessed for patients <65 and >65. Statistical comparisons were made with Student t-tests.

RESULTS

2102 patients between 10/1/2011 and 9/30/2013 were reviewed. 1009 patients were excluded as their CT was performed to assess for trauma, for post-operative changes, or because the patients had a known diagnosis or the CT examination was performed for cancer staging. 631 patients were included in the <65 group (298 men and 333 women; mean age 46, age range 18-64), and 462 were included in the >65 group (209 men and 253 women; mean age 78, age range 65-99). Overall, there were more positive CT findings explaining the abdominal/pelvic pain for patients <65 (388 positive cases, 61.5%), compared with the >65 group (258 positive cases, 55.8%), which was a statistically significant difference ($p<0.03$). However, patients >65 were more likely to have clinically/surgically relevant findings. 50% of patients >65 presenting with appendicitis had complications evident on the initial CT, compared with 27% of those <65 ($p<0.05$). In addition, bowel obstruction (41 vs 27 patients, $p<0.05$), ruptured abdominal aortic aneurysm (7 vs 2 patients, $p<0.05$) and malignancy (19 vs 12 patients, $p<0.05$) were all more common in individuals presenting to the ED >65 years of age.

CONCLUSION

The findings of our retrospective study refute the hypothesis that there is increased prevalence of positive abdominal and pelvic CT findings in patients >65. However, older patients in our series were more likely to present with clinically/surgically relevant findings, and a lower threshold for ordering imaging examinations in this patient population should be considered.

CLINICAL RELEVANCE/APPLICATION

64-MDCT shows more clinically/surgically relevant findings in individuals older than 65 than in younger patients presenting to the Emergency Department with acute non-traumatic abdominal complaints.

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Douglas S. Katz, MD - 2013 Honored Educator
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RC308-11 MR of the Acute Abdomen

Tuesday, Dec. 1 11:00AM - 11:25AM Location: N228

Participants
Stephan W. Anderson, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To overview the current utilization of MR of the acute abdomen, with an emphasis on protocol optimization, and correct interpretation, using case examples. 2) To examine potential pitfalls in the interpretation of MR of the acute abdomen. 3) To review the current literature of MR of the acute abdomen.

RC308-12 The "Onyx Rim" Sign in Pelvic MRI: Perifollicular Hemorrhage as a Potential Predictor of Viability in the Setting of Ovarian Torsion

Tuesday, Dec. 1 11:25AM - 11:35AM Location: N228

Participants
Iva Petkovska, MD, Tucson, AZ (*Presenter*) Nothing to Disclose
Zeenia Irani, MD, MS, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Bobby T. Kalb, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Christopher Geffre, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Janiel Cragun, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
James R. Costello, MD, PhD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose
Hina Arif Tiwari, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose

Ferenc Czeyda-Pommersheim, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Diego R. Martin, MD, PhD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To correlate noncontrast MRI features of perifollicular hemorrhage with ovarian viability in the clinical setting of torsion.

METHOD AND MATERIALS

This is an IRB-approved retrospective review of 8 patients with ovarian torsion on MRI confirmed with intraoperative exam. Preoperative MR exams were performed on either a 1.5T/3.0T system (Siemens Magnetom Aera/Skyra) using 18-channel anterior abdominal and pelvic surface coils. Images were acquired without breath holding using multiplanar T2-weighted Half-Fourier Single-shoT Echo-train (HASTE) sequences, repeated with fat-suppression using SPectral Adiabatic Inversion Recovery (SPAIR). All MRIs were retrospectively reviewed in a blinded fashion separately by two radiologists for the presence or absence of a T2-hypointense perifollicular rim. This finding, when present, was utilized as a predictor of nonviability of the torsed ovary. Each torsed ovary was categorized as either a) viable or b) nonviable based on presence/absence of a perifollicular T2-hypointense rim. Clinical outcomes were determined by either a) histopathologic correlation, or b) imaging follow-up and review of the patient's medical records.

RESULTS

Of 8 patients with ovarian torsion on MRI, 5 were categorized as non-viable on MRI due to the presence of a perifollicular T2 hypointense rim, and 3 as viable due to a lack of perifollicular T2-hypointense rim. Using the reference standards of pathology (n=5) and medical chart review and imaging follow-up (n=3), MRI demonstrated a sensitivity of 100 %, and specificity of 100 % for predicting viability of a torsed ovary based on presence of a perifollicular T2-hypointense rim. Histopathological correlation demonstrated perifollicular hemorrhage separating the theca interna and externa in every patient with non-viable ovaries, corresponding to the perifollicular T2-hypointenstiy identified on preoperative MRI.

CONCLUSION

Preoperative noncontrast MRI may hold promise for the prediction of ovarian viability in clinical setting of torsion.

CLINICAL RELEVANCE/APPLICATION

Preoperative MRI for the diagnosis of ovarian torsion may provide a biomarker for prediction of ovarian viability, with potential impact on preoperative planning and management.

RC308-13 Diagnostic Performance of Individual and Combined MR Signs of Acute Cholecystitis

Tuesday, Dec. 1 11:35AM - 11:45AM Location: N228

Participants
Avneesh Gupta, MD, Boston, MA (*Presenter*) Nothing to Disclose
Christina A. LeBedis, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stephan W. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the performance of individual and combined MR signs of acute cholecystitis, and to propose a rapid non-contrast MR protocol for emergency diagnosis of right upper quadrant pain.

METHOD AND MATERIALS

The institutional review board approved this HIPAA-compliant retrospective study. Informed consent was waived. 288 patients presenting to the emergency department with acute right upper quadrant pain between 10/3/2010 and 11/28/2012 undergoing MR within 48 hours of US were included. MR was performed in all included patients due to equivocal US and persistent symptoms. Individual MR signs were graded in a blinded fashion using single shot T2, diffusion (b=0, b=600) and 3D GRE post contrast sequences. Sensitivity and specificity values for individual and combined imaging signs were calculated using surgical diagnosis as the reference standard for acute cholecystitis.

RESULTS

Of 288 patients, 128 were treated conservatively and excluded from analysis. 160 underwent cholecystectomy and 77 were diagnosed with acute cholecystitis at surgery. Sensitivities of the MR findings of gallstones, distention, wall thickening, pericholecystic fluid, gallbladder fossa restricted diffusion, wall restricted diffusion, gallbladder fossa hyper enhancement and wall hyper enhancement for the detection of acute cholecystitis were 96%, 59.7%, 72.7%, 49.4%, 47.3%, 26.7%, 55% and 11%, respectively. Corresponding specificities were 24.6%, 71%, 55.9%, 78.2%, 74.8%, 88.3%, 83.2% and 98.4%. Combining stones, distention, pericholecystic fluid and gallbladder fossa restricted diffusion yielded sensitivity of 35% and specificity of 92.7%, and these findings were identifiable using single shot T2 and diffusion sequences only. The combination of stones, distention and gallbladder fossa hyper enhancement was 43.8% sensitive and 89.6% specific for acute cholecystitis.

CONCLUSION

Individual and combined MR features show high specificity for acute cholecystitis. Most signs can be detected by diffusion and single shot T2 weighted sequences only. Gallbladder fossa restricted diffusion is a novel imaging sign, and when combined with the presence of gallstones, pericholecystic fluid and distention yields a specificity of 92.7% for acute cholecystitis.

CLINICAL RELEVANCE/APPLICATION

A highly specific, rapid non-contrast MR protocol consisting of diffusion and single shot T2 weighted sequences can be effective for the diagnosis of acute cholecystitis when US findings are equivocal.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at:

https://www.rsna.org/Honored-Educator-Award/

Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

RC308-14 **Question and Answer**

Tuesday, Dec. 1 11:45AM - 12:00PM Location: N228

Participants

RC309

Pitfalls in Abdominal Imaging

Tuesday, Dec. 1 8:30AM - 10:00AM Location: E353C

GI CT MR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC309A Pitfalls in Bowel Imaging

Participants
David H. Kim, MD, Madison, WI (*Presenter*) Consultant, Viatronix, Inc; Co-founder, VirtuoCTC, LLC; Medical Advisory Board, Digital ArtForms, Inc; Stockholder, Cellectar Biosciences, Inc

LEARNING OBJECTIVES

1) List the advantages/disadvantages of positive and negative oral contrast 2) Recognize common pitfalls that mimic disease 3) Devise practical approaches to manage common bowel imaging scenarios

RC309B Atypical Liver Lesions

Participants
Rendon C. Nelson, MD, Durham, NC, (rendon.nelson@duke.edu) (*Presenter*) Consultant, General Electric Company Consultant, Nemoto Kyorindo Co, Ltd Consultant, VoxelMetrix, LLC Research support, Bracco Group Research support, Becton, Dickinson and Company Speakers Bureau, Siemens AG Royalties, Wolters Kluwer nv

LEARNING OBJECTIVES

1) To understand the typical imaging appearance of various focal liver lesions on CT and MR and how they can present in an atypical fashion (i.e. the imaging spectrum).

ABSTRACT

Active Handout:Rendon C. Nelson

http://abstract.rsna.org/uploads/2015/14000560/Active RC309B.pdf

RC309C Pitfalls in Hepatic Doppler Sonography

Participants
Jonathan B. Kruskal, MD, PhD, Boston, MA, (jkruskal@bidmc.harvard.edu) (*Presenter*) Author, UpToDate, Inc

LEARNING OBJECTIVES

1) Discuss the common technical pitfalls that occur when performing the liver Doppler examination, and how these can be mitigated. 2) Discuss the perceptual and interpretive errors that occur when performing the liver Doppler examination, and how these can be minimized. 3) Describe the clinical impact of technical and interpretive errors.

ABSTRACT

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Jonathan B. Kruskal, MD, PhD - 2012 Honored Educator

RC309D Pearls and Pitfalls in Pancreatic Diseases

Participants
Khaled M. Elsayes, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe most commonly encountered imaging pitfalls of the pacreas. 2) Describe relevant technical background. pathophysiology and hemodynamics of these pitfalls. 3) Discuss tips to avoid erroneous diagnosis and pearls to reach correct diagnosis.

ABSTRACT

There is a wide range of common pitfalls in pancreas imaging, which can lead to frequent incorrect diagnoses mainly because many radiologists are not completely familiar with anatomical, morphological, physiological, hemodynamic and biological principles as well as deficiency of modern clinical and radiological knowledge. This leads to common misinterpretations which would further results in

wrong management with potentially negative outcome. In this course, we will review important typical features of common pancreatic pathologies and mimics of these pathologies that may require different treatment and improved prognosis.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Khaled M. Elsayes, MD - 2014 Honored Educator

RC311

Imaging Alzheimer's Disease -The Search for the Holy Grail

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S505AB

NR MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credit: 0

Participants

LEARNING OBJECTIVES

1) Discuss the potential roles and limitations of PET imaging for amyloid and tau protein in evaluating patients with dementia. 2) Describe anatomic and functional MRI techniques for evaluating Alzheimer's disease. 3) Understand the clinical challenges of diagnosing and managing patients with dementia.

Sub-Events

RC311A PET Imaging, Tracers

Participants
Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC311B MRI and fMRI

Participants
Jeffrey R. Petrella, MD, Durham, NC (*Presenter*) Advisory Board, Johnson & Johnson Speakers Bureau, Quintiles Inc Advisory Board, Piramal Enterprises Limited

LEARNING OBJECTIVES

View learning objectives under main course title.

RC311C Clinical Examples

Participants
P. M. Doraiswamy, MD, Durham, NC (*Presenter*) Research Consultant, Bristol-Myers Squibb Company Research Consultant, Eli Lilly and Company Research Consultant, Neuronetrix, Inc Research Consultant, Medivation, Inc Research Grant, Bristol-Myers Squibb Company Research Grant, Eli Lilly and Company Research Grant, Neuronetrix, Inc Research Grant, Medivation, Inc Stockholder, Sonexa Therapeutics, Inc Stockholder, Clarimedix, Inc Speaker, Forest Medical, LLC

LEARNING OBJECTIVES

View learning objectives under main course title.

RC312

Vascular Series: MR Angiography: New Techniques and Their Application

Tuesday, Dec. 1 8:30AM - 12:00PM Location: S102AB

VA MR

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants
Dominik Fleischmann, MD, Palo Alto, CA (*Moderator*) Research support, Siemens AG;

Sub-Events

RC312-01 Non-contrast MRA Techniques

Tuesday, Dec. 1 8:30AM - 8:55AM Location: S102AB

Participants
Scott B. Reeder, MD, PhD, Madison, WI (*Presenter*) Institutional research support, General Electric Company Institutional research support, Bracco Group

RC312-02 Depiction of Transplant Renal Vascular Anatomy and Complications: Unenhanced MR Angiography by Using Spatial Labeling with Multiple Inversion Pulses

Tuesday, Dec. 1 8:55AM - 9:05AM Location: S102AB

Participants
Hao Tang, Wuhan, China (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the ability to depict anatomy and complications of renal vascular transplant with unenhanced magnetic resonance (MR) angiography with spatial labeling with multiple inversion pulses (SLEEK) and to compare the results with color Doppler (CD) ultrasonography (US), digital subtraction angiography (DSA), and intraoperative findings.

METHOD AND MATERIALS

This study was approved by the institutional review board, and written informed consent was received before examination. Seventy-five patients who underwent renal transplantation were examined with unenhanced MR angiography with SLEEK and CD US. DSA was performed in 15 patients. Surgery was performed in eight patients. The ability of SLEEK to show transplant renal vascular anatomy and complications was evaluated by two experienced radiologists who compared the results with CD US, DSA, and intraoperative findings.

RESULTS

Patients successfully underwent SLEEK MR angiography. Transplant renal vascular anatomy was assessed in 87 arteries and 78 veins. Renal vascular complications from transplantation were diagnosed in 23 patients, which included 14 with arterial stenosis, three with arterial kinking, two with arteriovenous fistulas, two with venous stenosis, one with pseudoaneurysms, and one with fibromuscular dysplasia. Three patients had two renal transplants and nine patients had nine accessory renal arteries. More accessory renal arteries were detected with SLEEK than with CD US. Correlation was excellent between the stenosis degree with SLEEK and DSA (r= 0.96; P ,.05). For those with significant artery stenosis (.50% narrowing) proved with DSA (n= 7) or surgery (n= 3), positive predictive value was 91% (10 of 11).

CONCLUSION

Unenhanced MR angiography with SLEEK preliminarily proved to be a reliable diagnostic method for depiction of anatomy and complications of renal vascular transplant. It may be used for evaluation of patients with renal transplant, and in particular for those with renal insufficiency.

CLINICAL RELEVANCE/APPLICATION

Unenhanced MR angiography with SLEEK may be used for evaluation of patients with renal transplant, and in particular for those with renal insufficiency.

RC312-03 Nonenhanced ECG-gated Quiescent-interval Single Shot (QISS) MRA of the Lower Extremity for Planning of Interventional Procedures: Results in 43 PAD Patients

Tuesday, Dec. 1 9:05AM - 9:15AM Location: S102AB

Awards
RSNA Country Presents Travel Award

Participants
Peter Liersch, Duesseldorf, Germany (*Presenter*) Nothing to Disclose
Patric Kroepil, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christoph K. Thomas, MD, Dusseldorf, Germany (*Abstract Co-Author*) Speaker, Siemens AG
Joel Aissa, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Rotem S. Lanzman, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the clinical value of nonenhanced ECG-gated Quiescent-Interval Single-Shot MR angiography (QISS-MRA) for planning of interventional procedures in patients with peripheral artery disease (PAD).

METHOD AND MATERIALS

43 patients (mean age 68.5 ± 10.8 years) with peripheral artery disease were included in this study. Nonenhanced QISS-MRA of the distal aorta and the lower extremity were acquired at 1.5T with 3mm slice thickness, with 0.6 mm overlap and an inplane resolution of 1.0 x 1.0 mm, resulting in a total scan time of approx. 9 min. ECG-gating was applied for synchronization of the quiescent interval with the period of maximum systolic inflow. The degree of stenosis was assessed by using a 4-point scale (grade 1, normal appearing vessel; grade 2, vessel narrowing < 50%; grade 3, stenosis 50%-99%; grade 4, vessel occlusion) for 15 predefined anatomical segments. QISS-MRA was used to plan interventional procedures. Interventional digital subtraction angiography (DSA) served as the reference standard.

RESULTS

QISS-MRA was performed successfully in all patients. 434 of 645 segments visible on QISS-MRA were evaluated with DSA during interventional procedures and were considered for further analysis. With QISS-MRA the degree of stenosis was assessed correctly in 404 of 434 (93.1%) segments, overestimated in 26 of 434 (5.9%) segments and underestimated in 4 of 434 (0.9%) segments. As compared to DSA, QISS-MRA had a high sensitivity (99.3%), specificity (97.2%) as well as positive and negative predictive value (89.3% and 97.3%) for the detection of significant stenosis (grade 3 and 4). Based on QISS-MRA, an appropriate arterial access was selected in all patients and the estimated length of stenosis or vessel occlusion was assessed correctly. 6 of 6 (100%) stented segments were not assessable.

CONCLUSION

ECG-gated QISS-MRA is a solid nonenhanced imaging technique for assessment of stenosis of the lower extremities and provides a reliable basis for interventional procedures. A limitation of QISS-MRA is the evaluation of stented segments.

CLINICAL RELEVANCE/APPLICATION

QISS-MRA is a reliable and precise nonenhanced imaging technique for assessment of peripheral arterial disease and can be applied safely in patients with contraindications for contrast material.

RC312-04 Qualitative and Quantitative Image Quality of Lower Extremity Angiography Using Non-Contrast-Enhanced Quiescent Interval Single-Shot (QISS) MRA: Comparison with CTA

Tuesday, Dec. 1 9:15AM - 9:25AM Location: S102AB

Participants
Akos Varga-Szemes, MD, PhD, Charleston, SC (*Presenter*) Nothing to Disclose
Giuseppe Muscogiuri, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Carlo N. De Cecco, MD,PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Pal Suranyi, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Julian L. Wichmann, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Bracco Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; ; ;
Stefanie Mangold, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Paola Maria Cannao, MD, San Donato Milanese, Italy (*Abstract Co-Author*) Nothing to Disclose
Shivraman Giri, PhD, Chicago, IL (*Abstract Co-Author*) Employee, Siemens AG
Thomas M. Todoran, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the qualitative and quantitative image quality of non-contrast quiescent interval single-shot (QISS) MRA in patients with peripheral artery disease (PAD).

METHOD AND MATERIALS

Twenty patients (67±6 years, 11 male) with PAD referred for a clinically indicated lower extremity CTA were consented for a non-contrast enhanced lower extremity MRA on a 1.5 clinical scanner (MAGNETOM Avanto, Siemens AG, Erlangen, Germany) using an investigational prototype QISS sequence (FOV 400x260mm2, TR/TE 3.5/1.4ms, flip angle 90°, acquisition length 144mm). Contrast to noise ratio (CNR) based on the vascular and peri-vascular signal was measured according to an 18-segment model. The segmental vascular enhancement and the image noise were rated on five-point scales (1-poor/non-diagnostic, 5-excellent) by two readers. Additionally, the number of non-diagnostic segments were counted and compared between CTA and QISS-MRA.

RESULTS

A total of 360 segments were evaluated. The average CNR measured in QISS-MRA images was 63.4±17.5. QISS-MRA vascular enhancement ratings by the two readers were 3.7±0.5 and 3.8±0.4, respectively, while the CTA readings were 4.0±0.4 and 4.1±0.5, respectively, resulting in no significant difference between the two modalities. QISS-MRA image noise ratings were 3.4±0.7 and 3.6±0.5, respectively, while those for CTA were 4.0±0.5 and 4.2±0.5, respectively. Excellent inter-reader agreement was found in image quality ratings (κ>0.8). Thirty-one segments (8.6%) were excluded from the CTA analysis due to stent artifacts (11), total occlusion (14), or heavy calcification (6) and 26 segments (7.2%) were non-diagnostic at MRA due to major image artifacts (12) or total occlusion (14). Five out of the six heavily calcified segments were diagnostic at QISS MRA.

CONCLUSION

In this study, image quality of non-contrast QISS-MRA was comparable to that of contrast enhanced CTA. In certain circumstances, such as in heavily calcified segments, QISS-MRA provides superior lumen visibility compared to CTA. Such a non-contrast technique may have potential advantage in patients with severe renal disease or with other risk factors that prohibit the use of iodinated or gadolinium-based contrast material.

CLINICAL RELEVANCE/APPLICATION

QISS-MRA enables non-contrast evaluation of the lower extremity arteries with comparable image quality to CTA, and is potentially

beneficial for patients with severe renal disease.

RC312-05 Role of Preoperative Dynamic Time Resolved MRA (DTR MRA) for Detection and Localization of Perforators in Patients Undergoing Free Fibula Flap (FFF) for Head and Neck Reconstruction

Tuesday, Dec. 1 9:25AM - 9:35AM Location: S102AB

Participants
Manohar Kuruva, MBBS, MD, Little Rock, AR (*Presenter*) Nothing to Disclose
Mauricio A. Moreno, MD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Tarun Pandey, MD, FRCR, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Roopa Ram, MD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Kedar Jambhekar, MD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study aimed at evaluating the accuracy of preoperative DTR MRA for the detection and localization of lower extremity septo-cutaneous perforators in patients undergoing free fibula flap (FFF) for head and neck reconstruction.

METHOD AND MATERIALS

Retrospective chart review of 43 patients who underwent pre-operative DTR MRA prior to FFF in a tertiary academic setting from 2009-2015. DTR MRA scans were evaluated for presence of perforators and their location relative to fibular head, and subsequently correlated with intra-operative findings. We considered location of perforator to be in concordance if the vessel was within 3cms based on DTR MRA and surgical findings, and hypothesized that differences within this range could represent distal perforator branches presenting radiologically as separate vessels.

RESULTS

DTR MRA and surgery identified at least one perforator in 42/43, and 41/43 patients respectively. The technique appropriately detected the presence of perforators in 40/41 patients and ruled out perforators in 1/2 patients, yielding a sensitivity, specificity and accuracy of 97.5%, 50% and 95.3%. Collectively, DTR-MRA accurately predicted the location of the perforators in 75% of the cases (48/64). On a patient-based analysis, DTR MRA correctly predicted the location of at least one perforator in 37/41 patients yielding an accuracy of 90% for this purpose.

CONCLUSION

DTR MRA accurately predicts the presence and location of cutaneous perforators in patients undergoing FFF reconstruction.

CLINICAL RELEVANCE/APPLICATION

To our knowledge, this is one of the largest study validating the role of MRA for this purpose. Preoperative localization of the vessels significantly impacts surgical planning and may prevent unnecessary surgical explorations in a percentage of patients.

RC312-06 One-stop-shop Preoperative Evaluation for Living Liver Donors with Gd-EOB-DTPA-enhanced MRI: Can it be More Cost-effective and Convenient?

Tuesday, Dec. 1 9:35AM - 9:45AM Location: S102AB

Participants
Shuangshuang Xie, Tianjin, China (*Presenter*) Nothing to Disclose
Wen Shen, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Chenhao Liu SR, PhD,PhD, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Tao Ren, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Lihua Chen, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Lixiang Huang, MD, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Yue Cheng, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Qian Ji, PhD, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Jianzhong Yin, MD, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the efficacy, cost-effectiveness and convenience between one-stop-shop gadoxetic-acid-disodium (Gd-EOB-DTPA)-enhanced MR imaging (MRI) and multi-detector CT combined with conventional magnetic resonance cholangiopancreatography (MDCT-MRCP) in preoperative evaluation for living liver donors.

METHOD AND MATERIALS

Eighty living liver donors were included in this prospective study. They were randomly grouped in Gd-EOB-DTPA-enhanced MRI group (n=40) and MDCT-MRCP group (n=40). Anatomical variations determined by pre- and intra-operative findings, costs, and time for preoperative images were recorded. Image quality for the depiction of hepatic vessels, bile ducts and graft volume were ranked on a 4-point scale and compared between both groups.

RESULTS

Gd-EOB-DTPA-enhanced MRI provided better image quality than MDCT-MRCP for the depiction of hepatic and portal veins, and graft volume by both reviewers ($P<0.01$), and for the depiction of bile ducts by one reviewer ($P<0.01$). MDCT provided better image quality than Gd-EOB-DTPA-enhanced MRI for the depiction of hepatic arteries by both reviewers ($P<0.01$). Fifty nine living donors proceeded to liver donation (n=21 for Gd-EOB-DTPA-enhanced MRI group and n=38 for MDCT-MRCP group) with all anatomical findings of hepatic vessels and bile ducts accurately confirmed by intraoperative findings ($P>0.05$). The repeatability for graft volume measurements on Gd-EOB-DTPA-enhanced MRI was higher than MDCT-MRCP. Gd-EOB-DTPA-enhanced MRI was cheaper than MDCT-MRCP (US$519.72 vs US$631.85). The effective "in room" time in the Gd-EOB-DTPA-enhanced MRI was 3 minutes longer than MDCT-MRCP (25±5 min vs 28±6 min, $P<0.05$).

CONCLUSION

One-stop-shop Gd-EOB-DTPA-enhanced MRI is a more cost-effective and convenient modality with the similar diagnostic accuracy

One-stop-shop Gd-EOB-DTPA-enhanced MRI is a more cost-effective and convenient modality with the similar diagnostic accuracy as MDCT-MRCP in preoperative evaluation.

CLINICAL RELEVANCE/APPLICATION

Gd-EOB-DTPA-enhanced MRI is equal to MDCT-MRCP in preoperative evaluation of hepatic vessels, bile ducts and graft volume and is more cost-effective and convenient for living donors.

RC312-07 Contrast Enhanced MRA with Gadolinium and Ferumoxytol

Tuesday, Dec. 1 9:45AM - 10:10AM Location: S102AB

Participants
J. Paul Finn, MD, Los Angeles, CA (*Presenter*) Research Grant, Bracco Group; ; ;

LEARNING OBJECTIVES

1) Be familiar with the major clinical applications of Contrast Enhanced MRA using Gadolinium Agents and Ferumoxytol. 2) Be aware of the relative advantages and disadvantages of Gadolinium agents and Ferumoxytol for CEMRA in various clinical scenarios. 3) Be familiar with differences in techniques and acquisition protocols for CEMRA using Gadolinium agents and Ferumoxytol.

ABSTRACT

Contrast enhanced MR angiography (CEMRA) with gadolinium based contrast agents (GBCA) is well established as a reliable clinical tool for a variety of applications. Within the past decade, concerns about the risk of nephrogenic systemic fibrosis (NSF) has impacted the utilization of CEMRA and has stimulated the search for safer GBCA and alternatives to gadolinium agents. High stability and high relaxivity GBCA are now recommended for CEMRA to minimize risk of NSF in patients with renal failure, and dose reduction strategies have become standard. Also, early results with non-gadolinium CEMRA, specifically with ferumoxytol, are becoming available and suggest that in many cases, ferumoxytol may be a powerful alternative to GBCA for CEMRA. In this talk, we will review techniques and applications for CEMRA both with GBCA and ferumoxytol in adults and children over a spectrum of disease states.

RC312-08 Principles and Applications of 4D-flow

Tuesday, Dec. 1 10:20AM - 10:45AM Location: S102AB

Participants
James C. Carr, MD, Chicago, IL (*Presenter*) Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA

RC312-09 4D Flow can Depict and Quantify the Reflected Flow in the Lower Abdominal Aorta in Patients with Arteriosclerosis

Tuesday, Dec. 1 10:45AM - 10:55AM Location: S102AB

Participants
Masataka Sugiyama, Hamamatsu-Shi, Japan (*Presenter*) Nothing to Disclose
Yasuo Takehara, MD, Hamamatsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Naoki Ooishi, Hamamatsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Marcus T. Alley, PhD, Stanford, CA (*Abstract Co-Author*) Research Funding, General Electric Company; Research Consultant, Arterys;
Tetsuya Wakayama, PhD, Hino-shi, Japan (*Abstract Co-Author*) Employee, General Electric Company
Atsushi Nozaki, Hino, Japan (*Abstract Co-Author*) Employee, General Electric Company
Hiroyuki Kabasawa, Bunkyo, Japan (*Abstract Co-Author*) Employee, General Electric Company
Shuhei Yamashita, MD, Hamamatsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hatsuko Nasu, Hamamatsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Harumi Sakahara, MD, Hamamatsu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Majorities of physiological evidences indicate that the increase of Oscillatory Shear Index (OSI) produces an expression of pro-atherogenic genes. In patients with arteriosclerosis, reflected flow appears within the lower abdominal aorta during early diastolic phase. 3D cine PC MRI (4D-Flow) has enabled the coverage of full spatial and cardiac phase resolved data of the velocity vectors of the flowing blood within the whole abdominal aorta, thereby allow OSI mapping and flow volume analysis. The purpose of our study was to test if 4D Flow can depict reflected flow in the lower abdominal aorta, to quantitate the retrograde flow volume, and to verify their association with atherosclerosis, in the non-dilated lower abdominal aorta.

METHOD AND MATERIALS

37 patients (30 to 84 y.o.) underwent 3.0T MR study including 4D-Flow and Gd-3D MRA. The wall shear stress (WSS), the OSI, and aortic flow volume were measured for abdominal aorta. The ratio of retrograde to antegrade flow (R/A ratio) volume was calculated. Two experienced radiologists rated the presence of atherosclerosis in three grades in terms of the presence of the intimal lipidemic deposits with CT. Multiple regression analysis with explanatory variables of age, sex, systolic and diastolic blood pressure, diameters, systolic and diastolic WSS, OSI, maximum progressive and retrograde flow volume, and the R/A ratio was performed. The response variable was CT determinations of atheroma in the lower abdominal aorta.

RESULTS

Among flow dynamic parameters R/A ratio (p=0.019), and OSI (p=0.0364) were the determinant factors for the presence of atheroma. Prominent back flow collided with antegrade flow was also visually observed at early diastole in atherosclerotic patients and was considered to have induced instable shear stress directions, which resulted in higher OSI. The prominent retrograde flow represents reflected flow from the iliac arteries, which may be due to the lack of compliance of the atherosclerotic aorta and peripheral arteries.

CONCLUSION

4Dflow can depict and quantify the prominent retrograde flow during early diastole, which is closely related to the presence of

atheroma in the lower abdominal aorta.

CLINICAL RELEVANCE/APPLICATION

4DFlow could be an indicator of a loss of arterial volumetric compliance and increased OSI in the lower abdominal aorta, which might be the initiation factors of atherosclerotic degradation that leads to various fatal aortic diseases.

RC312-10 Assessment of Wall Shear Stress in Patients without Aortic Disease, with Aortic Aneurysms and with Penetrating Aortic Ulcers using Velocity Encoding 4D MRI

Tuesday, Dec. 1 10:55AM - 11:05AM Location: S102AB

Participants
Michael Rasper, Munich, Germany (*Presenter*) Nothing to Disclose
Jan Rudolph, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Maegerlein, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Bettina M. Gramer, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Marcus Settles, PhD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Reeps, MD, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans-Henning Eckstein, MD, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Armin M. Huber, MD, Munchen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether patients with aortic aneurysms and penetrating aortic ulcers have an increased or reduced peak average wall shear stress magnitude compared to patients without aortic disease.

METHOD AND MATERIALS

26 patients (10 patients without aortic disease, 8 patients with aortic aneurysms (AA) and 8 patients with penetrating aortic ulcers (PAU)) underwent velocity encoded time resolved 3D MRI (4D PC MRI) of the aorta after contrast material (0.15 mmol/kg gadobenate dimeglumine) application during high resolution contrast-enhanced MR angiography of the aorta. 4D PC MRI was performed using ECG Gating and navigator echo based respiratory gating. Data acquisition was accelerated by SENSE in two directions (AF 1.5 x 2.5). The spatial resolution was 1.5 x 1.5 x 1.5 mm3. The temporal resolution was 40 ms. The peak velocity and the peak average wall shear stress magnitude were determined using the software GT-Flow (Version 2.0.10, Gyrotools, Switzerland).

RESULTS

The peak velocity was 71.6 ± 6.8 cm/s in patients without aortic disease, 35.6 cm/s ± 3.2 cm/s in patients with penetrating aortic ulcer and 18.2 ± 2.7 cm/s in patients with aortic aneurysms. The peak average wall shear stress magnitude was 0.35 ± 0.09 N/m2 in patients without aortic disease, 0.13 ± 0.004 N/m2 in patients PAU and 0.07 ± 0.018 N/m2 in AA patients. Both patients with aortic ulcera and patients with aortic aneurysms showed lower mean values for peak velocity ($p < 0.001$ and $p < 0.00001$) and peak average wall shear stress magnitude ($p < 0.01$ and $p < 0.004$) compared to patients without aortic disease. Patients with AA had significantly lower wall shear stress magnitude values than PAU patients.

CONCLUSION

Compared to patients without aortic disease, peak velocity and wall shear stress were significantly reduced in patients with penetrating aortic ulcers and patients with aortic aneurysms.

CLINICAL RELEVANCE/APPLICATION

Aortic segmental wall shear stress and flow velocity can reliably be determined with velocity encoded 4D MRI. Reduced wall shear stress is associated with aneurysma growth and might therefore help to identify patients at risk.

RC312-11 A Speeding Ticket for Perfusion MRI? Acceleration Techniques and Their Effect on Arterial Input Function Sampling: Non-accelerated versus View-sharing and Compressed Sensing Sequences

Tuesday, Dec. 1 11:05AM - 11:15AM Location: S102AB

Participants
Matthias Benz, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose
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Tobias Heye, MD, Basel, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Initiatives such as the Quantitative Imaging Biomarkers Alliance and the American College of Radiology Imaging Network seek to identify sources of variation that may contribute to the overall measurement error in dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI). The aim of this study was to determine the ability of various DCE-MRI sequences to image the arterial input function (AIF) of an arterial bolus in comparison to a reference standard in a flow-phantom.

METHOD AND MATERIALS

The dynamic flow-phantom consists of three input ports representing the venous backflow and three mixing chambers simulating the cardiopulmonary circulation with 4L/min. A 25 mm diameter cylindrical outflow representing the aorta, a water- and a muscle-phantom were scanned on a 3T MRI (Magnetom Prisma, Siemens Healthcare, Erlangen, Germany) using fast low angle shot 2d (Fl2d; temporal resolution [tr] 0.6s; reference standard) and 3d (Fl3d; tr 2.4s [P2=parallel imaging factor 2] and 3.9s), time-resolved imaging with stochastic trajectories (TWIST; tr 2.2s), and golden-angle radial sparse parallel imaging (GRASP, tr 1.1s) GRE sequences. Each acquisition with administration of 10 ml contrast agent (Dotarem, Guerbet) via a power injector (2ml/s flow rate)

was repeated three times. Essential sequence parameters were standardized: flip angle 15°; spatial resolution 2.3x2.3x3mm3. Signal over time curves were normalized and analyzed by full width half maximum (FWHM) measurements to asses within sequence (coefficient of variation [COV]) and between sequence variations (percentage difference).

RESULTS

Water and muscle signal COV ranged from 0.1-0.8%. Within sequence FWHM COV was 1.0% for Fl3d, 1.0% for Fl3dP2, 9.1% for TWIST and 0.3% for GRASP. Percentage difference FWHM in comparison to Fl2d as reference standard was 2.2% for Fl3d, 0.3% for Fl3dP2, 45.9% for TWIST, and 7.8% for GRASP.

CONCLUSION

MRI acceleration techniques vary in reproducibility and sampling of arterial input function. Incomplete coverage of the k-space with TWIST as representative of view-sharing techniques demonstrates incoherent data over time and thus limitations in the evaluation of AIF.

CLINICAL RELEVANCE/APPLICATION

In order to establish DCE-MRI as a reproducible quantitative imaging biomarker it is necessary to assess how various forms of accelerated sequences handle the dynamic signal over time.

RC312-12 Clinical Impact of MRA in Site Selection in Patients Undergoing Free Fibular Flap Transfer (FFF)

Tuesday, Dec. 1 11:15AM - 11:25AM Location: S102AB

Participants
Manohar Kuruva, MBBS, MD, Little Rock, AR (*Presenter*) Nothing to Disclose
Roopa Ram, MD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Kedar Jambhekar, MD, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
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Tarun Pandey, MD, FRCR, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the role and clinical impact of Dynamic Time-Resolved Magnetic Resonance Angiography (DTR MRA) for selecting the site for free fibula flap (FFF) harvest.

METHOD AND MATERIALS

A retrospective review of medical records of 69 patients who underwent pre-operative lower extremity DTR MRA prior to head and neck reconstructive surgery was done. Clinical findings were compared with MRA in determining the appropriate site of graft harvest.

RESULTS

DTR MRA identified vascular abnormalities, which led to change in management plan in 18/67 (27%) patients. Clinical findings were abnormal only in 4/18 (22%) of these patients. The two most common abnormalities included atherosclerotic narrowing (12 patients) and anatomical variations (4 patients). DTR MRA had significantly higher sensitivity to detect vascular abnormalities with implications in management than clinical examination alone (p=0.002). Addition of venous phase of imaging led to clinically occult venous pathologies in 4 patients, including deep venous thrombosis (2), varicose veins (1) and arteriovenous malformation/fistula (1).

CONCLUSION

Preoperative DTR MRA detected significant vascular abnormalities in patients undergoing FFF for head and neck reconstructive surgeries when compared to clinical examination,with a change in management in 28% of patients..

CLINICAL RELEVANCE/APPLICATION

DTR MRA prior to FFF can identify vascular pathology and anatomic variations and can potentially reduce the rate of complications and morbidity post fibular transfer for head and neck reconstructive surgeries.

RC312-13 Contrast-enhanced T1 Free-breathing Gradient Echo Sequences in the Assessment of Aortic Disease: Diagnostic Efficacy in Comparison with Standard T1 Breath-hold Gradient Echo Sequences

Tuesday, Dec. 1 11:25AM - 11:35AM Location: S102AB

Participants
Cammillo R. Talei Franzesi, Milan, Italy (*Presenter*) Nothing to Disclose
Davide Ippolito, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose
Pietro A. Bonaffini, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose
Davide Fior, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose
Giulia Querques, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose
Sandro Sironi, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the diagnostic accuracy of contrast-enhanced T1 free-breathing gradient echo sequences in comparison with standard MR-angiographic sequences in the evaluation of aortic disease.

METHOD AND MATERIALS

From January 2012 to January 2015, 57 patients (35 men; mean age 62.1 years) with aortic disease were evaluated. All patients were examined with a 1.5T magnet (Achieva, Philips), using a phased array multi-coil, after the intravenous injection of 0.1 mL*Kg of gadobutrol. The standard thoracoabdominal MR angiography (MRA) protocol included 3D-angiographic T1 gradient-echo fat-suppressed (3D-HR) sequences and T1 breath-hold gradient-echo fat-suppressed sequences (THRIVE). Multiplanar T1 free-breathing gradient-echo fat-suppressed (THRIVE-FB) sequences were additionally performed in all the examinations. Two

radiologists independently compared the diagnostic quality of the different angiographic sequences, in terms of visualization of aortic wall and lumen and main arterial branches. The vascular calipers at different aortic levels were calculated, compared and statistically analyzed among the different sequences. The interobserver agreement was then evaluated using the Intraclass Correlation Coefficient (ICC).

RESULTS

THRIVE-FB sequences showed high diagnostic accuracy in the assessment of vascular calipers and walls, with no significant differences in comparison with standard breath-hold sequences. They also demonstrated high sensitivity and specificity in the evaluation of vascular plaques, thrombus and adjacent structures. Not significant differences were obtained in terms of overall diagnostic quality between THRIVE-FB sequences and standard angiographic sequences (interobserver agreement ICC of 0.97).

CONCLUSION

Contrast-enhanced T1 free-breathing gradient-echo fat-suppressed sequences have shown higher diagnostic efficacy, with any significant differences, in comparison with standard breath-hold angiographic sequences, permitting to correctly visualize and evaluate the aorta and its major branches.

CLINICAL RELEVANCE/APPLICATION

Free-breathing angiographic protocol represents a useful tool, even in not-compliant patients, offering high diagnostic quality images, able to correctly evaluate thoracic and abdominal arteries.

RC312-14 Role of MR in Cardiovascular Disease Research

Tuesday, Dec. 1 11:35AM - 12:00PM Location: S102AB

Participants
Tim Leiner, MD, PhD, Utrecht, Netherlands, (t.leiner@umcutrecht.nl) (*Presenter*) Speakers Bureau, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, Bracco Group

LEARNING OBJECTIVES

1) To identify how MRI can contribute to understanding the pathophysiology of non-cardiac vascular disease and to describe its merits and shortcomings in relation to other commonly used imaging modalities. 2) To describe different MR methods that can be used to study vascular disease such as vessel wall imaging, atherosclerotic plaque imaging and measurement of pulse wave velocity. 3) To explain which of the above MR methods can be used clinically, and which methods are primarily experimental.

RC313

Pediatric Series: CV/Chest

Tuesday, Dec. 1 8:30AM - 12:00PM Location: E353A

CH VA CT MR PD

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.50

FDA Discussions may include off-label uses.

Participants
Shreyas S. Vasanawala, MD, PhD, Palo Alto, CA (*Moderator*) Research collaboration, General Electric Company; Consultant, Arterys; Research Grant, Bayer AG;
Lorna Browne, MD, FRCR, Denver, CO (*Moderator*) Nothing to Disclose
Rajesh Krishnamurthy, MD, Houston, TX (*Moderator*) Research support, Koninklijke Philips NV; Research support, Toshiba Corporation
R. Paul Guillerman, MD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

RC313-01 Imaging of Aortopathies

Tuesday, Dec. 1 8:30AM - 8:50AM Location: E353A

Participants
Cynthia K. Rigsby, MD, Chicago, IL, (crigsby@luriechildrens.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define aortopathy. 2) Describe the imaging features of common aortopathies. 3) Show potential complications associated with aortopathies.

RC313-02 4D flow MRI Based Volumetric Aortic Peak Velocity Quantification: Efficiency, Observer Variability and Comparison to 2D Phase Contrast MRI

Tuesday, Dec. 1 8:50AM - 9:00AM Location: E353A

Participants
Michael Rose, Chicago, IL (*Presenter*) Nothing to Disclose
Kelly Jarvis, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Varun Chowdhary, MD, BS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Alex Barker, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Bradley D. Allen, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Joshua D. Robinson, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Michael Markl, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Susanne Schnell, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Cynthia K. Rigsby, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Standard methods for measuring peak blood flow velocity include Doppler echocardiography and 2D CINE phase contrast (PC) MRI. Due to their reliance on single-direction velocity encoding and regional flow analysis (2D planes) both methods can underestimate peak velocities, especially in cases of complex flow jets as commonly seen in patients with abnormal aortic valves. The aim of this study was to test the feasibility and efficiency of a new method for volumetric peak velocity quantification of aortic peak systolic blood flow velocities in a cohort of pediatric BAV patients using 4D flow MRI and velocity maximum intensity projections (MIPs).

METHOD AND MATERIALS

51 pediatric BAV patients (age = 14 ± 5, range = 3-24 years, 18 female) underwent aortic 4D flow MRI (1.5T Aera, Siemens, Germany). After pre-processing (velocity anti-aliasing, phase offset correction) and 3D segmentation of the aorta, velocity MIPs were generated to determine peak velocities in the ascending aorta, arch, and descending aorta by two independent observers. 4D flow derived peak velocities were compared to results from 2D CINE PCMRI from the same study for 36 BAV patients.

RESULTS

4D flow peak systolic velocities were significantly higher than 2D CINE PC MRI (2.02±0.72 m/s vs 1.72±0.81 m/s, p = 0.0001, Wilcoxon signed-rank test). Bland-Altman analysis of peak velocity assessment showed excellent inter-observer variability (mean difference = -0.005 m/s, limits of agreement = ± 0.192 m/s) with low average inter-observer error 2.0 %. The estimated time for 4D flow MRI pre-processing and segmentation was 20 min. Average analysis time (calculation of velocity MIP, ROI analysis) was 92 ± 49 s.

CONCLUSION

4D flow MRI in combination with 3D segmentation of the aorta and velocity MIP analysis can be used to determine aortic peak systolic velocity with high efficiency and low observer variability. The full volumetric coverage and 3-directional velocity of 4D flow MRI fully captures complex aortic flow patterns and is thus better suited to identify the highest velocity in an entire aortic segment compared to 2D CINE PC MRI, which underestimated peak velocities in our BAV cohort by 15%.

CLINICAL RELEVANCE/APPLICATION

In patients with aortic valve disease such as bicuspid aortic valve (BAV), the severity of valve disease is characterized using peak blood velocity to estimate the peak transvalvular pressure gradient (via the simplified Bernoulli equation).

RC313-03 Accuracy of Ventricular Septal Defect Measurements by High Pitch Computed Tomography Angiography of the Thorax in Pediatric Patients Younger Than One Year Compared to Echocardiographic and Intraoperative Measurements

Tuesday, Dec. 1 9:00AM - 9:10AM Location: E353A

Participants
Matthias S. May, Erlangen, Germany (*Presenter*) Speakers Bureau, Siemens AG
David Nau, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Oliver Rompel, MD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Michael M. Lell, MD, Erlangen, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Research Grant, Bayer AG ; Speakers Bureau, Bayer AG; Research Consultant, Bracco Group; ;
Wolfgang Wust, MD, Erlangen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG

PURPOSE

Preoperative assessment of VSDs is routinely performed by echocardiography. However, it seems to be challenging to obtain precise and reproducible findings, due to the limited angulations that are available. Additional preoperative evaluation by Computed Tomography (CT) has become reasonable in the recent years for complex congenital heart disease and allow for assessment of the size of VSDs in a static and isovolumetric dataset. Our aim was to evaluate the accuracy of size measurement of congenital ventricular septal defects (VSD) using High Pitch Computed Tomography Angiography of the thorax compared to echocardiography and intraoperative findings in children with congenital heart disease below 1 year.

METHOD AND MATERIALS

Angiography of the chest was performed using a second and third generation Dual-Source CT in 54 patients (median age 7 days, range 1-348 days) with a high-pitch protocol (p=3.2-3.4) at low tube voltages (70-80 kV). The margins of the VSDs were angulated by Multiplanar Reformations and Minimum Intensity Projection (MinIP) was used to overcome partial volume effects. The results were compared to the measurements from echocardiography and intraoperative measurements served as reference.

RESULTS

Mean deviation of the CT-measurements compared to the intraoperative findings was not statistically significant (3.5 ± 3.0 mm, p=0.21), while the mean difference compared to echocardiography was significantly higher (7.4 ± 4.8 mm, p<0.01). The VSDs can be classified into four different types by CT. With the exception of apical septal defects the size of the defects seems not to correlate with a specific location. Median radiation dose was as low as 0.37 mSv (range 0.12 - 2.00 mSv).

CONCLUSION

High Pitch Computed Tomography Angiography of the thorax provides precise measurements of VSDs in pediatric patients with congenital heart disease younger than one year.

CLINICAL RELEVANCE/APPLICATION

Preoperative High Pitch Computed Tomography Angiography of the thorax, besides the advantages in imaging of the coronaries and great intrathoracic vessels, provides precise measurements of VSDs at reasonable low radiation dose.

RC313-04 Image Quality and Accuracy of a Prototype Self-Navigated 3D Whole-heart Sequence for the Assessment of Coronary Artery Anomalies in a Pediatric Patient Population

Tuesday, Dec. 1 9:10AM - 9:20AM Location: E353A

Participants
Giuseppe Muscogiuri, MD, Charleston, SC (*Presenter*) Nothing to Disclose
Akos Varga-Szemes, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
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Pal Suranyi, MD, PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Julian L. Wichmann, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Bracco Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; ; ;
Paola Maria Cannao, MD, San Donato Milanese, Italy (*Abstract Co-Author*) Nothing to Disclose
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Anthony M. Hlavacek, MD, Charleston, SC (*Abstract Co-Author*) Investigator, Siemens AG Research Grant, Siemens AG
Arni C. Nutting, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Siemens AG

PURPOSE

The aim of this study was to assess the feasibility, image quality, and diagnostic performance of a prototype non-contrast enhanced self-navigated 3D (SN3D) whole-heart MRA acquisition in comparison with coronary CT angiography (cCTA) for delineating the coronary artery origin and proximal course in pediatric patients with suspected coronary artery anomalies.

METHOD AND MATERIALS

Seven patients (13±3 years) with suspected coronary artery anomalies underwent a reference standard cCTA (SOMATOM Flash, Siemens Healthcare, Forchheim, Germany) and a research non-contrast cardiac MRA (MAGNETOM Avanto 1.5T, Siemens Healthcare, Erlangen, Germany) for the assessment of the origin and proximal course of the coronary arteries. The steady-state free precession based SN3D MRA was performed using the following parameters: TR/TE 3.1/1.5ms, flip angle 115°, FOV 220mm, voxel size: 1.1mm3, and 12064 radial views distributed over 377 heartbeats. Subjective image quality of the SN3D MRA and cCTA was evaluated using a 4-grade scale (1, nondiagnostic; 2, sufficient; 3, good; 4, excellent). Visualization of the left main, left anterior descending (LAD), circumflex (LCX) and right coronary arteries (RCA), as well as the time of acquisition and signal to noise

ratio (SNR), were assessed. Wilcoxon test was used to compare subjective image quality between cCTA and MRA.

RESULTS

The acquisition time of the SN3D MRA was 5.9±1.4min with an average heart rate of 81bpm, while the mean SNR was 27±9. MRA and cCTA image quality ratings were 2.3±0.7 and 3.3±0.7, respectively (p>0.05). SN3D MRA allowed the visualization of the left main, the LAD and the RCA with good agreement to cCTA in all cases, but failed to visualize the LCX in a single case.

CONCLUSION

In this preliminary study there was good agreement for the evaluation of coronary artery anatomy between SN3D MRA and cCTA. The novel radial SN3D sequence allows for the acquisition of an isotropic volume in a free-breathing fashion in about half the time as a standard respiratory-navigated coronary MRA, with an improved ease of use, without penalties in image quality, and without radiation exposure, contrast agent administration or the need for general anesthesia.

CLINICAL RELEVANCE/APPLICATION

This non-contrast self-navigated MRA sequence provides relatively rapid, free-breathing radiation-free evaluation of anomalies of the coronary artery origin and proximal course in children.

RC313-05 Contrast Material Injection via Fenestrated Catheters is Useful in Pediatric Patients with Congenital Heart Disease Undergoing CT Angiography

Tuesday, Dec. 1 9:20AM - 9:30AM Location: E353A

Participants
Takanori Masuda, Hiroshima, Japan (*Presenter*) Nothing to Disclose
Yoshinori Funama, PhD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masao Kiguchi, RT, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Takayuki Oku, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
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Kazuo Awai, MD, Hiroshima, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Reseach Grant, DAIICHI SANKYO Group; Medical Advisor, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Nemoto-Kyourindo; ; ; ; ;
Tomoyasu Sato, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Noritaka Noda, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

While 3D CT angiography (CTA) images are useful for evaluating the complex anatomy in patients with congenital heart disease, they require higher contrast enhancement to identify blood vessels and soft tissues. However, the thin pediatric vessel wall imposes an injection pressure limit and can result in poor CT enhancement. As the gauge of the fenestrated- is smaller than of the conventional nonfenestrated catheter, optimal enhancement can be achieved by controlling the injection pressure. We compared the injection rate, aortic enhancement, and injection pressure when intravenous contrast material was injected with fenestrated- and conventional non-fenestrated catheters.

METHOD AND MATERIALS

We randomly divided 34 pediatric patients seen between December 2014 and March 2015 into two groups. Group A consisted of 18 children (age one week to 8 months, body weight 3.6 ± 1.2 kg) and group B of 16 (age one week to 12 months, body weight 3.3 ± 0.9 kg). In group A we delivered the contrast medium via a 22-gauge conventional non-fenestrated catheter and in group B we used a 24-gauge fenestrated catheter. Whole-heart helical CTA scans were performed on a 64-detector scanner (GE VCT, tube voltage 80 kVp, detector configuration 64 x 0.625 mm, rotation time 0.4s/r, helical pitch 1.375, preset AEC noise index 12) and the injection rate, aortic enhancement, and injection pressure were compared in groups A and B.

RESULTS

The mean injection rate and aortic enhancement were 0.9 ± 0.1 ml/sec and 468 ± 45.0 HU in group A and 0.87 ± 0.3 ml/sec and 444 ± 63.5 HU in group B. There was no significant difference in the injection rate and aortic enhancement ($p = 0.34$, $p = 0.38$). The maximum injection pressure was significantly lower in group B than group A (0.33 vs. 0.55 kg/cm2, $p < 0.05$).

CONCLUSION

Use of the fenestrated catheter decreases the injection pressure limit while retaining the injection rate and aortic enhancement of conventional catheters.

CLINICAL RELEVANCE/APPLICATION

With use of the fenestrated catheter, pediatric CT angiography obtains the optimal aortic enhancement by changing injection rate in safety.

RC313-06 The Impact of Dual-source Parallelradiofrequency Transmission with Patient-adaptive Shimming on the 3.0 T Cardiac Magnetic Resonance in Children

Tuesday, Dec. 1 9:30AM - 9:40AM Location: E353A

Participants
Haipeng Wang, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Cuiyan Wang, MD, PhD, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Fei Gao, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Bin Zhao, MD, Jinan, China (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the effect of dual-source parallel RF transmission on the B1 homogeneity, the image quality (image contrast and off-resonance artifacts) in the cine b-SSFP sequence and the repeatability of left-ventricle cardiac function in 3.0T CMR of children.

METHOD AND MATERIALS

The prospective intraindividual comparison study was approved by the institutional ethics committee and written informed consent was obtained. The 3.0T cardiac magnetic resonance (CMR) was performed in 30 chronic myocarditis children by using the dual-source radiofrequency (RF) transmission with patient-adaptive RF shimming. B1 homogeneity and image contrast with and without RF shimming were quantitatively evaluated and t-test was used for statistical significance. The off-resonance artifacts were evaluated independently by two readers. Statistical significance was assessed by the Mann-Whitney U test and inter-observer agreement by Cohen's kappa test. The inter-observer agreement of LV cardiac function with dual-source RF transmission was evaluated by Bland-Altman analysis and the intra-class correlation coefficient (ICC).

RESULTS

Compared with single-source RF transmission, dual-source RF transmission with patient-adaptive RF shimming performed a higher mean percentage of flip angle (FA), lower coefficient of variation (CV) and higher image contrast in both free-breathe (NBH) and breathe-hold (BH) scanning($P < 0.05$ for all). The scores of off-resonance artifacts with patient-adaptive RF shimming were lower than that without RF shimming ($P < 0.05$) and inter-observer agreement between two readers was good to very good (kappa values from 0.66 to 0.86). A high level inter-observer agreement for cardiac function with RF shimming was acquired both in NBH scanning (CV: 1.91%-11.84%; ICC, 0.83-0.98) and BH scanning (CV: 0.52%-4.44%; ICC, 0.98-0.99)

CONCLUSION

Dual-source parallel RF transmission with patient-adaptive RF shimming could significantly improve the B1 homogeneity and image contrast, reduce the off-resonance artifacts in the b-SSFP cine image and show excellent reproducibility of cardiac function in the 3.0T CMR of children.

CLINICAL RELEVANCE/APPLICATION

Dual-source parallel RF transmission could significantly improve the B1 homogeneity and image quality and is suitable for the 3.0T cardiac magnetic resonance in children.

RC313-07 Estimation of Functional Lung Capacity and Correlation with the Results of Infant Pulmonary Function Test and Quantitative CT Assessment in Infants with Postinfectious Bronchiolitis Obliterans

Tuesday, Dec. 1 9:40AM - 9:50AM Location: E353A

Participants
Mi-Jung Lee, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Yoon Hee Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Joo Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myung-Joon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myung Hyun Sohn, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the possibility for estimating functional lung capacity from ventilation inhomogeneity using infant pulmonary function test (iPFT) and quantitative CT assessment for air trapping in infants with postinfectious bronchiolitis obliterans (BO).

METHOD AND MATERIALS

This prospective study included infants with clinically and radiologically proven BO since 2009. We performed iPFT in these patients and measured tidal volume (TV), functional residual capacity (FRC) and lung clearance index (LCI) by sulphur hexafluoride multiple breath washout using an ultrasonic flow meter. From chest CT, we calculated total lung volume (CT-TLV) and imaging functional lung volume (CT-FLV) which showed higher attenuation than the mean attenuation of the grossly normal and air trapping areas. We compared iPFT and CT parameters using Spearman correlation analysis.

RESULTS

Thirteen infants (M:F = 11:2) were included in this study. The age was 3-17 months with the mean of 10.4 ± 4.5 months. The mean body weight and height were 9.4 ± 1.7 kg and 75.9 ± 8.0 cm. The values of TV, FRC and LCI were 82.0 ± 19.9 ml, 184.1 ± 49.1 ml and 8.2 ± 1.3, respectively. For chest CT, the effective radiation dose was 0.2-1.8 mSv with the mean of 1.0 ± 0.5 mSv. The values of normal lung attenuation and air trapping attenuation on CT were -571.3 ± 63.1 HU and -767.1 ± 58.3 HU. And the calculated CT-TLV and CT-FLV were 268.8 ± 90.9 ml and 202.9 ± 70.4 ml. In the correlation analysis, CT-TLV had a positive correlation with TV ($\gamma = 0.602$, $p = 0.029$) and FRC ($\gamma = 0.731$, $p = 0.005$). CT-FLV also showed a significant negative correlation with LCI ($\gamma = -0.670$, $p = 0.012$) which represented ventilation inhomogeneity.

CONCLUSION

Both iPFT and chest CT can demonstrate ventilation inhomogeneity and estimate functional lung capacity in infants with postinfectious BO with good correlation. Both methods can be useful and complementary for evaluating in these patients.

CLINICAL RELEVANCE/APPLICATION

Not only infant pulmonary function test but also quantitative chest CT assessment can demonstrate ventilation inhomogeneity and estimate functional lung capacity in infants who are not easy to evaluate lung function due to limited compliance.

RC313-08 Coronary Artery Imaging in Children

Tuesday, Dec. 1 9:50AM - 10:10AM Location: E353A

Participants
Lorna Browne, MD, FRCR, Denver, CO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) How to successively image the coronary arteries in children with both MR and CT. 2) How to interpret a range of coronary artery anomalies and pathologies.

RC313-09 Dynamic Airway Imaging

Tuesday, Dec. 1 10:30AM - 10:50AM Location: E353A

Participants
Rajesh Krishnamurthy, MD, Houston, TX (*Presenter*) Research support, Koninklijke Philips NV; Research support, Toshiba Corporation

LEARNING OBJECTIVES

1) Discuss indications and protocols for dynamic airway imaging in children using CT and MRI, with emphasis on advantages offered by new generation CT scanners. 2) Learn appropriate use of common post-processing tools and measurement metrics for the pediatric airway that correlate well with bronchoscopy. 3) Understand imaging findings that distinguish between intrinsic and extrinsic airway pathology. 4) Review common applications for dynamic airway imaging, including tracheobronchomalacia, vascular mediated airway compromise, complete tracheal rings, mediastinal masses, and airway tumors.

ABSTRACT

This talk will provide an overview of indications and protocols for dynamic airway imaging in children using CT and MRI, with emphasis on advantages offered by new generation CT scanners, and post-processing tools that allow derivation of metrics similar to bronchoscopy, We will review examples of intrinsic and extrinsic airway pathology in children, including tracheobronchomalacia, vascular mediated airway compromise, complete tracheal rings, mediastinal masses, and airway tumors.

RC313-10 Comparison of a ROI-based and a Whole-lung Segmentation Based Approach for MR Lung Perfusion Quantification in Two-year Old Children after Congenital Diaphragmatic Hernia Repair

Tuesday, Dec. 1 10:50AM - 11:00AM Location: E353A

Participants
Meike Weidner, Mannheim, Germany (*Presenter*) Nothing to Disclose
Verena Sommer, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank G. Zoellner, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Claudia Hagelstein, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Schaible, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan O. Schoenberg, MD, PhD, Mannheim , Germany (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Wolfgang Neff, MD, PhD, Alzey, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

By the means of a region-of-interest (ROI) based approach it has been demonstrated that 2-year old children after congenital diaphragmatic hernia (CDH) repair show reduced MR lung perfusion values on the ipsilateral side. As ROI-based approaches only cover parts of the lung tissue, this study aimed to evaluate if results can be reproduced by segmentation of whole lung, whether there are differences between both approaches and as a consequence which technique should be applied.

METHOD AND MATERIALS

DCE-MRI was performed in 30 children (24.3±1.8 month) after CDH repair using a 3D TWIST sequence (Siemens Healthcare, Germany). 0.05 mmol/kg body weight of contrast agent (Dotarem, Guerbet, France) were administered. Pulmonary blood flow (PBF) was calculated based on a pixel-by-pixel deconvolution approach. For ROI-based quantification, three circular ROIs (apical, middle and basal) per lung side were used both in the ventral and dorsal lung. Propagation of those circular ROIs through five adjacent sliced generated 6 cylindrical ROIs in the ventral and dorsal lung respectively. For whole-lung analysis, the whole lung was contoured. In both techniques larger vessels were excluded from analysis (Fig. A).

RESULTS

In the ROI-based approach, PBF was significantly reduced on the ipsilateral side (74.5±30.3 ml/100ml/min) in comparison to the contralateral side (113.1±40.4 ml/100ml/min; $p<0.0001$). Also in the whole-lung based approach ipsilateral PBF was significantly lower (73.9±25.5 ml/100ml/min) than in the contralateral lung (102.3±31.8 ml/100ml/min; $p<0.0001$). In the ipsilateral lungs, quantification results of the ROI-based and the whole-lung segmentation based approach were equal ($p=0.50$). In the contralateral lungs, the ROI-based approach significantly overestimated PBF in comparison to the whole-lung approach by approximately 9.5% ($p=0.0013$; Fig. B).

CONCLUSION

MR lung perfusion in 2-year children after CDH is significantly reduced ipsilaterally, both when quantified by a ROI-based and a whole-lung based approach. In the contralateral lung, the ROI-based approach significantly overestimates perfusion results and therefore whole lung segmentation should be preferred.

CLINICAL RELEVANCE/APPLICATION

With MR lung perfusion imaging, perfusion deficits after congenital diaphragmatic hernia can be depicted. Whole-lung segmentation for quantification is advisable, as a ROI-based approach can overestimate results.

RC313-11 Functional Lung MRI for Non-invasive Monitoring of Regional Effects of Inhaled Hypertonic Saline in Children with Cystic Fibrosis

Tuesday, Dec. 1 11:00AM - 11:10AM Location: E353A

Participants
Till F. Kaireit, Hannover, Germany (*Presenter*) Nothing to Disclose
Julius Renne, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian O. Schoenfeld, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Voskrebenzev, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Marcel Gutberlet, Dipl Phys, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Angela Schulz, Hanover, Germany (*Abstract Co-Author*) Nothing to Disclose
Gesine Hansen, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose

Tobias Welte, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank K. Wacker, MD, Hannover, Germany (*Abstract Co-Author*) Research Grant, Siemens AG Research Grant, Pro Medicus Limited
Burkhard Tuemmler, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Jens Vogel-Claussen, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Quantification of regional effects of inhaled hypertonic saline (7% NaCl) by functional lung MRI in adolescents with cystic fibrosis (CF).

METHOD AND MATERIALS

The clinical effect of a single treatment with hypertonic saline inhalation in patients with CF is still under debate. 17 CF patients prospectively underwent two functional lung MRI scans and pulmonary function tests on the same day before and 1h after a single treatment of inhaled hypertonic saline (n=10, mean 15,2y, mean FEV1% 80±21) or without any treatment (n=7, mean 13,9y, mean FEV1% 80±20) at 1.5T. As a 2nd control group 12 healthy volunteers (mean 28,5y) were included. Assessed parameters for both cohorts were as follows: MRI-derived T1 relaxation measurements breathing room air (T1(21)) and 100% oxygen as well as the calculated oxygen transfer function (OTF), normalized fractional ventilation (FV) obtained by ventilation-weighted Fourier Decomposition MRI; pulmonary blood flow (PBF) obtained by dynamic contrast enhanced MRI, a morpho-functional CF-MRI score and the lung clearance index (LCI). After manual segmentation of each lobe mean and coefficient of variation (CoV) were calculated.

RESULTS

Comparing the CF group to healthy controls, mean values of T1(21) (1176ms vs. 1246 ms, $p < 0.01$) and FV (0.67 vs. 0.95, $p < 0.001$) were significantly lower and the CoV significantly higher (CoV T1(21) 0.08 vs. 0,04; CoV FV 0.73 vs. 0.37, $p < 0.001$ for all). In CF group receiving treatment, mean values in the whole lung of OTF (pre 13.1/post 12.7 10-4/s/%O2), FV (pre 0.69/post 0.76), PBF (pre 98/post 102ml/100 ml/min), LCI (pre 12.1/post 13.1) and the morpho-functional score (pre 15 / post 17) did not show a significant difference between pre and post treatment measurements ($p > 0.05$). Also data on a lobar level in the treatment group as well as measurements in the CF-control group did not show any significant differences between the 2 MRI exams ($p > 0.05$).

CONCLUSION

Compared to healthy controls functional lung MRI detects significantly increased ventilation heterogeneity in CF patients. After a single treatment with inhalation of hypertonic saline (7% NaCl) neither functional lung MRI nor LCI detected a significant change in CF patients.

CLINICAL RELEVANCE/APPLICATION

This study shows the feasibility of functional lung MRI, as a non-invasive, radiation-free tool for visualization and quantification of potential regional treatment effects in patients with CF.

RC313-12 Comparison of Lung Ultrasound and Chest Radiographyin Estimating Lung Edema after Surgery for Congenital Heart Disease in Children

Tuesday, Dec. 1 11:10AM - 11:20AM Location: E353A

Participants
Laura Martelius, Helsinki, Finland (*Presenter*) Nothing to Disclose
Anu Kaskinen, Helsinki, Finland (*Abstract Co-Author*) Nothing to Disclose
Kirsi Lauerma, MD, Helsinki, Finland (*Abstract Co-Author*) Nothing to Disclose
Paula Rautiainen, Helsinki, Finland (*Abstract Co-Author*) Nothing to Disclose
Sture Andersson, Helsinki, Finland (*Abstract Co-Author*) Nothing to Disclose
Olli Pitkanen, Helsinki, Finland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Lung edema is a frequent complication after surgery for congenital heart disease in children. A readily available accurate measure for lung edema is lacking. Chest radiographs (CXR) are commonly used for this purpose. CXR, however, is inaccurate especially in intensive care when portable supine radiographs are used. In lung ultrasound (US) vertical artifacts known as B-lines have been shown to correlate with lung liquid. In adults with congestive heart disease B-lines in US correlates with lung edema scored from CXR. Our aim was to compare lung US and CXR in estimating lung edema in children after surgery for congenital heart disease.

METHOD AND MATERIALS

Lung US was performed on 50 children 1-6 h postoperatively using a high-frequency linear transducer. Videoclips from three anterolateral intercostal spaces on both sides were stored. An observer blinded to the patient data and CXR scored the abundance of B-lines on each videoclip using a 5-step scale (0 = no artefact, 1 = B-lines in <25% of surface area, 2 = <50%, 3 = <75%, and 4 = >75%). The postoperative CXR were evaluated for lung edema at the right and left upper and lower lobes, the middle lobe and lingula using a 4-step scale (0 = normal lung, 1 = minimal opacity, 2 = opacity partially obscuring lung vessels, 3 = opacity totally obscuring lung vessels). For each patient a mean score for lung US (B-line score), and for CXR (CXR LE score) was calculated.

RESULTS

There was a significant positive correlation between the B-line score and the CXR LE score ($R = 0.65$, $p < 0.001$).

CONCLUSION

Lung US is a promising diagnostic tool in evaluation of postoperative lung edema in patients with congenital heart disease.

CLINICAL RELEVANCE/APPLICATION

Lung US has great potential since the current methods for estimating lung edema are unsatisfactory (CXRs are nonspecific, invasive techniques are unreliable in patients with intracardiac shunts).

RC313-13 Computerized Texture Analysis of Pulmonary Nodules in Pediatric Osteosarcoma Patients:

Differentiation of Pulmonary Metastases from Non-metastatic Nodules

Tuesday, Dec. 1 11:20AM - 11:30AM Location: E353A

Participants
Yeon Jin Cho, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Young Hun Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yoo Jin Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji-Eun Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Suk Cho, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Joon Park, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung-Eun Cheon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Sun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
In-One Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the value of computerized 3D texture analysis for differentiation of pulmonary metastases from non-metastatic lesions in pediatric osteosarcoma patients.

METHOD AND MATERIALS

Our study comprised 42 pathologically confirmed pulmonary nodules in 16 children with osteosarcoma who had undergone preoperative CT scans between January 2009 and December 2014. Each pulmonary nodule was manually segmented and its computerized texture features were extracted by using an in-house software program. Multivariate logistic regression analysis was performed to investigate the differentiating factors of metastatic nodules from non-metastatic lesions. A subgroup analysis was performed to identify significant differentiating parameters in non-calcified pulmonary nodules. The ROC curve was created to evaluate the discriminating performance of established model.

RESULTS

There were 24 metastatic pulmonary nodules and 18 non-metastatic pulmonary lesions. Pulmonary metastases and non-metastatic lesions exhibited significant differences in various histograms and volumetric parameters (P< .05). Multivariate analysis revealed that higher mean Hounsfield units (HU) (adjusted odds ratio (OR), 1.02) and larger effective diameter (OR, 17.03) are significant differentiators (P< .05). The subgroup analysis with non-calcified pulmonary nodules (13 metastases and 18 non-metastases) revealed significant differences between metastases and non-metastases in various parameters. Multivariate logistic regression analysis revealed that lower entropy (OR, 0.01) and larger effective diameter (OR, 38.92) are significant predictors of non-calcified pulmonary metastases (P< .05). The established logistic regression model of subgroup showed excellent discriminating performance in ROC analysis (AUC, 0.927).

CONCLUSION

Metastatic pulmonary nodules from osteosarcoma can be accurately differentiated from non-metastatic pulmonary lesions by using computerized texture analysis. High HU and larger effective diameter were the significant predictors for pulmonary metastases, while lower entropy and larger effective diameter were for non-calcified pulmonary metastases from non-metastatic lesions.

CLINICAL RELEVANCE/APPLICATION

The computerized 3D texture analysis can accurately differentiate pulmonary metastases from non-metastatic pulmonary lesions in pediatric osteosarcoma patients.

RC313-14 Extralobar pulmonary sequestration: initial CT findings predicting spontaneous regression in neonates

Tuesday, Dec. 1 11:30AM - 11:40AM Location: E353A

Participants
Hee Mang Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jin Seong Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ahyoung Jung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Ah Cho, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chong Hyun Yoon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In general, it is accepted that extralobar pulmonary sequestration (EPS) may spontaneously regress. However, radiologic features associated with spontaneous regression of EPS have not been well documented. Therefore, we tried to find the CT features predicting spontaneous regression of EPS.

METHOD AND MATERIALS

A total of 51 patients were included in our study with the following inclusion criteria: (a) antenatally diagnosed with EPS, (b) underwent a CT scan within 1 month after birth, and (c) had more than one follow-up CT without treatment. Spontaneous regression of EPS was determined by percent decrease of volume (PDV) and decrease in diameter of feeders. Volume of EPS and diameters of feeding systemic arteries (FSA) were evaluated on all 148 CT. For the enhancement degree of EPS, CT attenuation number of EPS and the back muscle were measured on initial CT and the ratio of EPS-to-back muscle was calculated. The PDV and the changes in diameter of FSA between initial and follow-up CT scans were calculated. Univariate and multivariate linear regression analysis were performed to assess factors related to PDV and decrease in diameter of FSA.

RESULTS

PDV more than 50% (PDV≥50%) was noted in 20 patients (38.5%) within one year, in other 12 patients (23.1%) between one and two years, and in 6 patients after two years. The enhancement degree of EPS was significantly different between 38 patients with PDV≥50% and 13 patients with PDV<50 % (1.0±5.4 vs 2.1±1.1, respectively, p<0.001). Enhancement degree of EPS was the only significant factors predicting PDV≥50% (B=-26.227, p<0.001), and the decrease in diameter of FSA (B=-21.476, p=0.009). In addition, PDV showed significant correlation with decrease in the diameter of the FSA (r=0.602, p<0.001).

CONCLUSION

The volume of EPS had spontaneously decreased more than 50 % within 2 years without treatment in 63% of patients. The most important factor predicting spontaneous regression of the EPS was the enhancement degree on initial CT scan. Therefore, a significant volume regression and decrease in diameter of FSA can be expected without any treatment in a neonate with EPS showing hypoenhancement on initial CT scan.

CLINICAL RELEVANCE/APPLICATION

The enhancement degree of EPS on initial CT scan is significantly associated with spontaneous regression of EPS during follow-up. Based on this result, we can more confidently predict spontaneous regression of EPS in neonates.

RC313-15 Pediatric Chest Interventions

Tuesday, Dec. 1 11:40AM - 12:00PM Location: E353A

Participants
Kamlesh U. Kukreja, MD, Bellaire, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1. Describe different types of chest interventions for children.

RC315

Breast Series: Emerging Technologies in Breast Imaging

Tuesday, Dec. 1 8:30AM - 12:00PM Location: Arie Crown Theater

BR MR

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants
Emily F. Conant, MD, Philadelphia, PA (*Moderator*) Speaker, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Siemens AG
Margarita L. Zuley, MD, Pittsburgh, PA (*Moderator*) Research Grant, Hologic, Inc;
Bonnie N. Joe, MD, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose

Sub-Events

RC315-01 MRI Acquisition and DWI

Tuesday, Dec. 1 8:30AM - 8:50AM Location: Arie Crown Theater

Participants
Savannah C. Partridge, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the basics of clinical breast MRI acquisition. 2) Identify factors that may impact image quality and interpretation. 3) Describe advanced MRI approaches with potential value for breast imaging.

ABSTRACT

RC315-02 Correlation of R2* Value Using Iterative Decomposition of Water and Fat with Echo Asymmetry and Least-squares Emission (IDEAL) with Histologic Prognostic Factor and Hypoxic Biomarker

Tuesday, Dec. 1 8:50AM - 9:00AM Location: Arie Crown Theater

Participants
Mari Miyata, MD, Kitakyushu, Japan (*Presenter*) Nothing to Disclose
Takatoshi Aoki, MD, PhD, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsuji Matsuyama, MD, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose
Shohei Shimajiri, MD, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose
Shunsuke Kinoshita, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukunori Korogi, MD, PhD, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshiko Hayashida, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Hypoxic breast cancers are difficult to treat by radiation and chemotherapy, and a fibrotic focus (FF) induced by hypoxia is an important predictor of early tumor recurrence. The purpose of this study is to correlate R2* value using iterative decomposition of water and fat with echo asymmetry and least-squares emission (IDEAL) with FF and hypoxic biomarker (HIF-1α) in breast carcinoma.

METHOD AND MATERIALS

This study consisted of 30 patients who were diagnosed with invasive carcinoma of breast and underwent breast MRI including IDEAL before surgery. The scan time of IDEAL R2* map imaging was 23 sec. Entire region of interest (ROI) was delineated on the R2* map carefully, and average tumor R2* value was calculated for each ROI. Histological specimens were evaluated for the presence of FF (a scar-like lesion near the center of a carcinoma) and the grading of HIF-1α (0, no staining; 1, weakly positive and/or positive cells in less than 10 %; 2, moderately positive and/or positive cells in 10-50 %; 3, strongly positive and/or positive cells in more than 50 %) by 2 pathologists and final decision was reached by consensus.

RESULTS

Fibrotic focus was identified in 43.3% (13/30) breast carcinomas. Average R2* value for breast carcinoma with FF (45.1±18.9) was significantly higher than that without FF (29.8±13.9) ($p<0.05$). Spearman rank correlation suggested that average R2* value correlated with the grade of HIF-1α ($p<0.05$), and the grade of HIF-1α with FF was significantly higher than that without FF ($p < 0.01$).

CONCLUSION

Quantification of tumor R2* using IDEAL is associated with the presence of FF and the overexpression of HIF-1α, and may therefore be a useful prognostic and hypoxic biomarker for breast carcinoma.

CLINICAL RELEVANCE/APPLICATION

In vivo IDEAL-R2*imaging is simple to perform without extrinsic contrast agent and the R2* value may be useful for therapeutic strategy for breast carcinoma.

RC315-03 Apparent Diffusion Coefficient Values of Breast Cancer and Normal Breast Tissue in Diffusion-weighted Imaging: Effects of the Menstrual Cycle and Menopausal Status

Tuesday, Dec. 1 9:00AM - 9:10AM Location: Arie Crown Theater

Participants
Jin You Kim, MD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Shinyoung Park, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Il Moon, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji Won Lee, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Suk Kim, MD, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether the apparent diffusion coefficient (ADC) values of breast tumor and normal fibroglandular tissue vary with the menstrual cycle and menopausal status.

METHOD AND MATERIALS

The institutional review board approved this prospective study, and informed consent was obtained from each participant. Forty-six patients (20 premenopausal and 26 postmenopausal) with newly diagnosed breast cancer underwent diffusion-weighted (DW) imaging with b values of 0 and 1,000 s/mm2 twice (interval 12-21 days) before surgery. Two radiologists independently measured the ADC values of the breast tumor and normal fibroglandular breast tissue of the contralateral breast and the differences according to the phases of the menstrual cycle and postmenopausal breast were evaluated. The reproducibility of the ADC measurement was analyzed using the intraclass correlation coefficient (ICC).

RESULTS

The ADC values of normal fibroglandular tissue were significantly higher in premenopausal women than in postmenopausal women (1.77±0.25×10-3 vs. 1.53±0.12×10-3 mm2/s; P = 0.007). In premenopausal women, the ADC values of the breast tumor did not differ significantly between the proliferative and secretory phases of the menstrual cycle (0.92±0.128×10-3 vs. 0.93±0.150×10-3 mm2/s; P = 0.421). No significant differences were observed in the ADC values of normal breast tissue in relation to the menstrual cycle phase (1.74±0.22×10-3 vs. 1.77±0.25×10-3 mm2/s; P = 0.202). In postmenopausal women, there were no significant differences in the ADC values of either breast tumors or normal fibroglandular tissue between the two time intervals (P = 0.983 and P = 0.363, respectively); the magnitude of the ADC differences was similar in women who were taking estrogen-replacement therapy and those who were not (P = 0.368 and P = 0.418, respectively). The intra- and interobserver agreement was excellent for all of the ADC measurements, with ICCs ranging from 0.84 to 0.94.

CONCLUSION

The ADC values of breast cancer and normal fibroglandular tissue are not affected by the change in the menstrual cycle and the ADC measurements are highly reproducible within and across observers.

CLINICAL RELEVANCE/APPLICATION

Since ADC values are not influenced by the change in the menstrual cycle, it is not necessary to restrict the timing of performing diffusion-weighted imaging of the breast to a certain phase of the menstrual cycle.

RC315-04 Unenhanced Breast MRI (STIR, T2-weighted TSE, DWIBS): An Accurate and Alternative Strategy for Detecting and Differentiating Breast Lesions

Tuesday, Dec. 1 9:10AM - 9:20AM Location: Arie Crown Theater

Participants
Marco Moschetta, MD, Bari, Italy (*Presenter*) Nothing to Disclose
Michele Telegrafo, MD, Bari, Italy (*Abstract Co-Author*) Nothing to Disclose
Leonarda Rella, Bari, Italy (*Abstract Co-Author*) Nothing to Disclose
Amato Antonio Stabile Ianora, Bari, Italy (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Angelelli, Bari, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the role of STIR, T2-weighted TSE and DWIBS sequences for detecting and characterizing breast lesions and to compare unenhanced (UE)-MRI results with contrast enhanced (CE)-MRI and histological findings, having the latter as the reference standard.

METHOD AND MATERIALS

280 consecutive patients (age range, 27-73 years; mean age ± standard deviation (SD), 48.8 ± 9.8 years) underwent MR examination with a diagnostic protocol including STIR, T2-weighted TSE, THRIVE and DWIBS sequences. Two radiologists blinded to both dynamic sequences and histological findings evaluated in consensus STIR, T2-weighted TSE and DWIBS sequences and after two weeks CE-MRI images searching for breast lesions. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy for UE-MRI and CE-MRI were calculated. UE-MRI results were also compared with CE- MRI.

RESULTS

UE-MRI sequences obtained sensitivity, specificity, diagnostic accuracy, PPV and NPV values of 94%, 79%, 86%, 79% and 94 %, respectively. CE-MRI sequences obtained sensitivity, specificity, diagnostic accuracy, PPV and NPV values of 98%, 83%, 90%, 84% and 98%, respectively. No statistically significant difference between UE-MRI and CE-MRI was found.

CONCLUSION

Breast UE-MRI could represent an accurate diagnostic tool and a valid alternative to CE-MRI for evaluating breast lesions. STIR and DWIBS sequences allow to detect breast lesions while T2-weighted TSE sequences and ADC values could be useful for lesion characterization.

CLINICAL RELEVANCE/APPLICATION

Unenhanced MR imaging of the breast including STIR, T2-weighted TSE and DWIBS sequences could characterize breast lesions, although not yet able to avoid histological characterization.

RC315-05 Breast Cancer: Feasibility and Preliminary Experience of Diffusion Kurtosis Imaging for Detection and Assessment of Invasive Ductal Carcinoma Comparing with Intravoxel Incoherent Motion and Conventional Diffusion-weighted Imaging

Tuesday, Dec. 1 9:20AM - 9:30AM Location: Arie Crown Theater

Participants
Kun Sun, Shanghai, China (*Presenter*) Nothing to Disclose
Fuhua Yan, MS, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the feasibility of diffusion-kurtosis imaging (DKI) for distinguishing benign from malignant breast lesions in comparison with IVIM and conventional DWI

METHOD AND MATERIALS

The institutional review board approved this retrospective HIPAA-compliant study and waived informed consent. Twenty-five breast disease patients who underwent surgery from January 2014 and April 2014 were retrospectively analyzed. Multi-b-value diffusion images with five b values (range:0-2800s/mm²) were acquired and processed using the DKI model, yielded kurtosis (K),and corrected diffusion(D) coefficient, similarly, IVIM model was also acquired with 5 b values(range:0-200s/mm²), yielded D*,D,f,ADC, The apparent diffusion coefficient (ADC) was also calculated using the conventional mono-exponential diffusion weighted imaging (DWI) model with 2 b values(50,1000) .Two radiologists reviewed these maps and measured the all these parameters. Two independent sample t test was employed and receiver operating characteristic curves were plotted for data analysis.

RESULTS

Among the 25 patients, 15(60%) were invasive ductal carcinoma and 10 (40%) were fibroadenoma. The area under the curve for all these parameters as following: DKI model: 0.973 for K, 0.967 for D;IVIM model::0.74 for D*,:0.793 for D, 0.673 for f, 0.947 for ADC; Conventional DWI: 0.90 for ADC. Then we chosen K represent DWI model, IVIM-ADC represent IVIM model, ADC represent Conventional DWI model to compare the diagnostic accuracy. Although the area under the curve of K was relatively higher than IVIM-ADC and Conventional ADC, there's no significant difference (P>0.05).K was significantly higher in the malignant lesions than in the benign lesions (0.91±0.13vs.0.68±0.10,P<0.0001). IVIM- ADC and Conventional ADC were significantly lower in the malignant lesions than in the benign lesions (0.93±0.14 vs.1.05±0.20 and 1.53±0.35 vs.1.60±0.43, respectively, P<0.0001).

CONCLUSION

DKI model had a similar diagnostic ability with IVIM and DWI model in assessing benign and malignant breast lesions. Performing DKI model with quantification K values reduces the overlap between benign and malignant lesion than ADC values from IVIM and DWI model.

CLINICAL RELEVANCE/APPLICATION

DKI model had a similar diagnostic ability with IVIM and DWI model in assessing benign and malignant breast lesions.

RC315-06 DBT Technology

Tuesday, Dec. 1 9:30AM - 9:50AM Location: Arie Crown Theater

Participants
Martin J. Yaffe, PhD, Toronto, ON (*Presenter*) Research collaboration, General Electric Company Founder, Matakina International Ltd Shareholder, Matakina International Ltd Co-founder, Mammographic Physics Inc

LEARNING OBJECTIVES

1) To review the basic principles of digital breast tomosynthesis (DBT). 2) Identify factors that may impact image quality and interpretation.

RC315-07 Detection and Classification of Calcifications on Two-dimensional Mammography: Comparison of Synthetic Mammography Reconstructed from Digital Breast Tomosynthesis and Full-field Digital Mammography

Tuesday, Dec. 1 9:50AM - 10:00AM Location: Arie Crown Theater

Participants
Ji Soo Choi, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Young Ko, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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PURPOSE

To evaluate the interpretative performance of two-dimensional (2D) synthetic mammography (SM) reconstructed from digital breast tomosynthesis (DBT) in the detection and classification of calcifications, compared to 2D full-field digital mammography (FFDM).

METHOD AND MATERIALS

The institutional review board approved this study, and the patients' informed consent was waived. Between January and October 2013, 73 patients with 81 calcifications (40 biopsy proven malignant calcifications, 24 biopsy-proven benign calcifications, 17 typical benign calcifications) were consecutively enrolled. For each patient, FFDM and DBT were performed, and SM was reconstructed from each set of DBT slices. Three breast radiologists, blinded to the histology, interpreted SM and FFDM images and recorded the conspicuity (three-point scale; 1 low conspicuity, 2 medium conspicuity, 3 high conspicuity) and the presence of calcifications, and corresponding BI-RADS categories. Diagnostic performance of SM was compared with that of FFDM in terms of percentage of detected calcifications (detection sensitivity) and the percentage of times each detected calcifications was

correctly classified as benign or malignant. BI-RADS category 2 was assigned as negative and BI-RADS category greater than or equal to 3 was assigned as positive.

RESULTS

There was no significant difference in detection sensitivity of calcifications between SM (range 91.4-95.1%) and FFDM (range 85.2-90.1%) for all readers (P>0.05). The conspicuity scores of SM and FFDM were also not significantly different for each observer (range of mean scores 1.9-2.8 for SM, 1.9-2.8 for FFDM; P > 0.05). For correct classification of calcifications, there was no significant difference between SM (68.9-74.0%) and FFDM (62.1-69.6%) for all readers (P>0.05). Of discordant cases between SM and FFDM, correct classifications were more frequent with SM, compared to FFDM for all readers.

CONCLUSION

Diagnostic performance of SM and FFDM are comparable for detection and classification of calcifications. Therefore, our results indicate that SM may overcome the limitation that DBT may underestimate the calcifications during DBT-based screening.

CLINICAL RELEVANCE/APPLICATION

SM may overcome the limitation that DBT may underestimate the calcifications. DBT with SM may be sufficient in the detection and classification of calcifications during DBT-based screening, without addition of FFDM

RC315-08 Comparison of Low Dose Tomosynthesis Plus Synthesized Mammography and Digital Mammography Alone for Breast Cancer Screening

Tuesday, Dec. 1 10:00AM - 10:10AM Location: Arie Crown Theater

Participants
Tokiko Endo, MD, Nagoya, Japan (*Presenter*) Institutional research support, FUJIFILM Holdings Corporation
Takako Morita, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Mikinao Ooiwa, Nagaya, Japan (*Abstract Co-Author*) Nothing to Disclose
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Misaki Shiraiwa, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
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Yukie Hayashi, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Hirotoshi Ogawa, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Takao Horiba, Kagamihara, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Satoh, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
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Tomonari Sendai, Ashigarakami-Gun, Japan (*Abstract Co-Author*) Employee, FUJIFILM Holdings Corporation

PURPOSE

To compare the diagnostic performance (sensitivity, specificity and AUC) of breast tomosynthesis (DBT) plus synthesized mammography (S2D) with several-levels of dose reduction versus conventional digital mammography (FFDM) alone in breast cancer screening.

METHOD AND MATERIALS

An institutional review board approved this study and informed consent was provided by all patients. Images of 200 breasts were acquired from 100 subjects aged 27-86 years (mean, 53 years) who underwent FFDM and DBT with the same positioning and included both mediolateral oblique and craniocaudal views. All FFDM images were acquired at normal dose (AGD 0.65 ~ 4.16mGy). For DBT, half the patients were imaged at the same dose level (AGD 0.95 ~ 3.19mGy) of FFDM and the remainder at about 75% (AGD 0.87 ~ 2.7mGy). In addition, DBT + S2D images with 60% dose were generated virtually using approximately half the normal 15 projection images. The DBT + S2D images with dose reduction were processed by improved reconstruction algorithms. Eight radiologists specialized in breast imaging were divided equally into two groups and each group reviewed images of 100 breasts retrospectively. The FFDM and DBT + S2D images were interpreted independently with an interval of minimum 4 weeks for memory washout. Diagnostic performance was assessed by comparing sensitivity, specificity and area under the receiver operating characteristic (ROC) curve.

RESULTS

We found no significance difference in sensitivity and specificity between FFDM and DBT + S2D acquired with normal dose. Furthermore, FFDM and DBT + S2D acquired with 75% dose showed a significant difference in sensitivity (P = .043) keeping specificity and AUC because spiculated or lobulated masses were more precisely identified by the improved DBT images.

CONCLUSION

Dose reduction is possible with DBT + S2D in screening with the same sensitivity and specificity as FFDM. In addition, the improvement of reconstruction algorithm has the potential to provide higher sensitivity, even when the dose is reduced more than 25% compared to FFDM.

CLINICAL RELEVANCE/APPLICATION

Screening by DBT + S2D with the improved reconstruction algorithm contributes to not only dose reduction, but also improved sensitivity keeping specificity.

RC315-09 Impact on Recall Rates Following Implementation of Synthesized 2D Mammography in Digital Breast Tomosynthesis Screening

Tuesday, Dec. 1 10:10AM - 10:20AM Location: Arie Crown Theater

Awards
Trainee Research Prize - Resident

Participants
Samantha P. Zuckerman, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Speaker, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Siemens AG
Susan Weinstein, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, Siemens AG
Marie Synnestvedt, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Katrina Korhonen, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Elizabeth McDonald, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The combination of digital breast tomosynthesis (DBT) with full field digital mammography (DM) decreases recall rates and improves cancer detection in breast cancer screening compared to using DM alone. Synthesized 2D images (s2D) are being used to replace conventional DM as a method to reduce dose. However, the reconstructed s2D images frequently have a different appearance varying by breast density and lesion type, particularly "calcification-only" lesions. We have evaluated the early implementation of s2D in a population screened entirely with s2D/DBT and compared recall rates and recall finding types to similar historic outcomes from DM/DBT screening. Comparison of cancer detection rate is on-going.

METHOD AND MATERIALS

Recall rates and lesion type were compared for 15,571 women screened with DM/DBT from October 1, 2011-February 28, 2013 and 2,090 women screened with s2D/DBT from January 7th, 2015 to March 20th, 2015. Data collection is on-going. Differences between groups were compared using Wilcoxon rank sum test.

RESULTS

Overall recall rate for s2D/DBT was 8.3% compared to 8.8% for DM/DBT (p=0.45). In addition, s2D/DBT screening was not associated with a significant change in the distribution of recalled lesion type. The percentage of screened patients recalled for calcifications, masses, asymmetries, architectural distortion and technical reasons was 1.6, 2.4, 3.8, 1.1 and 0.05 for s2D/DBT compared to 1.6, 2.7, 4.5, 1.0 and 0.2 for DM/DBT (p=ns). Specifically, there was no change in the rate of recall for calcific lesions.

CONCLUSION

Preliminary data demonstrates stable recall rates and lesion types with the replacement of DM with s2D in combination with DBT. Ongoing data collection will allow comparison of cancer detection rates and PPVs.

CLINICAL RELEVANCE/APPLICATION

The replacement of DM with s2D in combination with DBT will lead to decreased radiation dose in screening with DBT with maintenance of recall reduction.

RC315-10 Synthesized 2D Mammography+Tomosynthesis: Can We See Clearly?

Tuesday, Dec. 1 10:20AM - 10:30AM Location: Arie Crown Theater

Participants
Melissa A. Durand, MD, New Haven, CT (*Presenter*) Research Grant, Hologic, Inc
Madhavi Raghu, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Jaime L. Geisel, MD, New Haven, CT (*Abstract Co-Author*) Consultant, QView Medical, Inc; Consultant, Siemens AG
Regina J. Hooley, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Xiaopan Yao, PhD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Liane E. Philpotts, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Compare synthesized 2D mammography+tomosynthesis (C-view+Tomo) to 2D mammography+tomosynthesis (2D+Tomo) in a clinical setting.

METHOD AND MATERIALS

Screening mammograms were performed with C-view+Tomo and 2D+Tomo from 8/1/2014-1/9/2015. A hanging protocol showed C-view+Tomo first, followed by 2D+Tomo. Findings (calcifications, asymmetries, masses, architectural distortions) on C-view+Tomo were prospectively assessed as better, equally, or less well seen compared to 2D+Tomo. Separate BIRADS final assessments were recorded and Kappa statistics assessed agreement. Recall and cancer detection rates were compared with Fisher's exact test. Multivariate logistic regression analysis determined effect of breast density or age on visualization of C-view+Tomo findings.

RESULTS

201 C-view+Tomo and 2D+Tomo mammograms were performed. 4 types of findings were recorded (calcifications 50.8%,102/201;asymmetries 28.9%,58/201;masses 14.4%,29/201;architectural distortions 6.0%,12/201). 53.7% (108/201) were not dense and 46.3% (93/201) were dense; average age 56 years. 82.1% (165/201) of findings were equally/better seen with C-view+Tomo, 17.9% (36/201) less well seen. This was most evident for architectural distortions and calcifications (architectural distortions 100%,12/12); calcifications 96.1%,98/102;asymmetries 63.8%,37/58;masses 62.1%,18/29). Logistic regression models showed neither density nor age had a significant effect on visibility of findings (p 0.8358 density;p 0.3336 age). Kappa statistics showed perfect agreement in BIRADS assessment for architectural distortions (K 1.0000), strong agreement for asymmetries (K 0.9695) and masses (K 0.9247), moderate agreement for calcifications (K 0.7850). Recall rates were not significantly different (C view: 10.9%,22/201; 2D: 9.45%,19/201); p 0.7421). All recalled patients returned for diagnostic imaging. 6 biopsies were performed and 2 malignancies found (PPV1:10.5%;PPV3:33.3%). Cancer detection rate was the same as both cancers were identified on both modalities.

CONCLUSION

C-view+Tomo shows the majority of mammographic findings equally well/better than 2D+Tomo, regardless of breast density or age, with equitable recall rates and cancer detection.

CLINICAL RELEVANCE/APPLICATION

Visibility of findings on C-view+Tomosynthesis is at least equal to 2D, with no significant difference in recall rates or cancer detection, and suggests potential as a screening modality.

RC315-11 Synthetized Digital Mammography Compared to Conventional Digital Mammography in a Diagnostic Setting

Tuesday, Dec. 1 10:30AM - 10:40AM Location: Arie Crown Theater

Participants
Giovanna Mariscotti, Turin, Italy (*Abstract Co-Author*) Nothing to Disclose
Manuela Durando, Turin, Italy (*Presenter*) Nothing to Disclose
Camilla Bogetti, MD, Torino, Italy (*Abstract Co-Author*) Nothing to Disclose
Pier Paolo Campanino, Turin, Italy (*Abstract Co-Author*) Nothing to Disclose
Elisa Regini, Torino, Italy (*Abstract Co-Author*) Nothing to Disclose
Mirella Fasciano, Turin, Italy (*Abstract Co-Author*) Nothing to Disclose
Giulia Schivazappa, Turin, Italy (*Abstract Co-Author*) Nothing to Disclose
Enrica Caramia, Turin, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessia Milan, Torino, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo Fonio, Vercelli, Italy (*Abstract Co-Author*) Nothing to Disclose
Giovanni Gandini, MD, Torino, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performances of conventional Digital Mammography (DM) versus Synthetized Digital Mammography (SDM) used alone (without combination with Digital Breast Tomosynthesis (DBT) images) in the identification and characterization of breast malignant and benign lesions in a diagnostic setting.

METHOD AND MATERIALS

A retrospective observer performance study was performed using anonymized images acquired between August 2014 and January 2015 (compliant to protocols approved by the Institutional Ethic Committee). The sample included 120 consecutive patients with 73 biopsy-proven cancer (confirmed histologically) and 64 biopsy-proven benign lesions. All patients (after signing an informed consent) had undergone DM combined to DBT; SDM images were obtained in both standard views. Two dedicated breast radiologists, blinded to the clinical information and histological diagnosis, retrospectively reviewed all the studies. The readers reviewed separately DM images and then SDM studies, in a different order. BIRADS category was used for the classification of the findings in both techniques. Mammographic features (mass, architectural distortion, microcalcification, asymmetry) were also indicated. A statistical analysis was performed on the data, by evaluating the differences in sensitivity (SE), specificity (SP), negative and positive predictive value (NPV and PPV) between DM and SDM. Accuracy was calculated by using areas under the receiver operating characteristic curve (AUC) for both techniques.

RESULTS

The SE and SP were respectively 78.6% and 67.9% for DM and 87.1% and 63.5% for SDM. No significant differences were found regarding SE and SP between DM and SDM (p=0.14 and 0.63). The AUC was 0.75 for DM and 0.81 for SDM. There were not significant differences between both AUC´s (p=0.27). By stratifying the results according to mammographic features, SDM better identified and classified (according to BIRADS category) architectural distortions than DM.

CONCLUSION

In our study, SDM alone is comparable in performance to DM, demonstrating a similar SE, SP and AUC values; SDM could be used instead of DM in addition to DBT images as part of routine clinical study.

CLINICAL RELEVANCE/APPLICATION

Preliminary studies suggest that SDM alone is comparable in performance to DM, so it could be used instead of DM in addition to DBT images as part of routine clinical study.

RC315-12 Clinical Evidence of DBT Utility

Tuesday, Dec. 1 10:50AM - 11:10AM Location: Arie Crown Theater

Participants
Sarah M. Friedewald, MD, Chicago, IL (*Presenter*) Consultant, Hologic, Inc; Research Grant, Hologic, Inc

LEARNING OBJECTIVES

1) Acquire brief knowledge of the basics of tomosynthesis aquisition, interpretation and implementation. 2) Learn the clinical evidence that supported FDA approval for tomosynthesis. 3) Describe the European Clinical Evidence. 4) Describe the American Clinical Evidence. 5) Be aware of the additional studies needed for further research.

RC315-13 Tomosynthesis in Diagnostic Mammography - Continued Change after Three Years of Experience

Tuesday, Dec. 1 11:10AM - 11:20AM Location: Arie Crown Theater

Participants
Reni S. Butler, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Vivek B. Kalra, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Jaime L. Geisel, MD, New Haven, CT (*Abstract Co-Author*) Consultant, QView Medical, Inc; Consultant, Siemens AG
Jacquelyn Crenshaw, RT, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Liane E. Philpotts, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess how the initial impact of tomosynthesis on the diagnostic work-up changes with increasing experience over a 3 ½ year

time interval.

METHOD AND MATERIALS

After IRB approval, a HIPAA-compliant retrospective review of diagnostic mammography examinations was performed before and at three time points over a 3 ½ year period after tomosynthesis implementation. Diagnostic exams were performed on 2D digital mammography units (Selenia, Hologic, Bedford, MA) prior to tomosynthesis implementation and on both 2D and 3D digital breast tomosynthesis units (Dimensions, Hologic, Bedford, MA) in the 3 ½ years after implementation. Total number of additional views (AV), spot compression views (SCV) and magnification views (MV), were recorded during a one month period immediately prior to tomosynthesis (2D) and compared to one month periods during the second (3D1), third (3D2), and fourth year (3D3) after tomosynthesis utilization. The number of "routine" diagnostic studies, consisting only of MLO and CC views, was recorded for each time point. Statistical analysis was performed using the two-tailed student t-test with unequal variance.

RESULTS

The study population consisted of 497 2D diagnostic mammograms (2D) and 350 (3D1), 410 (3D2), and 314 (3D3) tomosynthesis diagnostic exams. AV, SCV and MV per exam decreased each year from 2.07, 0.84 and 0.85 (2D) to 1.42, 0.59 and 0.73 (3D1), 1.11, 0.33 and 0.41 (3D2), and 0.53, 0.23 and 0.20 (3D3), respectively. Significant differences were observed in all categories between 2D and 3D1, 3D1 and 3D2, and 3D2 and 3D3 ($p < 0.01$). Concordantly, the number of routine diagnostic exams increased from 29.9% (2D) to 41.4% (3D1), 44.9% (3D2), and 73.3% (3D3), ($p < 0.01$).

CONCLUSION

In the first 3½ years after tomosynthesis implementation, there has been a continual shortening of the diagnostic work-up from year to year. This data suggests a learning curve exists in developing comfort with utilizing tomosynthesis in the diagnostic setting and that, with time, fewer additional views are seen to be necessary. The majority of diagnostic cases require only the routine views, making the difference between screening and diagnostic mammography start to blend.

CLINICAL RELEVANCE/APPLICATION

Reported experience from a diagnostic center where tomosynthesis was adopted early may aid in shortening the learning curve at centers implementing tomosynthesis presently or in the future.

RC315-14 Biopsy Outcomes Following Diagnostic Work-up with Digital Breast Tomosynthesis

Tuesday, Dec. 1 11:20AM - 11:30AM Location: Arie Crown Theater

Participants
Madhavi Raghu, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Melissa A. Durand, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, Hologic, Inc
Liva Andrejeva-Wright, MD, Wallingford, CT (*Abstract Co-Author*) Nothing to Disclose
Regina J. Hooley, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Jaime L. Geisel, MD, New Haven, CT (*Abstract Co-Author*) Consultant, QView Medical, Inc; Consultant, Siemens AG
Liane E. Philpotts, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the positive predictive value of biopsies performed (PPV3) before and after the implementation of tomosynthesis.

METHOD AND MATERIALS

A retrospective review of all biopsies performed following diagnostic work-up with mammography before (2D: June 2010-June 2011) and three consecutive years (3D1:1/1/2012-12/31/2012; 3D2:1/1/2013-12/31/2014; 3D3:1/1/2014-12/31/2014) following the implementation of tomosynthesis was conducted. The recorded mammographic features of lesions recommended for biopsy (masses, architectural distortions (AD), calcifications (Ca++) and asymmetries) and subsequent pathology were evaluated. The PPV3 was compared and trends from year to year were evaluated.

RESULTS

A total of 3567(2D), 3385(3D1), 4542(3D2) and 4507 (3D3) diagnostic mammograms were performed. There was a nonsignificant slight decrease in the proportion of BI-RADS 4,5 studies: 2D 8.5% (304/3567), 3D1 7.9% (269/3385), 3D2 8.4% (384/4542), 3D3 7.7% (345/4507)) as well as biopsies performed over time: 2D 94% (287/304); 3D1 96% (257/269); 3D2 93% (358/384); 3D3 93% (321/345)). With tomosynthesis, there was a 40% increase in the PPV3 over time, from 29% in 2D (85/287) to 41.2% (3D1;106/257;p=.005), 45% (3D2;162/358;p<.0001) and 51.1% (3D3;164/321;p<.0001). Of the total malignancies in the 2D group, 69% were masses, 2.3% AD, 28% Ca++ and 0% asymmetries. With tomosynthesis there was an increase in the proportion of malignancies manifesting as noncalcified lesions, particularly masses (66%(3D1), 78%(3D2), 80%(3D3)) and AD (4.7%(3D1), 3.0% (3D2), 5.5%(3D3)), with a small proportion of cancers manifesting as asymmetries (3.8% (3D1), 1.9% (3D2) and 0%(3D3)). Over time, calcifications made up a smaller proportion of the malignancies (24.5%(3D1), 16.7%(3D2), 15.2%(3D3)).

CONCLUSION

Utilization of tomosynthesis resulted in a significant increase of 40% in the PPV3 for BIRADS 4, 5 lesions, demonstrating increased diagnostic acumen in characterizing lesions requiring biopsy.

CLINICAL RELEVANCE/APPLICATION

Diagnostic work up with tomosynthesis resulted in a significant and steady increase in the PPV.

RC315-15 Clinical and Imaging Features of Tomosynthesis Occult Breast Cancer and Reasons for Non-Detection

Tuesday, Dec. 1 11:30AM - 11:40AM Location: Arie Crown Theater

Participants
Liva Andrejeva-Wright, MD, Wallingford, CT (*Abstract Co-Author*) Nothing to Disclose
Regina J. Hooley, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Kaitlin Eng, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

Jonathan R. Weisiger, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Madhavi Raghu, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Reni S. Butler, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Liane E. Philpotts, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Laura S. Sheiman, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the clinical and imaging features of tomosynthesis (DBT) occult cancers and determine reasons for non-detection of these cancers.

METHOD AND MATERIALS

This is a HIPPA compliant study with IRB approval. Between August 2011 and December 2014, a retrospective database review identified 32 cancers in 32 women diagnosed by breast ultrasound (US) or MR within one year of a normal combined DBT + 2D mammogram. Patient breast cancer risk, mammographic density, and tumor histology were assessed. Three radiologists blinded to clinical outcomes and study purpose reviewed each mammogram to determine if the cancers were truly mammographically occult. Two radiologists unblinded to clinical outcomes also reviewed each case in order to determine reasons why cancers were undetected.

RESULTS

The average patient age was 57 years (range 41-82). Breast cancer risk was average in 44% (14/32), intermediate in 22% (7/32), and increased in 34% (11/32). Breast density was scattered fibroglandular in 13% (4/32), heterogeneously dense in 69% (22/32), and extremely dense in 19% (6/32). Cancer detection was made by US in 75% (24/32) and by MR in 25% (8/32), with 4/9 MR detected cancers also identified on MR-directed US. Four cancers were DCIS and 28 were invasive, including 20 ductal and 8 lobular tumors. Of the invasive cancers 12 were grade1, 13 were grade 2, and 3 were grade 3. 63% (20/32) of the cancers were diagnosed more than two years since implementation of DBT. Upon case review, 72% (23/32) cases were truly occult on DBT and 28% (9/32) were seen retrospectively, including subtle findings in 16% (5/32) and interpretative errors in 13% (4/32). Of 4 cancers missed due to interpretive error, three were spiculated masses and one was a subtle architectural distortion (avg. tumor size 30 mm, range 13 - 66 mm).

CONCLUSION

The majority of DBT occult cancers were invasive, detected in women with dense breast tissue, and identified on US. These cancers may be seen in women across all risk groups and may occur despite more than two years of reader experience. Subtle masses and architectural distortions were the common findings in tumors identified retrospectively. Cancers missed due to interpretive error tended to be large.

CLINICAL RELEVANCE/APPLICATION

Despite the increased sensitivity of tomosynthesis combined with 2D mammography, some cancers may still be occult and radiologists should be aware of the limitations of tomosynthesis.

RC315-16 Comparing the Performance of Full-Field Digital Mammography (FFDM), Digital Breast Tomosynthesis (DBT) and Whole Breast Ultrasound (WBUS) in the Initial Staging Evaluation of Breast Cancer: Interim Results of a Prospective Study

Tuesday, Dec. 1 11:40AM - 11:50AM Location: Arie Crown Theater

Participants
Rosalind P. Candelaria, MD, Houston, TX (*Presenter*) Nothing to Disclose
Monica L. Huang, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Beatriz E. Adrada, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Elsa M. Arribas, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Marion E. Scoggins, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Wei T. Yang, MD, Houston, TX (*Abstract Co-Author*) Researcher, Hologic, Inc
Jennifer G. Schopp, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Mark J. Dryden, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
H. Carisa Le-Petross, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Tanya W. Moseley, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Gary J. Whitman, MD, Houston, TX (*Abstract Co-Author*) Book contract, Cambridge University Press
Gaiane M. Rauch, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Lumarie Santiago, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the incremental cancer detection rate (ICDR) of FFDM+DBT and FFDM+DBT+WBUS when compared to FFDM alone in the local staging of patients with recently diagnosed invasive breast cancer (BI-RADS 6) and patients with mammograms and/or ultrasound highly suspicious for invasive breast carcinoma (BI-RADS 5).

METHOD AND MATERIALS

This IRB-approved, prospective study was performed in a single, large tertiary cancer center. Informed written consent was obtained. We enrolled the first 100 women who were referred to our center from 12/2014-3/2015, met inclusion criteria and agreed to participate. All women had FFDM with DBT followed by WBUS; FFDM interpretation occurred blinded to DBT images. WBUS was performed with knowledge of FFDM/DBT results. Suspicious lesions on FFDM, DBT or WBUS farthest apart in the breast were biopsied to determine disease extent and to establish multifocality and/or multicentricity. Gold standard for diagnosis of malignancy was histopathology from needle biopsy and/or surgery. A separate surgical plan was recorded for each patient based on findings from FFDM alone, FFDM+DBT and FFDM+DBT+WBUS. In patients who did not have mastectomy, true negatives were defined by negative clinical and imaging assessment at 12-month follow-up (pending).

RESULTS

Median patient age was 54 years, range 26-82. Mean index tumor size was 2.1 cm, range 0.4-15. Mean satellite tumor size was 1.2

cm, range 0.4-4.2. Breast tissue density among the study group was predominantly fatty (1%), scattered fibroglandular (26%), heterogeneously dense (70%) and extremely dense (3%). ICDR of FFDM+DBT when compared to FFDM alone was 1% (exact 95% CI:0.02%-5.4%) in the ipsilateral and 0% (exact 95% CI:0%-5.7%) in the contralateral breast. ICDR of FFDM+DBT+WBUS when compared to FFDM alone was 20% (exact 95% CI:12.7%-29.2%) in the ipsilateral and 1.6% (exact 95% CI:0.04%-8.7%) in the contralateral breast. FFDM+DBT findings changed the surgical plan in 1% while FFDM+DBT+US findings changed the surgical plan in 20%.

CONCLUSION

Our interim analysis indicates that there is a greater increase in cancer detection in the ipsilateral and contralateral breasts when adding WBUS to FFDM, compared to adding DBT to FFDM.

CLINICAL RELEVANCE/APPLICATION

In large tertiary cancer centers, use of FFDM+DBT provides no significant advantage over FFDM when staging breast cancer; more studies are needed to establish proper indications for DBT in the diagnostic setting.

RC315-17 Analysis of False Negative Exams in 2D and Tomosynthesis Screening Mammography: Comparison by Breast Density

Tuesday, Dec. 1 11:50AM - 12:00PM Location: Arie Crown Theater

Participants
Liane E. Philpotts, MD, New Haven, CT (*Presenter*) Nothing to Disclose
Cameron Thomson, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Melissa A. Durand, MD, New Haven, CT (*Abstract Co-Author*) Research Grant, Hologic, Inc
Madhavi Raghu, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Regina J. Hooley, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

While digital breast tomosynthesis (DBT) has been shown to increase specificity in screening mammography, the sensitivity of this new modality has not yet been determined. The purpose of this study was to assess the false negative cases in patients undergoing screening with different technologies - 2D FFDM, DBT, +/- supplemental screening ultrasound.

METHOD AND MATERIALS

An IRB-approved, retrospective search of the breast imaging database (PenRad, MN) was performed to identify all screening mammograms over a two year period (8/1/11 - 7/31/13) when both DBT and 2D machines were utilized (Hologic Dimensions or Selenia) yielding 14, 295 DBT (8,291 not dense, 6,004 dense) and 10,132 2D (6,943 not dense, 3,189 dense) exams. Thirty percent of women with dense tissue underwent supplemental screening ultrasound (US). All false negative exams were identified through PenRad and reviewed for method of diagnosis, breast density, and cancer type and size.

RESULTS

The 2D cancer detection rate (per 1000) was significantly different for dense and non dense (7.3 versus 3.4, p=0.02) however, it was similar in the DBT group (not dense 5.3, dense 5.4). Eleven cancers were identified as false negatives (10 Invasive, 1 DCIS): 6 in the 2D group (6/10,132, 0.6 per 1000) and 5 in the DBT group (5/14,295, 0.3 per 1000)(p=0.56, NS). Five were palpable interval cancers (4 in the 2D group and 1 in the DBT group). Missed cancers in the DBT group were smaller (mean 10mm, range 5-15mm) and more likely to be diagnosed by MRI (3/5, 60%) compared to those in the 2D group, which were larger (mean 20mm, range 10-45mm) and palpable (4/6, 67%). The missed cancer rate in the dense patients (6/9,193, 0.7 per 1000) was not significantly different to not dense patients (5/15,234, 0.3 per 1000)(p=0.39, NS). Of 3000 patients undergoing screening US, only two interval cancers were identified; one as a palpable mass 8 months after screening US, and the other as a new 8mm mass found on 6 months follow up of a different BIRADS 3 lesion.

CONCLUSION

In our current practice, missed cancers were infrequent and occurred at a similar rate in dense as in non dense women. Cancers in false negative DBT exams were smaller and more likely to be found by MRI.

CLINICAL RELEVANCE/APPLICATION

Current screening modalities including DBT and screening US are proving to result in a very low rate of missed and interval cancers.

RC317

PET-MR/Hyperpolarized MR

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S504CD

MR NM BQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Heike E. Daldrup-Link, MD, Palo Alto, CA (*Moderator*) Nothing to Disclose

Sub-Events

RC317A Hyperpolarized 13C MR-A Complementary Method to PET for Imaging in Vivo Metabolism

Participants
Daniel M. Spielman, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Assess the basic principles of hyperpolarized 13C MRS, including sample preparation, image acquisition, and data analysis. 2) Differentiate metabolic parameters measurable by hyperpolarized 13C MRS from though obtained with PET. 3) Compare PET versus hyperpolarized 13C MRS sensitivities, spatial resolution, and temporal resolution.

RC317B PET/MR: Applications in Clinical Imaging

Participants
Karin A. Herrmann, MD, PhD, Cleveland, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand technical limitations, workflow and current challenges of PET/MR compared to PET/CT. 2) To learn about most successful applications of PET/MR in clinical practice. 3) To be informed about the incremental value of PET/MR over current imaging strategies in selected clinical scenarios. 4) Identify appropriate clinical indications for PET/MR in current clinical practice. 5) Understand and manage procedural and logistic challenges of PET/MR.

RC317C The Emerging Clinical Role of Hyperpolarized ^{13}C MR in Prostate Cancer Imaging

Participants
John Kurhanewicz, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the clinical need and biochemical rationale for the use of hyperpolarized [1-13C] pyruvate for prostate cancer imaging. 2) Demonstrate a multi-hyperpolarized probe approach for simultaneously measuring prostate cancer metabolism and tumor micro-environment. 3) Demonstrate the utility of hyperpolarized 13C MR for measuring prostate cancer aggressiveness and response to therapy. 4) Demonstrate the safety, clinical feasibility, sensitivity and resolution, and future availability of clinical hyperpolarized 13C MR.

RC320

Confluence of Diagnostic Radiology and Radiation Oncology in Management of Pediatric Malignancies

Tuesday, Dec. 1 8:30AM - 10:00AM Location: S403A

NR MR RO PD

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Stephanie A. Terezakis, MD, Baltimore, MD (*Moderator*) Speaker, Elekta AB

Sub-Events

RC320A Supratentorial CNS Tumors

Participants
Stephanie M. Perkins, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Tina Y. Poussaint, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the common supratentorial brain tumors of childhood. 2) Evaluate the imaging features of supratentorial brain tumors.

ABSTRACT

The most common type of solid tumor among children is the pediatric brain tumor, which is the second most frequent childhood malignancy after leukemia, and the leading cause of death from solid tumors in this population. Among children aged 0-19, the incidence rate for all primary brain and central nervous system tumors was roughly 5.3 per 100,000, with approximately 4350 cases of new cases of childhood primary malignant and non-malignant CNS tumors were expected to be diagnosed each year in the United States in 2013.Supratentorial tumors are most common in the first 2-3 years of life and in children older than 10 years, supratentorial and infratentorial are of equal frequency. This lecture will focus on the standard and advanced MR imaging features of the common supratentorial tumors of childhood affecting the cerebral hemispheres, suprasellar/sellar regions and pineal regions.

RC320B Infratentorial Central Nervous System Tumors

Participants
David B. Mansur, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Thierry Huisman, MD, Baltimore, MD, (thuisma1@jhmi.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the types of diagnostic imaging most useful in the management of infratentorial CNS tumors. 2) Describe how proper diagnostic imaging aids in target delineation, staging, and treatment planning in posterior fossa CNS radiotherapy. 3) Define how conventional and advanced neuroimaging may characterize and differentiate brain neoplasms from treatment-related imaging findings following radiotherapy.

ABSTRACT

The radiotherapeutic management of infratentorial CNS tumors requires close collaboration between neuroradiology and radiation oncology. This process begins with accurate initial tumor description and delineation in the pre-operative setting. Detection of drop metastases is another critical role for neuroimaging which can be done either preoperatively or post operatively. Post-operative imaging is essential to assist with determining extent of resection as well as defining radiotherapy treatment volumes. Finally, neuroimaging after radiotherapy can aid in determining benign radiation therapy changes from recurrent or progressive tumor.

RC320C Pediatric Sarcomas: MR Imaging

Participants
Oren Cahlon, Princeton, NJ (*Presenter*) Investor, ProCure Treatment Centers, Inc
Laura M. Fayad, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Examine the roles MRI plays in the evaluation of pediatric sarcomas. 2) Assess the utility of various imaging sequences for the initial assessment and post-treatment follow-up of sarcomas. 3) Apply anatomic, functional and metabolic techniques for the identification of tumor extent and character.

ABSTRACT

MRI plays a critical role in the assessment of pediatric musculoskeletal tumors, both osseous and soft tissue masses. Although such neoplasms may initially be evaluated on other modalities, such as sonography or radiography, the most salient role for MRI is in determining the extent of disease. MRI sequences also offer information for tumor detection, characterization, the assessment of treatment response and the distinction of post-operative scar from recurrence. With conventional MRI, excellent anatomic detail is obtained, but with the advent of non-contrast chemical shift imaging, diffusion weighted imaging and MR spectroscopy, functional and metabolic features of a neoplasm can be evaluated noninvasively. In this presentation, a comprehensive MRI approach to assessing pediatric musculoskeletal tumors will be reviewed, focusing on the roles of anatomic, functional and metabolic MRI sequences.

RC329

Characterization of Complex and Sonographically Indeterminate Adnexal Masses (An Interactive Session)

Tuesday, Dec. 1 8:30AM - 10:00AM Location: E353B

GU MR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC329A Overview of the Clinical Indications for Using MRI

Participants
Andrea G. Rockall, MRCP, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To be familiar with the typical clinical presentation of adnexal masses. 2) To understand the role role of ultrasound in the initial evaluation and diagnosis of adnexal masses. 3) To know the current indications for MRI in the characterisation of adnexal masses.

ABSTRACT

Clinical presentation of adnexal masses can be due to symptoms (such as acute or chronic pelvic pain or sepsis) or may be incidental. Ultrasound is the initial investigation in almost every case, although CT may be used initially in patients presenting with an acute abdomen. Ultrasound features that can differentiate benign from malignant adnexal masses are well defined and over 80% of cases can be confidently characterised on the basis of ultrasound findings. However, when the nature of a mass is indeterminate on ultrasound, MRI can be useful in further characterisation of the mass. This can be particularly useful in cases where fertility preservation is of paramount importance or where the risks of surgery are high due to other co-morbidities. This lecture will include a full discussion of the current indications for MRI in characterisation of adnexal masses.

RC329B Review of Scoring System for Complex and Sonographically Indeterminate Adnexal Masses (The RULES)

Participants
Isabelle Thomassin-Naggara, MD, Paris, France (*Presenter*) Speakers Bureau, General Electric Company; Research Consultant, Olea Medical

LEARNING OBJECTIVES

1) To learn how to optimise the MRI protocol and how to improve the characterisation of indeterminate complex adnexal masses. 2) To understand the added value of functional sequences (DCE MRI and DWI) in diagnosing adnexal masses. 3) To present a novel diagnostic score named ADNEX MR score for classified adnexal masses using MR imaging according to their positive predictive value.

ABSTRACT

For complex adnexal masses, MR imaging add to conventional criteria of malignancy common to all imaging modalities (bilaterality, tumor diameter larger than 4 cm, predominantly solid mass, cystic tumor with vegetations, and secondary malignant features, such as ascites, peritoneal involvement, and enlarged lymph nodes) specific features based on the characterization of the solid tissue (including vegetation, thickened irregular septa and solid portion) of the adnexal tumor. Using ADNEX MR-SCORING system for adnexal masses, areas under the curve for diagnosis of malignancy is high both for experienced and junior reader (AUCR1/R2=0.980/0.961). A score is 4 or greater is associated with malignancy with a sensitivity of 93.5% (58/62) and specificity of 96.6% (258/267), the risk of malignancy is high, and the patient should be referred to a cancer center. When the diagnostic score is 3 or less, the association with malignancy is minimal and the patient may benefit from more imaging follow-up or conservative treatment. Finally, if the diagnostic score is 2, the mass has a very low risk to be malignant (<2%). This new MR diagnosis classification will be detailed with interactive clinical cases during this session

RC329C Interactive Cases

Participants
Elizabeth A. Sadowski, MD, Madison, WI (*Presenter*) Nothing to Disclose
Isabelle Thomassin-Naggara, MD, Paris, France (*Presenter*) Speakers Bureau, General Electric Company; Research Consultant, Olea Medical

LEARNING OBJECTIVES

1) Develop a method for classifying adnexal masses on MRI by assessing their signal characteristics and enhancement patterns. 2) Assess the risk of ovarian cancer based on the MRI appearance of an adnexal lesion and clinical information. 3) Emphasize the role of MRI in the evaluation of adnexal lesions.

ABSTRACT

ABSTRACT There is a spectrum of ovarian neoplasms ranging from benign to malignant. Identifying the MR imaging features suggestive of benign versus worrisome lesions can help appropriately triage adnexal lesions into follow up versus surgical consultation. The purpose of the interactive session is to review the imaging features of benign and worrisome adnexal lesions on MRI and to discuss the appropriate follow up in each case.

RC351

Pelvic MRI in Oncology: Pearls for Practice

Tuesday, Dec. 1 8:30AM - 10:00AM Location: E350

GU MR OI RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC351A Practical Approach to Understanding Gene Mutations with Interpretation of Imaging in Gynecologic Malignancy

Participants
Priya R. Bhosale, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn the gentic mutations present in Endomtrial and Ovarian Cancer. 2) Pathogenesis of Ovarian Cancer. 3) Implications on image interpretation.

ABSTRACT

Endometrial cancer is teh most common female gynecologic malignancy.Epithelial ovarian cancer is the most common cause of gynecological cancer death in the United States. More recently epithelial ovarian tumors have been broadly classified into two distinct groups. The type I tumors have low grade serous, clear cell, endometrioid, and mucinous histological features. Typically, these tumors are slow growing and confined to the ovary, and are less sensitive to standard chemotherapy. BRAF and KRAS somatic mutations are relatively common in these tumors, which may have important therapeutic implications. Type II tumors are high grade serous cancers of the ovary, peritoneum, and fallopian tube. These tumors are clinically aggressive and are often widely metastatic at the time of presentation. We will discuss the gene mutations associated with different endometrial and epithelial ovarian cancer, pathogenesis, implications on therapy and imaging.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Priya R. Bhosale, MD - 2012 Honored Educator

RC351B Pearls and Pitfalls in Prostate MRI

Participants
Aradhana M. Venkatesan, MD, Houston, TX, (avenkatesan@mdanderson.org) (*Presenter*) Institutional research agreement, Koninklijke Philips NV

LEARNING OBJECTIVES

1) List the elements of common prostate MRI acquisition protocols, defining the roles for each pulse sequence in prostate cancer detection. 2) List imaging findings critical to accurate prostate cancer detection and staging. 3) Identify imaging pitfalls in the detection and staging of prostate cancer. 4) Describe common MRI findings of treated prostate cancer. 4) List the elements of the Prostate Imaging-Reporting and Data System (PI-RADS) structured reporting scheme. 5) List the updated changes reflected in the most recent PI-RADSv2 structured reporting scheme.

ABSTRACT

Prostate cancer is one of the most frequently diagnosed cancers in the male population. It is the second most common type of cancer detected in American men and their second leading cause of cancer death. The proposed refresher course will provide an overview of MRI for prostate cancer imaging, including a discussion of salient imaging findings on multi-parametric MRI, pitfalls in imaging interpretation, and an overview of existing standardized reporting templates for prostate MR interpretation.

RC351C How to Perform and Interpret MRI of the Bladder and Urethra: Anatomy, Technique, and Applications

Participants
Mukesh G. Harisinghani, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) MR techniques to image the bladder and urethra will be discussed. 2) Pointers for optimal MR evaluation will be discussed. 3) Pointers for accurate diagnosis on MRI will be discussed.

ABSTRACT

The propsed course will be provide an overview of applying MR for imaging the bladder and uretheral region

SSG02

Cardiac (MRI/CT Outcomes and Risk Stratification)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S504AB

CA CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Bernd J. Wintersperger, MD, Toronto, ON (*Moderator*) Speakers Bureau, Siemens AG; Research support, Siemens AG
David A. Bluemke, MD, PhD, Bethesda, MD (*Moderator*) Research support, Siemens AG

Sub-Events

SSG02-01 Predictive Value of Cardiovascular Magnetic Resonance-Derived Myocardial Strain for Poor Outcome in Patients with Acute Myocarditis

Tuesday, Dec. 1 10:30AM - 10:40AM Location: S504AB

Participants
Minkyu Kwak, MD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ji Won Lee, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yeon Joo Jeong, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Geewon Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin You Kim, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Suk Kim, MD, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ki Seok Choo, MD, Yangsan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the value of cardiovascular magnetic resonance (CMR)-derived myocardial strain for predicting poor outcome in patients with acute myocarditis.

METHOD AND MATERIALS

We retrospectively included 37 consecutive patients with acute myocarditis who performed CMR (23 male, mean age 41.5 yrs). Myocardial strain parameters, left ventricular (LV) end-diastolic and end-systolic volumes, LV myocardial mass, LV ejection fraction (EF) and right ventricular EF were derived from CMR. Presence of late gadolinium enhancement (LGE) was also recorded. Primary outcome was major adverse cardiovascular events (MACE). Incomplete LV functional recovery was used as secondary outcome in the group of patents who performed follow-up echocardiography after 1 year.

RESULTS

During an average follow-up of 41 ± 34 months, 11 of 37 patients (29.7%) suffered MACE, including cardiac death (n = 2), heart transplantation (n = 1), cardiac pacemaker (n = 1), rehospitalization due to cardiac events (n = 4) or embolic stroke (n = 3). Multivariable Cox proportional hazard regression analysis revealed the presence of LGE (hazard ratio 42.88, p = 0.014) and radial strain obtained from the long axis views (ErrLax, hazard ratio 0.77, p = 0.004) were significant predictors of MACE. Kaplan-Meier analysis showed worse outcome in patients with LGE or ErrLax ≤9.48. Thirty one of 37 patients (83.7%) performed follow-up echocardiography. Multivariable backward stepwise regression analysis revealed ErrLax was the sole significant predictor of LV functional recovery (hazard ratio 1.87, p = 0.042). Receiver operating characteristic curve of ErrLax was used to find optimal cut-off values for prediction of incomplete LV functional recovery, with corresponding area under the curve of 0.96. Cut-off value with the best combination of sensitivity and specificity for ErrLax was ≤14.86 (sensitivity 88.9%, specificity 95.5%).

CONCLUSION

CMR-derived ErrLax can predict poor outcome such as MACE or incomplete LV functional recovery in the patients with acute myocarditis.

CLINICAL RELEVANCE/APPLICATION

CMR-derived ErrLax can predict poor outcome in the patients with acute myocarditis. Furthermore, presence of scar indicated by LGE is also the good independent predictor of MACE. This results support the necessity for future large longitudinal follow-up studies to establish LGE and CMR-derived myocardial strain as an independent predictor of MACE in acute myocarditis.

SSG02-02 Characterization of the Right Ventricle by T1-mapping and T2-mapping in Patients with Pulmonary Arterial Hypertension

Tuesday, Dec. 1 10:40AM - 10:50AM Location: S504AB

Participants
Celia P. Corona-Villalobos, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Yan Zhang, MD, PhD, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Kristin Porter, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Stockholder, Pfizer Inc
Paul M. Hassoun, MD, Baltimore, MD (*Abstract Co-Author*) Scientific Advisory Board, Gilead Sciences, Inc
Stephen M. Mathai, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ihab R. Kamel, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Stefan L. Zimmerman, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Rachel Damico, MD,PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Todd Kolb, MD,PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Right ventricular (RV) function is a major determinant of prognosis in pulmonary arterial hypertension. Pressure overload triggers compensatory mechanisms such as RV hypertrophy, dilatation, fibrosis and RV failure.Diffuse myocardial fibrosis and inflammation have been detected in the left ventricle non-invasively by T1 and T2-mapping using cardiac magnetic resonance (CMR) imaging. The purpose of our study was to evaluate whether T1- and T2-mapping could detect myocardial fibrosis and/or edema of the RV in patients with pulmonary arterial hypertension (PAH).

METHOD AND MATERIALS

A prospective, IRB-approved, HIPAA-compliant study identified from February of 2013 to March of 2015, 34 (6 males and 33 females with mean age of 58±15 years) subjects with PAH (24 subjects had scleroderma-induced PAH (SSc-PAH) and 10 had idiopathic PAH (IPAH). Fifteen age-matched normal controls underwent the same CMR protocol. Standard multi-sequence CMR protocol including pre-contrast (native) short-MOLLI and T2-mapping was performed. Images were processed on a dedicated workstation by drawing a region of interest on the RV inferior wall. Reproducibility was assessed by independently blinded by a second reader.

RESULTS

Right ventricular inferior wall native T1 and T2 times were significantly higher in patients compared to controls (T1: 1017 ± 96 ms vs. 930 ± 94 ms, p=0.009; T2: 55 ± 6 ms vs. 49 ± 6 ms, p<0.001). Both measures were reproducible with strong repeated measure linear regression correlations for interobserver analysis (T1: r=0.79, p<0.001; T2: r=0.72, p<0.001). There was a weak correlation between T1 values and pulse pressure (r=0.37,p<0.05). No significant correlation was found between T1 or T2 values with CMR-derived RV-ejection fraction, RV-end diastolic volume and RV wall thickness or hemodynamic measures of PAH severity from RHC such as mean pulmonary artery pressure and pulmonary vascular resistance.

CONCLUSION

T1- and T2-maping of the right ventricle is feasible and shows high reproducibility. Future studies with a larger sample size are needed to determine its clinical utility.

CLINICAL RELEVANCE/APPLICATION

T1 and T2-mapping of the RV are potentially novel measures of fibrosis and edema for the assessment of pulmonary arterial hypertension.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ihab R. Kamel, MD, PhD - 2015 Honored Educator
Stefan L. Zimmerman, MD - 2012 Honored Educator
Stefan L. Zimmerman, MD - 2015 Honored Educator

SSG02-03 The Prognostic Value of Coronary Computed Tomography Angiography in Asymptomatic Adults at Intermediate Risk

Tuesday, Dec. 1 10:50AM - 11:00AM Location: S504AB

Participants
Su Jin Hong, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Yeo Koon Kim, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Yeon Wi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Ju Chun, MD, PhD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Il Choi, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The risk stratification methods based on conventional risk factors have limitations to predict the coronary artery disease. The purpose of this study is to evaluate the prognostic value of coronary CT angiography (CCTA) over traditional risk factors and coronary artery calcium score (CACS) in asymptomatic subjects at intermediate risk.

METHOD AND MATERIALS

From January 2006 to December 2007, 1156 asymptomatic patients at intermediate risk who underwent both CACS and CCTA for health surveillance were included. Basic demographic data, medical history, family history, laboratory data were acquired for risk factor assessment. CCTA images were analyzed by 2 cardiac radiologists in consensus. Analysis included degree of stenosis and type of plaque. The follow-up information was obtained from the hospital medical records or data on National health insurance review and assessment service by two trained researchers. Follow-up was made for cardiac events (cardiac death, nonfatal myocardial infarction, unstable angina requiring hospital stay, or revascularization later than 90 days after CCTA).

RESULTS

During a median 76 months of follow-up, the cardiac event occurred in 5.2% (n=60). For the prediction of both cardiac events and major adverse cardiac events (MACE; cardiac death, myocardial infarction and unstable angina), all of the CCTA parameters correlated significantly with outcome (all p<0.01). For the prediction of all cardiac events, the area under curves(AUCs) of Framingham risk score(FRS), FRS with CACS, and FRS with CCTA showed gradual increase (AUC 0.64 for FRS alone, 0.81 for FRS + CACS and 0.91 for FRS + CCTA; all p<0.05). However, the addition of CACS on CCTA with FRS did not add the prediction power (AUC 0.90) to the CCTA with FRS (AUC 0.91). The results for the prediction of MACE were similar. The addition of CACS or CCTA to FRS had the incremental predictive power than FRS alone (AUC 0.65 for FRS alone, 0.80 for FRS + CACS, and 0.91 for FRS + CCTA. all p<0.05). The CACS did not have the incremental value over FRS with CCTA (AUC 0.90 for FRS + CACS + CCTA and 0.91 for FRS + CCTA).

CONCLUSION

CCTA has incremental prognostic value over FRS and CACS in the asymptomatic subjects at intermediate risk.

CLINICAL RELEVANCE/APPLICATION

CCTA has a potential to replace the screening role of CACS in the asymptomatic subjects at intermediate risk.

SSG02-04 Assessment of Semi-automatic Quantification of Non-Calcified Plaque as a Predictor of Outcome in Acute Chest Pain Patients at Coronary CT Angiography

Tuesday, Dec. 1 11:00AM - 11:10AM Location: S504AB

Participants
Andreas Bucher, MD, Frankfurt, Germany (*Presenter*) Nothing to Disclose
Rui Wang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Felix G. Meinel, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Julian L. Wichmann, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Carlo N. De Cecco, MD,PhD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (*Abstract Co-Author*) Research Grant, Bracco Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; ; ;
Aleksander Krazinski, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
James Spearman, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Justin R. Silverman, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Paul Apfaltrer, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the predictive value of quantified non-calcified plaque volume on clinical outcome in acute chest pain patients.

METHOD AND MATERIALS

Total plaque volume was analyzed using semi-automated segmentation software from CTA datasets of 151 acute chest pain patients (90 female; age 59.1±11.0 years). CT series were acquired on a 64 dector-row dual source CT system and reconstructed in 0.75 mm slice thickness. Non-calcified plaque volume (ncPV) was sub-categorized by density: necrotic plaque volume (nPV): -30-75 HU; fibrous fatty plaque volume (ffPV): 76-130 HU; fibrous plaque volume (fPV): 131-350 HU. As a primary endpoint, major adverse cardiac events (MACE) were recorded on follow-up. Total plaque burden (TPB) was calculated as sum of all analyzed coronary segments. Cox proportional-hazards regression, correlation coefficient and student-t tests were used for statistical evaluation.

RESULTS

Twenty-one MACE (14.4% of cases) occurred during follow-up (mean follow-up: 12.1±6.2 months). In patients who experienced MACE ncPV was significantly higher (median: 760.5 mm^3; inter-quartile range: 535.7-873.2 mm^3) compared to patients without MACE (median: 607.2 mm^3; inter-quartile range: 448.8-760.5 mm^3; P=0.024), while TPB was comparable (P=0.220). ffPV was a statistically significant predictor of MACE (P=0.001). Necrotric and fibrous plaque volume did not show significant predictive value (P>0.1).

CONCLUSION

Non-calcified fibrous fatty plaque volume was a significant predictor of subsequent MACE events in acute chest pain patients.

CLINICAL RELEVANCE/APPLICATION

Semi-automated non-calcified plaque quantification might provide reproducible predictive parameters in acute chest pain patients to predict outcome.

SSG02-05 Benefit of Four-Dimensional Computed Tomography Derived Ejection Fraction of the Left Atrial Appendage to Predict Thromboembolic Risk in the Patients with Valvular Heart Disease

Tuesday, Dec. 1 11:10AM - 11:20AM Location: S504AB

Participants
In-Cheol Kim, MD,PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyuk-Jae Chang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Iksung Cho, New York, NY (*Presenter*) Nothing to Disclose
Ran Heo, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyung Bok Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
In-Jeong Cho, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chi Young Shim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Geu-Ru Hong, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong-Won Ha, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young-Jin Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byoung Wook Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namsik Chung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Decreased left atrial appendage (LAA) emptying velocity in transesophageal echocardiography (TEE) is related with higher incidence of thrombus in LAA and increased risk of stroke. Patients with valve disease are at higher risk of thrombus formation before and after surgery. The aim of this study is to investigate the role of four-Dimensional (4D) CT performed for the evaluation of valvular heart disease to predict the risk of thrombus formation.

METHOD AND MATERIALS

Between March 2010 to March 2015, total of 62 patients who underwent 4D CT scan and TEE for cardiac valve evaluation before

surgery in Younsei Cardiovascular Hospital were retrospectively included in the current study. LAA was observed during TEE between 45 to 90 degree. Fractional area change (FAC) in TEE view (FACTEE) and emptying velocity at LAA (VeTEE) was measured. Ejection fraction (EF) of LAA (EFCT) was calculated by 4D CT with full volume analysis. The best cut-off value of EFCT to predict the presence of SEC or thrombus and correlation between the parameters were also estimated.

RESULTS

Mean age was 60 ± 15 years old and 53.2% were male. Spontaneous echo contrast (SEC) or thrombus was observed in 45.2%. Correlation between EFCT and VeTEE was noted (r=0.452, p<0.001). However, FACTEE was not significantly related to VeTEE (r=0.085, p=0.512). EFCT < 37.5% best predicted SEC or thrombus in the patients with valve disease who underwent 4D CT and TEE (AUC = 0.654, p = 0.038, sensitivity = 0.824, specificity = 0.536).

CONCLUSION

In the patients who are undergoing 4D CT before surgery, LAA EF by volume analysis might provide additional benefit to predict the risk of thromboembolic event.

CLINICAL RELEVANCE/APPLICATION

Valve CT with 4D reconstruction might provide useful information predicting SEC or thrombus.

SSG02-06 A Prospective Observational Single Blinded Study on the Role of Preoperative Computed Tomography Coronary Angiogram in Cardiac Risk Stratification in Non-Cardiac Surgery

Tuesday, Dec. 1 11:20AM - 11:30AM Location: S504AB

Participants
Eric You-Ten, MD,PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
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Deep Grewal, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Narinder S. Paul, MD, Richmond Hill, ON (*Presenter*) Research Grant, Toshiba Corporation; Research Grant, Carestream Health, Inc

PURPOSE

To determine the role of wide volume CT Coronary Angiography (CTCA) in assessing the cardiac risk of patients undergoing intermediate and high risk surgery.

METHOD AND MATERIALS

Prospective recruitment of 91 patients undergoing elective intermediate-major non-cardiac surgery and vascular surgery. All patients were seen and assessed in a pre-operative high risk clinic and assigned a Revised Cardiac Risk Index (RCRI). Patients with a RCRI ≥ 1 were eligible for inclusion in the trial. Patients had 12 lead ECG, cardiac stress tests and/or TTE; and all patients had preoperative CTCA using 320x0.5mm detector rows (AqONE, TMS, Japan), 0.35ms GR, 80-135kVp and 350-580mA depending on x-ray absorption profile. MACE were assessed on postoperative days: 0 - 3 and 30 using elevated blood Troponin I plus positive ECG changes, and/or cardiac symptoms, and by telephone for cardiac symptoms requiring medical attention on day 30 (if discharged at home). The results of CTCA were blinded to the clinical team unless high grade disease; severe stenosis (≥ 50%) of left main, critical stenosis (≥70%) of proximal LAD, and/or critical stenosis in ≥ 2 major coronary arteries (2VD)

RESULTS

The physical characteristics, risk factors and medications were similar between patients who were positive for MACE (n=12) and those who were not (n=79). Preoperative CTCA was unblinded in 5 patients of low-intermediate cardiac risk with high grade lesions; left main (2), LAD (2), and 2VD (1). After intervention these 5 patients had their surgery without experiencing MACE. Six blinded patients experienced MACE with an elevated troponin and ischemic ECG within 3 days post-surgery. In these patients, CTCA showed severe 2VD (1 patient) and 3VD (1 patient) and non-significant stenosis (4 patients). One patient died of a fatal MI on postoperative day 31 and CTCA showed non-significant stenosis.

CONCLUSION

CTCA can detect severe and high grade disease in patients assessed as low to intermediate cardiac risk (1-2 RCRI) with conventional methods.

CLINICAL RELEVANCE/APPLICATION

Preoperative CTCA has a promising role in cardiac risk stratification and may lead to development of optimization strategies that improve patient outcome and safety

SSG02-07 CMR in Pulmonary Arterial Hypertension before and after Therapy in Systemic Sclerosis-Induced Pulmonary Arterial Hypertension

Tuesday, Dec. 1 11:30AM - 11:40AM Location: S504AB

Participants
Celia P. Corona-Villalobos, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Kristin Porter, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Stockholder, Pfizer Inc
Paul M. Hassoun, MD, Baltimore, MD (*Abstract Co-Author*) Scientific Advisory Board, Gilead Sciences, Inc
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Ihab R. Kamel, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Stefan L. Zimmerman, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Pulmonary arterial hypertension (PAH) is one of the most lethal complications of systemic sclerosis (SSc) and RV function is the

Pulmonary arterial hypertension (PAH) is one of the most lethal complications of systemic sclerosis (SSc) and RV function is the major determinant of prognosis. Management of systemic sclerosis induced PAH (SSc-PAH) is challenging and despite therapeutic advances, there is still limited evidence that these therapies improve RV function. The purpose of our study was to evaluate whether CMR can identify RV functional changes in response to treatment in patients with SSc-PAH.

METHOD AND MATERIALS

Prospective, multicenter, IRB-approved, HIPAA-compliant study. Twenty-four treatment naïve subjects with SSc-PAH underwent right heart catheterization (RHC) and CMR assessment at baseline and after 36 weeks of treatment with tadalafil (40 mg daily) and ambrisentan (10mg daily). A standard multi-sequence CMR was acquired. All images were analyzed by a single reader on a dedicated workstation for both LV and RV quantitative volumes and function.

RESULTS

Treatment had a significant impact on CMR measurements such as RV end-systolic (ES) volume index, RV stroke volume (SV), RV ejection fraction (EF), RV cardiac index (CI), LV end-diastolic (ED) volume index, LV SV and LV CI. There was also a significant reduction of mean pulmonary arterial pressure (mPAP), pulmonary vascular resistance (PVR) and cardiac output by RHC. Exercise capacity improved significantly after treatment in this cohort (Table 1).

CONCLUSION

Patients treated for SSc-PAH demonstrated significant improvements in RV volumes and function by CMR with corresponding improved hemodynamics on RHC and improved exercise capacity.

CLINICAL RELEVANCE/APPLICATION

CMR can be used to non-invasively monitor improvements in RV function in patients undergoing treatment for SSc-PAH.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ihab R. Kamel, MD, PhD - 2015 Honored Educator
Stefan L. Zimmerman, MD - 2012 Honored Educator
Stefan L. Zimmerman, MD - 2015 Honored Educator

SSG02-08 Clinical Significance of Coexistent Coronary Artery Disease in Hypertrophic Cardiomyopathy Using Coronary CT Angiography

Tuesday, Dec. 1 11:40AM - 11:50AM Location: S504AB

Participants
Yoon Joo Shin, MD, Seongnam, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Sang Il Choi, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Ju Chun, MD, PhD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the prevalence and clinical significance of coexistent coronary artery disease (CAD) in patients with hypertrophic cardiomyopathy (HCM) using coronary CT angiography (CCTA).

METHOD AND MATERIALS

Among the CCTA data registry which was composed of 41,588 consecutive patients with suspected CAD, a total of 248 patients with HCM diagnosed by clinical findings, electrocardiography, and echocardiography were retrospectively enrolled. Using CCTA, we evaluated the obstructive CAD (>50% stenosis) and plaque types (calcified, non-calcified, high-risk plaque [HP]) according to the 16-segment model. HP was defined as plaque density with <30HU and positive remodeling with >1.1, napkin ring sign and spotty calcification. Clinical risk factors and echocardiographic functional parameters were also evaluated from all the patients. The endpoint was defined as cardiac death, myocardial infarction, unstable angina requiring hospitalization, revascularization after 90 days from CCTA, or implantable cardioverter defibrillator insertion.

RESULTS

In patients with HCM, the prevalence of obstructive and non-obstructive CAD was 16.5% and 42.7%, respectively. During the median of 37-months observation period (range; 3-108 months), total cardiac events were occurred in 11.7% of patients with HCM. Using univariate Cox regression analysis, age, family history of previous heart disease, atrial fibrillation, lower ejection fraction (EF < 55%), Framingham risk score, calcium scoring, obstructive CAD and HP were significantly related with cardiac events (all $p<0.05$). After adjustment of these factors, lower EF (hazard ratio [HR], 5.7) and obstructive CAD (HR, 7.3) were independent factors (all $p<0.001$).

CONCLUSION

The prevalence of obstructive CAD was approximately one-fifth of the HCM population, and the presence of obstructive CAD was one of the independent factor for cardiac events. Therefore, the evaluation of CAD should not be overlooked.

CLINICAL RELEVANCE/APPLICATION

In our study, the coexistent CAD was one of the prognostic factor for cardiac events in HCM. In this regard, CCTA is helpful to provide the information not only myocardial hypertrophy but also CAD.

SSG02-09 Association between Late Gadolinium Enhancement and Three Types of Ventricular Tachyarrhythmia in Patients with Hypertrophic Cardiomyopathy

Tuesday, Dec. 1 11:50AM - 12:00PM Location: S504AB

Participants
Yasuo Amano, MD, Tokyo, Japan (*Presenter*) Nothing to Disclose
Fumi Yamada, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
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Shogo Imai, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masaki Tachi, MD, PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Morimasa Takayama, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinichiro Kumita, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Myocardial scarring may be related to ventricular tachyarrhythmia, one of the most serious complications associated with hypertrophic cardiomyopathy (HCM). We aimed to assess the association between late gadolinium enhancement (LGE) on MRI and 3 types of ventricular tachyarrhythmia, including ventricular fibrillation (VF), sustained ventricular tachycardia (SVT) and non-sustained ventricular tachycardia (NSVT), in patients with HCM.

METHOD AND MATERIALS

LGE MRI was performed in 167 patients with HCM. We assessed the association between the 3 types of ventricular tachyarrhythmia and the myocardial LGE, clinical risk markers (e.g., family history of sudden cardiac death [SCD], syncope) and cine MRI data (e.g., ejection fraction, myocardial mass). The myocardial LGE was defined as the region with the mean signal intensity ≥ 6 SD above the remote myocardium. Extent of LGE was estimated based on the American Heart Association (AHA) 17-segment model.

RESULTS

Of the 167 patients with HCM, 8, 4, and 23 had VF, SVT and NSVT, respectively. The remaining 132 patients had no ventricular tachyarrhythmia. Overall, 104 patients (62.3%) had myocardial segments displaying LGE. The patients with NSVT frequently showed a family history of SCD, more risk markers, and more presence and wider extent of LGE compared with patients without tachyarrhythmia ($P < 0.05$). The LGE extent, a family history of SCD and risk markers were significantly related to NSVT ($P < 0.01$), whereas there were no apparent MRI findings related to VF and SVT. The LGE extent ≥ 3 segments was related to the family history of SCD, episode of cardiac arrest and prevention ICD installation for NSVT.

CONCLUSION

There is a significant association between the extent of LGE and NSVT in patients with HCM, but we find no apparent relationship between MRI findings and VF or SVT. We should discriminate between NSVT and the other types of ventricular tachyarrhythmia and be vigilant for the LGE extent when applying LGE MRI to risk stratification for HCM with NSVT.

CLINICAL RELEVANCE/APPLICATION

Extent of late gadolinium enhancement is associated with non-sustained ventricular tachycardia among the 3 types of ventricular tachyarrhythmia in patients with hypertrophic cardiomyopathy.

SSG04

Gastrointestinal (Liver Masses)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: E350

GI CT MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Ernst J. Rummeny, MD, Munich, Germany (*Moderator*) Nothing to Disclose
Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

SSG04-01 Predictive Value of MRI Combined with MR Cholangiography in the Preoperative Assessment of Perihilar Cholangiocarcinoma

Tuesday, Dec. 1 10:30AM - 10:40AM Location: E350

Participants
Claudio Sallemi, MD, Milan, Italy (*Presenter*) Nothing to Disclose
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Paolo Marra, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Luca Aldrighetti, MD, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the predictive value of contrast enhanced MR images with MR cholangiography (MRC) in the preoperative evaluation of perihilar cholangiocarcinoma.

METHOD AND MATERIALS

twenty-five patients that underwent MRI/MRC and surgical treatment were included. Two radiologists evaluated the biliary MR images, including 3D-MRC and gadolinium-enhanced dynamic images, regarding the tumor resectability (including longitudinal tumor extent, vascular involvement of the bile duct cancer, and lymph node metastasis) and the surgical radicality, intended as tumor-free\tumor-involved margins (R0\R1) of biliary ducts and portal vein. The results of preoperative and retrospective (blinded) assessment of diagnostic data were compared with the surgical and pathology findings used as the reference standards.

RESULTS

The prospective assessment of the resection to be performed was correct in 80% of cases. For determining the assessment of tumor margins (R0\R1) of biliary ducts and portal vein, the overall accuracy was, respectively, 84% and 88% for each reviewer. The area under the receiver operating characteristic curve (Az) of the 2 reviewers for evaluation of tumor margins (R0\R1) was 0.83 and 0.78 for biliary ducts, and 0.68 and 0.97 for portal vein. In the assessment of lymph node metastasis, the overall accuracy was 0.75 for each reviewer.

CONCLUSION

MR imaging combined with MRC showed excellent diagnostic capability for assessing the tumor resectability of bile duct cancer, although it generally underestimated the tumor involvement of lymph nodes, and predicted with good diagnostic accuracy surgical radicality.

CLINICAL RELEVANCE/APPLICATION

MRI combined with MRC can predict in advance R0\R1 resection in perihilar cholangiocarcinoma . In case of R1, it can lead to a focused neo adjuvant therapy or change of the treatment strategy.

SSG04-02 Correlation between Standardized Uptake Value and Apparent Diffusion Coefficient in Focal FDG-PET Positive Hepatic Metastasis

Tuesday, Dec. 1 10:40AM - 10:50AM Location: E350

Participants
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Aruna R. Patil, MD, FRCR, Bangalore, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

1)To evaluate a potential correlation of the maximum standard uptake value (SUVmax) and the minimum apparent diffusion coefficient (ADCmin) in FDG-PET positive hepatic metastasis2) To study the role of Diffusion Weighted MR Imaging in patients with FDG-PET positive hepatic metastasis

METHOD AND MATERIALS

Twenty patients with a known and histopathologically proven extrahepatic primary lesion, who were referred for FDG PET and found

to have FDG avid hepatic lesion were enrolled. Regions of interest were drawn on the PET images and SUV mean was calculated. Patients with a SUVmean more than 4 were further imaged with MRI within 30-60 min of acquisition of PET images. Diffusion-weighted imaging was performed with free breathing and with b values of 0, 500, and 800. ADC map was generated using the above raw diffusion data. Regions of interest were manually drawn along the contours of neoplastic lesions, which were identified on PET and diffusion-weighted images. Maximum SUV (SUVmax) and mean SUV (SUVmean) were recorded from PET-CT fusion images using fusion viewer (Philips medical systems).Minimum ADC (ADCmin), and mean (ADCmean) were recorded on MRI workstation for each FDG-avid lesion. Pearson correlation coefficient was used to assess the following relations: SUVmax versus ADCmin and SUVmean versus ADCmean. A total of 33 lesions were studied.

RESULTS

Thirty three lesions were evaluated in a total of 20 patients. The mean SUVmax was 13.5 with standard deviation of 5.1; SUVmean, 8.3 with standard deviation of 3.1; mean ADCmin, 491 with standard deviation of 235; and mean ADCmean, 809 with standard deviation of 263. Pearson correlation coefficient of 0.026 was found between SUVmean and ADCmean. Pearson correlation coefficient of 0.002 was found between SUVmax and ADCmin.

CONCLUSION

There was no correlation between SUVmax and ADCmin or SUVmean and ADCmean. Focal hepatic lesions visualized on PET/CT were visualized clearly with a high contrast in the background of reduced signal from normal liver on b 0,500 and 800 maps of DWI

CLINICAL RELEVANCE/APPLICATION

Liver metastases are the most frequently encountered malignant liver lesions. DWI is a non-contrast technique that is easy to perform, fast, has the potential to provide tissue characterization, and gives qualitative and quantitative information that can be helpful for tumor assessment. DWI gives visually comparable imaging which can be approximated to PET CT

SSG04-03 Improving Detection of Vascular Structure and Intratumoral Hemorrhage in Primary Hepatic Carcinoma with a Multi-breath-hold Susceptibility-weighted Imaging Technique

Tuesday, Dec. 1 10:50AM - 11:00AM Location: E350

Participants
Ling Zhang, MD, Nanning, China (*Presenter*) Nothing to Disclose
Zhongkui Huang, Nanning, China (*Abstract Co-Author*) Nothing to Disclose
Yongming Dai, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Wenmei Li, Nanning, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose is to evaluate the role of abdominal susceptibility-weighted imaging (SWI) in the detection of vascular structure and intratumoral hemorrhage of primary hepatic carcinoma.

METHOD AND MATERIALS

Nineteen patients with pathologically identified primary hepatic carcinoma were imaged at 3T (MAGNETOM Verio, A Tim System, Siemens, Germany) using a standard body matrix-coil. Imaging included precontrast transverse T1-weighted GRE (fiip angle 70°,TR/TE 140/2.46 msec), transverse T2-weighted fat-suppressed 2D turbo-spin-echo (TSE, fiip angle 122°, TR/TE 3700/84 msec, ETL 9) and transverse abdominal 2D SWI (fiip 20°, TR/TE 150/2.5 msec). For all sequences, the following parameters were used: field of view (FOV) 380×285 mm2; matrix 320-384×250, slice thickness 5 mm with a gap of 1 mm. Two to three 15-20 second breath-hold acquisitions were acquired to cover the liver. Two radiologists prospectively analyzed all magnetic resonance imaging (MRI) studies. Vascular structure and hemorrhage detected by each imaging technique were evaluated for comparison.

RESULTS

Nineteen lesions were found in nineteen patients. 2D SWI showed the evidence of hemorrhage in 12 of all 19 cases. SWI displayed vasculature of tumors in 11 cases. Only 5 cases found vasculature in conventional sequences. On 2D SWI, the hemorrhage or vasculature in the lesions manifested dot-like, streak, circular areas with hypointensity signal. In the evaluation of blood products, SWI is superior to the conventional T1WI and T2WI for visualizing the intra vascular structure and hemorrhage ($X2 = 4.17$, $P < 0.05$). There was close correlation between pathological results and SWI in depicting internal architecture of lesions.

CONCLUSION

SWI surpassed conventional MRI sequences in discovering vascular structure in tumor and intratumoral hemorrhage. SWI offers a new way to show the internal structures of primary hepatic carcinoma. It is more useful than conventional MRI in showing blood products and details of tumor related veins.

CLINICAL RELEVANCE/APPLICATION

SWI offers a new way to show the internal structures of primary hepatic carcinoma. It is more useful than conventional MRI in showing blood products and details of tumor related veins.

SSG04-04 Subtraction Images of Gadoxetic Acid-enhanced MR: The Impact on Image Interpretation of Focal Hepatic Lesions in Patients at Risk for HCC

Tuesday, Dec. 1 11:00AM - 11:10AM Location: E350

Participants
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Yong Moon Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Moon-Gyu Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the impact of subtraction images of gadoxetic acid-enhance on image interpretation of hepatic lesions in patients at risk for hepatocellular carcinomas (HCC)

METHOD AND MATERIALS

We retrospectively identified 228 patients (181 men, 47 women; mean age, 55.2 years) with chronic viral hepatitis or liver cirrhosis who underwent gadoxetic acid-enhanced liver MR for the evaluation of focal hepatic lesions and then hepatic resection. The patients were confirmed to have 243 focal hepatic lesions including 227 HCCs, and 16 cholangiocarcinomas. We compared the detection rate of arterial hypervascularity on subtraction images and that on visual assessment of arterial phase images. Subgroup analysis was performed according to the pathology and the size of the lesions (≤ 3 cm vs. > 3 cm). We assessed the impact of subtraction images in diagnosing HCC according to the American Association for the Study of Liver Diseases (AASLD) guidelines in comparison with that of visual assessment.

RESULTS

Subtraction images (92.6%, 225/243) detected arterial hypervascularity of all the focal hepatic lesions more sensitively than visual assessment (85.6%, 208/243; P = .001). On the subgroup analysis according to the pathology, the same trend was also observed in HCC (96.0% vs. 90.3%, P = .011), and in cholangiocarcinomas (43.8% vs. 18.8%, P = .125). In the 113 lesions ≤ 3 cm, subtraction images (91.2%, 103/113) depicted arterial hypervascularity significantly better than visual assessment (81.4%, 92/113; P = .013), while they did not significantly differ in detecting arterial hypervascularity in the 130 large lesions (> 3 cm, P = .109). When we included arterial hypervascularity detected on subtraction images, it increased the sensitivity from 86.3% to 92.5% in diagnosing HCCs with the increased false positive rate from 0.8% to 2.5%.

CONCLUSION

Subtraction images can enhance the sensitivity of the non-invasive diagnosis of HCC by detecting arterial hypervascularity more sensitively especially in small focal hepatic lesions, with minimal increase in a false positive rate.

CLINICAL RELEVANCE/APPLICATION

Subtraction images may be considered as an option to enhance the diagnostic performance of the noninvasive diagnosis for HCC.

SSG04-05 Is Contrast-Enhanced Ultrasound Comparable to MRI with Liver-Specific Contrast Agent for Diagnosis of Focal Nodular Hyperplasia and Hepatocellular Adenoma?

Tuesday, Dec. 1 11:10AM - 11:20AM Location: E350

Participants
Krishan Ramsaransing, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Roy S. Dwarkasing, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Francois Willemssen, MD, Hoogstraten, Belgium (*Presenter*) Nothing to Disclose
Marianne De Vries, MD, Maastricht, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of contrast-enhanced ultrasonography (CEUS) with MRI with gadobenate dimeglumine (CEMRI) for the diagnosis of focal nodular hyperplasia (FNH) and hepatocellular adenoma (HCA) in a tertiary referral center for hepatobiliary diseases.

METHOD AND MATERIALS

One hundred-nineteen patients (111 female and 8 male, mean age 39 years) referred to a tertiary center for hepatobiliairy diseases were included. Patients had undergone standard diagnostic work-up with CEUS and CEMRI for the diagnosis of FNH or HCA. Final diagnosis was considered correct when outcome of CEUS and CEMRI were concordant. Histopathologic assessment (PA) followed in case of discrepancy between outcome of CEUS and CEMRI. CEMRI was considered as the reference method for final diagnosis when lesion biopsy for PA was considered undesirable or contra-indicated. Agreement between CEUS and CEMRI was calculated with Cohen's kappa and sensitivity, specificity, predictive values and likelihood ratios were calculated for CEUS and CEMRI.

RESULTS

Outcomes of CEUS and CEMRI were concordant in the majority of patients (n=80, 67%) (p<0.001) with an unweighted kappa of 0.34 (95% CI 0.20-0.49). In case of discrepancy between CEUS and CEMRI (n=39, 33%), PA followed in fourteen cases (12% of total), where CEMRI was correct in thirteen cases (93%) and CEUS in one case (7%) (p=0.002). In the remaining twenty-five cases (21% of total), CEMRI was considered as reference for final diagnosis. For HCA, sensitivity was 64% (95% CI 48% - 78%) with CEUS and 100% (95% CI 92% - 100 %) with CEMRI. For FNH, sensitivity was 67% (95% CI 55% - 77%) with CEUS, and 99% (95% CI 93% - 100%) with CEMRI.

CONCLUSION

In our study, agreement between CEUS and CEMRI was fair and the diagnostic performance of CEUS was inferior to CEMRI for diagnosis of FNH and HCA, especially with emphasis on PA proven cases.

CLINICAL RELEVANCE/APPLICATION

In case of discordance between CEUS and CEMRI, it may be justifiable to be prudent with liver biopsy and prefer CEMRI-outcome as final diagnosis, especially when the diagnosis on CEMRI is firm.

SSG04-06 Hypoenhancement on Delayed Phase Contrast-enhanced MRI is a More Sensitive Sign of Malignancy in Colorectal Cancer Patients with Intravascular Contrast Agent, Gadofosveset, Than with Extracellular Contrast Agent, Gadobutrol

Tuesday, Dec. 1 11:20AM - 11:30AM Location: E350

Participants

Helen Cheung, MD, Toronto, ON (*Presenter*) Nothing to Disclose
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PURPOSE

Hypoenhancement on delayed phase contrast-enhanced MRI using extracellular contrast agents, such as gadobutrol, is often used as a sign to diagnose colorectal liver metastases. Some studies have suggested that MRI with intravascular contrast agent, gadofosveset, may be useful in diagnosing focal liver lesions. The goal of this study is to determine the diagnostic accuracy of this sign using gadofosveset versus gadobutrol.

METHOD AND MATERIALS

This is an interim analysis on an institutional REB-approved, prospective study. Patients with known colorectal cancer referred for a clinical gadobutrol-enhanced MRI at our institution met inclusion criteria for our study. Patients with known contraindication to MRI or MR contrast agents were excluded. Patients received both gadobutrol- and gadofosveset-enhanced liver MRI's, performed within 4 weeks of each other. Lesion-liver contrast-to-noise ratios (CNR) of all solid focal liver lesions (cysts were excluded) were measured on 10-minute delayed phase imaging for both contrast agents. Lesions with CNR<0 were considered hypoenhancing and lesions with CNR≥0 were considered hyperenhancing. We calculated the sensitivity, specificity, and likelihood ratio's of the ability of hypoenhancement to predict malignancy. Weighting was performed to account for the effects of clustering. The generalized estimating equation (GEE) was used to determine the effect of the contrast agent on the ability of the sign to predict malignancy.

RESULTS

There were a total of 265 lesions from 14 patients. The weighted sensitivity and specificity of gadofosveset was 89.2% (SD: 25.0%) and 81.3% (SD: 37.2%) respectively, which corresponds to positive and negative likelihood ratio's of 4.76 and 0.13, respectively. The weighted sensitivity and specificity of gadobutrol 41.6% (SD: 40.9%) and 98.1% (5.6%), which corresponds to positive and negative likelihood ratios of 22.5 and 0.59. In the GEE model, hypoenhancement on delayed phase significantly predicted malignancy (p=0.005) as did the interaction of hypoenhancement and contrast agent (p=0.006).

CONCLUSION

Hypoenhancement on delayed phase contrast-enhanced MRI with gadofosveset is a more sensitive sign of malignancy in colorectal cancer patients than with gadobutrol.

CLINICAL RELEVANCE/APPLICATION

Delayed phase gadofosveset-enhanced MRI may be a helpful problem-solving tool for excluding malignancy in colorectal cancer patients.

SSG04-07 Accuracy of the Extended Washout of Gadoxetic-Acid for Distinguishing Hypervascular Hepatic Metastases from Hemangiomas on MRI

Tuesday, Dec. 1 11:30AM - 11:40AM Location: E350

Participants
Sheela Agarwal, MD, MS, Boston, MA (*Presenter*) Subsequent to the conduct of this research, speaker has become an employee of Bayer HC.
Cinthia Cruz, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Joseph R. Grajo, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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Peter F. Hahn, MD, PhD, Belmont, MA (*Abstract Co-Author*) Stockholder, Abbott Laboratories Stockholder, Medtronic, Inc Stockholder, CVS Caremark Corporation Stockholder, Kimberly-Clark Corporation Stockholder, Landauer, Inc

PURPOSE

The extended washout sign, slow de-enhancement of liver lesions in early hepatobiliary phase, has been proposed to help distinguish hemangiomas from conventional metastases. The intent of this study was to test this sign for hypervascular metastases.

METHOD AND MATERIALS

This IRB approved retrospective study performed quantitative and qualitative image analysis of 24 patients with proven neuroendocrine liver metastases, together with data on 45 hemangioma patients and 39 with hypovascular metastases already reported. Gadoxetic-acid MR imaging was obtained during arterial and portal-venous phase, and delays of 3, 8, and 20 minutes. During each phase, signal intensities were measured for the lesion, liver, and aorta, and were normalized by paraspinal musculature. Quantitatively, extended washout was defined as a 10% change in signal intensity from 8 to 20 minutes. Statistical analysis was performed using paired Student's t-test. Qualitative analysis was performed by one reader, who assessed the appearance of all lesions on T2-weighted images alone, dynamic images alone, and combined early (8 min) and late (20 min) hepatobiliary phases. Extended washout was defined as a perceptible change in signal from 8 to 20 minutes.

RESULTS

On quantitative analysis, 84% (n=38) of hemangiomas demonstrated a positive extended washout sign while only 8% (n=2) of hypervascular metastases, and 4% (n=7) of hypovascular metastases did. Hemangiomas demonstrated a mean change in signal intensity of 18.4% as compared to 5.5% for hypervascular metastases (p<0.05). Qualitatively, 78% of hemangiomas demonstrated a perceptible change is signal from 8 to 20 minutes, but only 4.1% of metastases did. 67% of hemangiomas demonstrated peripheral nodular enhancement during dynamic phases and 87% demonstrated classic T2 hyperintensity. Arterial enhancement of the metastases was appreciated with gadoxeticacid in 83% of the cases. When extended washout was used in combination with T2 hyperintensity, specificity increased to 98%, with a sensitivity of 96%.

CONCLUSION

The extended washout sign on gadoxetic acid-enhanced MRI can be applied to hypervascular as well as to non-hypervascular liver metastases to help in distinguishing them from hemangiomas.

CLINICAL RELEVANCE/APPLICATION

Extended washout sign, particularly when used in conjunction with T2 signal intensity, can be used to increase accuracy of differentiating hemangiomas from metastases on gadoxetate-enhanced MRI.

SSG04-09 Fully Integrated PET/MRI for the Colorectal Cancer Liver Metastases: Diagnostic Performance and Prognostic Value

Tuesday, Dec. 1 11:50AM - 12:00PM Location: E350

Participants
Dong Ho Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jeong Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Grant, Guerbet SA; Support, Siemens AG; Support, Koninklijke Philips NV ; Grant, Bayer AG; Consultant, Bayer AG; Grant, General Electric Company; Support General Electric Company; Grant, STARmed Co, Ltd; Grant, RF Medical Co, Ltd; Grant, Toshiba Corporation; Grant, Dong-Seo Medical Industrial Col, Ltd
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Bo Yun Hur, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic performance and prognostic value of fully integrated PET/MRI in patients with colorectal cancer liver metastases (CRLMs)

METHOD AND MATERIALS

between January 2013 and June 2014, 55 patients with 98 CRLMs who underwent fully integrated PET/MRI and MDCT were included in this study. Among these CRLMs, 66 CRLMs in 34 patients were diagnosed by histopathology after hepatic resection, and 32 CRMLs in 21 patients were diagnosed by follow-up imaging. Among the 34 patients who underwent hepatic resection for CRLMs, 17 patients received neoadjuvant chemotherapy (NAC) and then followed by surgery. Two board-certificated radiologists independently and randomly assessed both MDCT and fully integrated PET/MRI for detection of CRLMs. In order to compare the diagnostic performance of PET/MRI for detecting CRLMs to MDCT, jackknife alternative free-response receiver-operating characteristic (JAFROC) and generalized estimating equations (GEE) were used. For the evaluation of prognostic value of PET, we analyzed recurrence-free survival in17 patients who underwent NAC and followed by hepatic resection for CRLMs.

RESULTS

reader average figure-of-merit of PET/MRI was significantly higher than that of MDCT for detecting CRLMs (0.842 for MDCT vs. 0.932 for PET/MRI, P=0.004). Sensitivity per tumor as well as per patients of PET/MRI was also significantly higher than those of MDCT in both two readers. Especially, PET/MRI showed significantly higher sensitivities for CRLMs ≤1cm and CRLMs treated by NAC in both tow readers. According to the PET imaging findings of PET/MRI, six of 17 patients who underwent NAC were classified as having iso-metabolic CRLMs on PET, while 11 patients as having hyper-metabolic CRLMs. 1-year recurrence-free survival rate was 80.0% in 6 patients with iso-metabolic CRLMs, compared to 15.2% in 11 patients with hyper-metabolic CRLMs: this difference was statistically significant (P=0.034).

CONCLUSION

fully integrated PET/MRI can provide significantly higher diagnostic performance for detecting CRLMs compared to MDCT, especially for small CRLMs and CRLMs treated by NAC. PET imaging findings of PET/MRI after NAC was a significant affecting factor for recurrence-free survival after hepatic resection.

CLINICAL RELEVANCE/APPLICATION

fully integrated PET/MRI can be helpful for patients with CRLMs.

SSG06

ISP: Genitourinary (Imaging Gynecological Malignancy)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: N229

GU MR OI BQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Susanna I. Lee, MD, PhD, Boston, MA (*Moderator*) Nothing to Disclose
Andrea G. Rockall, MRCP, FRCR, London, United Kingdom (*Moderator*) Nothing to Disclose

Sub-Events

SSG06-01 Genitourinary Keynote Speaker: Gynecologic Cancer Imaging-Present and Future

Tuesday, Dec. 1 10:30AM - 10:40AM Location: N229

Participants
Susanna I. Lee, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

ABSTRACT

The past decade has seen the development of MRI and FDG PET-CT, both of which now play central and complementary roles in treatment planning and followup of women with uterine, ovarian and vulvar cancer. Ongoing investigations of novel techniques such as diffusion and perfusion imaging, and of PET tracers capable of targeting hypoxia and hormone receptors, will push cancer radiology firmly into the realm of the molecular, quantitative and predictive in the coming decade. PET-MRI, capable of concurrent multi-modality functional imaging, will likely prove to be a mainstay in personalized gynecologic cancer care.

Honored Educators

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Susanna I. Lee, MD, PhD - 2013 Honored Educator

SSG06-02 High Grade Serous Ovarian Cancer: BRCA Mutation Status and CT Imaging Phenotypes

Tuesday, Dec. 1 10:40AM - 10:50AM Location: N229

Participants
Stephanie Nougaret, MD, New York, NY (*Presenter*) Nothing to Disclose
Yuliya Lakhman, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hebert Alberto Vargas, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Maura Micco, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Melvin D'Anastasi, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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Ramon E. Sosa, BA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Krishna Juluru, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Noah Kauff, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hedvig Hricak, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Evis Sala, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the associations between BRCA mutation status and preoperative CT imaging phenotypes in women with high-grade serous ovarian cancer (HGSOC).

METHOD AND MATERIALS

115 patients with HGSOC (76 BRCA mutation-positive and 39 BRCA mutation-negative) and CT scans prior to the primary cytoreductive surgery were included in this retrospective HIPAA-compliant study. Two radiologists (R1 and R2) independently reviewed all CT scans and R1 determined total measurable peritoneal tumor volume (TPTV) for each patient. Associations between BRCA mutation status, CT imaging features, and TPTV were analyzed using Fisher exact test and Mann Whitney test. Inter-reader agreement was assessed with the Cohen's kappa. Kaplan-Meier and Cox proportional hazards regression survival analyses were performed.

RESULTS

BRCA mutation-positive HGSOC had less frequent peritoneal disease, mesenteric infiltration, and lymphadenopathy at CT ($p = 0.0002$, < 0.0001-0.03, 0.03 for both readers, respectively). Furthermore, the pattern of peritoneal implants was correlated with the BRCA mutation status: nodular pattern was more common in BRCA-associated tumors whereas infiltrative pattern was more frequent in sporadic tumors ($p = 0.0009$ and $p = 0.0005$ for R1 and R2, respectively). BRCA mutation-positive HGSOC had higher mean TPTV (125 cm3 ± 171) than sporadic tumors (56 cm3 ± 95) ($p<0.001$). Irrespective of BRCA mutation status, mesenteric involvement by tumor was associated with shorter progression-free survival ($p <0.0001$ for both readers) and overall survival ($p<0.0002$ and $p<0.0001$ for R1 and R2, respectively).

CONCLUSION

BRCA mutation status in HGSOC was linked to the distinct CT imaging phenotypes. Mesenteric disease at CT was an independent

predictor of reduced survival in both BRCA mutation-positive and sporadic tumors.

CLINICAL RELEVANCE/APPLICATION

BRCA-associated HGSOC have characteristic prognostically significant morphology on CT.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Stephanie Nougaret, MD - 2013 Honored Educator
Evis Sala, MD, PhD - 2013 Honored Educator

SSG06-03 Advanced Cervical Cancer: Quantitative Assessment of Early Response to Neoadjuvant Chemotherapy with Intravoxel Incoherent Motion Diffusion-weighted Magnetic Resonance Imaging

Tuesday, Dec. 1 10:50AM - 11:00AM Location: N229

Participants
Yanchun Wang, Wuhan, China (*Presenter*) Nothing to Disclose
Dao Y. Hu, MD, PhD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the utility of intravoxel incoherent motion (IVIM) diffusion-weighted magnetic resonance imaging (MRI) for predicting and monitoring the response of cervical cancer to neoadjuvant chemotherapy (NACT).

METHOD AND MATERIALS

This prospective study was approved by an institutional review board, and informed consent was obtained from all patients. A total of 42 patients with primary cervical cancer were recruited into this study. IVIM diffusion-weighted MRI was performed on all patients at three time points (prior to NACT, 3 weeks after the first NACT, and 3 weeks after the second NACT).The response to treatment was determined according to the Responded Evaluation Criteria in Solid Tumors (RECIST) three weeks after the second NACT treatment, and the subjects were categorized into responders and non-responders. The standard ADC, true diffusion coefficient (D), perfusion-related pseudo-diffusion coefficient (D*), and perfusion fraction (f) values were determined.

RESULTS

Patients were divided into responders (n=24) and non-responders (n=18) according to the RECIST guidelines. Before treatment, the D and standard ADC values were significantly higher in responders than in non-responders (both $p<0.01$). No significant differences were observed in D* and f . Analysis of the receiver operating characteristic (ROC) curves indicated that the threshold of $D<0.93\times10\text{-}3mm2/s$ and the standard $ADC<1.11\times10\text{-}3mm2/s$ could be used to differentiate responders from non-responders, yielding area under curve (AUC) values of 0.804 and 0.768, respectively. Three weeks after both the first and second NACT treatments, the D and standard ADC values in the responders were still significantly higher than those in the non-responders.D* and f values still showed no significant differences.The ROC curve analysis indicated that the AUC values for D and standard ADC were 0.823 and 0.763 for the second time point and 0.787 and 0.794 for the last time point.

CONCLUSION

IVIM may be useful for predicting and monitoring the efficacy of NACT in cervical cancer. D and standard ADC values could represent reliable early predictors of the NACT response prior to treatment. Furthermore, these parameters can be used to monitor NACT responses during and after therapy.

CLINICAL RELEVANCE/APPLICATION

These results should be useful for both patients and clinical doctors. Patients who are unsuitable for NACT could be given radiation or surgical treatment in a more timely manner.

SSG06-04 Prognostic Value of Diffusion-weighted MRI and PET/CT During Concurrent Chemoradiotherapy in Uterine Cervical Cancer

Tuesday, Dec. 1 11:00AM - 11:10AM Location: N229

Participants
Jung Jae Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chan Kyo Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byung Kwan Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the prognostic value of diffusion-weighted MRI (DWI) and PET/CT during concurrent chemoradiotherapy (CCRT) of cervical cancer for predicting disease progression.

METHOD AND MATERIALS

This retrospective study included 67 consecutive patients (median age, 55 years; range, 28-78 years) who received CCRT for locally advanced cervical cancer. All patients underwent both 3T-DWI and PET/CT before and during (at 4 weeks) treatment. The mean apparent diffusion coefficient (ADC) and maximum standardized uptake value (SUVmax) were measured on the tumors and the percentage changes of each parameter between the two time points (ΔADC and ΔSUVmax) were calculated. In the prediction of disease progression, the diagnostic performance of tumor ΔADC and ΔSUVmax was evaluated using the time-dependent receiver operating characteristics (ROC) curve analysis. The relationship between disease progression and clinical and imaging parameters was investigated using univariate and multivariate Cox regression analyses.

RESULTS

During a mean follow-up of 2.7 years, disease progression was identified in 16 patients (23.9%): local recurrence (n= 7), distant metastasis (n= 8) and both local recurrence and distance metastasis (n= 1). During treatment, the mean ADC and SUVmax significantly increased and decreased, respectively (both P < 0.001). The mean ΔADC and ΔSUVmax were 42.6 ± 17% and 67.6 ± 16.5%, respectively. In the prediction of disease progression, the integrated area under the curve of ΔADC (0.791) and ΔSUVmax (0.781) were not significantly different (P = 0.88) and the optimal cut-offs of ΔADC and ΔSUVmax were 35.1% and 60.7%, respectively. On multivariate Cox regression analysis, the ΔADC (< 35.1%) and ΔSUVmax (< 60.7%) were the only independent predictors of disease progression after treatment (hazard ratio, 4.1 and 4.5; P , 0.04 and 0.03, respectively).

CONCLUSION

The percentage changes of DWI and PET/CT parameters during CCRT offer similar prognostic value for the prediction of post-treatment disease progression in patients with cervical cancer.

CLINICAL RELEVANCE/APPLICATION

DWI, as a noninvasive tool, can be used in the prediction of therapeutic outcomes following concurrent chemoradiotherapy in patients with cervical cancer, instead of PET/CT with the risk of ionizing radiation exposure.

SSG06-05 Application of Non-Gaussian Water Diffusional Kurtosis Imaging in the Assessment of Uterine Tumors: A Preliminary Study

Tuesday, Dec. 1 11:10AM - 11:20AM Location: N229

Participants
Aliou A. Dia, MD, Suita, Japan (*Presenter*) Nothing to Disclose
Masatoshi Hori, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiromitsu Onishi, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Makoto Sakane, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Takahiro Tsuboyama, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Mitsuaki Tatsumi, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoyuki Okuaki, RT, Chuo-Ku, Japan (*Abstract Co-Author*) Employee, Koninklijke Philips NV

PURPOSE

To retrospectively evaluate the feasibility and the value of diffusional kurtosis imaging (DKI) in the assessment of uterine tumors compared with that of conventional diffusion weighted imaging (DWI) and with pathological findings as gold-standard.

METHOD AND MATERIALS

Sixty-one women (mean age: 54.85 years ±14.09, range 26-89 years) with histopathologically proven uterine cancers (51 cervical cancers and 10 corpus cancers) underwent 3-T MR imaging using DKI with high b values (b=700, 1000, 1700 and 2500 s/mm2) and DWI (b=0 s/mm2, b=700 s/mm2). Thirteen of the 61 patients (21.3 %) had coexisting leiomyomas.ROI-based measurements of diffusivity (D), kurtosis (K) and ADC of the uterine cancers, leiomyomas, healthy myometrium and endometrium were performed.The areas under the ROC curve (AUC) in differentiating malignant from benign lesions were also compared.

RESULTS

Mean D of uterine cancers (0.879 mm/s2 ± 0.30) was significantly lower than that of the leiomyomas (1.174 mm/s2±0.43) (P=0.006), the healthy myometrium (1.178 mm/s2± 0.27) (P=0.000) and the healthy endometrium (1.308 mm/s2±0.5) (P=0.013). Mean K of uterine cancers (0.754 mm/s2± 0.22) was moderately higher than that of leiomyomas (0.686 mm/s2± 0.24), the healthy myometrium (0.708 mm/s2± 0.19) and the healthy endometrium (0.568mm/s2± 0.25).No significant difference was found between the mean K of the uterine cancers, the leiomyomas, the healthy myometrium and endometrium (P=0.33, 0.27 and 0.23).There was no significant difference in AUC between D and ADC.

CONCLUSION

D is not superior or inferior to the conventional ADC in the differentiation between benign and malignant uterine lesions. The K that is related to the microstructural complexity was higher in uterine cancers than that of leiomyomas but without any significant difference, opposite to K values in white matter tissue of the brain, in breast or prostate cancers where the mean K of malignant lesions was significantly higher than of the benign lesions.

CLINICAL RELEVANCE/APPLICATION

The D, in non-Gaussian DKI, is equal to the conventional ADC in differentiating benign from malignant uterine lesions. The K of uterine malignant tumors was not significantly higher than that of the benign lesions, unlike in breast or prostate cancers.

SSG06-06 Clinical Value of Proton (1H-) Magnetic Resonance Spectroscopy (MRS) Using Body-phased Array Coil at 3.0 T in Pretreatment Assessment for Cervical Cancer Patients

Tuesday, Dec. 1 11:20AM - 11:30AM Location: N229

Participants
Gigin Lin, MD, Guishan, Taiwan (*Presenter*) Nothing to Disclose
Yu-Ting Huang, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Koon-Kwan Ng, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Yu-Chun Lin, MSC, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
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Hung-Hsueh Chou, MD, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Angel Chao, MD, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Chiun-Chieh Wang, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Chyong-Huey Lai, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Pen-An Liao, MD, Taipei City, Taiwan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the clinical value of proton (1H-) magnetic resonance spectroscopy (MRS) using body-phased array coil at 3.0 T, in pretreatment assessment for cervical cancer patients.

METHOD AND MATERIALS

We prospectively enrolled 52 histology proven cervical cancer patients (age 27-80 years) and 30 age-matched surgical candidates for benign uterine myoma without evidence of cervical cancer. Pretreatment MR study plus MRS and diffusion weighted imaging (DWI) sequences were carried out at a 3.0 T system using body-phased array coil for the pelvis. PRESS localized 1H-MRS was applied to cervical tumor or normal tissue, with resonances analyzed by using the LC-Model algorithm. Cramer-Rao lower bound (CRLB) threshold of 20% was used as quality control. We compared resonances based on: (1) tumor vs normal cervical tissue, (2) histopathology type (squamous vs adenocarcinoma) (3) T stage = IIb (4) nodal metastasis (5) distant metastasis using Mann-Whitney test.

RESULTS

Cervical tumor showed a lower 1.3-ppm lipid level (0.30 vs 1.01μM, $P < .05$), as compared with normal cervical tissue. Squamous cell carcinoma demonstrated lower levels in 1.3-ppm lipid (0.17μM vs 0.59μM, $P < .05$) and 0.9-ppm lipid (0.04μM vs 0.16μM, $P < .05$), as compared with adenocarcinoma. Tumor with T stage >= IIb had lower levels in 1.3-ppm lipid (0.15μM vs 0.53μM, $P < .05$), 0.9-ppm lipid (0.04μM vs 0.15μM, $P < .05$) and total choline (0.04μM vs 0.16μM, $P < .05$). Tumors with nodal metastasis contained lower levels of 1.3-ppm lipid (0.16μM vs 0.44μM, $P < .05$) and glutamine (0.01μM vs 0.02μM, $P < .005$), whereas tumors with distant metastasis contained a lower level of 1.3-ppm lipid (0.12μM vs 0.50μM, $P < .05$). However, resonances from cervical tumor were independent to maximal tumor size or ADC value on MRI.

CONCLUSION

1H-MRS using body-phased array coil at 3.0 T in cervical cancer patients is useful in differentiating tumor, histopathology type, T stage >= IIb, nodal or distant metastasis, and is independent to maximal tumor size or ADC value on MRI.

CLINICAL RELEVANCE/APPLICATION

1H-MRS using body-phased array coil at 3.0 T added additional dimensions for pretreatment assessment in cervical cancer patients.

SSG06-07 Impact of Multiparametric MRI (mMRI) on the Therapeutic Management of Suspicious Adnexal Masses Detected by Transvaginal Ultrasound (TVUS)

Tuesday, Dec. 1 11:30AM - 11:40AM Location: N229

Participants
Simone Schrading, MD, Aachen, Germany (*Presenter*) Nothing to Disclose
Sabine M. Detering, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Dirk Bauerschlag, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Incidental adnexal masses at TVUS are common and diagnostically challenging. The primary goal of imaging is accurate tissue characterization to guide further management, i.e. the choice between plain follow-up vs laparoscopic surgery vs. open surgery. Aim of this study was to evaluate the diagnostic utility of mMRI for further management stratification in patients with such adnexal masses

METHOD AND MATERIALS

Prospective IRB-approved trial on 126 women (mean age 54.6 years) with inconclusive adnexal masses at TVUS. All women underwent conventional work up, including pelvic examination, TVUS, and CA-125 levels. In addition, all women underwent mMRI at 3T with high resolution T2-TSE in three planes, DWI (max. b-800) and DCE. Likelihood of malignancy and appropriate management (i.e. follow-up vs. laparoscopic vs. open surgery) was first determined based on results of conventional methods, and then, independently, based on mMRI. Then, all methods were reviewed in synopsis. Final surgical pathology served as standard-of-reference or clinical and imaging follow-up of at least 24 months

RESULTS

In 65% (82/126) of patients the adnexal mass finally classified as benign, in 29% (36/126) as malignant and in 6% (8/126) as borderline. The diagnostic indices for TVUS+CA-125 alone vs. MRI alone vs. all methods combined were as follows: Sensitivity: 86% (31/36) vs. 97% (35/36) vs. 100% (36/36); Specificity: 32% (29/90) vs. 83% (75/90) vs. 80% (68/90); PPV: 34% (31/91) vs. 70% (35/50) vs. 74% (40/54), NPV: 65% (29/44) vs. 98% (75/76) vs. 100% (72/72). After mMRI, the therapeutic management was changed in 41/126 (34%) of patients. In 30 patients in whom surgery had been recommended based on conventional assessment, mMRI correctly diagnosed typical benign findings; these patients underwent follow-up instead of surgery. None of these women developed malignancy during follow-up. In another 11 patients, mMRI results correctly suggested malignancy such that open surgery was performed instead of laparoscopic surgery

CONCLUSION

Compared with conventional assessment (pelvic exam, TVUS, CA-125), mMRI correctly changed the management in one-third of women with incidental adnexal masses. It helps avoid unnecessary surgery, or unnecessary surgical steps (conversion from laparoscopic to open surgery)

CLINICAL RELEVANCE/APPLICATION

Pelvic mMRI helps to significantly improve clinical management of asymptomatic women with incidental adnexal masses identified on TVUS

SSG06-08 Preoperative Tumor Texture Analysis from MRI Predicts Deep Myometrial Invasion and High Risk Histology in Endometrial Carcinomas

Tuesday, Dec. 1 11:40AM - 11:50AM Location: N229

Participants

Sigmund Ytre-Hauge, MD, Bergen, Norway (*Presenter*) Nothing to Disclose
Erik Hanson, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Arvid Lundervold, MD, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Jone Trovik, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Helga Salvesen, MD, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose
Ingfrid S. Haldorsen, MD, PhD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tumor heterogeneity is a key feature of malignant disease. Heterogeneity in MR images can be quantified by texture analysis. We aimed to explore whether high risk histological features are reflected in texture parameters derived from preoperative MRI in endometrial carcinomas.

METHOD AND MATERIALS

Preoperative pelvic contrast-enhanced MRI (1.5T) including diffusion-weighted imaging (DWI) was prospectively performed in 99 patients with histologically confirmed endometrial carcinomas. Tumor region of interest (ROI) was manually drawn encircling the uterine tumor on axial T1-weighted contrast-enhanced (CE) series on the slice displaying the largest cross-section tumor area. Histogram based texture features (standard deviation, skewness and kurtosis) were calculated from these tumor ROIs. Texture parameters were analyzed in relation to established histological subtype and grade, surgicopathological staging parameters (deep myometrial and cervical stroma invasion and lymph node metastases) and MRI based tumor volume and tumor apparent diffusion coefficient (ADC) value using Mann-Whitney U test, Jonckheere-Terpsta trend test and Pearson's bivariate correlation test.

RESULTS

Large standard deviation (SD) in the tumor ROIs was significantly associated with presence of deep myometrial invasion (p=0.009). Lower values for skewness were observed in the tumor ROIs from endometrioid high grade tumors (p=0.012) and from non-endometrioid tumors (by definition always high grade lesions, p=0.020). Kurtosis was positively correlated to tumor volume (r= 0.27; p=0.006) and negatively correlated to tumor ADC value (r=-0.28; p=0.006).

CONCLUSION

MRI derived tumor texture features reflecting tumor heterogeneity are significantly related to high risk histology and predict deep myometrial invasion in endometrial carcinomas. Thus, tumor texture features based on MRI represent promising biomarkers to aid preoperative tumor characterization for risk stratified surgical treatment.

CLINICAL RELEVANCE/APPLICATION

Tumor texture features derived from MRI reflect high risk endometrial carcinoma and may aid preoperative risk classification for stratified surgery.

SSG06-09 Endometrial Cancer MR Staging Accuracy in a Large Multi-site UK Cancer Network Over Three Years: Can the Reported Single Centre Staging Accuracies be Met in Clinical Practice?

Tuesday, Dec. 1 11:50AM - 12:00PM Location: N229

Participants
Neil Soneji, BSC, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Annarita Ferri, MD, Chieti, Italy (*Presenter*) Nothing to Disclose
Victoria Stewart, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Roberto Dina, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Nishat Bharwani, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrea G. Rockall, MRCP, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the radiological staging accuracy of endometrial cancer (EC) from images acquired from multiple MR scanners across a 10 centre UK cancer network over three years.

METHOD AND MATERIALS

Retrospective study of 382 consecutive patients with EC imaged in 9 external hospitals and 3 internal hospital sites discussed at our tertiary gyne-oncology centre between October 2011-October 2014. All patients with tertiary centre reports for both final histology and MRI were included (n=270). The radiological stage provided at MDT discussion was compared to the 'gold standard' histological report. Parameters assessed included depth of myometrial invasion, cervical and nodal stage. The use of DWI or DCE and the site for incorrect staging were recorded. MedCalc statistical software version 15.2.2 was used.

RESULTS

242 of 270 MRI reports (90%) included a final FIGO stage; of these 147 scans were performed internally and 95 at an external hospital. Accuracy of the reported depth of invasion was 72.7% for all cases (72.8% for internal and 72.6% for external scans). Sensitivity, specificity, positive and negative predictive values & accuracy with DWI (n=204) were 67%, 77%, 64%, 79%, 73% and without DWI (n=38) were 75%, 69%, 53%, 86%, 71% (p>.05). Accuracy with DCE (n=109) was 72% and without (n=130) was 73%. For cervical stromal invasion, sensitivity, specificity, PPV, NPV and accuracy for all scans were 59%, 94%, 64%, 93% and 89%. As a percentage of all causes of staging error, depth of invasion accounted for 41-52%, cervix stromal invasion 20-32% and nodal stage 8-16% depending on whether the patient was scanned internally or externally, or whether DWI or DCE were included (p>.05).

CONCLUSION

Staging accuracy in a large multi-site cancer network over three years does not meet the reported staging accuracies in meta-analyses of smaller single centre published research (pooled sensitivity/specificity of 86-90%). DWI and DCE did not affect staging accuracy, although only a small number of cases did not have these. The underlying causes for the reduction in sensitivity and specificity need to be evaluated in order to translate the highest achievable MR staging accuracy to long term routine practice.

CLINICAL RELEVANCE/APPLICATION

Accuracy of MR staging of endometrial cancer in a multi-site cancer network over three years does not reach single centre study results. The causes for staging inaccuracies need to be understood.

SSG09

Molecular Imaging (Gynecologic Oncology)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S504CD

BR GU MI MR RO

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Kathryn A. Morton, MD, Salt Lake City, UT (*Moderator*) Nothing to Disclose
Zaver M. Bhujwalla, PhD, Baltimore, MD (*Moderator*) Nothing to Disclose

Sub-Events

SSG09-01 First Clinical Trial on Ultrasound Molecular Imaging Using KDR-Targeted Microbubbles in Patients with Breast and Ovarian Lesions

Tuesday, Dec. 1 10:30AM - 10:40AM Location: S504CD

Participants
Juergen K. Willmann, MD, Stanford, CA (*Presenter*) Research Consultant, Bracco Group; Research Consultant, Triple Ring Technologies, Inc; Research Grant, Siemens AG; Research Grant, Bracco Group; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Lorenzo Bonomo, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonia Testa, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Pierluigi Rinaldi, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Guido Rindi, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Sanjiv S. Gambhir, MD, PhD, Stanford, CA (*Abstract Co-Author*) Board Member, Enlight Biosciences; Board Member, ImaginAb, Inc; Board Member, FUJIFILM Holdings Corporation; Board Member, ClickDiagnostics, Inc; Consultant, FUJIFILM Holdings Corporation; Consultant, Gamma Medica, Inc; Speaker, ImaginAb, Inc; Stock, Enlight Biosciences; Stock options, Enlight Biosciences; Travel support, Gamma Medica, Inc

PURPOSE

To assess if clinical ultrasound molecular imaging (USMI) using a novel clinical grade human kinase domain receptor (KDR)-targeted microbubble (BR55, Bracco) is safe and allows assessment of KDR expression in patients with breast and ovarian lesions, using immunohistochemistry (IHC) as gold standard.

METHOD AND MATERIALS

21 women (34-66 yrs) with focal breast lesions and 24 women (48-79 yrs) with focal ovarian lesions were injected IV with BR55 (0.03-0.08 mL/kg bw) and 2D USMI of the target lesions was performed dynamically every 2 min starting 5 min after injection up to 29 min, using the linear 15L8 probe (Siemens) or the endocavitary 1123 probe (Esaote). Normal breast tissues surrounding the lesion or the contralateral presumed normal ovary served as intra-patient controls. Blood pressure, EKG, oxygen levels, heart rate, CBC, and metabolic panel were obtained before, and 30 min, 1h, 24h after BR55 administration. Persistent focal BR55 binding on USMI was visually assessed in consensus by 2 blinded offsite radiologists as none, possibly or definitely. Patients underwent surgical resection of the target lesions and tissues were stained for CD31 and KDR. A pathologist assessed vascular KDR expression using a 4-point scale (none, weak, intermediate, high). Adjudication was performed in consensus (offsite radiologists and pathologist) to match clinically.

RESULTS

USMI with BR55 was well tolerated by all patients at all doses, without safety concerns. Among the 40 patients included in the analysis, KDR expression was higher in malignant breast and ovarian lesions (score 2.40±0.63 and 2.08±0.64, respectively) compared to benign breast and ovarian lesions (2.08±0.64 and 1.33±0.50). KDR expression matched well with presence of focal BR55 binding on USMI in malignant breast (13/15; 86.7%) and ovarian (11/13; 84.6%) lesions, as well as benign breast (2/3; 66.7%) and ovarian (8/9; 88.9%) lesions. Focal USMI signal could be detected up to 29 min after injection.

CONCLUSION

Use of BR55 in USMI of breast and ovarian lesions is safe and effective and preliminary data indicate that KDR-targeted USMI signal matches well with vascular KDR expression on IHC.

CLINICAL RELEVANCE/APPLICATION

This study provides proof of principle on feasibility and safety of KDR-targeted USMI in patients with breast and ovarian lesions and lays the foundation for further clinical trials.

SSG09-02 Imaged EGFR Expression Level Reflects Inhibited Growth-Pathway Node in Model of Triple-Negative Breast Cancer

Tuesday, Dec. 1 10:40AM - 10:50AM Location: S504CD

Participants
Eric Wehrenberg-Klee, MD, Boston, MA (*Presenter*) Nothing to Disclose
Nafize S. Turker, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Pedram Heidari, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mauri Scaltriti, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Umar Mahmood, MD, PhD, Charlestown, MA (*Abstract Co-Author*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth

Diagnostics Limited;

PURPOSE

Triple-negative breast cancer (TNBC) is an aggressive breast cancer subtype for which targeted inhibitors of the RTK/PI3K/AKT/mTOR growth pathway have demonstrated early treatment success. The surface receptor EGFR is one of the dominant RTKs mediating downstream growth signals along this pathway and changes in EGFR expression may be predictive of therapeutic inhibition. We sought to demonstrate that the changes in EGFR expression predictive of treatment response could be non-invasively assessed.

METHOD AND MATERIALS

64Cu-DOTA-cetuximab F(ab´)2 was prepared from cetuximab monoclonal antibody and probe affinity for EGFR assessed. A panel of TNBC cell lines (MDMBA468, MDMBA231, HCC70) was treated with the AKT inhibitor GDC-0068 or the PI3K inhibitor GDC-0941 for one day at a range of concentrations. Following treatment, we assessed in vitro EGFR probe uptake. In vitro uptake study results were compared to protein quantification as assessed by Western blot. After treatment of HCC70 mouse xenografts with control, GDC-0068, or GDC-0941 for two days, PET-CT imaging of HCC-70 tumors with 64Cu-DOTA-EGFR F(ab´)2 was performed.

RESULTS

In vitro treatment with GDC-0068 resulted in increased EGFR Probe uptake of 25%, 139%, and 16% for MDAMB468, MDMBA231, and HCC70, respectively. In vitro treatment with GDC-0941 resulted in increased EGFR uptake of 6%, 87%, and 88%, for the same panel of cell lines. In vitro uptake studies demonstrate close correlation with changes in EGFR expression as assessed by Western blot. In vivo imaging of HCC70 mouse xenografts with EGFR PET Probe after treatment with control, GDC-0068, or GDC-0941 demonstrate SUVmean of 0.32 (±0.03), 0.50 (±0.01), 0.62 (±0.01), with all comparisons significant ($p<0.01$).

CONCLUSION

We demonstrate in a murine model of triple-negative breast cancer that changes in EGFR expression induced by targeted therapeutics can be non-invasively assessed using a 64Cu-DOTA-EGFR F(ab´)2 PET imaging probe. We demonstrate that changes in the level of EGFR expression, potentially indicative of therapeutic response, differ depending on the growth-pathway inhibited.

CLINICAL RELEVANCE/APPLICATION

Noninvasive assessment of changes in EGFR expression could be a valuable clinical tool for rapid assessment of therapeutic efficacy of targeted growth pathway inhibitors in TNBC, allowing for dynamic clinical decision making in response to imaged resistance profiles.

SSG09-03 FACBC PET/CT Before and After Neoadjuvant Therapy in Locally Advanced Breast Cancer: A Prospective Pilot Clinical Trial

Tuesday, Dec. 1 10:50AM - 11:00AM Location: S504CD

Participants
Gary A. Ulaner, MD, PhD, New York, NY (*Presenter*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd
Serge Lyashchenko, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hanh Pham, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jason S. Lewis, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Genes for amino acid transport proteins are highly upregulated in both invasive ductal carcinoma (IDC) and ILC, as compared to normal breast epithelium. This molecular phenotype may allow for the development of imaging agents based on amino acid metabolism. We evaluated whether Fluorine-18 labeled 1-amino-3-fluorocyclobutane-1-carboxylic acid (FACBC), an amino acid analog labelled with fluorine-18, could be used as an imaging agent for local staging of locally advanced breast cancer before and after neoadjuvant therapy.

METHOD AND MATERIALS

This prospective clinical trial is being performed under IRB approval. In this trial, newly diagnosed breast cancer patients that are planned for neoadjuvant systemic therapy followed by surgical resection undergo FACBC PET/CT prior to systemic therapy and then again following completion of systemic therapy. Maximum Standardized Uptake Values (SUVmax) and other quantitative measures of FACBC-avidity are measured for the primary breast tumor and nodal metastases before and after systemic therapy. Following surgery, FACBC results are correlated with postoperative histopathologic results.

RESULTS

Of 28 planned patients, we have currently accrued 23. All 23 accrued patients have undergone the pre-neoadjuvant therapy FACBC PET/CT. All 23 primary breast lesions were FACBC avid with SUVmax values of 2.3 to 17.5. 18 of 23 patients (78%) had FACBC avid axillary nodes with SUVmax values of 1.2 to 14.6. In 2 of 23 patients (9%), an unsuspected extra-axillary local nodal metastasis was detected on the pre neoadjuvant therapy FACBC PET/CT. SUVmax of these nodes was 2.1 and 2.2, and both were pathologically proven to be metastases. 15 of 23 patients (65%) have completed both pre- and post-neoadjuvant PET/CT scans and histological analysis following surgical resection. In 13 of these 15 patients (87%), a reduction of SUVmax in the primary breast cancer of greater than 90% could accurately identify the presence or absence of complete response/near complete response as defined by post surgical histologic analysis.

CONCLUSION

This pilot trial of FACBC PET/CT in locally advanced breast cancer demonstrates potential uses of FACBC PET/CT before and after neoadjuvant therapy.

CLINICAL RELEVANCE/APPLICATION

Further work on FACBC as a radiotracer in locally advanced breast cancer is warranted.

SSG09-04 Operation-naive Invasive Ductal Carcinoma of the Breast. Comparison of Staging Performed with

Whole Body DWI, PET, PET-CT, and PET-MR

Tuesday, Dec. 1 11:00AM - 11:10AM Location: S504CD

Participants
Onofrio A. Catalano, MD, Napoli, Italy (*Presenter*) Nothing to Disclose
Bruce R. Rosen, MD, PhD, Charlestown, MA (*Abstract Co-Author*) Research Consultant, Siemens AG
Angelo Luongo, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Mark Vangel, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Marco Catalano, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Umar Mahmood, MD, PhD, Charlestown, MA (*Abstract Co-Author*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;
Emanuele Nicolai, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Andrea Soricelli, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Marco Salvatore, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the performance of whole body (WB) DW, WB-PET, WB-PETCT, and WB-PETMR in patients with newly diagnosed invasive ductal breast cancer, before undergoing treatment.

METHOD AND MATERIALS

49 consecutive women with newly diagnosed invasive ductal carcinoma of the breast underwent WB-DWI, WB-PET, WB-contrast enhanced (CE) PETCT and WB-CE-PETMR before treatment. A radiologist and a nuclear medicine physician evaluated in consensus the studies and searched for occurrence, number, and location of metastases. Final staging and number of lesions, according to each technique, were compared. Pathology and imaging follow up were used as the ground truth reference.

RESULTS

All the techniques correctly staged 32/49 patients: stage2b in 8, 2c in 7, 3c in 4, 4 in 13. They provided discordant stages in 17/49 patients: 1 (stage 2a): staged-4 by WB-PET; 4 (stage 2b): 3/4 staged-2a by WB-PET and WB-PETCT, 1/4 staged-4 by WB-DWI;3 (stage 3a): 2/3 staged-2b by WB-PET and WB-PETCT, 1/3 staged-4 by WB-DWI;3(stage 3c): 2/3 staged-2a by WB-PET and WB-PETCT, 1/3 staged-4 by WB-PET and WB-PETCT;6 (stage 4): 1/6 staged-3a by WB-PET, WB-DWI, and WB-PETCT, 1/6 staged-2b by WB-PET and WB-PETCT, 1/6 staged-2b by WB-PET, WB-DWI, and WB-PETCT, 1/6 staged-3a by WB-DWI, 1/6 staged-3c by WB-DWI, and 1/6 staged-3a by WB-PET, WB-PETCT and 3c by WB-DWI. Staging performance of WB-PETMR (49 correctly staged) was significantly better than WB-PETCT (38 correctly staged) (P=0.001, chi square-test).The best performing modality for malignant lymph-node detection was WB-PETMR (47 of 49 patients), followed by WB-DWI (37/49), followed by WB-PET and WB-PETCT (15 patients each). Significantly more malignant nodes were detected by WB-PETMR (P<0.0001, paired t-tests). At least as many true-positive lesions were detected by WB-PETMR than by any of the other three modalities for 46 patients. The corresponding number of patients for WB-PET, WB-PETCT, and WB-DWI were 40, 39 and 34, respectively.

CONCLUSION

PETMR allows a better accuracy in initial staging of surgical-naive ductal invasive breast cancer. The higher performance is likely related to the additive information of PET, DWI, as well as of the other sequences (STIR, T1-weighted Dixon, HASTE, ADC maps, and CE-T1-weighed images) of WB-PETMR

CLINICAL RELEVANCE/APPLICATION

When available WB-PETMR should be considered for proper staging of naive ductal invasive breast cancer.

SSG09-05 Multiparametric 18F-FMISO PET/MRI for Assessment of Treatment Response to Chemo-radiation and Hypoxia Monitoring in Cervix Cancer Patients: A Feasibility Study

Tuesday, Dec. 1 11:10AM - 11:20AM Location: S504CD

Participants
Petra Georg, MD,PhD, Wiener Neustadt, Austria (*Abstract Co-Author*) Nothing to Disclose
Piotr Andrzejewski, MA, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
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Stephan H. Polanec, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
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Alina Sturdza, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Georgios Karanikas, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Stephan Polterauer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
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Dietmar Georg, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Katja Pinker, MD, New York, NY (*Presenter*) Nothing to Disclose

PURPOSE

To demonstrate feasibility of combined multiparametric positron emission tomography/magnetic resonance imaging at 3T (3T MP PET/MRI) and to assess treatment response and hypoxia monitoring in cervix cancer patients undergoing chemo-radiation therapy.

METHOD AND MATERIALS

In this IRB-approved prospective study 7 patients underwent sequential 3T MP 18F-FMISO PET/MRI at baseline; 2 and 5 weeks (w) after start and 3 months (FU) after treatment. MRI protocol consisted of a high-resolution isotropic T2-w SPACE, a DWI EPI ($b=50/850$ sec/mm^2) and a high-resolution contrast-enhanced (CE) T1-w VIBE sequence. Patients were injected with 330 MBq 18F-FMISO and scanning was started 240 min after injection. CT data was used for attenuation correction. PET and MR image registrations were performed using Mirada RTx (Mirada Medical, Oxford, UK , ver. 1.4.0.23) software. Gross tumour volume (GTV)

was contoured by an experienced radiation oncologist on PET/MRI data sets. The volume of GTV was assessed for tumor size, CE-kinetics, restricted diffusivity and 18F-FMISO-avidity using SUVmax and SUV (SUVnorm) normalized to gluteal muscle uptake. At follow up, cervix was contoured, since all patients showed clinically complete remission.

RESULTS

3T MP 18F-FMISO PET/MRI was successfully performed in all patients at every time-point. Median GTV volume was 43.9cc at baseline, 22.4cc after 2w (20-25Gy) and 7.7cc after 5w (40-45Gy). Mean ADC values were 1.02x10-3mm2/sec increasing to 1.18x10-3mm2/sec after 2w and to 1.27x10-3mm2/sec after 5w and to 1.37x10-3mm2/sec at FU. All GTVs showed mean initial-enhancement (IE) followed by a plateau with an increasing IE at 2w and 5w and wash-out at 5w. At FU, there was a persistent enhancement. The mean 18F-FMISO SUVnorm was 3.1 at baseline and decreased to 2.3 at 2w and 2.0 at 5w and follow-up. In all patients there was never the whole tumor 18F-FMISO-avid, but 18F-FMISO-avid spots within the tumor indicative of hypoxia could be identified before and during the course of therapy.

CONCLUSION

MP 18F-FMISO PET/MRI in cervix cancer patients at 3T is feasible and enables non-invasive monitoring of morphological and functional changes during treatment.

CLINICAL RELEVANCE/APPLICATION

3T MP 18F-FMISO PET/MRI can depict areas of tumor hypoxia during therapy and thus identify patients at risk who need an aggressive treatment approach.

SSG09-06 Correlation of PET-MR Biomarkers with Breast Cancer Molecular Subtypes, Grading and Presence of Distant Metastases at Time of Presentation

Tuesday, Dec. 1 11:20AM - 11:30AM Location: S504CD

Participants
Onofrio A. Catalano, MD, Napoli, Italy (*Presenter*) Nothing to Disclose
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Marco Catalano, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Mark Vangel, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Umar Mahmood, MD, PhD, Charlestown, MA (*Abstract Co-Author*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;
Maria Lepore, MD, Avellino, Italy (*Abstract Co-Author*) Nothing to Disclose
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Emanuele Nicolai, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Andrea Soricelli, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate if PET-MR biomarkers correlate with molecular genetic subtypes, grading, and presence of distant metastases at time of presentation in naïve ductal invasive breast cancers.

METHOD AND MATERIALS

21 consecutive patients with naïve ductal invasive breast cancer and genetic molecular subtype profiling underwent whole-body contrast enhanced FDG-PET-MR (Biograph mMR, Siemens). Two readers, using commercially available software, measured the following PET-MR biomarkers: ADC, Ktrans, Ve, Kep, IAUC, SUVmax, SUVmean, and MTV. They were correlated with genetic molecular subtypes, grading and occurrence of distant metastases.

RESULTS

Genetic molecular subtypes were as follows: ER-7, ER+14; PR-8, PR+13; HER2-11, HER2+10; Ki67-low (<=35%), Ki67 medium/high (>35%). Grading was G2 in 14 and G3 in 7. Six patients had distant metastases. The following biomarkers were higher in the ER- and PR- compared to ER+ and PR+ patients: Kep (9234±1320 versus 6492 ±2358, p0.01), SUVmax (14.19±7.17 versus 6.17±4.24, p0.004), and SUVmean (8.44±4.01, p0.004). ADC directly correlated with the degree of Ki67 expression (1019±256 for Ki67<=35%, 1338±105 forKi67>35%, p0.002). The following biomarkers were lower in HER2- patients compared to HER2+ cases: ADC (1050±280 versus 1306±122, p0.009), Kep (6726±2240 versus 8599±2122, p0.028), SUVmax (6.29±4 versus 11.8±7.65, p0.046), and SUVmean (3.72±2.28 versus 7.03±4.43, p0.04).G2 patients experienced lower Kep (6638±2391 versus 8944±1764, p0.04) and lower SUVmax (6.83±4.73 versus 12.89±8.07, p 0.04) than G3 patients.No biomarkers correlated with presence of distant metastases.

CONCLUSION

In naïve ductal invasive breast cancers, PET-MR biomarkers correlate with molecular genetic subtypes and with grading, but not with the presence of distant metastases.

CLINICAL RELEVANCE/APPLICATION

PET-MR biomarkers might have prognostic and therapeutic implications on patients' management.

SSG09-07 Impact of Estrogen Receptor Gene Mutations on [18F]-Fluoroestradiol Uptake in Breast Cancer

Tuesday, Dec. 1 11:30AM - 11:40AM Location: S504CD

Participants
Manoj Kumar, MS, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Ginny L. Powers, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Justin Jeffery, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Yongjun Yan, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Amy M. Fowler, MD, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose

PURPOSE

Accurately predicting therapeutic responsiveness in women with breast cancer remains challenging. Positron emission tomography (PET) imaging using [18F]-16alpha-17beta-fluoroestradiol (FES) provides a way to non-invasively and longitudinally examine the subset of tumors expressing estrogen receptor alpha (ERα) which comprise approximately 70% of all breast cancers. However, the effect of mutations in the gene encoding ERα, recently identified in patients with endocrine-resistant, metastatic breast cancer, on FES uptake is unknown. We developed a model system to test how mutations in ERα influence the uptake of FES.

METHOD AND MATERIALS

Stable cell lines expressing either wild-type ERα (231-ER) or a point mutation in the ligand-binding pocket, G521R (231-G521R), were created in the ERα-negative human breast cancer cell line MDA-MB-231. ERα-positive MCF7 human breast cancer cells were used as a positive control and parental MDA-MB-231 cells were used as a negative control. Cell uptake of FES was measured in vitro with microPET/CT imaging and gamma counting. In addition, in vivo FES uptake was measured in MCF7 and 231-ER tumors grown as xenografts in athymic nude mice.

RESULTS

FES uptake was observed both in vitro and in vivo in the MCF7 and 231-ER cells/tumors. However, there was no significant FES uptake in the 231-G521R cells or parental MDA-MB-231 cells. The 231-ER cells had a similar dose response curve to MCF7 in competition assays using increasing doses of cold estradiol, and as consistent with the uptake data, 231-G521R binding was not altered by cold competition.

CONCLUSION

These data support the use of stable cell lines expressing variant forms of ERα as models for demonstrating the effects of ERα gene mutations on FES uptake. Ongoing studies are focusing on the effects of recently identified clinically-relevant ERα mutations on FES uptake and on the prediction of response to ER-targeted therapies.

CLINICAL RELEVANCE/APPLICATION

FES-PET imaging provides a non-invasive way to probe ERα function and may prove useful in identifying the development of ERα gene mutations and thus predicting endocrine resistance in ERα-positive breast cancer patients.

SSG09-08 Imaging Patients with Breast and Prostate Cancers Using Combined 18F NaF/18F FDG and TOF simultaneous PET/ MRI

Tuesday, Dec. 1 11:40AM - 11:50AM Location: S504CD

Participants
Ryogo Minamimoto, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose
Andreas M. Loening, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Valentina Taviani, PhD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Sanjiv S. Gambhir, MD, PhD, Stanford, CA (*Abstract Co-Author*) Board Member, Enlight Biosciences; Board Member, ImaginAb, Inc; Board Member, FUJIFILM Holdings Corporation; Board Member, ClickDiagnostics, Inc; Consultant, FUJIFILM Holdings Corporation; Consultant, Gamma Medica, Inc; Speaker, ImaginAb, Inc; Stock, Enlight Biosciences; Stock options, Enlight Biosciences; Travel support, Gamma Medica, Inc
Shreyas S. Vasanawala, MD, PhD, Palo Alto, CA (*Abstract Co-Author*) Research collaboration, General Electric Company; Consultant, Arterys; Research Grant, Bayer AG;
Andrei Iagaru, MD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG

PURPOSE

We previously reported the pilot evaluation of a simultaneous PET/MRI scanner with TOF capability, as well as the use of combined 18F NaF/18F FDG PET/CT in cancer patients. Here we prospectively compared the combined 18F NaF/18F FDG PET/ MRI against 99mTc-MDP in patients with breast and prostate cancers for the detection of metastatic disease.

METHOD AND MATERIALS

Fifteen patients referred for 99mTc-MDP bone scans were prospectively enrolled from Oct 14 - Mar 15. The cohort included 7 men with prostate cancer and 8 women with breast cancer, 41 - 85 year-old (average 61 ± 13). 18F NaF (0.7-2.2 mCi, mean: 1.2 mCi) and 18F FDG (3.8-5.2 mCi, mean: 4.2 mCi) were subsequently injected from separate syringes. The PET/MRI was done 6-30 days (average 9.3 ± 3.2) after bone scan. The whole body MRI protocol consisted of T2-weighted, DWI, and contrast-enhanced T1-weighted imaging. Lesions detected with each test were tabulated and the results were compared.

RESULTS

All patients tolerated the PET/MRI exam, and PET image quality was diagnostic despite the marked reduction in the administered dosage of radiopharmaceuticals (80% less for 18F NaF and 67% less for 18F FDG compared to standard protocols). Five patients had no bone metastases identified on either scans. Bone scintigraphy and PET/MRI showed osseous metastases in 9 patients, but more numerous bone findings were noted on PET/MRI than on bone scintigraphy in 3 patients. One patient had negative bone scan, but bone metastases were seen on PET/MRI. Lesions outside the skeleton were identified by PET/MRI in 3 patients.

CONCLUSION

The combined 18F NaF/18F FDG PET/MRI is superior to 99mTc-MDP scintigraphy for evaluation of skeletal disease extent. Further, it detected extra-skeletal disease that may change the management of these patients, while allowing a significant reduction in radiation exposure from lower dosages of PET radiopharmaceuticals administered. A combination of 18F NaF/18F FDG PET/MRI may provide the most accurate staging of patients with breast and prostate cancers prior to the start of treatment.

CLINICAL RELEVANCE/APPLICATION

The combined 18F NaF/18F FDG PET/MRI is superior to 99mTc-MDP scintigraphy for evaluation of skeletal disease extent.

SSG09-09 In Vivo Assessment of Ovarian Tumor Response to Tyrosine Kinase Inhibitor Pazopanib using Hyperpolarized 13C-Pyruvate MRS and 18F-FDG PET/CT Imaging in a Mouse Model

Tuesday, Dec. 1 11:50AM - 12:00PM Location: S504CD

Participants
Murali Ravoori, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Sheela Singh, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Jaehyuk Lee, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
James Bankson, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Vikas Kundra, MD, PhD, Houston, TX (*Presenter*) License agreement, Introgen Therapeutics, Inc

PURPOSE

Early response measures for ovarian cancer are needed to common targets such as tyrosine kinases. Via effects on signaling within tumor cells or via effects on angiogenesis, such inhibitory drugs have the potential to alter tumor metabolism. 18Fluorodeoxyglucose (18F-FDG) mimics glucose and can be used to evaluate early glycolysis. Hyperpolarization magnetic resonance spectroscopy (MRS) imaging can be used to study pyruvate, which can be produced by glycolysis and other pathways and sits at a decision point for aerobic versus anaerobic metabolism. Our purpose was to assess whether either early or late components of metabolism can serve as indicators of response of ovarian cancer to tyrosine kinase inhibitor (including angiogenesis inhibitor via VEGF receptor inhibition) Pazopanib.

METHOD AND MATERIALS

Seventeen days after injection of 2 x 106 human ovarian SKOV3 tumors cells into female nude mice, treatment with vehicle or Pazopanib (2.5 mg/mouse po) was initiated. Longitudinal T2-weighted MR, hyperpolarized pyruvate MRS, and 18F-FDG PET/CT imaging were performed pre-treatment as well as 2 days and 2 weeks after treatment.

RESULTS

Pazopanib was effective in inhibiting ovarian tumor growth compared to control ($p<0.05$). Significantly higher pyruvate to lactate conversion (lactate/pyruvate+lactate ratio) was found 2 days after treatment with pazopanib compared to pre-therapy ($p<0.005$, $n=8$). This was not seen with control or with 18F-FDG PET/CT imaging.

CONCLUSION

Findings suggest that later metabolic events (pyruvate to lactate conversion) may serve as as an early indicator of response of ovarian cancer to tyrosine kinase (angiogenesis) inhibitor pazopanib in mouse models, even when early glycolytic events do not.

CLINICAL RELEVANCE/APPLICATION

Hyperpolarized 13C-Pyruvate MRS may serve as an early indicator of response to tyrosine kinase (angiogenesis) inhibitors such as pazopanib in ovarian cancer even when 18F-FDG PET/CT does not.

SSG10

ISP: Musculoskeletal (Hand and Wrist)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: E450B

MK MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Mary G. Hochman, MD, West Roxbury, MA (*Moderator*) Stockholder, General Electric Company; Stock options, Nomir Medical Technologies, Inc; Author, UpToDate, Inc
Mary M. Chiavaras, MD, PhD, Ancaster, ON (*Moderator*) Nothing to Disclose

Sub-Events

SSG10-01 Musculoskeletal Keynote Speaker: MR Evaluation of the Hand-Technique and Application

Tuesday, Dec. 1 10:30AM - 10:50AM Location: E450B

Participants
Jean-Luc Drape, MD, PhD, Paris, France (*Presenter*) Nothing to Disclose

ABSTRACT

To optimize MRI of fingers nine technical points should be especially checked: (1) the choice of the surface coil according to the clinical findings, (2) the gradient strength and the bandwidth, (3) the positioning and the contention, (4) a dedicated scout view, (5) the spatial resolution, (6) the slice thickness with a special attention to 3D millimetric slices, (7) the choice of a main slice plane according to the suspected lesion, (8) the suppression of motion artifacts and (9) the use of stress images if possible (collateral ligaments, pulleys, extensor tendon).

SSG10-03 MR Morphology of Triangular Fibrocartilage Complex: Correlation with Quantitative MR and Biomechanical Properties

Tuesday, Dec. 1 10:50AM - 11:00AM Location: E450B

Participants
Thumanoon Ruangchaijatuporn, MD, Bangkoknoi, Thailand (*Presenter*) Nothing to Disclose
Eric Y. Chang, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Reni Biswas, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Sheronda Statum, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Betty Tran, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Won C. Bae, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Christine B. Chung, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Wrist pain may involve the triangular fibrocartilage complex (TFCC; Fig.A). The purpose of this study was to evaluate MR morphology of TFCC tissues, and relate it to regional quantitative MR (qMR) and biomechanical properties.

METHOD AND MATERIALS

Five cadaveric wrists (22 to 70 yrs) were imaged at 3T using morphologic (PD SE, Fig.AC; 3D SPGR, Fig.B) and quantitative (ME SE T2; UTE T2*; 2D SCMP T1rho; 3D MAPSS T1rho; UTE T1rho) MR sequences. In 8 geographic regions (Fig.B), morphology of TFCCdisc and the laminae were evaluated for pathology (Fig.BDE) and quantitative MR (qMR) values (Fig.F). Four of the samples were disarticulated, and biomechanical indentation testing was performed on the distal surface of the discs (Fig.C). Instantaneous (Indentation) modulus, taking into account tissue thickness, was determined.

RESULTS

On PD SE images, pathology of TFCC disc included degeneration (Fig.BE) and tears (Fig.E), while that of the lamina included degeneration, degeneration with superimposed tear, and mucinous transformation (Fig.E). Calcifications were highly visible on 3D SPGR images (Fig.D). Calcifications were found only among pathologic regions, and disc pathology was found more frequently in the proximal than distal regions. In the disc (Fig.G), most qMR values were the lowest in normal samples, and increased significantly with degeneration or tear. Indentation modulus (Fig.G) showed an inverse trend, being the highest in normal samples and decreasing with pathologic changes. qMR properties also correlated moderately with indentation modulus. Laminae samples (Fig.H) were mostly pathologic, and requires additional normal samples to discern qMR changes.

CONCLUSION

These results show potential utility of morphologic, qMR, and biomechanical techniques to characterize pathology of the TFCC.

CLINICAL RELEVANCE/APPLICATION

Quantitative MR techniques provide novel and sensitive means of evaluating tissues of TFCC, which compliment conventional techniques.

SSG10-04 Accessory Tendon Slips of the Extensor Carpi Ulnaris: MRI Findings and Association with Tendon Abnormalities

Tuesday, Dec. 1 11:00AM - 11:10AM Location: E450B

Participants

Fabio Becce, MD, Lausanne, Switzerland (*Presenter*) Nothing to Disclose
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Eric G. Pessis, MD, St Denis, France (*Abstract Co-Author*) Nothing to Disclose
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Henri Guerini, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Dominique Le Viet, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Luc Drape, MD, PhD, Paris, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Anatomic variants are common in the wrist and hand, and some of them may be the triggering factor of tendon disorders. The purpose of this study was to report the MRI findings of accessory tendon slips arising from the extensor carpi ulnaris (ECU), and evaluate their association with ECU tendon abnormalities.

METHOD AND MATERIALS

All wrist MRI scans performed over a 1-year period in two university hospitals were retrospectively reviewed. Patients with prior ulnar-sided wrist surgery and MRI scans without at least axial T1-weighted and T2-weighted sequences were excluded. Two musculoskeletal radiologists independently assessed the presence of accessory tendon slips arising from the ECU, as well as ECU tendinosis, partial or complete tears, and tenosynovitis. The origin and insertion of the accessory tendon slips were noted, and their diameter and the cross-sectional area of the ECU tendons were measured.

RESULTS

A total of 254 wrist MRI scans from 257 patients (139 men, 115 women; mean age, 46 years) were included. The prevalence of accessory tendon slips arising from the ECU was 23% (58/254). Surgical correlation was available in 12% (7/58) of cases. Their mean long-axis diameter was 1.1 ± 0.2 mm. Their origin was always visible, while their insertion on the fifth metacarpal or extensor digiti minimi tendon was seen in 33% (19/58) of cases. Patients with accessory tendon slips had statistically significantly more ECU tendon abnormalities and tenosynovitis than patients without the anatomic variant (14% vs. 6%, and 46% vs. 11%, respectively; $p \leq 0.02$). The prevalence of accessory tendon slips was statistically significantly higher in patients with ulnar-sided wrist pain (23% vs. 14%, $p = 0.01$).

CONCLUSION

Accessory tendon slips arising from the ECU are common and frequently associated with ECU tendon abnormalities. They are frequently found in patients with ulnar-sided wrist pain.

CLINICAL RELEVANCE/APPLICATION

Accessory tendon slips arising from the ECU are important to recognize because they represent a diagnostic pitfall and may also play a role in the pathogenesis of ECU tendon abnormalities.

SSG10-05 Computer-Based Temporal Subtraction Analysis of Joint Space Narrowing in Rheumatoid Patients: Validation Study in Carpal Joints

Tuesday, Dec. 1 11:10AM - 11:20AM Location: E450B

Participants
Shota Ichikawa, Sapporo, Japan (*Presenter*) Nothing to Disclose
Tamotsu Kamishima, MD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Kenneth Sutherland, Hokkaido, Japan (*Abstract Co-Author*) Nothing to Disclose
Takanobu Okubo, Asahikawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Kou Katayama, Asahikawa, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the computer-based method using temporal subtraction in carpal joints of rheumatoid arthritis (RA) patients, which can detect the difference in joint space between two images as the joint space difference index (JSDI).

METHOD AND MATERIALS

Twenty-seven rheumatoid arthritis patients (24 females and 3 males, mean age 60 years) on Tocilizmab were enrolled. Radiographs were obtained at baseline and at 1 year. The joint space narrowing (JSN) of a total of 229 carpal (3rd carpometacarpal, 5th carpometacarpal, scaphoid-trapezium, scaphoid-capitate, and radius-scaphoid) joints on bilateral hand radiographs was assessed by our computer-based method, setting the Sharp/van der Heijde method as the gold standard. We performed three examinations to confirm that the JSDI reflects the chronological change in joint space width. We compared the JSDI of joints with JSN progression (increase in Sharp/van der Heijde score) in the follow-up period with those without JSN progression. In addition, we examined whether there is a significant difference in JSDI in terms of laterality or topology of the joint.

RESULTS

The JSDI of joints with JSN progression was significantly higher than those without JSN progression (Mann-Whitney U test, $p < 0.001$). There was no statistically significant difference in the JSDI between left and right carpal joints, which was analyzed for 5 different joints altogether and each joint separately (Mann-Whitney U test, $p > 0.05$ respectively). There was no statistically significant difference in JSDI among different joints (Kruskal-Wallis test, $p = 0.155$). In all examinations, the results of the computer-based method were consistent with those of the Sharp/van der Heijde method as the gold standard.

CONCLUSION

These results suggest that our computer-based method may be useful to recognize the joint space narrowing progression on radiographs in carpal joints.

CLINICAL RELEVANCE/APPLICATION

The computer-based temporal subtraction method can detect the joint space narrowing progression in the wrist, which is the single most predilection site for rheumatic diseases.

SSG10-06 Cracking the Case on "Knuckle Cracking": The Sonographic Evidence

Tuesday, Dec. 1 11:20AM - 11:30AM Location: E450B

Participants
Robert D. Boutin, MD, Sacramento, CA (*Presenter*) Nothing to Disclose
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David Nakamura, MD, Orange, CA (*Abstract Co-Author*) Nothing to Disclose
Cyrus Bateni, MD, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
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Robert Szabo, MD,MPH, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Abhijit J. Chaudhari, PhD, Davis, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

1] Report the static and dynamic appearance of knuckle cracking (KC) with sonography (US) and 2] analyze the performance of US for the diagnosis of KC.

METHOD AND MATERIALS

A prospective, IRB-approved study was performed on healthy adult subjects with and without a history of habitual KC. Exclusion criteria were a history of pain or arthritis in the hands. Recorded clinical history included KC events per day multiplied by the number of KC years (allowing the calculation of "crack-years") and a QuickDASH questionnaire. Physical examination, including grip strength and Beighton scoring, was performed by two subspecialty orthopaedists blinded to subject KC history. US (with temporal resolution of 87 frames/sec) was conducted by a single sonographer, with static and cine images recorded before, during, and after metacarpophalangeal joint (MPJ) distraction was performed by the subjects. Two blinded musculoskeletal radiologists interpreted the images for a definite hyperechoic focus during and after MPJ distraction (not present prior to distraction); this was compared against the reference standard of an audible "crack" during joint distraction.

RESULTS

We studied 400 MPJs of 40 subjects (17 women, 23 men), with mean age of 33 years (range, 18-63). In comparing 10 non-KC subjects (with 0 "crack-years") versus 30 KC subjects (with "crack-years" ranging from 16 to 800), there was no significant difference in sex, age, QuickDASH score, grip strength, or Beighton score. In 62 of the 400 MPJs, there was an audible "crack" during manual distraction. Range of motion was noted to significantly increase in these 62 MPJs with respect to active and passive flexion, and passive extension between pre and post KC ($p<0.05$). With US, blinded readers had a good sensitivity (R1, 75%; R2, 80%) and excellent specificity (R1, 94%; R2, 95%), with a very good inter-observer reliability of 0.87 ($p<0.0005$). A brilliant hyperechoic flash that was simultaneous with the KC event and arose over approximately 115 msec was highly characteristic.

CONCLUSION

US examination during movement of the MPJs can show distinctive findings of KC with relatively high specificity and inter-observer reliability. US features corroborate the theory of cavitation as the etiology for sound generation in voluntary KC.

CLINICAL RELEVANCE/APPLICATION

Audible emissions may be associated with a broad array of (intraarticular and extraarticular) clinical conditions, but KC has a characteristic US appearance.

SSG10-07 Hand MRI: Quality of Fat Signal Suppression with Dixon versus CHESS and STIR Imaging

Tuesday, Dec. 1 11:30AM - 11:40AM Location: E450B

Participants
Thomas P. Kirchgesner, MD, Brussels, Belgium (*Presenter*) Nothing to Disclose
Vasiliki Perlepe, MD, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Nicolas Michoux, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Ahmed Larbi, MD, Nimes, France (*Abstract Co-Author*) Nothing to Disclose
Frederic E. Lecouvet, MD, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Bruno C. Vande Berg, MD, PhD, Brussels, Belgium (*Abstract Co-Author*) Consultant, Bone Therapeutics SA

PURPOSE

To compare the quality of fat signal suppression and signal to noise ratio (SNR) obtained by the Dixon method in comparison to the CHESS (CHEmical Shift Selective) and STIR (Short Tau Inversion Recovery) sequences at hand MRI of healthy subjects.

METHOD AND MATERIALS

Both hands of 14 healthy volunteers were imaged with IDEAL T1 SE (Spin Echo), IDEAL T2 SE, FS (Fat Saturated) T1 SE, FS T2 SE and STIR on a 1,5T MR scanner. Slice thickness, slice spacing and imaging plans were kept constant between sequences. Water pure IDEAL T1 SE, water pure IDEAL T2 SE, FS T1 SE, FS T2 SE and STIR images were anonymized and archived by an independent operator in the picture archiving communication system. Three radiologists blindly and independently scored the quality of the fat signal suppression (1: absent; 2: partial; 3: complete) in bone marrow and adjacent soft tissues of 20 articulations. One radiologist calculated the SNR in 5 locations for each hand.

RESULTS

Scores for fat signal suppression were significantly higher in water pure IDEAL T1 SE than in FS T1 SE for the 3 readers ($p<0.001$).Scores for fat signal suppression were significantly higher in water pure IDEAL T2 SE than in FS T2 SE for the 3 readers ($p<0,017$).Scores for fat signal suppression were statistically and significantly higher in water pure IDEAL T2 SE than in STIR for 2 readers ($p<0,022$), and not statistically different for the third reader ($p=0,109$).SNR in water pure IDEAL T1 SE was significantly higher than SNR in FS T1 SE ($p<0,001$).SNR in water pure IDEAL T2 SE was statistically and significantly higher than SNR in STIR ($p<0,001$), but statistically and significantly lower than SNR in FS T2 SE ($p<0,001$).

CONCLUSION

Quality of fat signal suppression at hand MRI achieved with the Dixon method is superior to that obtained with fat selective

Quality of fat signal suppression at hand MRI achieved with the Dixon method is superior to that obtained with fat selective presaturation and STIR. SNR is higher on IDEAL T1 but not on IDEAL T2 in comparison with the corresponding CHESS sequences.

CLINICAL RELEVANCE/APPLICATION

Dixon sequences should be further investigated in patients with inflammatory hand diseases as they yield better quality for fat suppression than currently validated sequences.

SSG10-08 Value of Tomosynthesis for Lesion Evaluation in Osteoarthritic Hands Using the OARSI Score

Tuesday, Dec. 1 11:40AM - 11:50AM Location: E450B

Participants
Katharina Martini, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Anton S. Becker, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Joerg Mueller, Dusseldorf, Germany (*Abstract Co-Author*) Employee, FUJIFILM Holdings Corporation
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Gustav Andreisek, MD, Zurich, Switzerland (*Abstract Co-Author*) Grant, Holcim Ltd; Grant, Siemens AG; Speaker, Mepha Pharma AG; Speaker, Guerbet SA; Travel support, Guerbet SA; Consultant, Otsuka Holdings Co, Ltd; Travel support, Otsuka Holdings Co, Ltd; Institutional Research Grant, Bayer AG; Institutional Research Grant, Guerbet AG; Institutional research collaboration, Siemens AG; Institutional research collaboration, Koninklijke Philips NV; Speaker, General Electric Company; Speaker, Koninklijke Philips NV; Speaker, Siemens AG; ;
Thomas Frauenfelder, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the value of Tomosynthesis in depicting osteoarthritic lesions in comparison to conv. X-ray, with use of computed tomography (CT) as standard-of-reference.

METHOD AND MATERIALS

Imaging of 12 cadaver wrists was performed with Tomosynthesis in anteriorposterior (ap) projection (50 kV at 40 mA; tube angle: 40°), conventional X-ray and multi-detector CT (70kV at 16mAs ref). Distal interphalangeal joint (DIP) II, DIP III, proximal interphalangeal joint (PIP) II, PIP III, first carpometacarpal (CMC) and scaphotrapezotrapezoidal joint (STT) were individually graded using the Osteoarthritis Research Society International (OARSI) score by two independent readers for the presence of osteophytes (0-3), joint space narrowing (0-3), subchondral sclerosis (0-1), lateral deformity (0-1), subchondral cysts (0-1) and erosion (0-1). Total scores range from 0-60. Inter-reader agreement (Cohen's k) was calculated. CT served as standard of reference.

RESULTS

Comparing Tomosynthesis and conventional X-ray to CT, the agreement was of 69.64% vs. 63.89% for the presence of osteophytes; 80.56% vs. 56.94% for joint space narrowing; 69.44% vs. 68.1% for subchondral sclerosis; 94.44% vs. 91.67% for lateral deformity; 97.22% vs. 80.56% for subchondral cysts; and 100% vs. 97.22% for erosion. While Tomosynthesis showed no significant difference (p=0.846) in OARSI score grading to CT (mean OARSI-score CT: 16.8, SD=10.64 vs. mean OARSI-score Tomosynthesis: 16.25, SD=9.56), conventional X-ray had significant lower mean OASIS scores (mean OARSI-score X-ray: 11, SD=8.33; p=0.037). Inter-reader agreement for OARSI scoring was excellent (k= 0.83).

CONCLUSION

Tomosynthesis depicts more lesions than conventional X-ray compared to CT.

CLINICAL RELEVANCE/APPLICATION

The mean OARSI score of Tomosynthesis is not significantly different from CT.

SSG10-09 Assessment of Pisotriquetral Instability with 3D Dual Echo Steady State (DESS): Is It Associated with Trauma or not?

Tuesday, Dec. 1 11:50AM - 12:00PM Location: E450B

Participants
Hee-Dong Chae, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hye Jin Yoo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ja-Young Choi, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Sung Hwan Hong, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if there is an association between pisotriquetral (PT) instability and trauma history or internal derangements of the carpal joint by using three-dimensional (3D) dual echo steady state (DESS)

METHOD AND MATERIALS

We evaluated 44 patients with distal radius fracture (patient) and other 44 patients without previous trauma history (control), who underwent 3T magnetic resonance (MR) imaging including 3D DESS sequence. To analyze PT instability, three parameters were measured on axial and sagittal images by two blinded-readers, independently: PT interval, PT angle and pisiform translation relative to triquetrum. The MR appearances of PT joint and ulnar-sided structures were also evaluated. The associations between PT instability and distal radius fracture, abnormality of ulnar-sided structures or osteoarthritic features of PT joint were calculated.

RESULTS

PT instability parameters measured by two radiologists showed good or excellent agreement (ICC=0.628-0.965). Proximal translation of pisiform in relation to triquetrum was reduced in the patients with distal radius fracture (P=0.028). However, there was no difference of other instability parameters between the two groups. ECU tendinopathy was associated with larger PT interval (P=0.01) and with wider opening of sagittal PT angle (P=0.021). Triangular ligament tear was also related to reduced proximal translation of pisiform (P=0.031). Osteoarthritic features of PT joint and triangular fibrocartilage tear were not associated with PT instability.

CONCLUSION

Only pisiform translation was associated with distal radius fracture. Other instability parameters were not affected by distal radius fracture. ECU tendinopathy and triangular ligament tear were associated with PT instability.

CLINICAL RELEVANCE/APPLICATION

Knowledge of PT instability and its relation to other carpal abnormality and traumatic disorder will facilitate early diagnosis of PT instability preventing symptomatic degenerative change of PT joint.

SSG11

Nuclear Medicine (PET/MRI for Oncology)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: S505AB

CT MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Farrokh Dehdashti, MD, Saint Louis, MO (*Moderator*) Nothing to Disclose
Samuel E. Almodovar-Reteguis, MD, Homewood, AL (*Moderator*) Nothing to Disclose

Sub-Events

SSG11-01 Outcome of Missed Lung Nodules in 18F-FDG-PET/MRI Compared to 18F-FDG-PET/CT in Cancer Patients

Tuesday, Dec. 1 10:30AM - 10:40AM Location: S505AB

Participants
Lino Sawicki, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Johannes Grueneisen, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Bockisch, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the clinical relevance of small pulmonary nodules missed by 18F-fluordesoxyglucose positron emission tomography/magnetic resonance (18F-FDG PET/MR) imaging compared to 18F-FDG PET/computed tomography (18F-FDG PET/CT).

METHOD AND MATERIALS

Fifty cancer patients (mean age: 56.4 years, range: 18-84, 29 female, 21 male) who underwent 18F-FDG-PET/CT and 18F-FDG-PET/MRI for tumor staging on the same day were retrospectively enrolled. 18F-FDG-PET/CT and 18F-FDG-PET/MRI datasets were analyzed by two independent readers in random order in seperate session with a minimum of four weeks apart. Presence, location, size and presence of focal tracer uptake was noted for each lung detected on 18F-FDG-PET/CT and on 18F-FDG-PET/MRI using T1w VIBE with fat saturation as morphological dataset. Follow-up CT or 18F-FDG-PET/CT (mean time-to-follow-up 11 months, range: 3-11) was used as reference standard to define each nodule as benign or malignant based on changes in size and under consideration of administered therapies. A nodule-to-nodule comparison between 18F-FDG-PET/CT and 18F-FDG-PET/MRI was performed using descriptive statistics.

RESULTS

Forty-two lung nodules detected on 18F-FDG-PET/CT were missed on 18F-FDG-PET/MRI. Average size of missed nodules was 4 mm +/- 1.3 mm; range: 2 mm - 7 mm. None of the missed lung nodules presented with increased tracer uptake. Of the 42 lung nodules missed on 18F-FDG-PET/MRI 33 (79%) nodules were rated benign, while 9 (21%) nodules were rated malignant according to follow-up examinations.

CONCLUSION

Even though the majority of small lung nodules missed on 18F-FDG-PET/MRI was rather benign, there was a relevant number of undetected potential metastases. The impact of these small additional metastases on therapeutic decisions and prognosis still has to be evaluated

CLINICAL RELEVANCE/APPLICATION

Lower detection rate of PET/MRI vs. PET/CT for small lung nodules must be considered in cancer staging. Our data indicate that there is a small but relevant number of undetected potential metastases.

SSG11-02 PET/MR versus PET/CT in the Initial Staging of Head and Neck Cancer

Tuesday, Dec. 1 10:40AM - 10:50AM Location: S505AB

Participants
Tetsuro Sekine, MD, PhD, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Felipe D. Barbosa, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Irene A. Burger, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Felix P. Kuhn, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Gustav K. Von Schulthess, MD, PhD, Zurich, Switzerland (*Abstract Co-Author*) Research Grant, General Electric Company; Speaker, General Electric Company;
Patrick Veit-Haibach, MD, Zurich, Switzerland (*Abstract Co-Author*) Research Grant, Bayer AG; Resaarch Grant, F. Hoffmann-La Roche Ltd; Research Grant, General Electric Company
Martin W. Huellner, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic accuracy of PET/MR with PET/CT for newly diagnosed head and neck cancer.

METHOD AND MATERIALS

This prospective study was approved by the institutional review board and by national government authorities. In this study,

This prospective study was approved by the institutional review board and by national government authorities. In this study, sequential contrast-enhanced PET/CT-MR was performed in 27 patients (median age 66, 16 males) with newly diagnosed head and neck cancer. MR sequences were:LAVA-Flex (whole body); axial T2-weighted, axial T1-weighted with and without contrast, sagittal and coronal T1-weighted with contrast, and DWI (head and neck). PET/CT and PET/MR were evaluated separately, and the TNM stage and factors that could impact on the potential resectability were assessed. Wilcoxon signed-ranks test was used.

RESULTS

The T/N/M staging by PET/CT was correct in 17 patients (63.0%) / 19 (70.4%) / 22 (81.5%), equivocal in 8 patient (29.6%) / 3 (11.1%) / 3 (11.1%), and incorrect in 2 patients (7.4%) / 5 (18.5%) / 2 (7.4%). The T/N/M staging by PET/MR was correct in 20 patients (74.1%) / 21 (77.8%) / 26 (96.3%), equivocal in 6 patients (22.2%) / 2 (7.4%) / 1 (3.7%), and incorrect in 1 patient (3.7%) / 4 (14.8%) / 0 (0%). Consistently, the TNM staging by PET/MR was comparable to PET/CT (T: $p = 0.331$, N: $p = 0.453$, M: $p = 0.034$). The sensitivity/specificity/accuracy of resectability-defining factors by PET/CT and PET/MR were 0.68/0.93/0.97, and 0.80/1.00/0.99, respectively.

CONCLUSION

Whole-body staging with PET/MR yields equal diagnostic accuracy as PET/CT in determining the stage of head and neck cancer.

CLINICAL RELEVANCE/APPLICATION

Patients with newly diagnosed head and neck cancer may be effectively staged with contrast-enhanced PET/MR instead of contrast-enhanced PET/CT.

SSG11-03 Added Value of PET/MRI to MDCT for the Assessment of Preoperative Staging and Resectability in Gastric Cancer

Tuesday, Dec. 1 10:50AM - 11:00AM Location: S505AB

Participants
Dong Ho Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Se Hyung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Mallinckrodt plc; Research Grant, Samsung Electronics Co Ltd
Bo Yun Hur, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether PET/MRI can improve the diagnostic performance of TNM staging and can help making accurate decision for resectability in patients with gastric cancer compared to MDCT alone.

METHOD AND MATERIALS

The institutional review board of our hospital approved this retrospective study. Twenty-nine patients with histologically confirmed gastric cancers underwent preoperative MDCT and PET/MRI for staging and decision of resectability. Two abdominal radiologists independently assessed MDCT without and with PET/MRI and determined preoperative TNM staging as well as resectability of gastric cancer. The diagnostic performance using MDCT without and with PET/MRI was compared by using McNemar test and receiver operating characteristic analysis.

RESULTS

Diagnostic accuracies for assessing T and N staging were not significantly improved by adding PET/MRI in both readers. However, PET/MRI showed significantly improved diagnostic accuracy for M staging in one reader (P=0.031) and marginal improvement in the other reader (P=0.063) compared to MDCT alone. Regarding resectability of gastric cancer, the diagnostic accuracy of MDCT with PET/MRI was significantly higher than that of MDCT alone in both readers (P=0.016 for reader 1 and P=0.004 for reader 2). Additional seven patients (7/23, 30.4%) in reader 1 and nine patients (9/23, 39.1%) in reader 2 were correctly classified according to the resectability of gastric cancer by adding PET/MRI.

CONCLUSION

PET/MRI could significantly improve the diagnostic accuracy for preoperative M staging as well as resectability of gastric cancer compared to those of MDCT alone, and additional one-third of patients were correctly classified according to the resectability by using PET/MRI.

CLINICAL RELEVANCE/APPLICATION

PET/MRI could significantly improve the diagnostic accuracy for preoperative M staging as well as resectability of gastric cancer compared to those of MDCT alone, and additional one-third of patients were correctly classified according to the resectability by using PET/MRI.

SSG11-04 Combined Reading of PET and MR Datasets in Integrated PET/MR: A Comparison of Different MR Sequences in Whole-body Oncological Imaging

Tuesday, Dec. 1 11:00AM - 11:10AM Location: S505AB

Participants
Benedikt M. Schaarschmidt, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Johannes Grueneisen, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Verena Ruhlmann, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Buchbender, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the performance of different magnetic resonance (MR) sequences in tracer uptake allocation and visual detectability in integrated [18]F-fluorodeoxyglucose ([18]F-FDG) positron emission tomography (PET)/MR examinations intraindividually and with

computed tomography (CT) from PET/CT.

METHOD AND MATERIALS

Whole-body, contrast-enhanced PET/CT and subsequent PET/MR was performed in 61 patients for an oncological tumor staging. In PET/MR, the protocol comprised the following sequences: T2, turbo inversion recovery magnitude (TIRM), non-enhanced T1, contrast-enhanced T1, and diffusion-weighted imaging (DWI). Per patient, visual lesion detectability and anatomical allocation of the PET finding were assessed using a four-point ordinal scale (scored from 0 to 3) in a maximum of ten [18]F-FDG-avid lesions in the different MR sequences and in CT from PET/CT. Malignancy of each lesion was confirmed using radiological follow-up and histopathology as standard of reference. Differences in each category were analyzed using Wilcoxon rank sum tests. To prevent α-error accumulation, Bonferroni-Holm correction was performed

RESULTS

A total of 225 PET positive lesions were analyzed. 156 lesions were confirmed as malignant by radiological follow up and 69 by histopathology. T2 (mean 2.4±0.9), TIRM (mean 2.5±0.9), DWI (mean 2.5±1.0), and CT (mean 2.5±0.9) had a comparable visual detectability and were superior to non-enhanced T1 (mean 2.2±1.0). Anatomic allocation of the PET finding was similar in T2 (mean 2.6±0.7), TIRM (mean 2.8±0.7), and CT (mean 2.6±0.7) but was significantly higher compared to non-enhanced T1 (mean 2.4±0.8) and DWI (mean 2.1±1.0).

CONCLUSION

In whole-body imaging, T2, TIRM and contrast-enhanced T1 provide a lesion detectability and an anatomical allocation of a PET finding that is comparable to PET/CT. While non-enhanced T1 may be omitted, the necessity of DWI has to be investigated further in specific diagnostic problems.

CLINICAL RELEVANCE/APPLICATION

The results of this study help to optimize PET/MR protocols, leading to reduced examination times, improved workflow and increased patient comfort in every day clinical practice.

SSG11-05 Evaluation of a FAST-protocol for Simultaneous 18F-FDG PET/MR Imaging for the Evaluation of Patients with Lymphoma

Tuesday, Dec. 1 11:10AM - 11:20AM Location: S505AB

Participants
Johannes Grueneisen, Essen, Germany (*Presenter*) Nothing to Disclose
Lino Sawicki, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Saravanabavaan Suntharalingam, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Thomas C. Lauenstein, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG

PURPOSE

PET/CT with 18F-FDG is widely accepted as the diagnostic standard of care for patients with lymphoma. The purpose of this study was to evaluate the diagnostic performance of a FAST-protocol for integrated PET/MR imaging, used for pretreatment staging, therapy monitoring and surveillance of patients with lymphoma in comparison to PET/CT.

METHOD AND MATERIALS

44 consecutive lymphoma patients were prospectively enrolled for a clinically indicated PET/CT and a subsequent PET/MR examination. For PET/MRI readings, a whole-body FAST-protocol was implemented, comprising (1) a transversal DWI (EPI) sequence, (2) a transversal T2w HASTE sequence and (3) a transversal post-contrast T1w VIBE sequence. Two readers separately evaluated both examinations and were instructed to identify all tumor lesions. Furthermore, the standardized uptake value (SUV) for all 18F-FDG-avid lesions was determined in PET/CT and PET/MRI, using volume of interest (VOI) analysis. Agreement between PET/CT and PET/MRI regarding SUVmax and SUVmean was tested using Pearson's product-moment correlation.

RESULTS

Malignant lesions were present in 24 of the 44 patients. Both, PET/CT and PET/MRI correctly identified disease presence in all 24 patients. Furthermore, all PET-positive lesions that were visible on PET/CT were also detectable on PET/MRI. Determined SUVs were significantly higher in PET/MRI than in PET/CT (SUVmax 9.8 vs 7.2, $p<0.001$; SUVmean 5.3 vs 4.2, $p<0.001$), however, there was a strong correlation between SUVmax and SUVmean of the two imaging modalities ($R=0.89$, $p<0.001$ and $R=0.90$, $p<0.001$). Estimated scan duration of one whole-body PET/CT examination as well as for the standard and fast protocol for whole-body PET/MR imaging amounted to 18.5 ± 1.0 min and 27.5 ± 2.0 min, respectively. Furthermore, calculated mean effective-dose for a whole-body PET/CT scan was 66.5% higher than for a FAST-PET/MRI examination.

CONCLUSION

The FAST-protocol for PET/MR imaging offers an equivalently high diagnostic performance for staging lymphoma patients in comparison to PET/CT with only a slightly prolonged examination time.

CLINICAL RELEVANCE/APPLICATION

With regard to patient comfort related to scan duration and a markedly reduced radiation exposure, FAST-PET/MRI may serve as a powerful alternative to PET/CT for a diagnostic work-up of patients with lymphoma.

SSG11-06 Diagnostic Accuracy of Whole-body 18F-FDG PET/MRI and Whole-body DWI/MRI for the Evaluation of Patients with Lymphoma

Tuesday, Dec. 1 11:20AM - 11:30AM Location: S505AB

Participants

Johannes Grueneisen, Essen, Germany (*Presenter*) Nothing to Disclose
Lino Sawicki, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
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Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG

PURPOSE

To prospectively evaluate the diagnostic performance of integrated 18F-FDG PET/MRI for whole-body staging of patients with lymphoma in comparison to DWI/MRI.

METHOD AND MATERIALS

42 consecutive patients underwent a whole-body 18F-FDG PET/MRI (Biograph mMR, Siemens) including diffusion-weighted imaging (DWI) for pretreatment staging as well as for therapy monitoring and surveillance of lymphoma disease. Two radiologists separately evaluated the DWI/MRI datasets, followed by a second reading of 18F-FDG PET/MRI datasets. Both readers were instructed to identify the total number of tumor lesions. Apparent diffusion coefficients (ADC) and standardized uptake values (SUV) were determined and served as an orientation for a differentiation between malignant and benign lesions. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy in the detection of malignant lesions were calculated for DWI/MRI and 18F-FDG PET/MRI.

RESULTS

Malignant lesions were present in 23 of 42 patients. 18F-FDG PET/MRI enabled correct identification of all 23 (100%) patients and was true negative in 18/19 (95%) cases. DWI/MRI detected disease presence in 20/23 (87%) patients and was true negative in 17/19 (89%) patients. Furthermore, the calculated sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of 18F-FDG PET/MRI for the detection of malignant lesions were 97%, 91%, 97%, 91% and 95%, respectively. The respective values for DWI/MRI were 80%, 74%, 89%, 59% and 79%.

CONCLUSION

The results demonstrate the superiority of 18F-FDG PET/MRI in detecting malignant and benign lesions in lymphoma patients in comparison to DWI/MRI alone.

CLINICAL RELEVANCE/APPLICATION

The present study underlines the usefulness of 18F-FDG PET data as a valuable additive to MR imaging for a more accurate evaluation of patients with lymphomas, enabling a reduction of false-positive findings.

SSG11-07 [18F]-FDG-PET/MR versus [18F]-FDG-PET/CT for the Assessment of Lymphoma: A Prospective Study in 30 Patients

Tuesday, Dec. 1 11:30AM - 11:40AM Location: S505AB

Participants
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Marius E. Mayerhoefer, MD, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess and compare the diagnostic performances of [18F]-FDG-PET/MR and [18F]-FDG-PET/CT in patients with Hodgkin (HL) and Non-Hodgkin lymphoma (NHL).

RESULTS

Thirty patients were included: MALT lymphoma, n=14 patients; mantle cell lymphoma, n=4; nodal marginal zone lymphoma, n=3; Burkitt, follicular lymphoma, and HL, n=2 respectively; and DLBCL, T-cell, and post-transplant NHL, n=1, respectively. Five patients were scanned twice: 3 for staging and restaging and 2 twice for restaging. Overall 35 examinations were available for this study. PET/MR showed 100% Se and Sp (95%CI, 86.7-100%; and 72.2-100%; respectively). PET/CT showed 80% Se and Sp (95%CI, 60.9-91.1%; and 49-94.3%; respectively). The region-based agreement between PET/MR and PET/CT was 98.9%. Three patients were upstaged by PET/MR (stage I instead of 0; all MALT lymphomas).

CONCLUSION

[18F]-FDG-PET/MR showed a higher diagnostic value for the detection of lymphoma than PET/CT, particularly for MALT lymphoma.

CLINICAL RELEVANCE/APPLICATION

[18F]-FDG-PET/MR showed a higher diagnostic value for lymphoma than PET/CT. Since PET/MR also offers a lower radiation exposure, it may possibly become the preferred imaging technique for lymphoma.

SSG11-08 PET/MRI versus PET/CT: Qualitative and Quantitative Assessment of Bone Lesion Conspicuity

Tuesday, Dec. 1 11:40AM - 11:50AM Location: S505AB

Participants
Tyler J. Fraum, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose
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Jonathan E. McConathy, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc

PURPOSE

Because standard MRI-based attenuation correction (AC) does not account for the effects of cortical bone on PET photons, PET/MRI may have reduced sensitivity for FDG-avid focal bone lesions (FFBLs). In contrast, the CT-based AC used in PET/CT does correct for cortical bone attenuation. This study evaluates whether MRI-based AC compromises detection of FFBLs, by comparing their conspicuity on PET/MRI versus PET/CT.

METHOD AND MATERIALS

190 general oncology patients underwent whole-body PET/CT followed by whole-body PET/MRI, utilizing the same FDG dose. Thirteen patients with a total of 50 FFBLs were identified. Using auto-contouring software, a region of interest (ROI) was generated for each FFBL and for an adjacent region of normal background bone (BB). For each ROI, SUV-max and SUV-mean were determined. Lesion-to-background SUV ratios served as quantitative metrics of conspicuity. Additionally, two blinded readers evaluated the relative conspicuity of FFBLs on PET images derived from MRI-based AC versus CT-based AC. The visibility of FFBLs on corresponding CT and MR images was also assessed.

RESULTS

As expected, the average SUV-mean was lower on PET/MRI for both FFBLs (-8.8%, $p = 0.009$) and BB (-22.7%, $p < 0.001$). The average SUV-max was lower on PET/MRI for BB (-14.3%, $p = 0.002$) but not for FFBLs (-7.4%, $p = 0.068$). On average, the ratio of FFBL SUV-mean to BB SUV-mean was higher for PET/MRI (+29.5%, $p < 0.001$). 40 of 50 lesions (80%) were visually deemed to be of equal or greater conspicuity on PET images derived from PET/MRI. 35 of 50 FFBLs (70%) had CT correlates, while 40 of 50 FFBLs (80%) had correlates on at least one MRI sequence. The mean tracer-to-image time was longer ($p < 0.001$) for PET/MRI (127 v. 62 min).

CONCLUSION

Both FFBLs and BB had lower mean SUVs on PET/MRI. This discrepancy was likely due to differences in the handling of cortical bone by MRI-based AC versus CT-based AC. Despite this systematic bias, FFBLs had greater conspicuity on PET/MRI, when assessed both qualitatively and quantitatively. This difference was at least in part due to the longer tracer-to-image time for PET/MRI, which allowed for more tracer accumulation by FFBLs and more tracer washout from BB.

CLINICAL RELEVANCE/APPLICATION

Our results suggest that whole-body PET/MRI and PET/CT provide comparable sensitivity for detection of FDG-avid focal bone lesions.

SSG11-09 Simulation of Tracer Dose Reduction in PET by Retrospective Undersampling of PET Listmode Data

Tuesday, Dec. 1 11:50AM - 12:00PM Location: S505AB

Participants
Sergios Gatidis, MD, Tubingen, Germany (*Presenter*) Nothing to Disclose
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Juergen F. Schaefer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Nina Schwenzer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Holger Schmidt, PhD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To implement and validate a method for simulation of low-dose PET images.

METHOD AND MATERIALS

In order to simulate a reduction of PET tracer dose, PET images acquired in list mode data were retrospectively undersampled by random deletion of predefined proportions of PET events. The resulting undersampled PET data were then reconstructed resulting in PET images simulating PET images acquired at lower tracer doses. In order to validate this proposed approach, phantom experiments were performed using a dedicated PET phantom according to the National Electrical Manufacturers Association (NEMA). Phantom compartments were filled with different activity concentrations of 18F-Fluoride. PET data were acquired at different time points corresponding to decreasing tracer dose concentrations (according to the radioactive decay of 18F) on a combined PET/MR scanner (Biograph mMR, Siemens). Reduced-dose PET images were additionally derived from the measured data set with the highest activity concentration (first measurement) using the proposed method. Measured and corresponding simulated PET images were compared by visual inspection and by quantification of image quality metrics signal-to-noise ratio (SNR), background variability (BV) and contrast recovery coefficients (CRC).

RESULTS

PET images acquired by measurement at different activity concentrations were visually equivalent to the corresponding simulated PET images. Quantitative analysis of the measured image quality metrics also revealed a high similarity between measured and simulated low-dose PET images. Deviations of SNR, BV and CRCs were lower than 20 % for all activity concentrations.

CONCLUSION

Simulation of low-dose PET images is possible by retrospective undersampling of PET list mode data and enables the generation of PET images with similar characteristics as PET images actually measured at low activity concentrations.

CLINICAL RELEVANCE/APPLICATION

The proposed approach will enable the simulation and comparison of different tracer dose regimes in a clinical setting. Thus, it will be possible to derive optimal dose regimes with minimal diagnostic radiation exposure and sufficient diagnostic image quality.

SSG12

Neuroradiology (The Aging Brain and Neurodegenerative Disease)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: N226

NR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Jeffrey R. Petrella, MD, Durham, NC (*Moderator*) Advisory Board, Johnson & Johnson Speakers Bureau, Quintiles Inc Advisory Board, Piramal Enterprises Limited
Mykol Larvie, MD, PhD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSG12-01 Tract-specific Degeneration of White Matter Microstructure is Related to Worse Cognitive Performance

Tuesday, Dec. 1 10:30AM - 10:40AM Location: N226

Participants
Lotte G. Cremers, MD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose
Marius De Groot, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, Siemens AG; Speakers Bureau, Siemens AG
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PURPOSE

Organization of white matter microstructure has been related to cognition. Yet, it remains unclear whether it is a brain-wide loss or localized loss of microstructure that leads to worse cognition. We investigated the role of tract-specific white matter microstructure in global cognitive function and specific cognitive domains.

METHOD AND MATERIALS

In 4516 non-demented middle-aged and elderly (mean age 63.8 ±11.1 years, 55.4% female) we obtained diffusion magnetic resonance imaging parameters (fractional anisotropy (FA) and mean diffusivity (MD)) in 25 white matter tracts using probabilistic tractography. In general, lower values of FA and higher values of MD are reflecting loss of white matter microstructural organization. With a cognitive test battery we assessed memory, information processing speed, executive function, and motor speed. We studied the association of tract-specific white matter microstructural organization and cognition using multivariable linear regression models, adjusting for macrostructural pathology, cardiovascular risk factors and APOE-ε4 allele carriership.

RESULTS

Loss of tract-specific white matter microstructure in all tracts, except for the brain stem tracts, was associated with worse global cognition. Lower FA in the association and callosal tracts and higher MD in the projection and association tracts most strongly related to poorer cognition. Loss of white matter microstructure associated with worse information processing speed, executive functioning, and motor speed, but not with memory.

CONCLUSION

Loss of white matter microstructure mainly in projection, association and callosal tracts is related to worse cognition, especially to worse information processing speed, executive function and motor speed, but not to memory.

CLINICAL RELEVANCE/APPLICATION

Tract-specific microstructural changes may aid in identifying early biomarkers to predict which persons will suffer from neurodegenerative diseases.

SSG12-02 Stripe Sign of Precentral Gyri in Amyotrophic Lateral Sclerosis: A Novel Finding on Phase Difference Enhanced Images-initial Results

Tuesday, Dec. 1 10:40AM - 10:50AM Location: N226

Participants
Shingo Kakeda, MD, Kitakyushu, Japan (*Presenter*) Nothing to Disclose
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Yukunori Korogi, MD, PhD, Kitakyushu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recently, we have developed new phase-weighted MR imaging, "Phase Difference Enhanced Imaging (PADRE)", in which phase difference between objective and surrounding tissue is selected in order to enhance the contrast of objective tissue. We compared the precentral gyri (PG) of patients with amyotrophic lateral sclerosis (ALS) and healthy subjects on PADRE images to determine whether the visualization of changes makes it possible to discriminate between ALS patients and healthy subjects on an individual

basis.

METHOD AND MATERIALS

At first, with a nonblinded manner, two radiologists reviewed the normal and ALS appearances of the PG on PADRE images, and deviations from the normal PG appearance were recorded. Next, the observer performance study based on the PG abnormalities on PADRE image was performed by two reviewers, and both diagnostic accuracy and inter-observer agreement for the diagnosis of ALS on PADRE images were calculated.

RESULTS

At the nonblinded evaluations, the two radiologists consensually defined the PG as abnormal when the following finding was present; a low signal intensity layer was seen in the middle gray matter in the PG. By the low signal intensity layer , we found that the four-layer organization could be characterized in the PG (Figure). The observer performance study demonstrated that the sensitivity, specificity, and accuracy of PG abnormalities on PADRE images for discriminating ALS patients from healthy subjects were 100% for reviewer 1 and 90%, 100%, and 96% for reviewer 2. The k values for inter-observer agreement were excellent (k = 0.932).

CONCLUSION

We propose the term "stripe sign" to describe the characteristically abnormal appearance (four-layer organization) of the PG in the ALS patients. Based on novel PADRE finding on the PG it was possible to discriminate between ALS patients and healthy subjects. The PADRE finding in ALS patients may reflect pathologic changes due to the degeneration of upper motor neurons.

CLINICAL RELEVANCE/APPLICATION

PADRE in ALS patients showed a stripe sign on precentral gyri, which may be the useful finding for diagnosis of ALS on an individual basis.

SSG12-03 Systolic Cerebrospinal Fluid Flow Distinguishes Patients with Normal Pressure Hydrocephalus from Age-Matched Controls

Tuesday, Dec. 1 10:50AM - 11:00AM Location: N226

Participants
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PURPOSE

Patients with idiopathic normal pressure hydrocephalus (iNPH) suffer from a potentially treatable cause of dementia, and therefore benefit from fast and precise diagnosis. However, MR-based imaging signs are often ambiguous, and obscured by concomitant age-related changes such as generalized atrophy and microangiopathy. The aim of this study was to find an MR-based flow measure that can help discriminate iNPH patients from age-matched controls.

METHOD AND MATERIALS

10 patients with NPH (mean age=74.4, STD=6.2, 8 female), 18 age-matched healthy control subjects (mean age=71.1, STD=5.2, 11 female), and 14 young control subjects (mean age=21.6, STD=1.7, 8 female) were studied using a 3.0 T MR scanner (Siemens Healthcare, Erlangen, Germany). Cine phase-contrast images of blood and CSF flow to and from the cranium were used to quantify systolic CSF flow rate and arterial blood flow rates.

RESULTS

Maximal systolic CSF flow rate was significantly decreased in iNPH patients as compared to age-matched healthy controls ($p<0.01$). Maximal systolic arterial blood flow, however, did not differ significantly between patients and their age-matched controls ($p>0.05$). Both maximal arterial blood flow and CSF flow were reduced in healthy adult subjects and iNPH patients as compared to the young control group ($p<0.0001$ respectively).

CONCLUSION

While both vascular and CSF flow rates showed age-related decline, only reduction of CSF flow exceeded age-related changes in iNPH patients.

CLINICAL RELEVANCE/APPLICATION

Reduced systolic CSF flow rates are a robust and easily obtainable MR-based measure that may support the diagnosis of iNPH.

SSG12-04 Enlarged Perivascular Spaces on MRI - Pathological or Normal Finding in Cognitive Impairment?

Tuesday, Dec. 1 11:00AM - 11:10AM Location: N226

Participants
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Lena Cavallin, MD,PhD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Enlarged perivascular spaces (EPVS) are seen as a normal finding in the brain. However, increased amounts of EPVS have shown associations with high age and impaired cognitive function, and are thought to be a marker of cerebral small vessel disease. In this study we sought to investigate EPVS in a continuum of cognitive impairment, and the associations with clinical and radiological parameters.

METHOD AND MATERIALS

989 patients undergoing memory investigation (mean age 63 ±10) were recruited and scanned on 1.5T MRI scanners. Routine clinical cerebrospinal fluid (CSF) biomarkers, amyloid B42 (AB42), total-tau (T-tau), tau phosphorylated at threonine 18 (P-tau), and CSF/ serum albumin ratios were analyzed in 761 patients. Rating of EPVS was made on T2-weighted sequences according to the EPVS rating scale. Associations between EPVS and clinical and radiological parameters were analyzed with multivariate linear and logistic regression models, controlling for appropriate variables.

RESULTS

Increasing number of EPVS had increased odds ratio for white matter hyperintensities (WMH) (OR: 3.7, 95CI: 2.5-5.4), cerebral microbleeds (OR: 2.3, 95CI: 1.6-3.3) and lacunar infarctions (OR: 3.2, 95CI: 2.2-4.8). Odds ratios for EPVS further increased with high age (OR: 2.5, 95CI:1.8-3.5), mild cognitive impairment (OR:1.1, 95CI: 1.0-1.1), and vascular dementia (OR:2.5, 95CI: 1.1-5.8), but not in Alzheimer's disease. No association between low cognition, measured by the MMSE test, and increased EPVS was seen. AB42 levels decreased with increasing EPVS (Beta: -0.131, P<0.01). T-tau (Beta: 0.10, P<0.01) and P-tau (Beta: 0.08, P<0.05) levels increased with increasing EPVS. No difference was seen in CSF/serum albumin ratios.

CONCLUSION

Our results suggest that increased EPVS may be a marker of cerebral small vessel disease, and associated with cognitive impairment. Increased EPVS with vascular dementia, but not with Alzheimer's disease suggests that EPVS may be more associated with vessel damage caused by hypertensive arteriopathy.

CLINICAL RELEVANCE/APPLICATION

Increased enlarged perivascular spaces may be a marker of cerebral small vessel disease, and associated with cognitive impairment.

SSG12-05 Diffusion Tensor Imaging of the Corticospinal Tract in Patients with Amyotrophic Lateral Sclerosis, Primary Lateral Sclerosis, and Mimic Syndromes

Tuesday, Dec. 1 11:10AM - 11:20AM Location: N226

Participants
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Sumit N. Niogi, MD, PhD, New York, NY (*Abstract Co-Author*) Institutional license agreement, Athlemetrics ; Potential royalties, Athlemetrics
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PURPOSE

Diffusion tensor imaging (DTI) of the corticospinal tract (CST) has been proposed as an objective method to aid in diagnosis of amyotrophic lateral sclerosis (ALS) and primary lateral sclerosis (PLS). Clinical diagnosis of ALS and PLS is difficult as early symptoms are indistinguishable from those of other neurologic disorders. We test whether CST changes measured by DTI are different in patients with ALS and PLS compared with other motor symptom-predominant neurologic disorders.

METHOD AND MATERIALS

3 Tesla 33-direction DTI data were retrospectively reviewed in patients with suspected ALS. 6 regions of interest (ROI) were selected along each CST bilaterally using a semi-automated technique operating on native space. Subjects were categorized by diagnosis (definite ALS, probable ALS, PLS, and disease mimics ultimately diagnosed with a non-upper motor neuron condition). Fractional anisotropy (FA) and mean diffusivity (MD) values from the ROIs were analyzed by diagnostic group using Mann-Whitney U-tests and non-parametric ANOVA.

RESULTS

DTI sequences for 27 patients including 13 patients with definite ALS, 3 probable ALS, 3 definite PLS, and 8 other suspected upper motor neuron diseases ultimately not diagnosed as ALS or PLS were analyzed. Average CST FA was lower in patients with definite or probable ALS and PLS vs other diagnosis (0.56 vs 0.61, p=0.009). MD was higher in definite or probable ALS and PLS vs other diagnosis (0.00076 vs 0.00071, p= 0.03). By ROI, FA in definite ALS and PLS groups was significantly lower than other diagnosis group at the level of the left pons, left cerebral peduncle, and left pyramid (p<0.05). MD was higher in the ALS and PLS groups than other diagnosis group in the left cerebral peduncle (p=0.01)

CONCLUSION

We have demonstrated significant differences in FA and MD in patients with ALS and PLS compared to mimic syndromes, which may be of clinical utility in differentiating these disorders. This is the first study to our knowledge to compare DTI measures in patients with known ALS, PLS, and other motor symptom-predominant neurologic disease. Further evaluation with additional patients and comparison with controls is warranted.

CLINICAL RELEVANCE/APPLICATION

DTI may provide an objective method to distinguish ALS and PLS from mimic syndromes.

SSG12-06 Fluid Dynamics Study of CSF in Idiopathic Normal Pressure Hydrocephalus

Tuesday, Dec. 1 11:20AM - 11:30AM Location: N226

Participants
Lekang Yin, Shanghai, China (*Presenter*) Nothing to Disclose
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Xiaoxue Zhang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the difference of CSF fluid dynamics at the aqueduct between idiopathic normal pressure hydrocephalus (iNPH) patients and normal elderly.

METHOD AND MATERIALS

A totle of 15 iNPH patients (iNPH group)and 20 healthy volunteers as normal control (NC group) were included in this study. The flow data of CSF through the aqueduct were collected with phase-contrast cine method in 3T MR unit (MR PC-cine). The CSF fluid dynamics parameters including peak cranio-caudal velocity, peak caudo-cranial velocity, net flow volume, stroke volume, minute flow volume, as well as the direction of net flow were measured and compared statistically between the two groups.

RESULTS

The flow curve of iNPH group was similar to the NC, both presented a sinusoidal flow pattern and caused a net flow per cardiac cycle. All fluid dynamics parameters except for peak cranio-caudal velocity (iNPH vs NC: 6.50±1.63 vs 5.76±1.32, P=0.20) were significantly increased in patients with iNPH. The net flow of 13 iNPH patients (13/15) were in the caudo-cranial direction, while 15 volunteers (15/20) were in the opposite direction, which was statistically significant differences (P =0.002).

CONCLUSION

iNPH patients present a hyperdynamic flow with increased velocity and volume during a cardiac cycle. The degree of rising in caudo-cranial direction exceeds that in cranio-caudal directon. The resulting reversal of net flow direction may play a key role in the occurrence of hydrocephalus in iNPH patients.

CLINICAL RELEVANCE/APPLICATION

This finding about the reversal of net flow direction in iNPH patients helps to understanding the development of the disease.

SSG12-07 Quantitative Susceptibility Mapping of the Motor Cortex in ALS and PLS Patients: A Biomarker for Upper Motor Neuron Dysfunction

Tuesday, Dec. 1 11:30AM - 11:40AM Location: N226

Participants
Santanu Chakraborty, FRCR, DMRD, Ottawa, ON (*Presenter*) Grant, Bayer AG; Grant, General Electric Company
Gerd Melkus, PhD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Pierre Bourque, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Motor Neuron Disease is a progressive neurodegenerative disease characterized by lower- (LMN) and upper motor neuron (UMN) dysfunction in ALS (Amyotropic Lateral Sclerosis) and mostly UMN dysfunction in PLS (Primary Lateral Sclerosis). The diagnosis is currently based on clinical assessment, electrodiagnostic studies and exclusion of other diseases. Electromyography effectively detects LMN degeneration but there is no definite technique for demonstrating UMN involvement and UMN findings on clinical examination may not occur until late in the disease course. A method that detects early UMN involvement and accurately monitors disease progression is highly desirable especially for future clinical trials and strategies for early intervention.

METHOD AND MATERIALS

Ten ALS and three PLS patients were included in the study. The QSM processing was performed with a software package developed in-house using Matlab. To evaluate the susceptibility changes, ROIs were drawn into the right (RMC) and the left motor cortex (LMC). For control, susceptibility values were calculated from ROIs in the anterior border of precentral gyrus on the right (RCT) and left (LCT). We correlated the susceptibility values between the primary motor cortex (in the hand knob area) and the anterior border of precentral gyrus with presence of UMN signs (spasticity and hyperreflexia) and also most affected side of symptoms.

RESULTS

Patients with spasticity symptoms have significant higher susceptibility values in the motor cortex area than those who do not ($p<0.043$). In the patient group showing symptoms of spasticity the susceptibility in the control cortex area is significant lower than in the motor cortex area ($p<0.001$).

CONCLUSION

Our results suggest QSM could be a quantitative tool to detect changes in the UMN chnages in ALS and PLS. Larger prospective studies will be needed to find the incidence, sensitivity and specificity of this sign in ALS patients and to establish its prognostic value.

CLINICAL RELEVANCE/APPLICATION

QSM could be a quantitative tool to detect changes in the motor cortex in ALS and PLS patients as an objective marker of UMN involvement. However, larger prospective studies will be needed to find the incidence, sensitivity and specificity of this sign and its

prognostic value.

SSG12-08 A Preliminary Study of the Relationship between the Volume of Hippocampal Subfields and Memory Deficits in Patients with Thalamus Infarction

Tuesday, Dec. 1 11:40AM - 11:50AM Location: N226

Participants
Tianyou Luo, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose
Li Chen, Chongqing, China (*Presenter*) Nothing to Disclose

PURPOSE

Although Clinical and animal studies show the memory function is affected in thalamus infarction (TI), and thalamic nucleus have prominent direct and indirect connections with the hippocampal system, there is no study on the effects of the diagnosis of memory dysfunction of TI on hippocampal subfields volume with in vivo magnetic resonance (MR) imaging. To investigate the influence of thalamus infarction on the memory and hippocampal subfields volume, we measured the volume of each hippocampal subfield of patients with TI using structural MR imaging and tested their association with the performance of the memory.

METHOD AND MATERIALS

A total of thirty-seven TI patients and thirty-eight age, education matched healthy elderly controls were enrolled in the present study. MR imaging were performed at a 3.0T MR scanner. Volumes of hippocampal subfields on MR images were automatically estimated using FreeSurfer software. Clinical examinations (verbal recall, recall of the complex graphics and digit span backward task) were performed for all subjects. Two sample t-test was conducted to explore differences in hippocampal subfield volumes, with intracranial volume and age as covariate variables. Partial correlation analyses were used to examine the relationship between volumes of hippocampal subfields and the memory function in patients, when controlling age, gender and years of education.

RESULTS

TI group had smaller volume in presubiculum (left, $p<0.001$; right, $p<0.001$) and subiculum (left, $p=0.029$; right, $p=0.006$) when compared with healthy control. In addition, smaller presubiculum volumes were related with poorer long delayed recall ($r=0.403$, $p=0.020$) and complex graphics recall ($r=0.410$, $p=0.018$) in TI patients. Moreover, smaller subiculum volumes were associated with poorer short delayed recall ($r=0.397$, $p=0.022$).

CONCLUSION

Our findings indicated that thalamus infarction lead to hippocampal abnormality and memory deficits. These preliminary results suggested that information might not be passed between hippocampal subfield regions and thalamus, and aberrant hippocampus could not be responsible for memory function in patients with thalamus infarction.

CLINICAL RELEVANCE/APPLICATION

o far as we know, this is the first study exploring the pattern of volume reductions in specific hippocampal subfields in TI patients and investigating association between hippocampal subfield volume and memory function.

SSG12-09 Alzheimer's Disease: Diagnostic Potential of Phase Difference Enhanced MR Imaging at 3T

Tuesday, Dec. 1 11:50AM - 12:00PM Location: N226

Participants
Machiko Tateishi, Kumamoto, Japan (*Presenter*) Nothing to Disclose
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Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

Phase difference enhanced imaging (PADRE) technique can selectively enhanced the phase difference between the target and surrounding tissue and might visualize amyloid-related brain changes in Alzheimer's disease (AD). We aimed to determine whether it is possible to diagnose patients with AD on an individual basis using 3T MR images with PADRE.

METHOD AND MATERIALS

All MRI studies were performed with a 2-mm 2D fast-field echo sequence on a 3-T Philips scanner. We studied 10 AD patients (7 females, 3 males; age range 53-82 years, mean age 64 years) and 10 age-matched healthy controls. Two radiologists independently graded the signal of the cerebral cortices in the superior frontal gyrus (SFG), superior temporal gyrus (STG), precuneus (PrCn) and cuneus (Cun) on MR images with PADRE using a 4-point scale: grade 0, no delineation of low signal area (LSA); grade 1, subtle delineation of LSA; grade 2, partial delineation of LSA; and grade 3, diffuse delineation of LSA. Contrast ratio (CR) between the cortices and adjacent white matter was measured. Mann-Whitney U test was used for qualitative and quantitative assessments.

RESULTS

For the cortices other than the SFG, the mean grade of the cerebral cortex was significantly higher for AD patients than control subjects (STG, $p=0.027$; PrCn, $p=0.0002$; Cun, $p=0.013$). Mean CR of the cerebral cortices other than the SFG was significantly higher for AD patients than control subjects (STG, $p=0.0052$; PrCn, $p=0.023$; Cun, $p=0.002$).

CONCLUSION

Our MR study using PADRE suggests that the signal in the specific cerebral cortices in AD patients is different from that in healthy subjects.

CLINICAL RELEVANCE/APPLICATION

3T MR images with PADRE may provide useful information for the diagnosis of AD.

SSG13

Neuroradiology (Imaging of White Matter and Demyelinating Disease)

Tuesday, Dec. 1 10:30AM - 12:00PM Location: N227

NR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Aaron S. Field, MD, PhD, Madison, WI (*Moderator*) Nothing to Disclose
Ashok Srinivasan, MD, Ann Arbor, MI (*Moderator*) Author, Reed Elsevier

Sub-Events

SSG13-01 Subcortical White Matter Hyperintensity Burden in Astronauts

Tuesday, Dec. 1 10:30AM - 10:40AM Location: N227

Participants
Jeremy Bernot, MD, Joint Base San Antonio Lackland, TX (*Presenter*) Nothing to Disclose
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PURPOSE

We postulated that subcortical white matter hyperintensities (WMH) without clinical symptoms might be occurring in astronauts exposed to hypobaric conditions. We previously demonstrated the presence of increased WMH burden in high altitude U-2 pilots (U2P) and altitude chamber aerospace physiology personnel (AOP) occurring in the absence of clinical symptoms.

METHOD AND MATERIALS

In our prior study evaluating WMH burden in high altitude U-2 pilots (U2P) and aerospace physiology personnel (AOP) we obtained 2-dimensional 5mm clinical MRI sequences, both T2 FSE and FLAIR. Brain exams were conducted on the two Siemens 3T magnets with either a 12-channel or 32-channel phased array head coil. The National Aeronautics and Space Administration (NASA) has previously obtained similar 3T brain MRI scans on 42 astronauts after international space station (ISS) mission completion. These scans were conducted on 3 different 3T magnets, two Siemens scanners and one Philips scanner, with 12-channel head coils. WMH burden was evaluated by 1 neuroradiologist and 1 neurologist for lesion count. Assessment of lesion volume is in progress. Nonparametric Wilcox statistics were used to compare the astronauts to our normative, advanced degree (DOC) population (n= 162) data as well as our AOP group (n = 83) and U2P group (n = 105). Age range of our prior study populations was 26-50; average DOC 34.6; average AOP 36.5; and average U2P 37.7. NASA age range 35-55, average 45.

RESULTS

The average number of WMHs for U2P was 8.1; AOP 6.3; DOC 2.8; and for the NASA astronauts 9.4. Wilcox rank sum test with continuity correction data demonstrates a significant difference for WMH burden between the NASA group and DOC (p value = 0.0211). There was no significant difference between the NASA group and AOP (p = 0.4762) or U2P (p = 0.725) groups.

CONCLUSION

Astronauts demonstrate a similar WMH burden to our high altitude U2 pilots and aerospace physiology personnel, significantly higher than the normal population.

CLINICAL RELEVANCE/APPLICATION

This study suggests the potential for similar pathophysiology in astronauts as seen in personnel exposed to the hypobaric environment in military operations, which has direct relevance to future deep space operations. Understanding the association between WMHs and hypobaric exposure may provide insight into the pathophysiology of other white matter disease processes.

SSG13-02 FLAIR² for Improved MS Lesion Detection

Tuesday, Dec. 1 10:40AM - 10:50AM Location: N227

Participants
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PURPOSE

To improve the spatial resolution and contrast-to-noise ratio (CNR) of fluid attenuated inversion recovery (FLAIR) MRI.

METHOD AND MATERIALS

Data from 5 healthy controls and 29 patients with relapsing-remitting and progressive multiple sclerosis (MS) were acquired on a Philips 3T using sagittal 3D sequences. Signal-to-noise ratio and CNR were estimate by assessing the noise between repeated acquisitions of the same scan. Various spatial resolutions ranging from 0.2 mm^3 to 1 mm^3 were tested.

RESULTS

Gray matter (GM)- white matter (WM) CNR was by 55% and 74.5% higher in FLAIR² than in FLAIR and double inversion recovery (DIR) and improved between lesions and WM by 59% and 29.6%, respectively. The figure shows a 3D T2 (A), a conventional 3D FLAIR (B), 3D FLAIR² (C) and 3D DIR of a person with relapsing-remitting MS. In agreement with the quantitative CNR measurements, lesion conspicuity and contrast between GM and WM appear improved on FLAIR². Here, FLAIR² was acquired at 0.6×0.75×1.35 mm^3 and reconstructed to 0.3 mm^3 voxels, while DIR was acquired and reconstructed to 1 mm^3. The 3D-nature of FLAIR² allowed the visualization of callosal and infratentorial MS lesions. Cortical and juxtacortical MS lesions were more conspicuous in FLAIR² than in the other scans.

CONCLUSION

We present a simple approach for obtaining CSF suppression with improved CNR compared to conventional FLAIR and DIR. Lesions in the entire brain are captured, including infratentorial regions, the corpus callosum and most of the cervical cord as well as cortical lesions, at high spatial resolution. With its DIR-like contrast, FLAIR² may elegantly resolve the debate whether or not to include DIR into the standard imaging protocol of MS.

CLINICAL RELEVANCE/APPLICATION

FLAIR² is very easy to acquire on most MR scanners. Apart from MS, the improved detection of WM hyperintensities will benefit research and diagnosis in Alzheimer's disease, neurotrauma, stroke and other applications. The isotropic 3D-acquisition allows for excellent image registration in serial studies, which may improve automated detection of lesions. Dedicated head-neck coils will allow to assess abnormalities in the entire cervical cord and parts of the thoracic cord.

SSG13-03 Clinical Feasibility of Synthetic MRI in Multiple Sclerosis: A Diagnostic and Volumetric Validation Study

Tuesday, Dec. 1 10:50AM - 11:00AM Location: N227

Participants
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Maria Kristoffersen Wiberg, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To implement synthetic magnetic resonance imaging (syMRI) on a new scanner type and to compare its diagnostic accuracy with conventional MRI in multiple sclerosis (MS). Secondary aims were to study the repeatability of syMRI volumetry and compare its feasibility with commonly used volumetric methods.

METHOD AND MATERIALS

This prospective study was approved by the ethical review board and written informed consent was obtained. In October 2014, 20 MS patients were consecutively recruited along with 20 healthy controls. SyMRI was implemented on a Siemens 3T scanner. Comparable conventional (11:00 minutes) and synthetic (6:50 minutes) T1, PD, T2 and FLAIR images were acquired. Diagnostic accuracy, lesion detection and artifacts were assessed by blinded neuroradiological evaluation and contrast-to-noise ratios by manual tracing. Volumetry was performed with SyMRI, Freesurfer, FSL and SPM. Ordinal data was analyzed using Wilcoxon signed ranks test and categorical data using McNemar test. Repeatability was quantified using the inter-measurement coefficient of variance (CoV).

RESULTS

Synthetic images were of good to sufficient quality, except FLAIR images that were degraded by artifacts. All participants were correctly classified as patients/controls and incidental findings were identical with both MRI techniques. There were no differences in lesion number ($P = 0.78$) or location ($P = 0.50$-0.77). SyMRI provided the fastest segmentations with the lowest CoV for brain volume (0.14%) and brain parenchymal fraction (0.14%).

CONCLUSION

SyMRI provides diagnostic T1-, PD- and T2-weighted images in MS patients and controls. Synthetic brain tissue segmentations are fast and precise quantitative biomarkers suitable for longitudinal MS studies.

CLINICAL RELEVANCE/APPLICATION

Synthetic MRI can lower the threshold of implementing radiological quantitative biomarkers into clinical practice in MS by providing fast and precise brain tissue segmentations Conventional T1, PD and T2 sequences could possibly be replaced by synthetic images with the additional benefits of being able to arbitrarily adjust the weightings post-hoc and a slight reduction in acquisition times, meanwhile providing abovementioned quantitative biomarkers.

SSG13-04 Grey/white Matter Ratio at Diagnosis, and the Risk of 10-year Multiple Sclerosis Progression

Tuesday, Dec. 1 11:00AM - 11:10AM Location: N227

Participants
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Mario Quarantelli, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
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Sirio Cocozza, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonio Carotenuto, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Grey and white matters are both affected in multiple sclerosis (MS), but poorly correlate among each other. This is possibly due to the heterogeneous pathological substrates of the disease, with preponderance of white matter demyelinating inflammation in relapsing-remitting (RR), and of grey matter neurodegeneration in secondary progressive (SP). Aim of the study is to investigate the relationship between grey and white matter in a population of newly diagnosed RRMS subjects, with long-term MS-related outcomes.

METHOD AND MATERIALS

The present 10-year retrospective longitudinal study included 134 RRMS subjects that performed MRI at the time of diagnosis with acquisition of T1-weighted volumes for segmentation purposes. In particular, the ratio between grey and white matter was subsequently calculated. The occurrence of clinical relapses, the reaching of Expanded Disability Status Scale (EDSS) 4.0, and the SP conversion were recorded during a mean follow-up period of 10.1±1.8 years (from 7.1 to 13.2).

RESULTS

During the study period, 54 subjects (40.3%) reached EDSS 4.0, and presented reduced grey/white matter ratio, as compared to subjects not reaching EDSS 4.0 (1.270±0.156 and 1.343±0.185, respectively) (p=0.017). At the same time, 29 subjects (21.6%) converted to SP, and presented reduced grey/white matter ratio, as compared to subjects not converting to SP (1.241±0.149 and 1.334±0.179, respectively) (p=0.012). In particular, subjects with higher grey/white matter ratio at diagnosis had a 80% reduced rate of reaching EDSS 4.0 (p=0.040; hazard ratio=0.195; 95% confidence interval=0.041-0.829), and a 90% reduced rate of SP conversion, as compared to subjects with lower grey/white matter ratio (p=0.043; hazard ratio=0.105; 95% confidence interval=0.011-0.831).

CONCLUSION

The ratio of grey/white matter is a predictor of disability progression and of SP conversion in newly diagnosed RRMS subjects, suggesting that different pathological substrates are present from the early phases of MS, and highlighting the importance of appropriate MRI techniques at MS diagnosis.

CLINICAL RELEVANCE/APPLICATION

The present study evaluated for the first time the ratio between grey and white matter in MS, suggesting a novel MRI method to predict MS progression from the diagnosis.

SSG13-05 Substages of Acute Multiple Sclerosis Lesions Demonstrated on Quantitative Susceptibility Mapping and R2* from Gradient Echo MRI

Tuesday, Dec. 1 11:10AM - 11:20AM Location: N227

Participants
Yan Zhang, Wuhan, China (*Presenter*) Nothing to Disclose
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Joseph P. Comunale JR, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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Yi Wang, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Multiple sclerosis (MS) lesions at early stages are highly dynamic and pathologically heterogeneous, and therefore not well delineated in standard MRI. Quantitative susceptibility mapping (QSM) and R2* may offer new insight into the rapid changes in myelin and iron content within new lesions. The goal of this study was to characterize changes in QSM and R2* at various stages of lesions gadolinium enhancement.

METHOD AND MATERIALS

This retrospective study included 43 MS patients with newly identified T2w white matter lesions that first appeared on the current T2w image compared to the former scans. All patients underwent a 3D gradient multiple echoes sequence to generate QSM and R2* maps. These new lesions were substaged according to enhancing patterns: nodular, shell and non-enhancing. Lesions susceptibilities and R2* values were quantified and compared using analysis of variance (ANOVA) among three patterns. A paired t test was used to analyze susceptibility and R2* between the enhancing rim and the non-enhancing core of shell lesions.

RESULTS

Of the total 116 new T2w WM lesions, 65 were nodular with 62 (95.4%) isointense on QSM, 17 were shell with 15 (88.23%)

hyperintense on QSM and 34 were non-enhancing hyperintense on QSM lesions. The susceptibilities relative to contralateral mirror side normal appearing WM (NAWM) were 0.66 ppb ± 4.64 for nodular, 10.21 ppb ± 6.92 for shell, and 19.94 ppb ± 7.39 for non-enhancing (P<.01). R2* values relative to NAWM were -5.60 Hz ± 7.39, -7.80 Hz ± 2.40 and -3.10 Hz ± 2.48 (P<0.001) respectively. Of the 17 shell enhancing lesions, the differences of susceptibilities and R2* between the enhancing rim and non-enhancing core were significant (7.65 ppb ± 6.92 vs 15.51 ppb ± 7.30, P < .05; -6.13 Hz ± 2.31 vs -9.13 Hz ± 2.95, P <.05).

CONCLUSION

Gadolinium enhancement of acute MS lesions only reflects breakdown of blood-brain barrier. New T2 MS lesions may be substaged into acute, sub-acute, and early chronic according to GRE data: no change in QSM but rapid decrease in R2* during acute stage, rapid increase in QSM and further decrease in R2* during sub-acute, and increase in both QSM and R2* during early chronic.

CLINICAL RELEVANCE/APPLICATION

QSM and R2* can be used to capture different stages of early multiple sclerosis (MS) lesions.

SSG13-06 Decreased GABA Concentrations in Patients with Relapsing-remitting Multiple Sclerosis Demonstrated by Edited Magnetic Resonance Spectroscopy

Tuesday, Dec. 1 11:20AM - 11:30AM Location: N227

Participants
Fei Gao, Jinan, China (*Presenter*) Nothing to Disclose
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Fuxin Ren, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Guanmei Cao, Jinan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Gamma-aminobutyric acid (GABA) is the main inhibitory neurotransmitter in the central nervous system. Previous studies have demonstrated that there is a dysfunctional GABAergic neurotransmission in animal models of multiple sclerosis (MS). Edited magnetic resonance spectroscopy (MRS), using the MEGA-PRESS sequence, is the most widely used technique for detecting GABA in the human brain. However, to date there has been a paucity of studies exploring changes in GABA concentration in patients with MS. In this study, therefore, J-difference edited MRS was used to investigate GABA concentrations in patients with relapsing-remitting MS (RRMS) and healthy controls.

METHOD AND MATERIALS

Fifteen patients with RRMS (7 males/8 females, mean age 41.7±3.6 years) and fifteen healthy controls (6 males/9 females, mean age 43.3±4.7 years) were examined on a 3T scanner and T1-weighted three-dimensional TFE images were used as a localizer. The MEGA-PRESS sequence (TR 2000 ms; TE 68 ms; 256 averages) was used to measure GABA concentrations in the posterior cingulate cortex (PCC), left dorsolateral prefrontal cortex (DLPFC) and left hippocampus (LHC). For quantification, a shorter measurement (8 averages) of the unsuppressed water signal was obtained. The MRS data were analyzed using 'Gannet' (GABA-MRS Analysis Tool) in Matlab with Gaussian curve fitting to the GABA peaks. 3 Hz exponential line broadening was applied. The ratios of the integrals of the GABA and water signals, making corrections for T1 and T2 relaxation times and partial volume effects, were used to calculate water-scaled GABA concentration in mmol/L (mM) using a formula.

RESULTS

GABA concentrations in the PCC and LHC regions were significantly lower in RRMS patients compared to healthy controls (PCC region: 0.95±0.09 mM vs. 1.06±0.13 mM, p = 0.01; LHC region: 1.04±0.20 mM vs. 1.23±0.22 mM, p = 0.02). No statistical difference in GABA concentrations in the DLPFC region was seen between groups (0.91±0.10 mM vs. 0.95±0.13 mM, p = 0.32).

CONCLUSION

These results are consistent with a hypothesis of dysfunctional GABAergic neurotransmission in the central nervous system in patients with MS, and suggest a potential treatment target for MS.

CLINICAL RELEVANCE/APPLICATION

MRS study suggests dysfunctional GABAergic neurotransmission in the central nervous system in patients with MS, as well as a potential treatment target for MS.

SSG13-07 Temporal Assessment of Injury and Repair in Multiple Sclerosis Lesions Using Structure Tensor Analysis

Tuesday, Dec. 1 11:30AM - 11:40AM Location: N227

Participants
Laura Chin, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose
Andrew Szava-Kovats, MD, Edmonton, AB (*Presenter*) Nothing to Disclose
Yunyan Zhang, MD, PhD, Calgary, AB (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Multi-focal plaques remain to be the hallmark of multiple sclerosis (MS). Subtle changes in lesion structure are ongoing but not detectable with standard measures. Here we aimed to determine how lesions evolve in brain MRI of MS patients using a new measure of tissue alignment, structure tensor analysis.

METHOD AND MATERIALS

19 untreated MS patients were scanned bimonthly for 14 months at 1.5T. All images were non-uniformity corrected and sequential images were co-registered to baseline MRI (month 0). T2 lesions were segmented with reference to other MRI contrasts and followed over time. For lesions appeared during study, we mapped their onset time to baseline for consistency. Structure tensor analysis was applied to the corrected T2 images that resulted in 2 index maps: coherency and energy, which represent tissue

anisotropy and total strength of directions respectively. Lesion outcomes were then extracted from corresponding index maps and averaged per MRI slice, timepoint, and patient. Lesion size was also computed for comparison. Outcome significance was assessed using multi-effect modeling (p<=0.05).

RESULTS

We identified 156 white matter lesions; 145 visible throughout the study; 15 lesions appeared post baseline and were adjusted. Overall, there is a trend to increase for lesion coherency, prominently from month 10. Lesion energy appeared stable except a remarkable decrease at month 8, as also seen in lesion coherency. These results are not affected by lesion adjustment. Lesion size tended to decrease over 14 months.

CONCLUSION

Abrupt increase in lesion coherency from month 10 suggests tissue repair including remyelination in these patients. While being a similar measure to diffusion anisotropy, structure tensor coherency has the advantage of using standard MRI, no extra scan time needed. Stable energy and lesion size may indicate lack of sensitivity of these measures. Further confirmation is warranted.

CLINICAL RELEVANCE/APPLICATION

Structure tensor coherency may become a new measure of nerve repair in MS lesions after demyelination. As it is embeddable to clinical MRI, this measure may improve routine patient care.

SSG13-08 Lack of Correlation between Neck Venous Drainage and Multiple Sclerosis

Tuesday, Dec. 1 11:40AM - 11:50AM Location: N227

Participants
Sirio Cocozza, MD, Napoli, Italy (*Presenter*) Nothing to Disclose
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Marco Salvatore, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Enrico Tedeschi, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Presence of flow abnormalities in neck veins of Multiple Sclerosis (MS) patients is still controversial, and the best imaging technique to evaluate them is not well defined yet. Aim of this study is to evaluate, using a quantitative MRI analysis, blood flow and venous stenosis in neck vessels, and investigate if there are differences between MS patients and healthy controls (HC), along with possible correlation with clinical scores.

METHOD AND MATERIALS

A group of 61 Relapsing-Remitting MS patients (mean age 38±11 years; F/M=27/34) and 18 HC (mean age 38±13.6 years; F/M=8/10) underwent MR scan of the neck. Acquisition included a 2D dynamic Phase-Contrast sequence (TR=66.8ms; TE=5.3ms; slice thickness=3mm; 30 time points), with peripheral retrospective triggering, acquired as a single slice at two different levels (C2 and C6).Quantitative measures, obtained with a semi-automated method through a dedicated software (Signal Processing In NMR - SPIN, Detroit, USA), were: left and right internal jugular vein (IJV) flow rates, and their cross-sectional areas, total IJV flow rate, total arterial and venous blood flow rates and the corresponding arteriovenous mismatch.Clinical variables included: number of relapses, disease duration, Expanded Disability Status Scale, Annualized Relapsing Rate and Multiple Sclerosis Severity Score.All statistical analyses were performed using SPSS (SPSS Inc, 2008, V.17.0. Chicago, SPSS Inc.).

RESULTS

Only 13/61 (21.3%) MS patients, with 7/18 HC (38.9%), showed a reduction in IJV cross sectional area. An independent samples t-test between MS patients and HC showed no significant differences for any flow measure. Furthermore, no correlations were found between any MR measure and clinical variables.

CONCLUSION

Quantitative MR evaluation of blood flow in neck vessels found no difference between MS patients and HC in any of the tested flow measures, confirming that the neurovascular hypothesis of MS is, in our sample, not suitable. Also, MS patients and HC showed no difference in terms of IJV area, suggesting that IJV stenosis is not related to the disease. Further studies, with a larger HC group, need to be performed to confirm our results.

CLINICAL RELEVANCE/APPLICATION

Neck venous drainage abnormalities have been claimed to be associated with Multiple Sclerosis. Conversely, our quantitative MR analysis seems to exclude that venous patterns are related to the disease

SSG13-09 fMRI and Multiple Sclerosis: Cognitive Function Assessment Using Verbal Fluency Paradigm

Tuesday, Dec. 1 11:50AM - 12:00PM Location: N227

Participants
Bernardo C. Bizzo, MD, Rio De Janeiro, Brazil (*Presenter*) Nothing to Disclose
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Lucas Faria, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose
Soniza Alves-Leon, PhD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

Emerson L. Gasparetto, MD, Rio de Janeiro, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Multiple Sclerosis (MS) is an autoimmune disease of Central Nervous System, characterized by chronic inflammatory demyelination of both white and grey matter pathology. Individuals with MS suffer from a range of physical, psychiatric and cognitive symptoms. Cognitive impairments have been reported in 40-60% of these patients and verbal fluency tests such as semantic and phonemic have consistently been reported as more sensitive to executive functions impairments in MS than other measures. The aim of this study was to evaluate MS patients by functional magnetic resonance imaging (fMRI) with a verbal fluency paradigm and cognitive neuropsychological scores.

METHOD AND MATERIALS

Nineteen patients with MS (14 women; mean age 35.47 years, SD +/- 9.01) underwent a neuropsychological assessment including: Mini Mental State Examination for exclusion criteria; Semantic and Phonemic Verbal Fluency to measure verbal initiation and inhibition, memory, phonological and semantic language; and Hayling test to evaluate verbal initiation and inhibition, search strategies, syntactic-semantic and processing speed. This was followed by one fMRI session within a period of no more than one month and no less than 1 week. All MRI studies were performed on a 3T Siemens Trio, using fMRI EPI sequences while the patients responded to a verbal fluency task. Image processing and analysis were done using BrainVoyager software using GLM.

RESULTS

During Whole brain analysis (qFDR<0.05) we found an increased BOLD response to verbal fluency task of Wernicke and Brocas areas and Inferior Frontal Gyrus (Broadman Area 9) in left hemisphere. In a ROI analysis, this activation had an inverse correlation (r = -0,61, p<0,01) between Hayling test scores and Wernicke area fMRI responses during Verbal Fluency task. In this situation, subjects that scored higher in Hayling test exhibited lower Wernicke responses to verbal fluency task.

CONCLUSION

This results revealed that those patients that had reduced processing speed to evoke words had higher scores in Hayling test and lower brain responses in Wernicke area, reflecting on executive functions difficulties in initiation and inhibition of phonological and semantic language.

CLINICAL RELEVANCE/APPLICATION

Cognitive impairments are important causes to functional disability on ME patients, and knowing its functional relationships in the brain can affect treatment decisions and improve patients life quality.

BRS-TUB

Breast Tuesday Poster Discussions

Tuesday, Dec. 1 12:45PM - 1:15PM Location: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants
Emily F. Conant, MD, Philadelphia, PA (*Moderator*) Speaker, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Siemens AG

Sub-Events

BR246-SD-TUB1 Breast Density Variation Across a Screening Program

Station #1

Participants
Samantha L. Heller, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose
Laura Ward, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sue Hudson, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Louise S. Wilkinson, MBBCh, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study aims to map density variation across a regional screening population using automated volumetric software and to perform a subset textural analysis of women with the densest breasts.

METHOD AND MATERIALS

This retrospective study on a screening population adheres to local confidentiality requirements. Breast density data was obtained from screening mammograms (March 2013-February 2015); density was measured using Volpara Density software (VolparaSolutions Wellington, NZ), a fully automated volumetric method. Breast volume(BV), fibroglandular tissue volume(FGV), and breast density% (%BD) were obtained. %BD was divided into preassigned categories (Grades 1-4) which accord to BI-RADS categories. BV, FGV as well as BD% and Volpara Grade were analyzed with respect to age using R statistics; breast cancer distribution was mapped with respect to %BD and age. Subset of women with highest (Grade 4) density was qualitatively categorized by a specialist breast radiologist for textural pattern based on Tabár classifications (Type IV-extensive nodular and linear densities; Type V-homogenous; or a mixed pattern).

RESULTS

40,760 screening records were evaluated (age range 43-90). Half of women had a breast volume between 488 and 1100 cm3. %BD was similar across age range as was FGV, but with slight downward trend. Negative trend for age versus %BD was noted in women < 56, but distribution of density measurements shifted >55; older women in our study generally had less dense breasts, but with more variability. Figure 1 shows Volpara %BD by age; cancers (yellow circles) are identified at all %BD. Subset analysis of Volpara Grade 4 cases was performed for evaluation of textural features. Majority of Volpara Grade 4 mammograms occurred in younger women (55% were in women <55). Nodular and smooth density patterns were seen in equivalent numbers across age groups.

CONCLUSION

As expected, age impacts on breast density. Of note, older women in our study generally had less dense breasts, but greater variability. Textural density distribution was equivalent across age groups.

CLINICAL RELEVANCE/APPLICATION

Age impacts on breast density. Older women in our study had generally less dense breasts, but with more variability. Longitudinal studies are warranted to determine cancer risk, especially in older women with densest breasts.

BR247-SD-TUB2 Predictive Value of Ultrasound Posterior Acoustic Features in the Biological Behaviour of Breast Cancer

Station #2

Participants
Salvador Alandete, MD, Valencia, Spain (*Presenter*) Nothing to Disclose
Yinet Fernandez Nunez, MD, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose
Rosana Medina, MD, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose
Esther Blanc Garcia, MD, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To correlate the sound-attenuating properties of breast cancer with tumor grade, hormone receptor status,HER2 overexpression and ki-67 biomarker as well as to assess the predicting value of these features.

METHOD AND MATERIALS

Our study includes 130 cases of invasive ductal carcinomas and invasive lobular carcinomas diagnosed from January to December of 2012.The predominant posterior acoustic features were retrospectively analyzed and divided into four categories:Posterior shadowing,posterior enhancement,mixed pattern and no change. The sound-attenuating properties were then correlated with tumor grade,hormone receptors,HER2 and Ki-67.

RESULTS

Of the 130 tumors,99 (77.6%) were ER-positive/PR-positive,16 (11.2%) were ER-positive/PR-negative and 15 (11.2%) were ER-negative/PR-negative (8 were triple negative).In tumors with posterior shadowing (n=51), 49 (96.0%) were ER-positive,having greater than four times the odds of having ER-positive/PR-positive findings (p<0.001). In tumors with posterior enhancement (n = 59), 13 (22.0%) were ER-negative/PR-negative, having greater than four times the odds of having at least one negative receptor (p<0.001) and a significantly greater probability of having triple-negative status than those without posterior enhancement.Of the lesions with posterior enhancement, 12 (20.3%) showed a high level expression of biomarker ki67 compared to tumors with posterior shadow (p<0.001).High levels of ki67 are associated with a low histological differentiation and the occurrence of lymph node metastases.There were no statistically significant differences between the presence of shadow or posterior enhancement and level of expression of ErbB2.

CONCLUSION

The presence of posterior shadow is strongly associated with ER+/PR+ status. Posterior enhancement is strongly associated with higher tumor grade and with higher risk of having at least one negative receptor, a triple-negative status and with higher expression of ki67 biomarker.

CLINICAL RELEVANCE/APPLICATION

Some of the sophisticated laboratory tests are not readily available or not cost-effective in many parts of the world. Knowing the predictive values of certain sonographic features of breast cancer may help to stratify their patients and manage them according to their own available resources. Increased diagnostic confidence in imaging can always help to develop cost-effective strategies around the world.

BR248-SD-TUB3 BI-RADS 3 (Short-Interval Follow-Up) Assessment Rate at Diagnostic Mammography: Correlation with Recall Rates and Utilization as a Performance Benchmark

Station #3

Participants
Kristin L. Harris, DO, Chicago, IL (*Presenter*) Nothing to Disclose
Kevin J. Kirshenbaum, MD, Evanston, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the correlation between established performance benchmarks for screening mammography and the BI-RADS 3 (short-interval follow-up) assessment rate from diagnostic mammographic examinations.

METHOD AND MATERIALS

Retrospective analysis was performed using data collected by a centralized mammography tracking and reporting system (PenRad™, Revision 4.0). Interpretation data for screening and diagnostic mammograms were obtained for five interpreting mammographers at a single mammography facility between January 2004 and December 2014. Exclusion criteria included mammographers with less than 700 mammogram interpretations per year. Recall rates from screening mammography and BI-RADS 3 assessment rates from diagnostic mammography were analyzed by radiologist and year. Data points were represented on a scatter plot as recall rate as a function of BI-RADS 3 assessment rate and correlation coefficients were calculated.

RESULTS

Preliminary results involved data analysis from a total of 75,269 screening mammography examinations and 42,753 diagnostic mammography examinations with a total of 16,369 BI-RADS 3 (short-interval follow-up) assessments. 63.2% of collected data points (N = 38) demonstrate a positive linear relationship between recall rate from screening mammography and BI-RADS 3 assessment rate from diagnostic mammography (correlation coefficient, r = 0.56).Initial data presented above. Final data analysis in progress; to include interpreting mammographers from all affiliated sites using exclusion criteria, as above.

CONCLUSION

The use of BI-RADS-3 (short-interval follow-up) assessment category for diagnostic mammographic examinations vary considerably between radiologists. Based on preliminary data from our institution, there appears to be a positive linear relationship between the BI-RADS 3 assessment rate from diagnostic mammography and the recall rate from screening mammography, suggesting potential utility in utilizing the BI-RADS 3 assessment category as a performance measure in the future.

CLINICAL RELEVANCE/APPLICATION

Although well-established performance benchmarks for screening mammography exist, performance criteria for diagnostic mammography are not well-established in the current literature. The utilization of BI-RADS 3 assessment rate as a performance measure may help reduce unnecessary imaging examinations and decrease associated costs and patient anxiety in the future.

BR249-SD-TUB4 Synthesized 2D Mammogram from Digital Breast Tomosynthesis (DBT) as a Preview Image: A Pilot Observer Study

Station #4

Participants
Jun Wei, PhD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Heang-Ping Chan, PhD, Ann Arbor, MI (*Abstract Co-Author*) Institutional research collaboration, General Electric Company
Mark A. Helvie, MD, Ann Arbor, MI (*Abstract Co-Author*) Institutional Grant, General Electric Company
Marilyn A. Roubidoux, MD, Ann Arbor, MI (*Abstract Co-Author*) Research Consultant, Delphinus Medical Technologies, Inc
Colleen H. Neal, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Lubomir M. Hadjiiski, PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Chuan Zhou, PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Ravi K. Samala, PhD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the acceptability of a synthesized mammogram (SM) from DBT as a preview for DBT interpretation.

METHOD AND MATERIALS

With IRB approval, 56 DBT cases including 105 views (CC or MLO) were collected from a data set acquired with a prototype GE DBT system. For each DBT view, a corresponding clinical digital mammogram (DM) was retrospectively collected from the patient archive. The time interval between the DBT and the corresponding DM was 3-76 days (17.8±15.2). DMs were acquired with a GE Essential system. An experienced MQSA radiologist marked 68 microcalcification clusters (MC) on 60 views from 31 cases and 48 masses on 45 views from 25 cases, of which 65 (52 MCs and 13 masses) were malignant and 51 (16 MCs and 35 masses) were benign, as lesions of interest. A computerized method was developed that utilized the raw DBT projection and a regularized reconstructed DBT to synthesize a mammogram-like image. A pilot observer study with three MQSA radiologists was conducted to assess the acceptability of the SM as a preview image. Each reader viewed the pair of SM and DM side by side and independently rated the appearance and conspicuity of the lesion on a 10-point scale, and provided a BI-RADS assessment (1, 2, 3, 4a, 4b, 4c, 5) of the marked lesion on SM and DM.

RESULTS

The mean conspicuities of MCs were 7.7, 7.0, 8.0 on SM and 5.8, 5.5, 7.2 on DM for the 3 readers, respectively; the differences were significant by paired t-tests (all p-values <0.0001). In contrast, the conspicuities of masses were 4.3, 4.5, 5.0 on SM and 4.9, 5.0, 5.9 on DMs; the differences were also significant (p-values: 0.007, 0.022, 0.004). The differences between SM and DM in the BI-RADS assessment of both MCs and masses did not reach statistical significance for all readers. Of the 348 (116x3) BI-RADS assessments, 4 (3 benign masses and 1 malignant MC) were changed from ≤3 on DM to ≥4a on SM, and 17 (11 benign and 3 malignant masses, 2 benign and 1 malignant MCs) were changed from ≥4a on DM to ≤3 on SM.

CONCLUSION

For MCs, the conspicuity on SM was superior while their morphology was slightly inferior to that on DM for BI-RADS assessment. For masses, the interpretation on SM may be affected by the degraded conspicuity.

CLINICAL RELEVANCE/APPLICATION

Detection of MCs is challenging in the DBT volume. Synthesized 2D DBT by our method may be acceptable for detection and assessment of MCs but masses should be read in DBT.

BR250-SD-TUB5 Imaging-detected Radial Scars without Associated Atypia, LCIS, or Papilloma may not Require Surgical Excision

Station #5

Participants
Mohammad Eghtedari, MD, PhD, La Jolla, CA (*Abstract Co-Author*) Research Consultant, Ziva Corporation;
H. Carisa Le-Petross, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Gildy Babiera, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Constance Albarracin, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Kenneth Hess, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Gary J. Whitman, MD, Houston, TX (*Presenter*) Book contract, Cambridge University Press

PURPOSE

Several studies have recommended surgical excision following the diagnosis of a radial scar (RS). Our purpose was to determine if imaging and clinical follow-up are appropriate after the diagnosis of a RS without atypia on core needle biopsy.

METHOD AND MATERIALS

We queried our institutional pathology data base for all percutaneous breast biopsies between January 2004 and December 2010 that had the words 'radial scar' or 'complex sclerosing lesion.' Cases with a breast cancer in the same breast were excluded. We included patients for which the pathology result indicated RS and the patient had at least 24 months follow-up imaging or surgical resection. The size of the core biopsy needle, the number of cores, the length of imaging follow-up, and the final surgical pathology results were collected.

RESULTS

54 cases had RS with no associated high risk lesion (Group A) and 27 cases had RS with a concurrent high risk lesion in the same biopsy specimen (Group B). In Group A, 44 cases had imaging follow-up (median, 49 months) and 10 cases had surgical resection. No cases in Group A developed malignancy (95% confidence interval: 0% to 7%). 3 cases in Group B were upgraded to DCIS on surgical excision (95% confidence interval: 4% to 28%).

CONCLUSION

The risk of missing a breast cancer associated with a RS on percutaneous core biopsy without associated abnormalities such as atypia, a papilloma, or LCIS is minimal. Clinical and imaging follow-up of a RS diagnosed by core needle biopsy is appropriate in selected patients.

CLINICAL RELEVANCE/APPLICATION

The study results can be useful in decreasing the number of excisions following percutaneous biopsy of a RS without associated atypia, LCIS, or papilloma.

BR251-SD-TUB6 Ultrafast and High Spatial DCE-MRI with CAIPIRINHA-Dixon-TWIST-VIBE Technique for Breast Lesions: Quantitative Analysis of Pharmacokinetics Parameters

Station #6

Participants
Tao Ai, MD, WuHan, China (*Presenter*) Nothing to Disclose
Yiqi Hu, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose
Mengdan Feng, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose
Xiao X. Xu, Nanchong, China (*Abstract Co-Author*) Nothing to Disclose

Xu Yan, Shanghai, China (*Abstract Co-Author*) Employee, Siemens AG
Hui Liu, Shanghai, China (*Abstract Co-Author*) Employee, Siemens AG
Liming Xia, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the feasibility of CAIPIRINHA-Dixon-TWIST-VIBE (CDT-VIBE) technique for ultrafast dynamic contrast-enhanced breast MRI with high spatial resolution, and the discrimination for breast lesions with quantitative parameters.

METHOD AND MATERIALS

From June 2014 to March 2015, 86 patients with 90 lesions (68 malignant and 22 benign) were included after the approval of the institutional review board. Dynamic breast MRI was performed on a 3T system (Skyra, Siemens Healthcare), using a 16-channel phased-array breast coil. The protocol was based on a work-in-progress CDT-VIBE sequence (spatial = 1 X 1 X 1.5mm; temporal = 11.24s for 35 phases), with the injection of contrast medium (Omniscan, 0.1mmol/kg·bw at 2.5ml/s). Quantitative pharmacokinetics parameters (Ktrans, Ve and Kep) were calculated for all lesions based on the Tofts model. Student's t test was performed to compare the differences of Ktrans, Ve and Kep between two groups, followed by a ROC analysis for the diagnostic accuracy.

RESULTS

DCE-MRI based on CDT-VIBE technique was successfully performed for each patient, with superior delineation of margins and internal characteristics of breast lesions. Quantitative parameters of Ktrans, Ve and Kep were 0.22 ± 0.11/ml, 0.44 ± 0.17/ml and 0.51 ± 0.09 for benign lesions; 0.37 ± 0.16/ml, 0.91 ±0.33/ml, and 0.42 ± 0.09 for malignant lesions. The difference was statistically significant between two groups for each quantitative parameter. Based on ROC analysis, the sensitivity, specificity, optimal cut-point and AUC were 92.3%, 58.3%, 0.193/ml and 0.808 for Ktrans; 92.3%, 75.0%, 0.546/ml and 0.922 for Kep; 83.3%, 66.7%, 0.455 and 0.743 for Ve.

CONCLUSION

CDT-VIBE technique can be used for ultrafast and high spatial resolution dynamic contrast-enhance breast MRI. Ktrans, Ve and Kep derived from CDT-VIBE sequence allowed for the classification of breast lesions with high sensitivity and accuracy. Kep had the best performance for the differentiation of breast lesions, followed by Ktrans and Ve.

CLINICAL RELEVANCE/APPLICATION

The protocol with high temporal and spatial resolution would be ideal for the quick screening and classification of breast lesions. Ultrafast DCE-MRI based on CDT-VIBE technique allows for both improved anatomic/morphological delineation and functional information of pharmacokinetics of breast lesions.

BR252-SD-TUB7 Assessing Bone Marrow uptake changes During Breast Cancer Therapy on 18F-FLT PET/CT

Station #7

Participants
Prayna Bhatia, BS, Columbus, OH (*Presenter*) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Preethi Subramanian, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Veena A. Nagar, MD, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Xiaoli Liu, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Bhuvaneswari Ramaswamy, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

FLT-PET is being utilized and validated as a non invasive imaging approach to assess the proliferative characteristics of breast cancer lesions and their changes during therapy. While the ability to visualize the bone marrow is readily recognized in FLT-PET, no detailed assessment has yet bene performed on the observable imaging findings during response assessment FLT PET studies

METHOD AND MATERIALS

FLT-PET/CT was performed using a 10 mCi target dose at baseline (BL), day 7 (F1), day 14 (F2) and after three cycles (F3) of an investigational breast cancer therapy in patients with HER2 negative metastatic breast cancer. A whole-body acquisition using a Gemini 64 TF PET/CT was acquired as part of a comprehensive investigational protocol. 25 patients are included in this dedicated analysis of the bone marrow using a blinded reader visual and ROI based assessment. ROI's were placed at L1, L3 and L5, as well as the liver at each time point.Changes in SUVmax were compared against baseline or between time points.

RESULTS

In the majority of cases (22/25), the FLT uptake decreased immediately after therapy (F1) with similar changes in the three vertebrae locations (L1 14% (ΔSUV 1.88), L3 (ΔSUV 2.34) 16%, L5 (ΔSUV 1.79) 13%) followed by a subsequent bone marrow recovery with increasing SUV by 12%. The visual changes appear even more pronounced. The liver presented an inverse trend of proliferative uptake increasing in 62% of patients at F1 (SUV [BL] 5.94, SUV [F1] 6.84, 0.91 increase) followed by a subsequent normalization at F3 (SUV [F3] 6.41, 0.48 increase).

CONCLUSION

Quantitative assessment of the bone marrow uptake is feasible and allows an individualized objective assessment of the proliferative response to ongoing therapy and the extent of recovery over time. The liver proliferation revealed an inverse trend. These therapy induced changes should be considered if FLT PET is assessed by visual reads only and may be relevant for normalization of quantitative readouts for response assessment.

CLINICAL RELEVANCE/APPLICATION

As FLT-PET/CT is being utilized to as a proliferation marker to assess response to therapy, the impact on the bone marrow and liver can also readily be assessed as an individualized tool and those changes need to be considered for visual and quantitative assessment.

Participants

Adverse Effects of Drugs in the Breast and Axilla. What Every Radiologist Should Know

TUB8

Station #8

Karina Pesce, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Flavia B. Sarquis, MD, Vicente Lopez, Argentina (*Presenter*) Nothing to Disclose
Bernardo O. Blejman, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Roxana A. Gerosa, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Vanina Kuznicki, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1- To Know the drug-induced adverse effects in the breast and axilla. 2- To Describe the radiographic findings of these effects by radiological techniques: mammography, ultrasound and magnetic resonance imaging (MRI).

TABLE OF CONTENTS/OUTLINE

IntroductionList of drugs associated breast disordersConcepts and Mechanism of pathogenesisImaging SpectrumCases ManagementConclusion: Drug-induced abnormalities in the breast are common and often undiagnosed. It is important for the radiologist to review medical records to obtain relevant information about drug use and determine whether a relationship exists between them and the findings. Knowledge of these effects and the correct interpretation of the imaging is essential for proper clinical management.

MSES33

Essentials of Musculoskeletal Imaging

Tuesday, Dec. 1 1:30PM - 3:00PM Location: S100AB

MK MR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

MSES33A Introduction to Musculoskeletal Ultrasound

Participants
Maha Torabi, MD, Winston Salem, NC, (mtorabi@wakehealth.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) List the indications, benefits, and limitations of musculoskeletal ultrasound. 2) Demonstrate proper transducer manipulation and system optimization to produce diagnostic images. 3) Recognize common pathology of the musculoskeletal system as seen at ultrasound.

ABSTRACT

Active Handout:Maha Torabi

http://abstract.rsna.org/uploads/2015/15001838/Active MSES33A.pdf

MSES33B MRI of Injuries in the High Performance Athlete

Participants
William B. Morrison, MD, Philadelphia, PA (*Presenter*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc

LEARNING OBJECTIVES

1) Recognize patterns of injury in high performance athletes using MRI. 2) Be able to relate pathology to common injuries in the general population. 3) Realize implications of injury in females and adolescent athletes.

MSES33C Return to Play: Imaging the Athlete

Participants
Bethany U. Casagranda, DO, Pittsburgh, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define Return to Play. 2) Discuss social pressures and controversial dogma surrounding Return to Play. 3) Recognize imaging findings of common sports related injuries. 4) Discuss the radiologist's role in diagnosis of pathology and communication with referring physicians.

ABSTRACT

Athletes of all levels are encumbered by injury and the social stresses of returning to play (RTP). RTP is a broad topic describing the time it takes an athlete to return to their sport after sustaining an injury. This discussion will encompass various levels of play, several sports and position-specific injuries. The focus will be on common injuries as well as controversial topics. Overall, emphasis is on imaging and the role of the radiologist caring for athletes.

MSRO36

BOOST: CNS Tumor Board-Case-based Review of PET/MR Imaging and Role in the Clinical Treatment Management of Brain Tumors (An Interactive Session)

Tuesday, Dec. 1 3:00PM - 4:15PM Location: S103CD

NR MR NM RO

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants
Christina I. Tsien, MD, Saint Louis, MO (*Moderator*) Speaker Bureau, Merck & Co, Inc
Soonmee Cha, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Michael Vogelbaum, MD, Cleveland, OH (*Presenter*) Stockholder, Infuseon Therapeutics, Inc
Patrick Y. Wen, MD, Boston, MA (*Presenter*) Research support, Agios Pharmaceuticals, Inc; Research support, Angiochem Inc; Research support, AstraZeneca PLC; Research support, Exelixis, Inc; Research support, F. Hoffmann-La Roche Ltd; Research support, GlaxoSmithKline plc; Research support, Karyopharm Therapeutics, Inc; Research support, Novartis AG; Research support, sanofi-aventis Group; Research support, Regeneron Pharmaceuticals, Inc; Research support, Vascular Biogenics Ltd; Advisory Board, AbbVie Inc; Advisory Board, Cavion; Advisory Board, Celldex Therapeutics, Inc; Advisory Board, Merck & Co, Inc; Advisory Board, F. Hoffmann-La Roche Ltd; Advisory Board, Midatech Pharma; Advisory Board, Momenta Pharmaceuticals; Advisory Board, Novartis AG; Advisory Board, NovoCure Ltd; Advisory Board, Sigma-Tau Pharmaceuticals, Inc; Advisory Board, Vascular Biogenics Ltd; Speaker, Merck & Co, Inc

LEARNING OBJECTIVES

1) Present latest advances in imaging of brain tumors with special emphasis on PET/MR Imaging. 2) Review strengths, pitfalls, and limitations of the advanced imaging methods in a case-based format. 3) Discuss key imaging methods and features to differentiate recurrent tumor and treatment effect and to identify brain tumor mimics.

RC413

Pediatric Series: Abdomen

Tuesday, Dec. 1 3:00PM - 6:00PM Location: S102AB

GI MR US PD

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.50

FDA Discussions may include off-label uses.

Participants
Brian D. Coley, MD, Cincinnati, OH (*Moderator*) Editor with royalties, Reed Elsevier
Oscar M. Navarro, MD, Toronto, ON, (oscar.navarro@sickkids.ca) (*Moderator*) Nothing to Disclose
Ethan A. Smith, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Jeanne S. Chow, MD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

RC413-01 Sonography of Neonatal Necrotizing Enterocolitis

Tuesday, Dec. 1 3:00PM - 3:20PM Location: S102AB

Participants
Oscar M. Navarro, MD, Toronto, ON, (oscar.navarro@sickkids.ca) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the limitations of abdominal radiographs in necrotizing enterocolitis. 2) Describe sonographic findings in necrotizing enterocolitis. 3) Define the role of sonography in necrotizing enterocolitis.

ABSTRACT

Necrotizing enterocolitis (NEC) is a relatively common disease affecting neonates, especially preterm infants, but can also be seen in term neonates. Despite the progress in neonatal medicine, it remains associated with significant morbidity and mortality, with reported death rates up to 20-30%.Traditionally, neonatal NEC has been imaged with abdominal radiographs, and in fact radiographic findings are part of the Bell staging clinical criteria. Radiographic assessment mainly relies in the evaluation of the bowel gas pattern and in the detection of extraluminal gas. However, most of the radiographic findings are indirect signs of bowel involvement in NEC or its complications and are not always present even in severe cases.Sonography, which can be done by the bedside and without the need of radiation, has the advantage that allows direct visualization of the bowel wall and can assess for the presence of pneumatosis, changes in wall echogenicity, wall thickening, wall thinning, peristalsis and even wall perfusion, including hyperemia and decrease or absent vascularity, all of which can be signs of NEC. Sonography also allows direct visualization of the peritoneal cavity and may detect complex free fluid and localized fluid collections, more often associated with complicated NEC. Furthermore, sonography may also detect portal venous gas and pneumoperitoneum, the latter indicative of bowel perforation. Therefore, sonography may provide information not available on radiographs and aid in the diagnosis of NEC and detection of complications. For example, sonography may allow diagnosis of bowel necrosis before perforation occurs and pneumoperitoneum becomes evident on abdominal radiographs thus facilitating early intervention.In summary, sonography has at least a complementary role to radiographs and its use may affect management of patients with neonatal NEC and possibly their outcome.

RC413-02 Development of a Near Infra-Red (NIR) Plenoptic Imaging System for Detecting Necrotizing Enterocolitis (NEC)

Tuesday, Dec. 1 3:20PM - 3:30PM Location: S102AB

Participants
Rohan Bhavane, PhD, Houston, TX (*Presenter*) Stockholder, Sensulin, LLC
Zbigniew Starosolski, PhD, Houston, TX (*Abstract Co-Author*) Stockholder, Alzeca Biosciences, LLC
Barbara Stoll, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Alex Kaay, BS, Santa Barbara, CA (*Abstract Co-Author*) Nothing to Disclose
Douglas Burrin, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Ananth Annapragada, PhD, Houston, TX (*Abstract Co-Author*) Stockholder, Marval Pharma Ltd Stockholder, Alzeca Biosciences LLC Stockholder, Sensulin LLC Stockholder, Abbott Laboratories Stockholder, Johnson & Johnson

PURPOSE

An early detection of necrotizing enterocolitis (NEC) in premature infants is key in order to reduce morbidity and mortality. Imaging of premature infants is challenging, since transportation outside the NICU and sedation are both unadvisable. We therefore designed a near infra-red (NIR) plenoptic camera system to image premature infants, and a novel liposomal nanoparticle that localizes to NEC lesions upon intravenous injection. This study tested the visualization of NEC lesions in a preterm piglet model.

METHOD AND MATERIALS

The NIR plenoptic camera assembly consists of 3 high-resolution camera CCD detectors mounted on a gantry with 1 axis of rotation with repeatable increment of 0.1 degree. This creates up to 1260 virtual cameras each with a resolution higher than 10 microns (Fig 1.A). Phantoms consisting of a tissue block with capillary tubes filled with the NIR dye - indocyanine green were utilized to fine tune the system for NIR signal detection.For the animal studies, pre term piglets (N=11) were delivered via C-section 2 weeks before reaching full term. The animals were maintained on total parenteral nutrition (TPN) for 2 days after which oral feeds were started.The animals were injected with liposomes containing a NIR dye, indocyanine green, after the oral feeding was commenced. The abdominal region of the animals was imaged at different time points to detect NIR signal.

RESULTS

NIR signal was detected from the location of gastro-intestinal (GI) tract. Animals that developed NEC showed stronger signal than those that did not go on to develop NEC. Figure 1.C shows representative images from a NEC positive and NEC negative animal.

CONCLUSION

The promising results from this preliminary study suggest that NIR optical imaging can aid in early detection of NEC.

CLINICAL RELEVANCE/APPLICATION

NEC is an inflammatory disease of the gastro-intestinal tract that affects pre-term infants. Early detection is critical to reducing mortality. This study reports an NIR imaging method that could be used for early detection of NEC. This technique eliminates the use of radiation, and is conducive to imaging within the NICU, and without the need for sedation.

RC413-03 Effectiveness of a Staged Ultrasound and Magnetic Resonance Imaging Protocol to Diagnose Pediatric Appendicitis

Tuesday, Dec. 1 3:30PM - 3:40PM Location: S102AB

Participants
Thaddeus W. Herliczek, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
David W. Swenson, MD, Brooklyn, CT (*Presenter*) Nothing to Disclose
Elizabeth H. Dibble, MD, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Claudia Cartagena, Providence, RI (*Abstract Co-Author*) Nothing to Disclose
Grayson L. Baird, MS, Providence, RI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to establish the effectiveness of a staged ultrasound (US) and magnetic resonance imaging (MRI) algorithm for the diagnosis of pediatric appendicitis.

METHOD AND MATERIALS

A staged imaging algorithm using US and MRI in pediatric patients with suspected appendicitis was implemented at our institution on January 1, 2011, with US as the initial modality, followed by MRI when US findings were equivocal. A search of the radiology database revealed 2180 pediatric patients who underwent imaging for suspected appendicitis, 1,982 (90.9%) of whom where evaluated according to our established imaging algorithm. A review of the electronic medical record (EMR) of all patients was performed. All imaging reports were reviewed and classified as positive, negative or indeterminate/equivocal for appendicitis, and correlated with surgical and pathology reports.

RESULTS

The prevalence of appendicitis in our patient population was 20.5% (407/1982). Ultrasound alone was performed in 1905 patients (96.1%), yielding sensitivity of 98.7% and specificity of 97.1% for appendicitis. An additional 77 patients underwent MRI following equivocal US, yielding an overall staged imaging algorithm sensitivity of 98.2% and specificity of 97.1%. 0.35% of patients experienced false negative results under the staged protocol. The negative predictive value of the staged protocol was 99.5%.

CONCLUSION

A staged protocol of US and MRI for pediatric appendicitis is effective. Our study demonstrates a staged protocol of US and MRI has a sensitivity of 98.2% and specificity of 97.1% for appendicitis in pediatric patients.

CLINICAL RELEVANCE/APPLICATION

We believe staged protocol of US and MRI could supplant other imaging protocols for pediatric appendicitis. Additionally, staged US and MRI is an effective algorithm to assess pediatric appendicitis without the use of ionizing radiation.

RC413-04 Diagnostic Performance of Noncontrast MRI in Pediatric Appendicitis

Tuesday, Dec. 1 3:40PM - 3:50PM Location: S102AB

Participants
Gray R. Lyons, MD,PhD, New York, NY (*Presenter*) Nothing to Disclose
Pooja Renjen, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ashley E. Giambrone, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Debra Beneck, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Arzu Kovanlikaya, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MRI is increasingly employed as a diagnostic modality for suspected appendicitis in children. However, there is discrepancy as to which MRI sequences are sufficient for safe, timely, and accurate diagnosis. We hypothesized that diffusion weighted imaging (DWI) in conjunction with T2-weighted sequences are sufficient for diagnosis.

METHOD AND MATERIALS

All MRI examinations (n=112) performed at our institution for the evaluation of appendicitis in children were retrospectively collected for re-evaluation. Exams were re-read by blinded pediatric radiologists first as non-contrast exams, including T2-weighted and DWI sequences, then secondly as contrast exams, including T1-weighted contrast enhanced sequences. Samples were scored as positive, negative, or equivocal for appendicitis, or non-visualized appendix. Findings were compared to pathologic or clinical data in the medical record.

RESULTS

The sensitivity (with contrast: 1.0, without contrast: 1.0) and specificity (with: 1.0, without: 0.98) of the exams were not significantly different. However, the percentage of nondiagnostic scans was higher for noncontrast exams (with: 26.1%, without: 37.7%). To test the role of contrast in improving certainty of interpretation, nondiagnostic without contrast scans were re-read

with addition of contrast sequences. With addition of contrast sequences, the number of equivocal scans was reduced from 10 to 2 (80% RR, 9.1% AR) and the number of non-visualized appendix scans was reduced from 23 to 15 (35% RR, 9.1% AR).

CONCLUSION

In the evaluation of appendicitis in children, non-contrast MRI examinations provide similar sensitivity/specificity to contrast-enhanced examinations, however, the number of nondiagnostic studies is higher without contrast. We propose a scanning algorithm whereby an exam is initialized as a noncontrast study and reviewed by a radiologist for diagnostic quality prior to contrast administration, if necessary. With this approach, fewer children will receive intravenous contrast without deterioration in overall diagnostic quality.

CLINICAL RELEVANCE/APPLICATION

MRI diagnosis of acute appendicitis can be performed without contrast for most patients; injection of contrast can be reserved for only those patients with nondiagnostic noncontrast imaging.

RC413-05 Shear-wave Elastography for Evaluation of Clinically Significant Portal Hypertension and Hepatic Fibrosis in Children

Tuesday, Dec. 1 3:50PM - 4:00PM Location: S102AB

Participants
Hee Mang Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Young Ah Cho, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ah Young Jung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Seong Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chong Hyun Yoon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the correlation among the liver stiffness (LS) measured by shear wave elastography (SWE), clinically significant portal hypertension (CSPH), and degree of hepatic fibrosis in children with liver diseases.

METHOD AND MATERIALS

We evaluated 38 consecutive pediatric patients (mean age, 9.7±4.6 years) who underwent ultrasound SWE and transjugular liver biopsy with hepatic venous pressure gradient (HVPG) measurement between June 2012 and March 2015. The patients had various liver diseases. Clinical and laboratory data were retrospectively collected. CSPH was defined as a HVPG ≥ 10 mmHg. Hepatic fibrosis was evaluated based on METAVIR classification of fibrosis. Linear regression analysis was performed to correlate LS with clinically significant PHT. Kruskal-Wallis test was conducted to correlation between LS and degree of hepatic fibrosis. Diagnostic performance of predicting clinically significant PHT and degree of hepatic fibrosis were assessed based on receiver operating characteristic (ROC) curve.

RESULTS

LS showed moderate to strong positive correlation with HVPG ($r=0.603$, $p<0.001$). On multivariate analysis, LS was a significant associated factor for diagnosis of CSPH (OR =1.275, $p=0.009$). The area of under the curve (AUC) for predicting CSPH was 0.839 ($p<0.001$) and the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for an LS cutoff value of 19.7 kPa were 77.8%, 93.1%, 77.8%, and 93.1%, respectively. There was a significant positive correlation between hepatic fibrosis and LS ($p=0.007$). The AUC for predicting advanced hepatic fibrosis (METAVIR stage, F3 or F4) was 0.845 ($p<0.001$) and the sensitivity, specificity, PPV and NPV of an LS cutoff value of 16.2 kPa were 78.6%, 87.5%, 78.6% and 87.5%, respectively.

CONCLUSION

LS exhibited significant correlation with HVPG and hepatic fibrosis. Cutoff values for predicting CSPH and advanced hepatic fibrosis were 19.7 kPa and 16.2 kPa , respectively.

CLINICAL RELEVANCE/APPLICATION

Measurement of LS using SWE can be used for noninvasive assessment and monitoring of CSPH and hepatic fibrosis in pediatric patients with various liver diseases.

RC413-06 US Elastography of Liver and Bowel in Children

Tuesday, Dec. 1 4:00PM - 4:20PM Location: S102AB

Participants
Jonathan R. Dillman, MD, Ann Arbor, MI, (jonathan.dillman@cchmc.org) (*Presenter*) Research support, Bracco Group; Research support, Siemens AG

LEARNING OBJECTIVES

1) Compare and contrast the different US elastography techniques that can be used in children. 2) Apply US elastography to the evaluation of the pediatric abdomen.

ABSTRACT

Multiple forms of ultrasound (US) elastography are available on state-of-the-art clinical ultrasound systems. In general, these techniques are based on either strain or shear wave imaging, and they can easily be performed in children. The basic physics behind each type of US elastography will be explained, and specific advantages and disadvantages will be discussed. Applications of US elastography in the evaluation of the pediatric abdomen will be presented, including assessment of the liver (e.g., for detection of parenchymal fibrosis) and bowel (e.g., for detecting fibrosis within segments of intestine affected by Crohn's disease). Recently published investigations related to US elastography in pediatric populations will be highlighted.

RC413-07 Pediatric Hepatobiliary Interventions

Tuesday, Dec. 1 4:40PM - 5:00PM Location: S102AB

Participants
C. Matthew Hawkins, MD, Decatur, GA, (matt.hawkins@emory.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the spectrum of pediatric hepatobiliary disorders in which invasive imaging is required (using vascular and nonvascular interventional techniques). 2) To describe important hepatobiliary disorders where IR plays a central role in patient management (hepatic vascular malformations, vascular shunts, transplant issues). 3) To emphasize collaboration and communication between clinicians, diagnostic and interventional radiology in managing pediatric hepatobiliary disease.

RC413-08 Accuracy of Multi-echo Magnitude-based MRI Proton Density Fat Fraction to Estimate Longitudinal Change in Hepatic Steatosis in Children with Known or Suspected Non-alcoholic Fatty Liver Disease Using MRS as Reference

Tuesday, Dec. 1 5:00PM - 5:10PM Location: S102AB

Participants
Elhamy R. Heba, MBBCh, MD, San Diego, CA (*Presenter*) Nothing to Disclose
Kevin A. Zand, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Omid Yeganeh, MD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Tanya Wolfson, MS, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Gavin Hamilton, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Michael S. Middleton, MD, PhD, San Diego, CA (*Abstract Co-Author*) Consultant, Allergan, Inc Institutional research contract, Bayer AG Institutional research contract, sanofi-aventis Group Institutional research contract, Isis Pharmaceuticals, Inc Institutional research contract, Johnson & Johnson Institutional research contract, Synageva BioPharma Corporation Institutional research contract, Takeda Pharmaceutical Company Limited Stockholder, General Electric Company Stockholder, Pfizer Inc Institutional research contract, Pfizer Inc
Jeffrey B. Schwimmer, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Claude B. Sirlin, MD, San Diego, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;

PURPOSE

To assess the accuracy of magnitude-based MRI (M-MRI) proton density fat fraction (PDFF) to estimate hepatic steatosis longitudinal change for two to six echoes in children with known or suspected non-alcoholic fatty liver disease (NAFLD), using magnetic resonance spectroscopy (MRS) as reference.

METHOD AND MATERIALS

This IRB-approved, HIPAA-compliant, single center, retrospective, longitudinal analysis included children with at least two MR visits between 2008 and 2011. Two-dimensional, spoiled gradient-echo unenhanced M-MRI was used to estimate hepatic PDFF. Low flip angle (10°) and repetition times of 120 to 270 ms were used to minimize T1 dependence. To correct for T2* decay, six nominally in- and out-of-phase echoes were obtained. Single-voxel MR spectra (STEAM) were analyzed by an experienced MR spectroscopist (8 cm3 voxel size, right lobe of liver away from artifact and vessels, long TR to avoid T1 dependence, five echoes to permit T2 correction, AMARES algorithm and jMRUI platform for analysis). Three circular regions of interest were placed on fifth-echo MR images on three consecutive slices co-localized to MRS voxel location, and propagated to images for the other echoes. M-MRI estimated PDFF was calculated for each visit from the first two to six echoes using a custom Matlab algorithm. M-MRI PDFF accuracy was assessed by Bland-Altman analysis and linear regression modeling of change in MRS PDFF vs. change in M-MRI PDFF, for each M-MRI method (two to six echoes).

RESULTS

Seventy-two children (158 MR examinations) were included in this analysis (50 M, 22 F; mean body mass index 33.6 ± 6.0 kg/m2; range 46.1 to 23.2 kg/m2). Regression analysis showed close agreement between change in M-MRI PDFF and change in MRS across all methods, with slope and intercept ranges for two to six echoes of 1.02 - 1.04 and 0.008 - 0.017%, respectively (close to the slope and intercept of the identity line), and R2 ranging from 0.93 to 0.95.

CONCLUSION

In comparison to MRS, M-MRI PDFF using two to six echoes provides an accurate estimate of hepatic steatosis change in children with known or suspected NAFLD.

CLINICAL RELEVANCE/APPLICATION

M-MRI PDFF may be used to evaluate hepatic steatosis changes in children since it shows strong agreement with MRS PDFF.

RC413-09 Superb Microvascular Imaging for the Detection of Parenchymal Perfusion in Undescended Testes in Young Children

Tuesday, Dec. 1 5:10PM - 5:20PM Location: S102AB

Participants
Mi-Jung Lee, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Yong Seung Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Myung-Joon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Joo Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Superb Microvascular Imaging (SMI) is a novel, highly sensitive technique that can detect low velocity microvascular flow. The purpose of this study was to evaluate differences in perfusion of undescended testes (UDT) compared with normal testes in young children using this technique.

METHOD AND MATERIALS

We prospectively performed testicular ultrasonography including Power Doppler Imaging (PDI) and SMI in young children. The diagnosis of UDT or normal testes was determined according to physical examination by experienced pediatric urologists. Testicular size, volume, and microvascular flow for each testis were evaluated by both PDI and SMI. Microvascular flow was categorized into four grades: grade 0, no detectable intratesticular flow; grade 1, one or two focal areas of flow; grade 2, one linear or more than two focal areas of flow; and grade 3, more than one linear flow. Statistical analysis was performed to compare the differences between undescended and normal testes.

RESULTS

We imaged 40 testes from 20 boys (age, 2-29 months). Eleven boys had normal testes, seven had unilateral UDT, and two had bilateral UDT. The mean age was younger in boys with UDT (7.8 vs. 15.9 months, $p < 0.001$). Testis sizes and volumes were similar between the 29 normal and 11 UDT. However, SMI, but not PDI, detected differences in flow grades between the groups ($p < 0.001$). In univariate analysis, age (odds ratio [OR], 0.829; $p = 0.012$) and low grade flow on SMI (OR of grade 0, 51.886 with $p < 0.001$ and OR of grade 1, 14.29 with $p = 0.017$) were associated with UDT. These parameters were also significant in multivariate analysis (area under the curve, 0.892).

CONCLUSION

This study demonstrated decreased perfusion in the UDT in young children using SMI, which can be helpful for visualizing microcirculation and informing prognosis.

CLINICAL RELEVANCE/APPLICATION

Superb Microvascular Imaging (SMI) can demonstrate microcirculation that cannot be detected using conventional Doppler imaging in young children with undescended testes.

RC413-10 Assessment of Pediatric Hydronephrosis via Quantitative Ultrasound Imaging

Tuesday, Dec. 1 5:20PM - 5:30PM Location: S102AB

Participants
Juan Cerrolaza, PhD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Nora Lee, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Craig A. Peters, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose
Marius G. Linguraru, DPhil, MS, Washington, DC (*Presenter*) Nothing to Disclose

PURPOSE

To create new ultrasound (US) based quantitative imaging (QI) biomarkers of pediatric hydronephrosis (HN) to identify thresholds of safety for the hydronephrotic renal units where diuretic nuclear renography could be avoided.

METHOD AND MATERIALS

The retrospective dataset (IRB approved) consists of 50 patients (mean age 9.6 months; range 0-168 months) of variable severity (grade 1 to 4 according to the Society for Fetal Urology HN scale (SFU-HS)) with concurrent renal 2DUS imaging and diuretic renography (MAG-3). Mean differential uptake was: 49% (range 14-100%). Mean washout half time (T1/2) was: 37.3 min. (range 3 to >120 min.). Manual segmentation of renal parenchyma (RP) and collecting system (CS) was performed for calibration and algorithm development. 131 morphological parameters were computed (e.g. RP and CS size, curvature). Based on these parameters, machine learning techniques (support vector machines) were used to identify critical cases based on different T1/2 thresholds that would be clinically relevant at 20, 30 and 40 min. A best-fit model was derived for each threshold using optimal morphological parameters to categorize the renal units and receiver operating characteristic curve analysis was performed. For comparison similar thresholding was performed using the SFU-HS and the HN Index (HI).

RESULTS

For T1/2 thresholds of 20, 30 and 40 min. and at 100% sensitivity, the specificities were QI: 94, 70 and 74%, SFU-HS: 0, 39 and 33%, and HI: 52, 47, and 62%, respectively. Area under the curve values were QI: 0.98, 0.94 and 0.94, SFU-HS: 0.74, 0.78 and 0.88, and HI: 0.77, 0.78, and 0.80, respectively. The improvement obtained by the QI method was statistically significant ($p < 0.05$ in all the cases using McNemar's statistical test).

CONCLUSION

QI analysis of renal US allows to identify thresholds of clinically significant T1/2 with 100% sensitivity and clinically acceptable specificity. This technology can potentially and safely reduce the number of MAG-3 scans between 50 and 62%.

CLINICAL RELEVANCE/APPLICATION

QI analysis of renal US demonstrates higher diagnostic power than SFU-HS and HI, having the potential to provide robust assessment of HN non-invasively, minimizing the use of ionizing tests and reducing clinical cost.

RC413-11 Comparison of Contrast-enhanced Voiding Urosonography (ceVUS) in Infants and Children Using Optison to Conventional Fluoroscopic Voiding Cystourethrography (VCUG): Preliminary Results

Tuesday, Dec. 1 5:30PM - 5:40PM Location: S102AB

Participants
Carol E. Barnewolt, MD, Boston, MA (*Presenter*) Nothing to Disclose
Jeanne S. Chow, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Catherine Stamoulis, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Harriet J. Paltiel, MD, Boston, MA (*Abstract Co-Author*) Equipment support, Koninklijke Philips NV

PURPOSE

ceVUS is a radiation-free technique currently used in some European centers for diagnosis of vesicoureteral reflux (VUR) in children, but has not been adopted in the USA. There are no reports on the use of Optison, a second-generation US contrast agent available in the USA, for diagnosis of VUR. This study compares our early experience using Optison for ceVUS to conventional VCUG.

METHOD AND MATERIALS

We retrospectively reviewed 48 patients who underwent ceVUS with Optison immediately followed by VCUG for evaluation of fetal hydronephrosis (24), febrile UTI (16), solitary functioning kidney (5), urethral valves (2) and family history of VUR (1). 24 males and 24 females ranged in age from 2 days-10 years, median 5 months, (25th, 75th) quartiles (1.0, 11.5 months). Optison doses ranging from 0.125-1.25 cc were injected into 250 cc of saline and instilled via gravity through a urethral catheter into the bladder. Image clips of bladder, ureters and kidneys were obtained during bladder filling and voiding. Patients voided around the catheter and transperineal urethral images were obtained. A conventional VCUG was then performed. Studies were reviewed for presence of VUR. VUR grading for ceVUS was into the ureter (1), renal collecting system (2), upper tract dilation (3); for VCUG the International Grading system (I-V) was used.

RESULTS

No adverse events related to Optison occurred. Optimal visualization of the urethra, bladder and upper tracts during ceVUS was achieved with a contrast dose of 0.15 cc. Urethral images were obtained in 40/48 patients, with urethral anatomy well shown in all 40 (21M, 19F). Both studies were negative for VUR in 77/96 kidneys (80%), both positive in 7/96 (7%). In 12/96 (13%), ceVUS was positive and VCUG was negative. VUR by ceVUS was grade 1 (0), grade 2 (8), grade 3 (11). VUR by VCUG was grade I (0), grade II-III (2), grade IV-V (5). Compared to VCUG, ceVUS had a sensitivity for detection of VUR of 100% and specificity of 86%.

CONCLUSION

ceVUS with Optison was easily performed and well tolerated, with high sensitivity and relatively high specificity for diagnosis of VUR compared to VCUG, but without the need for ionizing radiation.

CLINICAL RELEVANCE/APPLICATION

The high-sensitivity, safety, and ease of performance of ceVUS using the US contrast agent Optison has the potential to largely replace conventional fluoroscopic VCUG for diagnosis of VUR which requires exposure to ionizing radiation. Further study is needed.

RC413-12 Pediatric Hypertension - The Radiologist's Role

Tuesday, Dec. 1 5:40PM - 6:00PM Location: S102AB

Participants
Ethan A. Smith, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Have a broad understanding of causes of hypertension in children. 2) Understand the basic pathophysiology behind renin mediated hypertension. 3) Be familiar with the different imaging modalities available to evaluate suspected renin-mediated hypertension and to understand the advantages and limitations of these modalities.

ABSTRACT

Unlike adults, hypertension in children is most commonly secondary to an underlying condition. Renovascular hypertension accounts for between 5-10% of cases of pediatric hypertension and presents clinically with significantly elevated blood pressure, usually refractory to multiple medications. Renovascular hypertension is also associated with a variety of genetic syndromes, including neurofibromatosis type 1 and Williams syndrome. In patients with clinically suspected renovascular hypertension, imaging is employed to confirm the diagnosis, to characterize the renovascular abnormality and to guide surgical or endovascular therapy. Ultrasound with Doppler is the most frequently used initial imaging test, but has historically been thought to be unreliable due to suboptimal sensitivity and specificity. Computed tomography angiography (CTA) and magnetic resonance angiography (MRA) are both useful in the evaluation of suspected renovascular hypertension in adults, but may be less useful in children due to the frequency of intra-renal vascular abnormalities in children which are difficult to resolve with non-invasive imaging. Catheter based digital subtraction agiography remains the gold standard imaging test because of its superior temporal and spatial resolution, allowing for excellent visualization of both extra-renal (aorta, main renal artery) and intra-renal vascular lesions. It is important for the diagnostic radiologist to understand the differences between pediatric and adult renovascular hypertension, and to understand the strengths and weaknesses of the different imaging modalities available, in order to help guide the treatment of these patients.

SSJ01

Breast Imaging (Quantitative)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: Arie Crown Theater

BR BQ MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Fiona J. Gilbert, MD, Cambridge, United Kingdom (*Moderator*) Medical Advisory Board, General Electric Company; Research Grant, GlaxoSmithKline plc; Research Grant, General Electric Company
Despina Kontos, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose

Sub-Events

SSJ01-01 Relationship between Computer-extracted MRI-based Phenotypes and the Risk of Breast Cancer Recurrence as Predicted by PAM50 Gene Expression Array

Tuesday, Dec. 1 3:00PM - 3:10PM Location: Arie Crown Theater

Participants
Elizabeth S. Burnside, MD, MPH, Madison, WI (*Presenter*) Stockholder, NeuWave Medical Inc
Hui Li, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Charles Perou, PhD, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
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Elizabeth A. Morris, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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Ermelinda Bonaccio, MD, Amherst, NY (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Zuley, MD, Pittsburgh, PA (*Abstract Co-Author*) Research Grant, Hologic, Inc;
Marie A. Ganott, MD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Jose M. Net, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Elizabeth J. Sutton, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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Justin Kirby, Bethesda, MD (*Abstract Co-Author*) Stockholder, Myriad Genetics, Inc
C. Carl Jaffe, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Clinical teams are increasingly relying on genetic profiles for breast cancer subtyping, prognostication, and treatment decisions. We investigate the relationship between computer-extracted breast MRI phenotypes with the PAM50 gene array (which includes two methods: PAM50 Risk of Relapse Subtype [ROR-S] and PAM50 Risk of Relapse Subtype + Proliferation [ROR-P]) in order to understand MRI's potential role in assessing risk of breast cancer recurrence.

METHOD AND MATERIALS

We analyzed a retrospective dataset of 84 de-identified, breast MRIs contributed by 5 institutions to the NCI's "The Cancer Imaging Archive" (TCIA), along with clinical, histopathological, and genomic data from "The Cancer Genome Atlas" (TCGA). Each MRI examination imaged a biopsy proven invasive breast cancer comprised of 74 (88%) ductal; 8 (10%) lobular, and 2 (2%) mixed. Of these cancers, 73 (87%) were ER +, 67 (80%) were PR +, and 19 (23%) were HER-2 +. We performed computerized analysis on each cancer yielding computer-extracted image-based tumor phenotypes (CEIPs), quantifying size, shape, morphology, enhancement texture, kinetic curve assessment, and enhancement variance kinetics. Regression and ROC analysis were conducted to assess the predictive ability of CEIPs relative to the multi-gene assays' continuous outputs.

RESULTS

Multiple linear regression analyses demonstrated statistically significant Pearson correlations (0.5-0.55) between CEIP signatures and the PAM50 recurrence scores. The most important CEIPs included tumor size and enhancement texture patterns characterizing tumor heterogeneity. Use of CEIP in the tasks of distinguishing between good and poor prognosis in terms of levels of recurrence yielded area under the ROC curve values (standard error) of 0.88 (0.05), 0.73 (0.06), 0.72 (0.08), and 0.61 (0.09) for MammaPrint, Oncotype DX, PAM50 Risk of Relapse Subtype (ROR-S), and PAM50 ROR-P (subtype+proliferation), respectively, with all but the latter showing statistical difference from chance.

CONCLUSION

Quantitative breast MRI radiomics shows promise as a method for image-based phenotyping to assess risk of breast cancer recurrence. This work helps us begin to understand which MRI features may be most powerfully correlated with genetic recurrence risk.

CLINICAL RELEVANCE/APPLICATION

Computerized MRI tumor phenotyping yield quantitative predictive features that have the potential to advance precision medicine and affect patient treatment strategy.

SSJ01-02 Dynamic Contrast Enhanced (DCE) Breast MR Features Associated with Prognostic Factors in Triple Negative Breast Cancers (TNBC)

Tuesday, Dec. 1 3:10PM - 3:20PM Location: Arie Crown Theater

Participants
Bo La Yun, MD, Seongnam, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sun Mi Kim, MD, PhD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Mijung Jang, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Yoon Lee, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ja Yoon Jang, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the association of DCE MR features including texture and histogram analysis with pathologic prognostic factors in TNBC.

METHOD AND MATERIALS

From June 2012 to February 2015, 92 TNBC patients (mean age 53 ±13 years) based on immunohistochemical staining (IHC) enrolled our study. We excluded patient underwent primary systemic therapy. For texture (13 grey level co-occurrence matrix features) and histogram analysis using in-house program, the ROIs were drawn along the margin of the cancer in the largest diameter image at 1.5 minute after contrast injection. For dynamic enhancement pattern analysis, MR CAD system (CADstream) was used. The percentage of fast or medium initial enhancement and persistent, plateau and washout delayed enhancement were analyzed. The pathologic results of specimens were categorized according to histologic grade and axillary nodal status, and IHC result (Ki-67, cytokeratin 5/6, EGFR, p53). The correlation of texture features and enhancement patterns with each pathological prognostic factor were assessed. Interobserver agreement was also investigated.

RESULTS

High histologic grade was associated with low angular second moment (ASM, p=0.025). Axillary nodal metastasis was associated with high maximum MR diameter (p=0.013), high entropy (p=0.024), and low ASM (p=0.026), low information measure of correlation (IMC1, p=0.046). High Ki-67 index (≥14%) tumors showed high percentage of fast initial enhancement (p= 0.015), high percentage of plateau or washout delayed enhancement (p< 0.001, p=0.001) on dynamic enhancement pattern, high entropy (p<0.001), low ASM (p=0.004) and low IMC1 (p=0.004) on texture analysis. The positivity of cytokeratin 5/6 or EGFR associated with high entropy (p=0.004), high inverse difference moment (IDM, p=0.029), low sum average (p=0.038), low IMC1 (p=0.005) and low IMC2 (p=0.038) on texture analysis, and low mean (p=0.042) and low median (p=0.037) on histogram analysis. Positivity of p53 was not associated with DCE MR features. The agreement of texture and histogram features was good (ICCs>0.9).

CONCLUSION

Dynamic enhancement pattern, texture and histogram features in DCE MR were associated with pathologic prognosis factors in TNBC. These image features would predict aggressiveness of TNBC on preoperative MR.

CLINICAL RELEVANCE/APPLICATION

DCE MR features would predict TNBC aggressiveness. It could be used for non-invasive evaluation of TNBC before chemotherapy or surgery.

SSJ01-03 Automatic and Accurate Breast Cancer Volumetric Segmentation on MRI with Varying Degrees of Background Parenchymal Enhancement

Tuesday, Dec. 1 3:20PM - 3:30PM Location: Arie Crown Theater

Participants
Harini Veeraraghavan, New York, NY (*Presenter*) Nothing to Disclose
Brittany Dashevsky, MD, DPhil, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Girard Gibbons, BA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Morris, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Joseph O. Deasy, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Elizabeth J. Sutton, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Breast MRI background parenchymal enhancement (BPE) varies between women and can limit the radiologists ability to accurately define breast cancer extent of disease. Here we sought to develop a computer model that could automatically generate volumetric segmentations of breast cancers on MRI with varying degrees of BPE.

METHOD AND MATERIALS

46 patients with HER2+ invasive breast cancers were included with either mild (n=23) or marked (n=23) BPE. We developed in-house software that combines dynamic contrast enhanced (DCE) MR images acquired at multiple time points (1 pre and 3 post contrast) to generate volumetric tumor segmentation. The DCE-MR images are combined through spectral embedding from which scalar images are computed. The algorithm is initialized with a manually delineated contour of the tumor on a single slice. A model of the tumor is automatically learned using a Gaussian mixtures model (GMM) using the individual time series and the computed scalar images. The GMM classifications are used to refine a joint segmentation generated from the individual sequences using an automatically seeded grow cut method.

RESULTS

The computer-generated volumetric segmentations were compared with a radiologist-delineated segmentation by computing DICE overlap scores (1.0 -best, 0 -worst). For tumors with mild BPE, the maximum DICE score was 0.92, the lowest was 0.28 and the median was 0.79. For tumors with marked BPE, the maximum DICE score was 0.90, the lowest was 0.04 and the median was 0.71. Two sampled t-test between the scores computed for the mild and marked BPE tumors failed to reject the null hypothesis indicating that there was no difference in the segmentation performance regardless of the extent of BPE.

CONCLUSION

Our method achieves reasonably accurate volumetric tumor regardless of the extent of BPE.

CLINICAL RELEVANCE/APPLICATION

Automatic and accurate segmentation of breast cancers with marked BPE can aid the radiologist in accurately defining the extent of disease and minimizing inter-observer variability.

SSJ01-04 Association between Quantitative Measures of Breast Parenchymal Complexity and False-Positive Recall from Digital Mammography: Results from a Large Prospective Screening Cohort

Tuesday, Dec. 1 3:30PM - 3:40PM Location: Arie Crown Theater

Participants
Shonket Ray, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Brad M. Keller, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Jinbo Chen, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Speaker, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Siemens AG
Despina Kontos, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate associations between quantitative features of breast parenchymal complexity and false-positive (FP) recall from breast cancer screening with digital mammography.

METHOD AND MATERIALS

Digital mammography (DM) images from an entire one-year cohort of women screened for breast cancer at our institution (Sept. 2010 - Aug. 2011) were retrospectively analyzed. A total of 10,571 screening mammography exams were acquired using either a GE Essential or Hologic Selenia full-field digital mammography (FFDM) unit. All images sets consisted of bilateral cranio-caudal (CC) and medio-lateral oblique (MLO) views and were vendor post-processed (i.e., "For Presentation" images). To characterize breast tissue complexity, thirteen texture features were extracted using a locally adaptive computerized parenchymal texture analysis algorithm. As a comparative established risk factor for FP recall, breast percent density (PD) was estimated on a per-woman basis using previously validated automated software. Logistic regression was performed to evaluate associations between FP recall and the extracted complexity features, using a case-control design where FP-recalls (N=1064) were randomly age-matched to negative screening controls (N=3192) at a 1:3 ratio. Odds ratios (OR) and area under the curve (AUC) of the receiver operating characteristic (ROC) were used to assess strength of associations.

RESULTS

Combining PD and texture features yielded an AUC=0.62 (95%CI: 0.60-0.64), with PD (OR=1.01; 95%CI: 1.00-1.01), texture energy (OR=1.43; 95%CI: 1.27-1.61) and sum variance (OR=1.23; 95%CI: 1.07-1.52) associated to higher risk of FP recall ($p<0.05$), while texture difference variance (OR=0.67; 95%CI: 0.58-0.78) and information correlation (OR=0.77; 95%CI: 0.69-0.85) were inversely associated to FP recall ($p<0.05$). A baseline model of PD alone yielded had AUC=0.52 (95%CI: 0.50-0.54, PD OR=1.00; 95%CI: 1.00-1.01).

CONCLUSION

Quantitative features of mammographic parenchymal texture complexity may be indicative of the risk for false-positive recall from screening with digital mammography.

CLINICAL RELEVANCE/APPLICATION

Incorporating quantitative features of breast parenchymal texture may augment breast density as a parenchymal complexity descriptor to help guide personalized breast cancer screening recommendations.

SSJ01-05 Prediction of False-Negative Breast Cancer Screens with Digital Mammography: Preliminary evaluation of a Quantitative Breast Complexity Index

Tuesday, Dec. 1 3:40PM - 3:50PM Location: Arie Crown Theater

Participants
Andrew Oustimov, Philadelphia, PA (*Presenter*) Nothing to Disclose
Emily F. Conant, MD, Philadelphia, PA (*Abstract Co-Author*) Speaker, Hologic, Inc; Scientific Advisory Board, Hologic, Inc; Consultant, Siemens AG
Lauren Pantalone, BS, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Brad M. Keller, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Meng-Kang Hsieh, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Despina Kontos, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Breast density is a known confounder of mammographic sensitivity, and increasingly reported for guiding supplemental screening recommendations. We assess the predictive value of a refined quantitative index of dense tissue complexity in identifying women at high-risk of false-negative screens.

METHOD AND MATERIALS

We retrospectively analyzed data from an entire one-year (09/01/10 to 08/30/11) screening cohort at our institution (N = 10,728). Among women with negative screening, false negatives (FNs) were defined as cancer detected in a follow up period of 12 and up to 24 months prior to the next routine screening exam (N=11). Controls were identified as women confirmed negative also at subsequent screening, and were randomly selected and matched to FNs based on age and race, at a 1:3 ratio (N=33). To specifically determine the added value of our breast complexity index (BCI), controls were also matched to FNs based on BIRADS density, and on the interpreting radiologist. The BCI was derived from a range of computer-extracted parenchymal texture descriptors, including Grey-level Histogram, Haralick, and Edge-enhancement features (N=29), summarized via principal component analysis (PCA). Associations between the BCI-PCA components and the odds of FN screening were determined via univariate

logistic regression and discriminatory capacity was assessed via receiver operating characteristic (ROC) curve analysis.

RESULTS

The BCI was significantly associated with the odds of FN screening (OR: 0.67, 95% CI: 0.45 - 1.00, p = 0.05), while exhibiting potential to discriminate between false negative screeners and controls confirmed as negative at subsequent screening (AUC = 0.69, 95% CI: 0.48 to 0.88). The first 3 principle components accounted for 88% of the total variance in the features.

CONCLUSION

The significant association between BCI and the odds of FN screen, in a case-control sample with identical BIRADS density distributions, suggests that refined quantitative measures of breast complexity may be more sensitive than qualitative BIRADS density in identifying women at high-risk for a false-negative screening exam.

CLINICAL RELEVANCE/APPLICATION

Quantitative measures of breast complexity may result in more sensitive markers for guiding supplemental screening recommendations, than the reporting of conventional BIRADS breast density.

SSJ01-06 Dedicated Computer Aided Detection for Automated 3D Breast Ultrasound Detects Invasive Ductal Cancers Independent of Hormonal Receptor Status

Tuesday, Dec. 1 3:50PM - 4:00PM Location: Arie Crown Theater

Participants
Jan Van Zelst, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Tao Tan, Nijmegen, Netherlands (*Abstract Co-Author*) Research Grant, QView Medical, Inc
Nico Karssemeijer, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Shareholder, Matakina Technology Limited; Consultant, QView Medical, Inc; Shareholder, QView Medical, Inc; Director, ScreenPoint Medical BV; Shareholder, ScreenPoint Medical BV;
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG

PURPOSE

Prognostic factors such as hormonal receptor (HR) status (estrogen and progestron) in invasive ductal cancers (IDC) are associated with ultrasonographic imaging phenotypes that may limit differentiating aggressive IDC from benign masses. Therefore, in this study we compared the relative sensitivity of a commercially developed computer aided detection (CADe) program in the detection of HR+ and HR- IDCs and biopsied benign breast lesions.

METHOD AND MATERIALS

The local IRB waived the need for informed consent for this study. ABUS exams of 101 women with 66 IDCs and 35 biopsied benign lesions were randomly selected from a large image archive. All IDCs were examined by a pathologist on the surgical specimen and benign lesions were examined on a histological core needle biopsy specimen. For all IDCs we extracted HR status from the pathology reports. All lesions were annotated by outlining the contour of the lesion based on radiology and pathology reports. After reading the cases, the CADe program (Qview Medical Inc., Los Altos, ca., USA) generated a series of suspicious region candidates that were marked in the ABUS scans. The location of these candidates were objectively compared to the location of the annotations. Thereafter, the relative sensitivity of the CADe program was computed for the HR+ IDCs, HR- IDCs and the benign lesions. Chi-square tests were used to analyze the differences between the sensitivities of these three groups. Statistical differences are considered significant when $p < 0.05$.

RESULTS

CADe marked 71.2% of the IDC's as suspicious versus 45.7% of the benign lesions (p=0.012). Of the HR+ IDCs, 69.2% were marked by CADe. This is significantly higher than the marked proportion of benign lesions (p=0.028). Also the detection of HR- IDC's (78.6%) was better than that of the benign lesions (p= 0.037). The detection of HR+ IDC's did not statistically differ from the HR- IDC's that were marked by CADe (p=0.48).

CONCLUSION

Computer Aided Detection software can detect and mark IDCs independent from the hormonal status. Furthermore, CADe differentiates between suspicious benign breast lesions and HR negative IDC's that are known for their benign-like ultrasonographic appearance.

CLINICAL RELEVANCE/APPLICATION

Computer Aided Detection software has the potential to aid radiologists in detecting even the more aggressive breast cancers and may aid in differentiating between aggressive subtypes of cancer and suspicious benign lesions.

SSJ02

Breast Imaging (Nuclear Medicine/Molecular Imaging)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: E450A

BR MI MR NM

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Priscilla J. Slanetz, MD, MPH, Belmont, MA (*Moderator*) Nothing to Disclose
Donna M. Plecha, MD, Strongsville, OH (*Moderator*) Advisory Board, Hologic, Inc;

Sub-Events

SSJ02-01 Multiparametic Evaluation of Breast Lesions with 18-Fluorodeoxyglucose Positron Emission Tomography Magnetic Resonance Imaging

Tuesday, Dec. 1 3:00PM - 3:10PM Location: E450A

Participants
Courtney A. Garlick, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Jenny Wang-Peterman, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Peter F. Faulhaber, MD, Cleveland, OH (*Abstract Co-Author*) Speaker, Koninklijke Philips NV; Grant, Koninklijke Philips NV; Medical Advisor, MIM Software Inc
Kuan-Hao Su, Shaker Heights, OH (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Raymond Muzic, PhD, Cleveland, OH (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Maryam Etesami, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Nelly Salem, MD, Cleveland, AL (*Abstract Co-Author*) Nothing to Disclose
Donna M. Plecha, MD, Strongsville, OH (*Abstract Co-Author*) Advisory Board, Hologic, Inc;

PURPOSE

To assess the performance of multiparametric 18-Fluorodeoxyglucose positron emission tomography magnetic resonance imaging (MP PET-MRI) using dynamic contrast-enhanced MRI (DCE-MRI), diffusion weighted imaging (DWI) and FDG-PET in differentiating between benign and malignant abnormalities identified on DCE-MRI.

METHOD AND MATERIALS

28 newly diagnosed breast cancer patients were prospectively enrolled in this Institutional Review Board (IRB) approved study. 25 patients underwent FDG PET-MRI imaging. Breast abnormalities identified in these patients on DCE-MRI were assessed for their likelihood of malignancy for each individual parameter (DCE-MRI, DWI and PET) as well as for combinations of the parameters. Malignancy vs. benignity of each lesion was then determined by histopathology or, in some cases where final pathologic diagnosis was not available, by pre- and post-chemotherapy imaging. If an abnormality showed a response to chemotherapy, it was presumed malignant. Sensitivity, Specificity, PPV and NPV were then measured.

RESULTS

60 lesions were identified, of which 6 had no pathology or imaging follow-up, 11 were deemed benign and 43 malignant (6 presumed malignant). MP PET-MRI significantly improved specificity over DCE-MRI (100% vs 45%, p=0.012) and DCE-MRI combined with PET (100% vs 36%, p=0.004) or DWI (100% vs 44%, p=0.011). There was a trend toward increased PPV with MP PET-MRI vs DCE-MRI (100% vs 88%), but was not statistically significant. Further, there was no statistically significant differences in sensitivity or NPV (p>0.05).

CONCLUSION

Multiparameter 18FDG PET-MRI increases specificity and decreases false positives of DCE-MRI without significant loss of sensitivity.

CLINICAL RELEVANCE/APPLICATION

MP PET-MRI improves specificity of DCE-MRI which may lead to more accurate staging, decreasing false positives and unnecessary biopsies.

SSJ02-02 Visualization of Primary Breast Cancer Lesions with a Dedicated PET for Hanging Breast Imaging in Comparison to PET/CT

Tuesday, Dec. 1 3:10PM - 3:20PM Location: E450A

Participants
Suzana Teixeira, MD, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose
Jose Ferrer Rebolleda, MD, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose
Bastiaan Koolen, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jelle Wesseling, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Raul Sanchez Jurado, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose
M P. Stokkel, MD,PHD, Leiden, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Maria Del Puig Cozar Santiago, MD, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose
Vincent van der Noort, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Emiel Rutgers, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Renato Valdes Olmos, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evaluate the performance of a dedicated PET for hanging breast imaging (MAMMI-PET) for the visualization of breast cancer lesions

in two European hospitals while comparing the results obtained with whole body PET/CT.

METHOD AND MATERIALS

After institutional review board approval we prospectively included 230 female patients (age: mean 52 y, range 24-82y) with >= 1 histologically confirmed primary breast cancer lesion (=index lesion) between March 2011 and March 2014. All patients that gave written informed consent were scanned with the MAMMI-PET (Oncovision, Valencia, Spain) after injection of 180-240 MBq and following standard whole body PET/CT. All index lesions on the MAMMI-PET scored 0, 1 or 2 for quantity of FDG uptake, which was tested in relation to histological (ductal, lobular) and molecular (ER/PR/Her2) breast cancer subtype, tumor grade, breast length, maximal tumor diameter and affected breast quadrants. We also compared the visibility score of the primary tumor between MAMMI-PET with standard PET/CT.

RESULTS

Totally 234 affected breasts were scanned with proven primary breast cancer lesions (diameter 5-170 mm). The MAMMI-PET sensitivity was 98.6% for lesions located within the device scanning range. Twenty-three lesions (9.8%) near the pectoral muscle did not reach the scanning range and where therefore not visualised by MAMMI-PET. Of 11 index lesions smaller than 1 cm 9 where visualised by MAMMI-PET. Lesion visibility was not influenced by tumor grade (p=0.21) or cancer subtype (p=0.8345). In comparison to PET/CT MAMMI missed 19 lesions of which 18 were outside its scanning range. However PET/CT was not able to detect 15 index lesions visualized by MAMMI (p=0.61). MAMMI-PET detected 41 additional lesions of which 16 where proven malignant (39%), 15 (36.6%) seen on other modalities, and 14 (34,2%) only visible on MAMMI-PET.

CONCLUSION

Without limitations due to tumor size, grade or histological subtype the MAMMI-PET is able to detect almost all breast cancer index lesions located within its scanning range and is for this lesion category more sensitive than PET/CT.

CLINICAL RELEVANCE/APPLICATION

With the dedicated MAMMI-PET it is possible to visualise primary breast cancer lesions in prone position without compression without the limitation known for PET/CT of tumor size and histological subtype.

SSJ02-03 Pretreatment Prediction of Response to Preoperative Chemotherapy by Multiparametric F-18 Fluorodeoxyglucose Positron Emission Tomography - Magnetic Resonance Imaging in Breast Cancer Patients

Tuesday, Dec. 1 3:20PM - 3:30PM Location: E450A

Participants
Maryam Etesami, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Peter F. Faulhaber, MD, Cleveland, OH (*Abstract Co-Author*) Speaker, Koninklijke Philips NV; Grant, Koninklijke Philips NV; Medical Advisor, MIM Software Inc
Courtney A. Garlick, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Jenny Wang-Peterman, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Raymond Muzic, PhD, Cleveland, OH (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Kuan-Hao Su, Shaker Heights, OH (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Nelly Salem, MD, Cleveland, AL (*Abstract Co-Author*) Nothing to Disclose
Donna M. Plecha, MD, Strongsville, OH (*Abstract Co-Author*) Advisory Board, Hologic, Inc;

PURPOSE

To assess whether multiparametric [F-18]fluorodeoxyglucose (FDG) positron emission tomography (PET) - magnetic resonance imaging (FDG-PET/MR) using dynamic contrast-enhanced MRI (DCE-MRI), diffusion-weighted imaging (DWI), and FDG-PET is able to predict response to preoperative chemotherapy in breast cancer patients. A pilot study.

METHOD AND MATERIALS

A prospective, IRB approved study including twenty seven female patients with biopsy proven primary breast cancer underwent breast-specific PET/MR using Philips Ingenuity TF, 3T system. Patients treated with preoperative chemotherapy followed by surgery or post chemotherapy imaging were enrolled. Patients who had evidence of systemic metastases were excluded. DCE-MRI, DWI, and FDG-PET were qualitatively and semiquantitatively analyzed. The response to chemotherapy was assessed by the pathologic analysis of surgical specimen, or post chemotherapy imaging in two patients awaiting definitive surgery, and then correlated with PET/MR data.

RESULTS

Eighteen patients met the criteria to be enrolled in the study. Response to chemotherapy was complete in 4 (22%), partial in 8 (44%), and no response in 6 (33%) patients. On MRI, the apparent diffusion coefficient (ADC) value for responders to chemotherapy (partial or complete) (mean=0.78 x 10^{-3} mm²/s) was significantly higher than for non-responders (mean=0.56 x 10^{-3} mm²/s) (p=0.45). All the responders had ADC value of greater than 0.65 x 10^{-3} mm²/s. With FDG-PET, there was no significant difference in maximum standardized uptake value (SUVmax) in responders (mean=7.38) versus non-responders (mean= 6.87) (p=0.85). The DCE-MRI kinetic curves and morphology showed no significant difference between responders and non-responders.

CONCLUSION

In our pilot study, DCE-MRI with DWI was found to be valuable for pretreatment prediction of response to chemotherapy in breast cancer. Higher ADC values were associated with response. With limited number of patients, there was no proven benefit of PET/MR over DCE-MRI in the prediction of response to chemotherapy. Further studies with larger cohorts and evaluating imaging characteristic changes after an early dose of chemotherapy would be helpful.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI with DWI may improve the ability to predict response to preoperative chemotherapy in patients with breast cancer.

SSJ02-04 Insights in Physiology of Breast Parenchyma: Is There a Correlation of Breast Parenchymal Uptake of 18FDG, Breast Parenchymal Enhancement on DCE-MRI, Amount of Fibroglandular Tissue and Age?

Tuesday, Dec. 1 3:30PM - 3:40PM Location: E450A

Participants
Doris Leithner, Frankfurt am Main, Germany (*Presenter*) Nothing to Disclose
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Heinrich Magometschnigg, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Georg J. Wengert, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Thomas H. Helbich, MD, Vienna, Austria (*Abstract Co-Author*) Research Grant, Medicor, Inc; Research Grant, Siemens AG; Research Grant, C. R. Bard, Inc
Katja Pinker-Domenig, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess and correlate breast parenchymal uptake (BPU) in 18FDG PET-CT with breast parenchymal enhancement (BPE) and amount of fibroglandular tissue (FGT) with 3T DCE-MRI and to determine the influence of patient age on BPU, BPE and FGT.

METHOD AND MATERIALS

In this IRB-approved prospective study 129 patients with a BIRADS 4/5 lesion underwent 18FDG PET-CT and 3T DCE-MRI. Examinations were no longer than six days apart. Patients were injected with approximately 300 MBq 18FDG. After 60 min a prone PET-CT dataset over the breasts was acquired and CT data was solely used for attenuation correction. For DCE-MRI a contrast-enhanced high resolution 3D-T1-weighted sequence before and after application of a standard dose of 0.1 mmol/kg Gd-DOTA (Dotarem®) was employed. BPU and BPE were assessed in the healthy contralateral breast. BPU was calculated quantitatively using SUVmax. FGT and BPE were qualitatively assessed by two independent readers using the revised ACR BI-RADS® classification. To assess reproducibility all measurements were repeated by reader 1. Appropriate statistical tests were used to assess correlation of FGT, BPE, BPU, inter- and intra-reader agreement.

RESULTS

There was no BPE in 58, mild in 54, moderate in 14 and marked in 3 patients. SUVmax for patients with no BPE was 1.57 (SD 0.6), for mild BPE 1.93 (SD 0.6), for moderate BPE 2.42 (SD 0.5), and for marked BPE 1.45 (SD 0.3). There were highly significant correlations between age, BPU, BPE and FGT.Correlation coefficients ranged between moderate and strong. While BPE, BPU and FGT were positively correlated with each other, all of these parameters were negatively correlated with age (Figure 1). The intraclass correlation coefficient for BPU measurements was excellent with 0.973. Inter-reader and intra-reader agreement for BPE was very good with a Kappa-value of 0.860 and 0.822 respectively.

CONCLUSION

BPU of normal breast parenchyma can be reproducibly assessed using SUV metrics and is positively correlated with BPE and FGT in DCE-MRI. There is a negative correlation of BPU, BPE and FGT with age.

CLINICAL RELEVANCE/APPLICATION

BPU, BPE and FGT provide insights in tumor physiology and decrease with age. In patients with dense breasts a possible masking effect of lesions by BPU/BPE must be considered.

SSJ02-05 Clinical Comparison of MBI and BSGI for Low Dose Breast Imaging

Tuesday, Dec. 1 3:40PM - 3:50PM Location: E450A

Participants
Zaiyang Long, PhD, Rochester, MN (*Presenter*) Nothing to Disclose
Carrie B. Hruska, PhD, Rochester, MN (*Abstract Co-Author*) Institutional license agreement, Gamma Medica, Inc
Michael K. O'Connor, PhD, Rochester, MN (*Abstract Co-Author*) Royalties, Gamma Medica, Inc

PURPOSE

Breast specific gamma imaging (BSGI) and molecular breast imaging (MBI) are promising techniques for supplemental imaging in women with dense breast tissue. This study compares the performance of such systems at administered doses of Tc-99m sestamibi that are acceptable for low dose imaging.

METHOD AND MATERIALS

The BSGI system comprised a single-head multi-crystal NaI system (pixel size 3.2×3.2 mm) equipped with a hexagonal-hole lead collimator. The MBI system comprised a dual-head cadmium zinc telluride detector system (pixel size 1.6×1.6 mm) equipped with registered tungsten collimators. System sensitivity, uniformity, energy and spatial resolution were measured using NEMA methods. A 6-cm thick contrast detail (CD) phantom with 48 hot spots (3-10 mm diameter) was used to assess contrast-noise-ratio (CNR) using average background count densities observed in clinical studies at 4mCi dose. 25 patients receiving 4-8mCi doses were imaged on both systems under IRB approval.

RESULTS

The BSGI and MBI systems had integral uniformities of 6.1% and 3.8%, and energy resolution (at 140 keV) of 13.1% and 4.3%, respectively. System sensitivity was 403 cpm/uCi (BSGI) and 790 cpm/uCi (MBI) using a standard +/-10% energy window. In clinical use, MBI employs an energy window of 110-154 keV, yielding a sensitivity of 1042 cpm/uCi. At distances of 1, 3 and 5 cm from the collimator, spatial resolution was 4.1, 5.1 and 6.2 mm on BSGI, and 2.0, 4.7 and 7.3 mm on MBI, respectively. However, with the dual head configuration of MBI, spatial resolution at 5 cm distance from one detector is equivalent to 1cm from the opposing detector for the most frequently observed compressed breast thickness of 6cm. Application of the Rose criterion for lesion detection (CNR>3) to images of the CD phantom showed that for BSGI, 9 hot spots at 4mCi were undetectable. For MBI, 5 hot spots at 4mCi were undetectable. In the 25 patient studies, 5 lesions (CNR>3) were identified on MBI whereas 3 were identified on BSGI.

CONCLUSION

Over the clinical range 0-6 cm, the MBI system demonstrated better spatial resolution than the BSGI system while yielding a 2.6-

fold greater sensitivity. This resulted in improved lesion detection and allows MBI to be utilized at lower doses than BSGI.

CLINICAL RELEVANCE/APPLICATION

Molecular breast imaging (MBI) system demonstrated better performance characteristics than BSGI system. MBI is more suitable for low dose breast imaging.

SSJ02-06 Correlation of Semi-Quantitative Breast-Specific Gamma Imaging Findings with Dynamic Contrast-Enhanced MRI Parameters assessed by a Computer-Aided Evaluation Program and Prognostic Factors of Breast Cancers

Tuesday, Dec. 1 3:50PM - 4:00PM Location: E450A

Participants
Saemee Ahn, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hye Ryoung Koo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeong Seon Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soo-Yeon Kim, MD, Guri, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether a correlation exists between the semi-quantitative breast-specific gamma imaging (BSGI) findings and dynamic contrast-enhanced (DCE) MRI parameters assessed by a computer-aided evaluation program or prognostic factors of breast cancers

METHOD AND MATERIALS

Semi-quantitative index of lesion to non-lesion ratio (L/N) in BSGI and DCE-MRI parameters assessed by a computer-aided evaluation program and histopathologic prognostic factors of 47 invasive breast cancers were obtained. Correlation between L/N ratio and DCE-MRI parameters assessed by a computer-aided evaluation program, including tumor size (cm), angio-volume (cc), degree of initial peak enhancement (%), persistent enhancement proportion (%), washout enhancement proportion (%), or prognostic factors, including axillary nodal status, histologic grade, expression of estrogen receptor (ER), progesterone receptor (PR), human epidermal growth factor receptor 2 (HER2) and Ki-67 were analyzed.

RESULTS

The mean L/N ratio of 47 tumors was 3.63 ± 2.19 (range: 1-13.1). The L/N ratio was higher in tumors with larger tumor size ($P<0.001$), increased angio-volume ($P<0.001$), higher degree of initial peak enhancement ($P<0.001$), increased washout enhancement proportion ($P=0.003$), high histologic grade ($P=0.013$), and higher Ki-67 ($P=0.002$). The calculated multiple correlation coefficient was 0.80 ($P<0.001$).

CONCLUSION

There was a strong multiple correlation between the semi-quantitative L/N ratio in BSGI with DCE-MRI parameters assessed by a computer-aided evaluation program and prognostic factors of breast cancers.

CLINICAL RELEVANCE/APPLICATION

The relationship between the radiotracer uptake in molecular imaging and DCE-MRI parameters may offer an in-depth understanding into the characterization of breast cancer.

SSJ03

Cardiac (Pericardial and Cardiac Valve Imaging)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: S502AB

CA CT MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Leena Mammen, MD, Grand Rapids, MI (*Moderator*) Nothing to Disclose
Scott R. Akers, MD, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose
Diana Litmanovich, MD, Haifa, Israel (*Moderator*) Nothing to Disclose

Sub-Events

SSJ03-01 Remote 4D MR Flow Assessment of Aortic Valve Regurgitation

Tuesday, Dec. 1 3:00PM - 3:10PM Location: S502AB

Participants
Raluca G. Saru, MD, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose
Albert Hsiao, MD, PhD, San Diego, CA (*Abstract Co-Author*) Founder, Arterys, Inc; Consultant, Arterys, Inc; Research Grant, General Electric Company
Laurens E. Swart, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Piotr A. Wielopolski, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Shreyas S. Vasanawala, MD, PhD, Palo Alto, CA (*Abstract Co-Author*) Research collaboration, General Electric Company; Consultant, Arterys; Research Grant, Bayer AG;
Koen Nieman, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Toshiba Corporation Research Grant, Bayer AG Research Grant, General Electric Company

PURPOSE

4D MR Flow has shown to have advantages over standard cardiac magnetic resonance (CMR), offering both anatomical and functional information in just a single acquisition.Processing of the large amount of data requires dedicated software.We evaluated the feasibility and performance of a cloud-based application that combines pre-processing and visualization of 4D Flow data, and assessed its accuracy for the detection and grading of aortic valve regurgitation (AR) using trans-thoracic echocardiography (TTE) as reference.

METHOD AND MATERIALS

Between June 2014 and January 2015 patients planned for clinical CMR were consecutively approached to undergo the 4D Flow examination. The 4D Flow data was uploaded to a dedicated web-based software application for eddy-currents correction, interactive visualization of the anatomical and flow components, and detection and grading of the aortic regurgitation. The diagnostic characteristics of 4D MR Flow were evaluated against TTE.

RESULTS

Fifty-four patients were included. The agreement between 4D Flow and TTE for the grading of AR was good (κ=0.726). For detection of any degree of AR, 4D MR Flow had a sensitivity of 94.4% (81.3-99.2), a specificity of 72.2% (46.5-90), and a positive (PPV) and negative predictive value(NPV) of 86.7% (59.5-97.9) and 87.1% (72.6-95.7) respectively. To identify clinically relevant moderate or severe AR, 4D Flow MR had a sensitivity of 100% (40.2-100), specificity of 98% (89.3-99.7), PPV of 80% (28.8-96.7) and NPV of 100% (92.7-100).

CONCLUSION

Aortic regurgitation can be detected and graded accurately using 4D Flow in comparison to TTE. The use of a remote application with advanced data correction, integrated with interactive imaging tools allowed for interpretation of the 4D Flow data.

CLINICAL RELEVANCE/APPLICATION

The potential advantages of a 4D Flow protocol are that during a free-breathing acquisition of 7-10 minutes, flow sensitive information in all three dimensions is acquired for the entire thorax. Without a need to specify beforehand, or assistance during the examination, flow can be retrospectively measured anywhere and in any direction within the thorax. While 2D sequences measure flow in a static plane, 4D Flow allows for continuous alignment of the measurement plane to the position of moving structures (e.g. valve annulus). In case of regurgitation jets that change direction throughout the heart cycle, 4D Flow imaging can provide more complete visualization.

SSJ03-02 Mitral Annular Dimensions and Geometry in Normals and Patients with Mitral Regurgitation: Implications for CT-based Sizing in Transcatheter Mitral Valve Implantation

Tuesday, Dec. 1 3:10PM - 3:20PM Location: S502AB

Participants
Nicolas J. Bilbey, MD, Vancouver, BC (*Presenter*) Nothing to Disclose
Christopher Naoum, MBBS, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Jonathon A. Leipsic, MD, Vancouver, BC (*Abstract Co-Author*) Speakers Bureau, General Electric Company Speakers Bureau, Edwards Lifesciences Corporation Consultant, Heartflow, Inc Consultant, Circle Cardiovascular Imaging Inc
Anson Cheung, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
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George Mak, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Adam Berger, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

Danny Dvir, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Chesnal Dey Arepalli, MD, Burnaby, BC (*Abstract Co-Author*) Nothing to Disclose
Jasmine Grewal, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

The D-shaped mitral annulus was recently proposed as a potentially more appropriate method[DM1] for annular sizing prior to transcatheter mitral valve implantation (TMVI). We sought to firstly establish normative CT values for the D-shaped mitral annulus; and secondly, to evaluate these parameters in patients with mitral regurgitation (MR) and determine drivers of annular size.

METHOD AND MATERIALS

Patients with retrospectively-gated cardiac CT performed at our institution (2012-2014) and free of cardiovascular disease were included ('normals', n=105, 57±11yrs, 51 female). Patients with mitral regurgitation (MR) being considered for transcatheter mitral therapy were also evaluated (mitral valve prolapse, MVP, n=24, 78±12yrs, 10 female; functional MR, FMR, n=20, 69±14yrs, 6 female). Mitral annular dimensions (projected area, perimeter, trigone-trigone (TT), intercommissural (IC) and septal-lateral (SL) distance) were measured during mid-late diastole and compared between groups. Maximal left atrial (LA) and phasic left ventricular (LV) volumes were also measured.

RESULTS

Absolute (indexed) mean ± SD mitral annulus area, perimeter, TT, IC and SL values in normals were 8.95±1.53cm2 (4.68±0.62cm2/m2), 110±9mm (58±6mm/m2), 28.5±3.3mm (15.0±1.9mm/m2), 37.5±3.7mm (19.7±2.1mm/m2) and 27.8±2.8mm (14.6±1.7mm/m2), respectively. Indexed Annular area was larger in MR patients compared to controls (6.49±1.53m2/m2 vs. 4.68±0.62cm2/m2, P<0.001) and importantly, was larger in MVP patients compared to FMR patients (7.20±1.43cm2/m2 vs. 5.59±1.14cm2, P<0.001). Annular distortion was also observed in MR patients with reduced IC/SL ratio compared to normals (1.26±0.11 vs. 1.36±0.14, P<0.001). While LA and LV volumes independently predicted annular size in normals and were both associated with annular size in MVP patients, only LA volume was associated with annular size in FMR patients.

CONCLUSION

We describe normative CT values for the D-shaped mitral annulus. Moreover, we demonstrate differences in and varied drivers of annular dimensions in patients with MVP and FMR who are being considered for transcatheter mitral therapy.

CLINICAL RELEVANCE/APPLICATION

The data presented provides useful information regarding annular sizing using cardiac CT for the purposes of TMVI.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jonathon A. Leipsic, MD - 2015 Honored Educator

SSJ03-03 Aortic Valve Planimetry by High-Resolution 3-Dimensional MR Image Acquisition with a Breath-hold: Comparison with Conventional Cine MR Imaging and Echocardiography to Assess the Severity of Aortic Valve Stenosis

Tuesday, Dec. 1 3:20PM - 3:30PM Location: S502AB

Participants
Hae Jin Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Sung Mok Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Moon Young Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Hyeon Bak, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung-Ji Park, Seoul, Moldova, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yeon Hyeon Choe, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We intended to evaluate the novel application of high-resolution 3-dimensional MR image acquisition with single-breath-hold SSFP sequence to calculate the aortic valve area (AVA).

METHOD AND MATERIALS

In 88 consecutive patients (66.9 ± 9.59 years, 63% men) with varying degrees of aortic valve stenosis, high-resolution 3D SSFP images (3D planimetry; 2.0 mm slice thickness, 20 contiguous slices; image matrix, 256 ´ 209) were acquired with single breath-hold during mid systole and mid diastole. SSFP cine MR imaging (2D planimetry) and velocity-encoded cine MRI (slice thickness, 4.5 mm) in three levels of aortic valve were also performed. AVA area was measured by two experienced observers using commercial software (iNtuition, TeraRecon). MR imaging measurements and image quality were compared with transthoracic echocardiographic measurements of effective aortic orifices (EAO) using the continuity equation (1 = severe blurring of images, 2 = moderate blurring of valve contours; 3 = mild blurring of valve contours, 4 = excellent and no artifact). Sensitivity for accurate measurement and receiver operating characteristic (ROC) curve were calculated. Intra- and interobserver agreements were determined by using intraclass correlation coefficient (ICC).

RESULTS

Mean AVA derived by 3D planimetry, 2D planimetry, and echocardiography were 0.77 ± 1.04 cm2, 0.72 ± 1.16 cm2, and 0.75 ± 0.32

Mean AVA derived by 3D planimetry, 2D planimetry, and echocardiography were 0.77 ± 1.04 cm2, 0.72 ± 1.16 cm2, and 0.75 ± 0.32 cm2, respectively. The ICC value of 3D planimetry was higher than 2D planimetry [0.799 (CI, 0.691-0.869) vs. 0.743 (CI, 0.605-0.832)] with echocardiographic EAO as the standard of reference. The grade of image quality of 3D planimetry was superior to 2D planimetry (3.65 ± 0.65 vs. 3.17 ± 0.65). The correlation coefficients of maximum peak velocity on velocity-encoded cine MR imaging with 3D planimetry and that with 2D planimetry were 0.42 ($p < 0.05$) and 0.35 ($p < 0.05$). Intra- and interobserver agreements for 3D planimetry were excellent [ICC = 0.949 (CI, 881-979) and 0.846 (CI, 0.636-0.935), respectively; both, $p = 0.000$).

CONCLUSION

Novel application of high-resolution 3D SSFP breath-hold MR imaging enables planimetry of AVA in patients with valvular aortic stenosis with better image quality than 2D planimetry with conventional cine MR imaging.

CLINICAL RELEVANCE/APPLICATION

Our findings support the validity of 3D planimetry at accurate assessment of the severity of aortic valve stenosis.

SSJ03-04 Association between Geometric Distribution of Wall Shear Stress and Aortic Dilatation in Patients with Aortic Stenosis: Comparison between TAV and BAV

Tuesday, Dec. 1 3:30PM - 3:40PM Location: S502AB

Participants
Hojin Ha, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Dong Hyun Yang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Guk Bae, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jihoon Kweon, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young-Hak Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Joon-Won Kang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Tae-Hwan Lim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Although abnormal wall shear stress (WSS) distribution is suspected to have a significant role on the development of the aortic dilatation, the relationship between hemodynamics characteristics and aortic dilatations is not fully understood yet. The present study investigates the association between the WSS distributions and aortic dilatations in aortic-stenosis (AS) patients with tricuspid aortic valves (TAV) and bicuspid aortic valves (BAV).

METHOD AND MATERIALS

A total of 54 moderate and severe AS-patients (TAV=32, BAV=22) who underwent cardiac computed tomography (CT) and phase contrast magnetic resonance imaging (PC-MRI) at the ascending aorta were retrospectively collected. For calculation of WSS, 2D velocity profiles were extracted from PC-MRI at the level of ascending aorta. Then, a total of 360 velocity line-profiles were extracted from the center of the vessel to the wall with 1 degree angular increments. Aortic diameter was measured at 10 levels from aortic annulus to distal descending aorta using CT. Differences of the aortic diameters and WSS distributions between TAV and BAV were statistically analyzed using student t-test. Association between aortic diameter and regional WSS at the level right pulmonary artery were evaluated using linear regression.

RESULTS

Patients with BAV showed more asymmetric systole blood flow compared to those with TAV (center of flow r/R; 0.59±0.11 vs. 0.67±0.10, p=0.018). As a result, AS patients with BAV has significantly higher systolic WSS (0.55±3.14 Pa vs. 2.91±3.20 Pa, p=0.009) at the right-posterior region and lower systolic WSS (1.12±3.58 vs. 3.12±3.36, p=0.044) at the left and left-posterior regions of the ascending aorta. In accordance with the increased WSS distribution, AS patients with BAV are found to have larger diameters of the ascending aorta compared to those with TAV (BAV vs. TAV: 43.7±7.2 mm vs. 34.1±4.8 mm, $p < 0.001$). Linear regression between the aortic diameter and systolic WSS shows that the increment of the WSS represents about 14% of the aortic dilatation.

CONCLUSION

Among patients with aortic stenosis, patients with BAV showed more eccentric WSS and larger aortic diameter as compared to those with TAV at the level of ascending aorta. Eccentric distribution of WSS showed significant correlation with aortic diameter.

CLINICAL RELEVANCE/APPLICATION

WSS may be used to predict future risk of aortic dilatation in patients with aortic stenosis.

SSJ03-05 Multidetector-row Computed Tomography in Patients with Suspected Prosthetic Valve Dysfunction: A Prospective Study

Tuesday, Dec. 1 3:40PM - 3:50PM Location: S502AB

Participants
Dominika Sucha, MD, Utrecht, Netherlands (*Presenter*) Nothing to Disclose
Steven Chamuleau, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Petr Symersky, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Renee B. Van Den Brink, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Wilco Tanis, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Eduard M. Laufer, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Bas De Mol, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Willem P. Mali, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jesse Habets, MD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Lex Van Herwerden, Utrecht, Netherlands (*Abstract Co-Author*) Research Consultant, St. Jude Medical, Inc
Ricardo P. Budde, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To systematically assess the role of retrospectively ECG-gated multidetector-row computed tomography (MDCT) for the evaluation of patients with suspected prosthetic heart valve (PHV) dysfunction.

METHOD AND MATERIALS

We performed a prospective cross-sectional study and enrolled patients consecutively during their clinical presentation in two university hospitals. Inclusion criteria were: 1. Aortic PHVs with an increase (>20mmHg) of the max. transprosthetic pressure gradient (TPG), 2. Mitral PHVs with a high mean TPG (>10mmHg), 3. Abnormal (peri)valvular leakage, 4. Leaflet restriction on fluoroscopy (>5 degrees) or 5. Clinical abnormalities likely due to PHV-dysfunction (e.g. stroke). All patients underwent transthoracic (TTE) and transesophageal (TEE) echocardiography ± fluoroscopy (routine diagnostic work-up). Additional cardiac retrospectively ECG-gated MDCT imaging was performed on a 256-slice or 64-slice MDCT scanner in all patients.

RESULTS

Forty-two patients were included (mean age 62±13 years) with 40 mechanical and 9 biological PHVs (34 aortic, 15 mitral). Main reasons for suspected dysfunction were: aortic TPG increase (n=20, 48%), clinical abnormalities (n=14, 33%) and/or abnormal (peri)valvular leakage (n=12, 29%). Median radiation exposure was 11.6 mSv [interquartile range 10.8-14.4], 40 patients (95%) were imaged on the 256-slice scanner. MDCT detected one or more PHV-related pathologies in 32/42 (76%) patients: pannus (n=11), thrombus (n=5), pannus/thrombus (n=2), PHV angulation (n=2), left ventricular outflow tract obstruction (n=4), paravalvular leakage (n=7), pseudoaneurysms (n=2), bioprosthesis degeneration (n=1), native annulus remnant (n=1), patient prosthesis mismatch suspicion (n=2) and restricted leaflet motion of unknown cause (n=3).

CONCLUSION

In this prospective study, MDCT imaging revealed a morphological substrate in 32/42 (76%) patients with suspected PHV dysfunction and showed a valuable imaging tool for PHV evaluation.

CLINICAL RELEVANCE/APPLICATION

Additional MDCT imaging allows identification of the underlying pathology in the diagnostic work-up of suspected PHV dysfunction.

SSJ03-06 CT-Angiography Prior to Transcatheter Aortic Valve Replacement (TAVR) - Identification of Different Parameters Leading to a Post-interventional Valvular or Para-valvular Leak

Tuesday, Dec. 1 3:50PM - 4:00PM Location: S502AB

Participants
Florian Wolf, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Carmen Fischer, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Dietrich Beitzke, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Philip Kresl, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Sabine Scherzer, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Christian Loewe, MD, Vienna, Austria (*Abstract Co-Author*) Speaker, Bracco Group Speaker, Guerbet SA Speaker, General Electric Company Speaker, Medtronic, Inc Speaker, Bayer AG Speaker, Siemens AG

PURPOSE

The purpose of this study was to identify pre-interventional factors by means of CT-Angiography, which could predetermine the incidence of a significant post-interventional paravalvular or valvular leakage (PVL) in TAVR patients.

METHOD AND MATERIALS

In this retrospective study 160 datasets of patients that underwent TAVR from 2007 until 2013 were analyzed. In 87 patients (36 male, 51 female, mean age 82,6 years, range 63-95 years), all necessary post-interventional echocardiographic datasets were available to evaluate the degree of aortic insufficiency up to 30 days after TAVR (mild, moderate, severe - moderate to severe aortic insufficiency was rated as clinically significant). Using the CT-Datasets following parameters were evaluated: diameter (D) and area of the annulus, distance between the annulus and the right and left coronary artery, respectively, valve calcification degree (no, mild, moderate, severe calcification), cover index (100 × [prosthesis D - D_mean Annulus]/prosthesis D) and eccentricity indices (D_meanAnnulus - D_areaAnnulus and D_maxAnnulus - D_minAnnulus). Data was statistically analyzed by means of linear and multivariate regression analysis and correlated with degree of post-interventional aortic insufficiency.

RESULTS

CoreValve- and Edwards Sapien prostheses were implanted in 20 and 67 patients, respectively. In 94,3% of the patients a post-interventional PVL of any degree within 30 days was detected by echocardiography. Degree and rate of PVL was not different between the CoreValve or Edwards Sapient System. Univariate regression analysis reported a sole significant (p=0.01) reverse relationship between the cover index and severity of post-interventional PVL. All other parameters showed no significant correlation with degree of PVL. In patients with a prosthesis oversizing of at least 15% no clinical relevant PVLs were detected.

CONCLUSION

In this study the cover index is the strongest and sole predictor of post-interventional PVL in TAVR patients. A certain degree of prosthesis oversizing may be required to reduce the incidence of PVL.

CLINICAL RELEVANCE/APPLICATION

Pre-interventional identification of factors leading to a post-interventional PVL could help to develop strategies to reduce rate of post-interventional PVL.

SSJ04

Cardiac (Quantitative Imaging)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: S504AB

CA BQ CT MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Lisa Diethelm, MD, New Orleans, LA (*Moderator*) Nothing to Disclose
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Moderator*) Research Grant, Toshiba Corporation;
Dianna M. Bardo, MD, Seattle, WA (*Moderator*) Speaker, Koninklijke Philips NV; Consultant, Koninklijke Philips NV; Author, Thieme Medical Publishers, Inc

Sub-Events

SSJ04-01 Diagnostic Value of Quantitative Edema Detection Using T2-mapping in Acute Myocarditis

Tuesday, Dec. 1 3:00PM - 3:10PM Location: S504AB

Awards
Trainee Research Prize - Resident

Participants
Bettina Baessler, MD, Cologne, Germany (*Presenter*) Nothing to Disclose
Frank Schaarschmidt, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Anastasia Dick, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
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Guido Michels, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
David C. Maintz, MD, Koln, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander C. Bunck, Koln, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the diagnostic value of T2-mapping in patients with acute myocarditis (ACM) and to define an appropriate cut-off value for edema detection.

METHOD AND MATERIALS

CMR data of 35 patients with clinically suspected ACM and confirmation of diagnosis by CMR according to the Lake Louise criteria were retrospectively analyzed. 30 healthy volunteers (HV) served as a control. All patients and HV were examined on a clinical 1.5T scanner, where - in addition to the routine CMR protocol - a breathhold Gradient Spin Echo (GraSE) T2-mapping sequence had been acquired at a basal, midventricular and apical slice in short axis view. T2-maps were segmented according to the 16-segments AHA-model and segmental T2 values as well as the segmental pixel-SD were analyzed. Statistical analysis was conducted using independent t-test, multiple logistic regression analyses, random forests, and decision trees.

RESULTS

Means of global myocardial T2 or pixel-SD showed only small differences between HV and ACM patients (T2: 58.7 ± 0.3 ms vs. 63.1 ± 0.4, $p < .001$; pixel-SD: 7.7 ± 0.1 vs. 8.6 ± 0.2, $p < .001$), lying in the observed normal range of HV. In contrast, variation of T2 values as well as of pixel-SD was much larger in ACM patients compared to HV. In random forests and multiple logistic regression analyses, the combination of the highest segmental T2 value within each patient (maxT2) and the mean absolute deviation (MAD) of log-transformed pixel-SD (madSD) over all 16 segments within each patient proved to be the best discriminators between HV and ACM patients with an AUC of 0.85 in ROC-analysis. In decision trees, a cut-off of 0.22 for madSD and of 67.7 ms for maxT2 resulted in 83% specificity and 97% sensitivity for classification between HV and ACM, even when not taking into account Lake Louise criteria.

CONCLUSION

The proposed cut-off values for maxT2 and madSD in the setting of ACM allow edema detection with high sensitivity and specificity and in a quantitative manner. The two parameters have the potential to overcome the hurdles of T2-mapping for its integration into clinical routine and should be validated in a greater patient cohort.

CLINICAL RELEVANCE/APPLICATION

Myocardial edema is an important factor not only in ACM. T2-mapping promises to be a quantitative approach in edema imaging, overcoming some limitations of qualitative edema assessment.

SSJ04-02 Myocardial T1 Mapping in Asymptomatic Subjects: Variations According to Left Ventricular Segments and Correlation with Cardiovascular Risk Factors

Tuesday, Dec. 1 3:10PM - 3:20PM Location: S504AB

Participants
Moon Young Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Soo Jin Cho, Seoul, Moldova, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hae Jin Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Mok Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang-Chol Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Yeon Hyeon Choe, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether there is variation in precontrast and postcontrast myocardial T1 time (prT1 and poT1, respectively) and extracelluar volume fraction (ECVF) according to left ventricular (LV) segments and to search for any correlation between them and known cardiovascular risk factors.

METHOD AND MATERIALS

This study included 198 asymptomatic subjects (180 men and 18 women, age 54.4 ± 6.12 years) who underwent cardiac MR imaging. Precontrast T1 mapping and postcontrast T1 mapping 15 minutes after 0.2 mmol gadobutrol injection were performed using shortened modified look-locker inversion recovery [ShMOLLI] sequence at 1.5T (Magnetom Avanto, Siemens). Short-axial cine MR imaging was performed with SSFP technique. T1 values and ECVFs were calculated in 16 AHA myocardial segments. Those values were compared among LV segments and correlated with presence of hypertension (n = 52), diabetes mellitus (DM, n = 15), or both (n = 17). ECVF was also correlated with LV mass.

RESULTS

The overall prT1 and poT1 values and ECVF were 1006 ± 291.5 ms, 454.2 ± 38.5 ms, and 0.24 ± 0.04, respectively. There was significant difference between apical segments and mid-basal segments in poT1 value and ECVF ($p<0.03$) and between mid-septal segments and mid-lateral segments in T1 values and ECVF ($p <0.04$). ECVF showed reverse correlation with LV mass ($p=0.002$). There was significantly lower poT1 value (449 ± 35.6 ms) and higher ECVF (0.24 ± 0.04) in subjects with hypertension compared with those (459 ± 43.3 ms and 0.23 ± 0.02) of subjects without hypertension ($p<0.05$). Subjects with DM showed no difference in all T1 values from subjects without DM or hypertension, except poT1 values in mid-septal segments (447 ± 23.6 ms vs 459 ± 45.6 ms, $p=0.02$). Subjects with both risk factors showed no difference in all T1 values from subjects without DM or hypertension, except prT1 value between apical septal and lateral segments (1007 ± 126 ms vs 999 ± 156 ms, $p=0.03$).

CONCLUSION

The septal wall showed higher prT1 value and ECVF but lower poT1 value than the lateral wall of mid- and basal levels. PoT1 value and ECVF are significantly affected by hypertension and LV mass.

CLINICAL RELEVANCE/APPLICATION

Normal range of T1 values and ECVF and their segmental variation should be differentiated from myocardial pathologic conditions. Moreover the cardiovascular risk factors may affect T1 values, ECVF, and LV function in asymptomatic subjects before cardiovascular symptoms develop.

SSJ04-03 3D-Dixon MRI Based Volumetry of Peri- and Epicardial Fat

Tuesday, Dec. 1 3:20PM - 3:30PM Location: S504AB

Participants
Rami Homsi, Bonn, Germany (*Presenter*) Nothing to Disclose
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Darius Dabir, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Claas P. Naehle, MD, Bonn, Germany (*Abstract Co-Author*) Consultant, Medtronic, Inc
Daniel Kuetting, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans H. Schild, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Daniel K. Thomas, MD, PhD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Alois Martin Sprinkart, MSc, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

There is growing evidence that pericardial and epicardial fat volume (PFV, EFV) are associated with cardiovascular risk. The aim of this study was to develop a novel approach to accurately measure PFV and EFV using a 3D-Dixon based MRI approach.

METHOD AND MATERIALS

A cardiac triggered and respiratory navigator gated 3D-gradient echo pulse sequence (TR=5.4ms, TE1/TE2 = 1.8/4.0ms, α=20°, voxel size 1.5x1.5x3.0mm3) was developed for cardiac Dixon imaging. Based on this sequence fat fraction maps were computed. After correction for relaxation effects and setting of an appropriate noise threshold, voxels with more than 50% signal from fat were added for volumetry. Validation of the measurement accuracy was performed in a phantom consisting of muscle tissue and five different known volumes of fat (50-200ml). The proposed sequence was acquired in 34 healthy volunteers (22 male, BMI range 14-42 kg/m2, age range 21-79y) at 1.5T (Ingenia, Philips). Analysis was performed independently by two readers by drawing two 3D-region of interests, one for EFV and one for PFV. Additionally, EFV and PFV were compared between overweighted and non-overweighted subjects.

RESULTS

The phantom study showed an excellent agreement of measured and true fat volumes (maximum difference = 5 ml, linear correlation $R>0.99$). PFV over all volunteers was 158.0±126.4ml and EFV was 77.0±55.3ml. PFV and EFV were highly correlated ($R=0.96$). Inter-reader agreement was good with a mean difference of 0.2±5.6ml and 4.5±4.2ml for PFV/EFV, ($R>0.99$, each). EFV and PFV differed significantly between overweighted and non-overweighted subjects (BMI >25kg/m2 and BMI <25kg/m2, n=17 each) with PFV 219.0±151.8ml vs. 96.9±44.7ml and EFV 102.3±66.3ml vs. 51.7±23.6ml ($p<0.001$, each). There was no significant difference in age between the two groups (41.4±14.3y vs. 42.9±16.0y, $p= 0.76$).

CONCLUSION

The implemented Dixon method allows accurate measurement of PFV and EFV with all benefits of a 3D-approach similar to CT.

CLINICAL RELEVANCE/APPLICATION

The proposed 3D-Dixon based method allows accurate measurement of cardiac fat volumes, free of ionizing radiation and provides a

valuable tool for cardiovascular risk stratification.

SSJ04-04 Reproducibility of Cine Displacement Encoding with Stimulated Echoes (DENSE) in Human Subjects

Tuesday, Dec. 1 3:30PM - 3:40PM Location: S504AB

Participants
Kai Lin, MD, MSc, Chicago, IL (*Presenter*) Nothing to Disclose
Michael Markl, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Jeremy D. Collins, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Varun Chowdhary, MD, BS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Julie A. Blaisdell, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Gong Feng, MD,PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Bruce Spottiswoode, Chicago, IL (*Abstract Co-Author*) Employee, Siemens AG
James C. Carr, MD, Chicago, IL (*Abstract Co-Author*) Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA

PURPOSE

To test the hypothesis that two-dimensional (2D) displacement encoding via stimulated echoes (DENSE) is a reproducible technique for the depiction of segmental myocardial motion in human subjects.

METHOD AND MATERIALS

Following the approval of the institutional review board (IRB), 10 healthy volunteers without documented history of cardiovascular disease were recruited. For each participant, 2D DENSE were performed twice (at different days) and the data were obtained at basal, midventricular and apical levels of the LV with a short-axis view. The first and second principal strains (E1 and E2), radial thickening strain (Err), circumferential rotating strain (Ecc), twist and torsion were calculated. The intra-, inter-observer and inter-study variances were evaluated using coefficient of variation (CoV) and intra-class correlation coefficient (ICC).

RESULTS

In total, there are 160 pairs of myocardial segments (from 2 scans on 10 subjects) for quantitative analysis and comparison. Figure 1 shows an example set of DENSE images demonstrating myocardial displacement maps from a single subject for scan #1 and #2. The images demonstrated similar image quality and systolic displacement patterns for both acquisitions. These observations were confirmed by segment-by-segment comparisons which showed no significant differences in peak Ecc, E1, E2, twist and torsion between two sequential scans. A difference in radial strain was noted, Err (0.43 ± 0.22 vs.0.38 ± 0.19, $p = 0.008$). There was good scan-rescan reproducibility of peak Ecc (CoV = 20.59%, ICC = 0.815, $p < 0.001$), E2 (CoV = 14.85%, ICC = 0.757, $p < 0.001$), twist (CoV= 34.12%, ICC = 0.911, $p < 0.001$) and torsion (CoV = 11.07%, ICC = 0.818, $p < 0.001$). There was moderate scan-rescan reproducibility of Err (CoV = 36.36%, ICC = 0.664, $p < 0.001$) and E1 (CoV = 32.74%, ICC = 0.646, $p < 0.001$). The figure shows similar segmental patterns for all indices, significant differences only for 2 apical segments between two scans.

CONCLUSION

DENSE is a reproducible MRI technique for characterizing regional myocardial motion on a per-segment basis in human subjects.

CLINICAL RELEVANCE/APPLICATION

In the present study, we demonstrated the overall reproducibility of DENSE for the description of LV motion on a per-segment basis for human subjects.

SSJ04-05 The Relationship between the Transluminal Attenuation Gradient (TAG) Measured from Coronary CT Angiography (CTA) and Coronary Blood Flow: Validation in Left- versus Right-Dominant Circulation

Tuesday, Dec. 1 3:40PM - 3:50PM Location: S504AB

Participants
Dimitris Mitsouras, PhD, Boston, MA (*Presenter*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Rani S. Sewatkar, MBBS, Edison, NJ (*Abstract Co-Author*) Nothing to Disclose
Mukta Agarwal, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Andreas Giannopoulos, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Marcus Y. Chen, MD, Bethesda, MD (*Abstract Co-Author*) Institutional research agreement, Toshiba Corporation
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation;
Elizabeth George, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael Cheezum, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

TAG characterizes the dropoff in contrast enhancement across a coronary artery in a CT angiogram. We sought to validate a theoretical relationship to coronary flow using the known relationships of physiologic flow amongst the three main coronary arteries.

METHOD AND MATERIALS

We hypothesized that during changing inflow contrast concentration (eg, during bolus up-/down-slope), TAG relates to volumetric flow as Q~Lumen Area [mm^2]×Inflowing Contrast Enhancement Change [HU/sec]/TAG [HU/mm]. TAG and relative flow metrics using this equation were calculated in 25 patients with <25% diameter stenoses imaged with 320-row CTA (AquilionOne, Toshiba), and compared between those with right- (RD) vs left-/co-dominant (LD) circulation. Lumen area was determined for the arterial length used for TAG measurement. For 22 patients with bolus tracking images additionally available, inflow contrast enhancement change during the CTA was estimated in the ascending aorta. TAG-derived flow was averaged for each major coronary artery of LD and RD patients separately, and compared to invasively-measured flows reported in the PREDICTION trial (n=496 patients; Sakamoto et al, Am J Cardiol 2013;111:1420-).

RESULTS

20 patients were RD and 5 LD. In those with bolus tracking images, TAG-derived flow in the LAD and LCX was within 4-16% of physiologic values; RCA flow was over/underestimated by 21-40%. In terms of physiologic LD/RD ratios, TAG-derived flow in the

LAD for LD vs RD patients was 1.09 (104 vs 92.5 ml/min), which compares well to the known physiologic ratio of 1.07 (2% difference). Similarly, the ratio for the LCX was 1.47 (113 vs 76 ml/min) compared to the physiologic ratio of 1.57 (6% difference), and in the RCA it was 0.37 (56 vs 158 ml/min) compared to 0.50 (26% difference).

CONCLUSION

The TAG in coronary arteries appears inversely proportional to resting coronary flow. Knowledge of the temporal change of inflow contrast concentration further enables derivation of coronary flow from TAG.

CLINICAL RELEVANCE/APPLICATION

Knowledge of the relationship of TAG to coronary flow can enhance detection of functionally significant CAD. We have used this relationship to increase TAG accuracy for predicting a significant invasive fractional flow reserve (FFR<0.8), and to obtain more accurate hyperemic blood flow boundary conditions for FFR-CT estimation via computational fluid dynamics.

SSJ04-06 Feasibility of the Combined CT Assessment of Coronary CT Angiography and Quantitative Myocardial CT Perfusion Imaging for the Detection of Obstructive Coronary Artery Disease Assessed by Invasive Coronary Angiography and Cardiac Magnetic Resonance

Tuesday, Dec. 1 3:50PM - 4:00PM Location: S504AB

Participants
Yuki Tanabe, Toon, Japan (*Presenter*) Nothing to Disclose
Teruhito Kido, MD, PhD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Takahiro Yokoi, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Naoki Fukuyama, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Ryo Ogawa, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Rami Yokoyama, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshiko Nishiyama, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoyuki Kido, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Akira Kurata, PhD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Masao Miyagawa, MD, PhD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose
Teruhito Mochizuki, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study was to evaluate the diagnostic performance of the combined assessment of coronary computed tomography angiography (CTA) and quantitative myocardial CT perfusion (CTP) to identify obstructive coronary artery disease (CAD).

METHOD AND MATERIALS

The study group comprised consecutive 34 patients (mean age 68.7 years) who underwent combined CT protocol and cardiac magnetic resonance (CMR) prior to invasive coronary angiography (ICA). CT scan protocol consisted of pharmacological stress dynamic myocardial CTP and coronary CTA using 256-slice CT. Obstructive CAD was defined as stenosis>=50% on ICA with a corresponding myocardial ischemia on CMR. Quantitative CTP assessment was performed with myocardial blood flow (MBF), which was calculated by model-based deconvolution method using semi-automated prototype software (FUJIFILM RI Pharma Co., Ltd., Tokyo, Japan) built on MATLAB (The MathWorks Inc, Natick, MA). A cut-off value of CT-MBF was determined for detecting myocardial ischemia assessed by CMR using receiver operating characteristic (ROC) analysis at a vessel level. The presence of coronary stenosis was assessed with lesions defined as follows: 0-no luminal stenosis; 1-minimal (<25% stenosis); 2-mild (25-49% stenosis); 3-moderate (50-69% stenosis); 4-severe (70-99% stenosis); and 5-occlusion. Coronary stenosis >= 50% or unavailable vessels were defined as significant, and CT-MBF was referred consequently. A vascular territory with a significant stenosis on CTA along with CT-MBF less than the cut-off value was considered to be positive. Diagnostic performance (sensitivity, specificity, positive and negative predictive value [PPV and NPV]) of CTA, CTP and combined assessment (CTA+CTP) for detecting obstructive CAD.

RESULTS

A cut-off value of CT-MBF was 1.28 ml/g/min. In comparison with ICA and CMR, sensitivity, specificity, PPV and NPV were 97%, 47%, 52% and 97% for CTA, 84%, 76%, 67% and 89% for CTP and 84%, 89%, 82% and 90% for combined assessment. Area under the ROC curve of CTA, CTP and combined assessment were 0.79, 0.83 and 0.88.

CONCLUSION

Combined CT assessment of CTA and quantitative CTP imaging allows for evaluating obstructive CAD with high diagnostic accuracy using single modality.

CLINICAL RELEVANCE/APPLICATION

Combined CT protocol of CTA and CTP allows for anatomical and physiological assessment of coronary artery disease with high diagnostic accuracy by using a single modality.

SSJ07

Gastrointestinal (Small Bowel Imaging)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: E353A

GI MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Michael S. Gee, MD, PhD, Jamaica Plain, MA (*Moderator*) Nothing to Disclose
Tracy A. Jaffe, MD, Durham, NC (*Moderator*) Nothing to Disclose

Sub-Events

SSJ07-01 Reproducibility of Magnetic Resonance Enterography Scores for the Assessment of Disease Activity in Crohn's Disease Using Central Readers

Tuesday, Dec. 1 3:00PM - 3:10PM Location: E353A

Participants
Jordi Rimola, MD, Barcelona, Spain (*Presenter*) Consultant, F. Hoffmann-La Roche Ltd; Consultant, Takeda Pharmaceutical Company Limited
Cynthia S. Santillan, MD, San Diego, CA (*Abstract Co-Author*) Consultant, Robarts Clinical Trials Research Group
Stuart A. Taylor, MBBS, London, United Kingdom (*Abstract Co-Author*) Research consultant to Robarts plc
Karin van Gemert-Horsthuis, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Barrett G. Levesque, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Brian Feagan, London, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the reproducibility of two MRE disease activity instruments, the MaRIA and London indices, when centrally read by four expert gastrointestinal body imaging radiologist readers in a multi-center trial setting.

METHOD AND MATERIALS

Four central reader radiologists at different centers in Europe and North America reviewed 50 MRE sequences of patients with a spectrum of Crohn's disease activity and location. Readers assessed the MaRIA and London indices, pre-specified individual MRE findings, and a global rating of severity based on a visual analogue scale (VAS). Intraclass correlation coefficients (ICCs) for intra- and inter-rater agreement were calculated for each assessment.

RESULTS

Intra-rater ICCs (95% confidence intervals) for the MaRIA, London, London Extended indices and the VAS were 0.89 (0.84 to 0.91), 0.84 (0.76 to 0.88), 0.81 (0.71 to 0.85) and 0.86 (0.81 to 0.90).Corresponding inter-rater ICCs were 0.71 (0.61 to 0.77), 0.50 (0.32 to 0.62), 0.56 (0.40 to 0.64), and 0.71 (0.62 to 0.77). The correlation between each reader's VAS and the MaRIA, London, and London Extended indices were 0.79 (0.71 to 0.85), 0.68 (0.58 to 0.77) and 0.67 (0.58 to 0.76), respectively.These results indicate that there was "almost perfect" intra-rater reproducibility of centrally read MaRIA and London indices. Inter-rater agreement was "substantial" for the MaRIA and "moderate" for the London indices.

CONCLUSION

The MaRIA index appears to have the best operating characteristics which further supports its implementation as an instrument for use in clinical trials.

CLINICAL RELEVANCE/APPLICATION

Magnetic resonance enterography (MRE) will likely be increasingly utilized in clinical trials to improve Crohn's disease (CD) patient selection and because it may be more responsive to clinically important changes in inflammatory status than either symptom-based or endoscopic instruments.Reproducibility is a critical property of MRE CD activity indices if they are to be used as outcome measures in clinical trials.

SSJ07-02 Genetic Polymorphisms Associated with MR Enterography Imaging Features of Crohn's Disease

Tuesday, Dec. 1 3:10PM - 3:20PM Location: E353A

Participants
Cinthia Cruz, MD, Boston, MA (*Presenter*) Nothing to Disclose
Abra Guo, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
James H. Thrall, MD, Boston, MA (*Abstract Co-Author*) Board Member, Mobile Aspects, Inc; Board Member, WorldCare International Inc; Consultant, WorldCare International Inc; Shareholder, Antares Pharma, Inc; Shareholder, iBio, Inc ; Shareholder, Peregrine Pharmaceuticals, Inc
Vijay Yajnik, MD,PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael S. Gee, MD, PhD, Jamaica Plain, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate for associations between genetic loci related to Crohn's disease (CD) behavior and imaging features of disease.

METHOD AND MATERIALS

IRB approved HIPAA compliant single institution study of 76 patients with established CD who underwent MRE for disease evaluation. Scans were performed from 2009-2015 on a 1.5T clinical scanner using standard MRE protocol with oral and intravenous

contrast. 53 of these patients also had genetic testing performed on peripheral blood (Sequenom® genotyping platform). Two readers jointly evaluated the studies in consensus for findings of bowel inflammation [Mural early mucosal enhancement (ME), T2 Hyperintensity (T2), bowel wall thickening (BWT), Mesenteric inflammatory changes (MC)], evidence of penetrating disease (ulcer, fistula, or abscess), proximal bowel dilation, disease distribution, and overall length of involvement (LOI).Each scan was scored for disease distribution, activity, and behavior. Genetic analysis included evaluation for presence of 168 single nucleotide polymorphisms (SNPs) associated with inflammation. Fisher's Exact Test was used to assess for statistical significance.

RESULTS

31 females and 22 males were analyzed (mean age 40 years ranging 20-83). Activity was classified as active in 37(70%), chronic in 8 (15%), and normal in 8(15%) patients; behavior was classified as inflammatory(I) in 27 (60%), structuring(S) in 6(13%), and fistulizing(F) in 12(26%) patients; mean length of involvement was 14.9 +/- 3.6 cm. Out of 168 SNP tested, the highest incidence was observed for IL23(100%) followed by PTPN22(91%) and IL31RA-IL6ST(74%). HLA and CARD9(20%) were only observed in patients with active disease on imaging with a highly significant association (p=0.009). IL31R-IL6ST showed a significantly lower incidence in chronic disease (p=0.03). Among MRE imaging features, HLA and CARD9 mutations were most significantly associated with BWT (p=0.02), with ME and T2 also significant (p=0.04). MAP3K8 and TNFR showed a significantly higher associations with F disease (p<0.001) and (p=0.03) with evidence of abscess (4/37).

CONCLUSION

Multiple SNPs are associated with CD activity assessed on MRE, with HLA and CARD9 significantly associated with active disease, fistulizing behavior and presence of abscesses. BWT, ME, and T2 are individual imaging features showing significant genetic associations.

CLINICAL RELEVANCE/APPLICATION

CD patient genotype impacts on imaging phenotype depicted by MRE.

SSJ07-03 Bowel Imaging with PET/MR Enterography: First Results

Tuesday, Dec. 1 3:20PM - 3:30PM Location: E353A

Participants
Karsten J. Beiderwellen, MD, Essen, Germany (*Presenter*) Speaker, Siemens AG; Speaker, Bracco Group
Sonja Kinner, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lukas Lenga, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt Gomez, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG
Jost Langhorst, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Bockisch, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas C. Lauenstein, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate hybrid PET/MR enterography for the diagnostic assessment of intestinal pathologies.

METHOD AND MATERIALS

43 patients with Crohn's disease, bowel malignancies or fever of unknown origin (female: n=20, male: n=23, age: 51±13 years [20-74 years]) underwent PET/MR enterography (Biograph mMR, Siemens) with either [18F]FDG (n=34) or [68Ga]-DOTATOC (n=9). For small bowel distension 1500 ml of an oral contrast solution containing mannitol and locust bean gum were ingested. PET was acquired as list mode for 8 min per bed. The MR protocol encompassed: a) coronal TrueFISP; b) coronal T2w HASTE with fat saturation; c) coronal T1w 3D VIBE pre and post gadolinium; d) axial and coronal T1w 2D FLASH post-gadolinium. Datasets were evaluated regarding co-registration of anatomical structures based on a 3-point ordinal scale (3: good co-registration, 2: slight misregistration, 1: significant misregistration) and image quality using a 4-point scale (1: non-diagnostic - 4: excellent quality). Furthermore, visualization of intestinal and extraintestinal pathologies was described.

RESULTS

PET/MR enterography resulted in a high overall image quality (mean score MRI: 3.3, PET: 2.4) with good results for of PET and MRI co-registration (mean: 2.5 - 2.9). An excellent visualization of small and large bowel pathologies was achieved including inflammatory lesions (in 18 patients) as well as malignant lesions (in two patients). Furthermore, extraintestinal pathologies such as lymph node metastases (in two patients) were identified.

CONCLUSION

Integrated PET/MR enterography represents a technically robust examination allowing for good co-registration of bowel structures.

CLINICAL RELEVANCE/APPLICATION

The new method enables a multimodal assessment of bowel lesions in inflammatory as well as malignant disease. The simultaneous data acquisition might be of advantage in the interpretation of PET/MR in comparison to independently acquired PET and MRI data sets due to potential bowel motion artifacts and different patient positioning.

SSJ07-04 High Radiation Exposure in Symptomatic Crohn's Disease Patients and the Need for Reduction in Utilization of CT Imaging

Tuesday, Dec. 1 3:30PM - 3:40PM Location: E353A

Participants
Dorathy Tamayo-Murillo, MD, Dorchester, MA (*Presenter*) Nothing to Disclose
Alessandra Sax, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Christina Jeong, BS, MS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Yu Chen, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Charles G. Colip, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Hannah MIller, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Francis Farraye, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stephan W. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Patients with Crohn's disease are at risk of high radiation exposure, particularly from CT imaging. Symptomatic Crohn's patients are often scanned repeatedly due to broad differential diagnoses associated with the presenting complaint. While CT is a valuable tool in the assessment of Crohn's disease and its complications, we must be cognizant of its overutilization. Herein, we evaluated the utilization rate and indications for CT imaging of Crohn's patients at our institution.

METHOD AND MATERIALS

We performed a retrospective chart review of 100 consecutive Crohn's disease patients who received a CT scan from 2000 to 2015. All incidences of radiation from CT imaging were noted. The total and average number of CT scans were tallied. CT scans were categorized by indication; the total number of normal studies was also obtained.

RESULTS

100 patients with Crohn's disease were evaluated, 53 female and 47 male, a mean age of 48, with a range of 22 to 88 years. In this study population 491 CT scans were performed. The indications for the imaging studies included assessment of nonspecific abdominal or pelvic pain (46.8%), evaluation of suspected Crohn's flare or Crohn's related complications (30.5%), surgical complication or surgical follow up (9.5%), flank pain (5.2%), trauma (0.4%), or other (7.6%).In this population, the average number of CT scans performed was 4.9, with a range of 1 to 23. A total of 43 patients received >= 5 CTs, 12 received >= 10 CTs, 4 received >= 15 CTs and 2 received >= 20 CTs. Of the 491 CT scans performed, 135 (27.5%) were reported as normal or with stable chronic changes related to the patients underlying Crohn's disease.

CONCLUSION

The average number of CT scans per patient in this population approached 5 scans with a maximum of 23 scans in a single patient. Prior studies have shown that radiation above 50mSv (~5 CT scans) increases the risk of cancer, which is particularly pertinent for the Crohn's patient population. Of the scans performed a significant proportion were recorded as normal or with stable chronic changes from Crohn's disease, thus not providing a cause for the patient's symptoms.

CLINICAL RELEVANCE/APPLICATION

Our findings elucidate there is considerable room for reducing the use of CT imaging in symptomatic Crohn's patients, given the significant number of scans with normal or stable chronic findings

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

SSJ07-05 Head-to-head Prospective Evaluation of Small Bowel Distension and Patient Tolerance of a New Enteric Contrast Agent for Enterography

Tuesday, Dec. 1 3:40PM - 3:50PM Location: E353A

Participants
Amy B. Kolbe, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Adam Froemming, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Shannon P. Sheedy, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Chi Wan Koo, MD, Mankato, MN (*Abstract Co-Author*) Nothing to Disclose
Krishna Pundi, BS, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
David Bruining, MD, Rochester, MN (*Abstract Co-Author*) Research Grant, Given Imaging Ltd Consultant, Bracco Group
Jeanne Tung, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
W. S. Harmsen, MS, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
John M. Barlow, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Jeff L. Fidler, MD, Rochester, MN (*Abstract Co-Author*) Research Grant, Beekley Corporation
Joel G. Fletcher, MD, Rochester, MN (*Abstract Co-Author*) Grant, Siemens AG; ;

PURPOSE

To evaluate a new mannitol and sorbitol-containing flavored beverage (FB) as an enteric contrast agent for enterography compared to commercially available low Hounsfield barium sorbitol suspension (BS) for side effects, patient taste and willingness to repeat the exam, and small bowel distension.

METHOD AND MATERIALS

10 normal subjects ingested 5 different drinking algorithms on separate days (FB2: 1000 mL FB + 350 mL water; FB3: 1500 mL FB; BS2: 900 mL BS + 450 mL water; BS3: 1350 mL BS + 150 mL water; W3: 1500 mL water), with agents ingested over 45 minutes. Coronal SSFSE images were obtained through the bowel at 50 and 60 minutes following initiation of drinking. Subjects completed a questionnaire evaluating side effects, patient taste and willingness to repeat the exam. GI radiologists evaluated MR images using qualitative and quantitative scores for the jejunum, mid-ileum, and terminal ileum, blinded to imaging algorithm and time. Radiologists then ranked algorithms in order of preference based on distension of enteric contrast-filled bowel. Analyses were performed using ANOVA, pairwise Fisher's LSD, with p-values reporting overall significance of the 5 algorithms.

RESULTS

There was no significant difference in nausea or vomiting among regimens (p=0.20 and 0.42), but FB3 and V3 resulted in mild cramping (p=0.001). Using a 10 point scale, subjects rated taste of BS2 (mean=3.9) and BS3 (4.7) worst ($p < 0.0001$). Willingess to repeat drinking algorithm was highest for FB2 (9.8) and W3 (9.7) ($p<0.05$). There were significant overall differences in subjective small bowel distention for 2/3 readers (p=0.003, $p<0.02$), with both W3 regimens ranked significantly worse (Figure). For quantitative analyses, there was no significant difference in the diameter of the most distended small bowel loop for any segment or reader ($p>0.23$), with one reader identifying smaller representative loop diameters for W3 in the jejunum and ileum ($p<0.03$).

CONCLUSION

FB has a similar side effect profile and results in equivalent small bowel distention compared with BS. Normal subjects rated taste and willingness to repeat the exam with the new FB agent significantly higher.

CLINICAL RELEVANCE/APPLICATION

By improving taste and maintaining side effect profile and small bowel distention, a new flavored beverage oral contrast agent with sorbitol can result in improved willingness to undergo repeat enterography exams.

SSJ07-06 IBD Plus CTE Equals a New Equation for Disease Diagnosis

Tuesday, Dec. 1 3:50PM - 4:00PM Location: E353A

Participants
Jamaal Benjamin, MD,PhD, Dallas, TX (*Presenter*) Nothing to Disclose
Cecelia Brewington, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to harness our expanding understanding of the basic mechanisms of Inflammatory Bowel Disease (IBD) in order to develop more accurate and useful avenues of molecular imaging and Crohn's disease diagnosis.

METHOD AND MATERIALS

A cohort of 82 Crohn's disease (CD) patients who underwent endoscopy and CT enterography (CTE) was examined for 5 predetermined CT findings - mural hyperenhancement, bowel wall thickening, increased mural fat attenuation, mural stratification and combs sign and 5 predetermined lab measurements - fecal calprotectin, fecal lactoferrin, C-reactive protein (CRP), fecal elastase and serum IgA.For Fecal Calprotectin (FC) a lab value of 16 (mcg/g) or less were set as 16, CRP of 5 (mg/L) or less were set as 5 and Stool elastase (SE) of 500 (µg/g) or more were set as 500. Relationships between the variables and whether there was Active IBD were evaluated. Fisher's exact tests were performed on discrete variables while Wilcoxon rank sum tests were performed on continuous variables

RESULTS

Of the 5 evaluated clinical lab values, fecal calprotectin (FC) and CRP were the most useful predictors of active IBD. Both FC and CRP demonstrated statistically significant smaller median values in non-active IBD than active IBD. Utilizing logistic regression models and ROC curves, we determined threshold cutoff values of 142 (mcg/g) for FC and 5.4 (mg/L) for CRP. Following determination of individual variable threshold values, we then combined the two and developed the following predictive algorithm: If $FC < 142$ and $CRP < 5.4$ then categorize the case as "No IBD"; Otherwise categorize as "Yes IBD"Utilizing this algorithm, the sensitivity for active IBD was 92.86%, specificity was 77.78%, PPV of 86.67%, NPV of 87.57% and an accuracy of 86.96%.

CONCLUSION

This work demonstrates that combining CTE and clinical labs can be a powerful tool in the diagnosis of IBD, and that the most useful lab values in CT enterography evaluation of IBD cases are fecal calprotectin and CRP. Therefore, we propose all CT enterography should also include evaluation of FC and CRP for specific numerical thresholds when considering IBD in the differential diagnosis.

CLINICAL RELEVANCE/APPLICATION

CTE findings for IBD are difficult to interpret, therefore, a methodology for incorporating clinical lab values with CTE findings is critical for accurate initial diagnosis and disease surveillance.

SSJ09

Gastrointestinal (Liver Fat and Fibrosis)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: E350

GI CT MR US

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Frank H. Miller, MD, Chicago, IL (*Moderator*) Nothing to Disclose
Donald G. Mitchell, MD, Philadelphia, PA (*Moderator*) Consultant, CMC Contrast AB

Sub-Events

SSJ09-01 MR Elastography of the Liver: Comparison of GRE and EPI Sequences

Tuesday, Dec. 1 3:00PM - 3:10PM Location: E350

Participants
Mathilde Wagner, MD,PhD, Paris, France (*Presenter*) Nothing to Disclose
Temel K. Yasar, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Cecilia Besa, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To compare 2D-GRE (gradient recalled echo) liver MR-Elastography (MRE) with 2D-SE-EPI (echoplanar imaging) MRE in terms of image quality (IQ) and liver stiffness (LS) measurements.

METHOD AND MATERIALS

36 patients with chronic liver disease or focal liver lesion (M/F:23/13, mean age 57.8 y) who underwent 3T liver MRI (MR750, GE) using 2D-GRE and 2D-SE-EPI liver MRE were enrolled in this single-center IRB approved study. Both sequences were acquired in the axial plane, with 4 slices (same location), 10 mm thickness, a 60Hz mechanical motion, similar FOV (2D-GRE: TR/TE 50/20, 256x80, 60 MEG frequency, ASSET 2 / SE EPI: TR/TE 1000/55.4, 80x80, 155Hz MEG frequency, ASSET 2). Scan time for EPI MRE was 4 sec and 14 sec for GRE MRE (for each slice). One radiologist placed ROIs in the liver parenchyma for measurements of LS (kPa). ROIs were drawn as large as possible, avoiding voxels with less than 95% confidence level on the confidence map, large vessels, parenchyma edge and fissures. IQ scores were assessed by a second radiologist using a four-point scale (0: no observable wave propagation/no confidence map; 3: excellent wave propagation in liver/confidence map covering more than 50% of liver slice). Mean LS values and IQ scores between EPI and GRE MRE were compared using Wilcoxon test. Reproducibility of LS between these two sequences was assessed with intraclass coefficient correlation (ICC), coefficient of variability (CV) and Bland-Altman limits of agreement (BALA).

RESULTS

In 4 patients, GRE MRE completely failed while there was no case of failure with EPI MRE. IQ scores were significantly higher using EPI versus GRE MRE(score 14.4 vs 8.6, P<0.0001). ROI size was significantly higher using EPI than GRE MRE (56.06 cm^2 vs. 14.47 cm^2, P<0.0001). LS measurements were not significantly different between the EPI and GRE MRE (3.41±1.36 kPa vs 3.42±1.56 kPa, P=0.51), were significantly correlated (ICC=0.908, P<0.0001) and showed a high reproducibility (mean CV=10.2% (0.2-28.2), bias=0.09±0.63 kPa (BALA[-1.15;1.32]).

CONCLUSION

IQ scores of EPI MRE were significantly higher than GRE MRE, with faster acquisition and equivalent measurements. Larger ROI in EPI MRE allows more comprehensive liver sampling.

CLINICAL RELEVANCE/APPLICATION

GRE MRE is the most common approach for LS assessment. EPI MRE performs superior in terms of IQ and liver coverage with less breath-holds. This approach might improve the performance of MRE.

SSJ09-02 Associations between Nonalcoholic Fatty Liver Disease (NAFLD) Histologic Features and Magnetic Resonance Elastography (MRE)-estimated Liver Stiffness in Adults without Fibrosis

Tuesday, Dec. 1 3:10PM - 3:20PM Location: E350

Participants
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Anthony Gamst, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Kevin J. Glaser, Rochester, MN (*Abstract Co-Author*) Intellectual property, Magnetic Resonance Innovations, Inc; Stockholder, Resoundant, Inc

Meng Yin, Rochester, MN (*Abstract Co-Author*) The Mayo Clinic and MY have intellectual property rights and a financial interest in MRE technology.
Michael S. Middleton, MD, PhD, San Diego, CA (*Abstract Co-Author*) Consultant, Allergan, Inc Institutional research contract, Bayer AG Institutional research contract, sanofi-aventis Group Institutional research contract, Isis Pharmaceuticals, Inc Institutional research contract, Johnson & Johnson Institutional research contract, Synageva BioPharma Corporation Institutional research contract, Takeda Pharmaceutical Company Limited Stockholder, General Electric Company Stockholder, Pfizer Inc Institutional research contract, Pfizer Inc
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Claude B. Sirlin, MD, San Diego, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;

PURPOSE

Magnetic resonance elastography (MRE) has been established as a noninvasive method of estimating liver stiffness and thereby inferring hepatic fibrosis. The purpose of this work is to assess whether the other hepatic pathologies that are observed in NAFLD; steatosis, inflammation, and ballooning, have independent, significant affects on MRE estimated stiffness, and to assess whether they are possible confounds of the stiffness estimation.

METHOD AND MATERIALS

In this IRB approved study, adults receiving standard-of-care liver biopsy for NAFLD were consented and underwent MRE at 3T within 180 days of biopsy. MRE was performed using three methods (2D at 60 Hz, 3D at 40 Hz, and 3D at 60 Hz), from which MRE-estimated liver stiffness values were calculated. Histologic features were scored based on NASH CRN criteria; subjects with histologically-determined fibrosis were excluded. Associations between liver stiffness and inflammation or ballooning were assessed using t-tests. The association between liver stiffness and steatosis was assessed using Spearman rank correlation analysis. Multivariate linear regression analysis was used to test MRE stiffness against histologic features adjusted for age, BMI, and ALT.

RESULTS

Sixty-four adults (30 M; mean age 49.5 yrs, range 18.5 to 75.8 yrs) were enrolled in this study. Multivariate linear regression analysis showed a negative correlation of steatosis with log of 3D MRE-estimated liver stiffness at 40 Hz (-0.064, $p = 0.043$) and 60 Hz (-0.068, $p = 0.018$). Univariate analyses of MRE-estimated liver stiffnesses for all three methods showed no association with inflammation ($p = 0.08$ to 0.11), ballooning ($p = 0.51$ to 0.63), or steatosis (rho = 0.29 to 0.39).

CONCLUSION

Hepatic steatosis has an independent, statistically significant association with the MR elastographic estimation of liver stiffness when BMI, ALT, and age are controlled for. Inflammation and ballooning do not have a statistically significant association with liver stiffness.

CLINICAL RELEVANCE/APPLICATION

This association between steatosis and liver stiffness is a possible confound in the MRE estimation of liver stiffness, and should be accounted for when MRE is used to estimate fibrosis in adult patients.

SSJ09-03 Noninvasive Hepatic Fibrosis Staging Using Magnetic Resonance Elastography: The Usefulness of the Bayesian Prediction Method

Tuesday, Dec. 1 3:20PM - 3:30PM Location: E350

Participants
Shintaro Ichikawa, MD, Chuo-Shi, Japan (*Presenter*) Nothing to Disclose
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Hiroshi Onishi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the usefulness of the Bayesian prediction method (BPM) for noninvasive hepatic fibrosis staging (HFS) using magnetic resonance elastography (MRE).

METHOD AND MATERIALS

Chronic liver disease patients (n = 309) were included and fibrosis staging and MRE was performed. Receiver operating characteristic analysis was used to determine the optimal cut-off stiffness value (cut-off method; COM) of MRE to distinguish between fibrosis stages. A uniform distribution was assumed for pre-MRE probability of stages using the BPM. The MRE stiffness value determined the post-MRE probability and confidence of HFS. The distinguishing ability of COM and BPM were compared in all patients (Bayesian-all) and in patients with strong confidence (≥ 90%) with BPM (Bayesian-strong).

RESULTS

The ability to distinguish between hepatic fibrosis stages was not significantly different between COM and Bayesian-all. In patients who had strong confidence with BPM, the sensitivity and negative predictive value (NPV) of Bayesian-strong for diagnosing ≥ F2, ≥ F3, and F4 were significantly higher than with COM (sensitivity: COM vs. Bayesian-all for ≥ F2, 94.5% vs. 99.1% ($P = 0.0041$); ≥ F3, 89.6% vs. 99.4% ($P = 0.0001$); F4, 89.3% vs. 100% ($P = 0.0018$); NPV: ≥ F2, 78.8% vs. 93.9% ($P = 0.0059$); ≥ F3, 85.0% vs. 98.7% ($P < 0.0001$); F4, 93.4% vs. 100% ($P = 0.0009$)). The specificity of Bayesian-strong for diagnosing F4 was significantly higher than that of COM (97.3% vs. 100% ($P = 0.0428$)).

CONCLUSION

BPM has better distinguishing ability than COM for HFS using MRE if the confidence is strong.

CLINICAL RELEVANCE/APPLICATION

A liver biopsy followed by histopathological assessment is a common approach for staging liver fibrosis. However, a biopsy can

cause several complications. Consequently, noninvasive methods have been developed for assessing hepatic fibrosis. Recent studies have indicated that MRE is a promising, highly reproducible tool with advanced diagnostic capacity for the non-invasive staging of hepatic fibrosis. Hepatic fibrosis can be assessed more correctly by using BPM.

SSJ09-04 Direct Comparison of 3 Elastrometry Devices (Fibroscan, Acoustic Radiation Force Impule, Supersonic Shearwave Imaging) for the Non-Invasive Diagnosis of Liver Fibrosis in Chronic Liver Diseases

Tuesday, Dec. 1 3:30PM - 3:40PM Location: E350

Participants
Victoire Cartier, MD, Angers, France (*Presenter*) Nothing to Disclose
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Jerome Lebigot, MD, Angers, France (*Abstract Co-Author*) Nothing to Disclose
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Paul Cales, MD, PhD, Angers, France (*Abstract Co-Author*) Research Consultant, Echosens SA
Christophe Aube, MD, PhD, Angers, France (*Abstract Co-Author*) Speaker, Bayer AG Support, General Electric Company

PURPOSE

Liver stiffness measurement using elastography allows for a non-invasive diagnosis of liver fibrosis with immediate results at bedside. We aimed to evaluate and compare the feasibility and the diagnostic accuracy Fibroscan (FS), Acoustic Radiation Force Impulse (ARFI), and Supersonic Shearwave Imaging (SSI) for the non-invasive diagnosis of liver fibrosis.

METHOD AND MATERIALS

192 patients with chronic liver disease, liver biopsy, FS, ARFI and SSI were included. Metavir F staging on biopsy was taken as the reference for liver fibrosis. Result for each elastographic device was the median of 10 valid measurements. Diagnostic cut-offs were calculated to maximize the sum of sensitivity + specificity.

RESULTS

Cause of chronic liver disease was NAFLD in 55.7% of cases, viral hepatitis: 16.1%, alcohol: 16.7%, and others: 11.5%. Fibrosis stage prevalence was: F0: 23.4%, F1: 37.0%, F2: 19.3%, F3: 13.5%, F4: 6.8%. Failure of liver stiffness measurement (no valid measurement) occurred in 18 patients (9.4%) with FS, no patients with ARFI, and 3 patients (1.6%) with SSI (p=0.001 between FS and SSI). Results for the 3 devices were available in 171 patients. Obuchowski indexes were: FS: 0.855±0.018, ARFI: 0.761±0.027, SSI: 0.789±0.025 (FS vs ARFI or SSI: p<=0.020). AUROC for significant fibrosis (Metavir F>=2) were: FS: 0.863±0.027, ARFI: 0.749±0.039, SSI: 0.781±0.036 (p=0.006; FS vs ARFI or SSI: p<=0.021). Diagnostic cut-offs for F>=2 were: FS: 8.0 kPa, ARFI: 1.29 m/s, SSI: 1.85 m/s. Using this cut-offs, diagnostic accuracy for F>=2 was: FS: 76.0%, ARFI: 70.2%, SSI: 77.2% (p=0.204). AUROC for cirrhosis were: FS: 0.941±0.027, ARFI: 0.895±0.048, SSI: 0.870±0.035 (p=0.011; FS vs SSI: p=0.010). Diagnostic cut-offs for cirrhosis were: FS: 16.6 kPa, ARFI: 1.87 m/s, SSI: 1.93 m/s. Using this cut-offs, diagnostic accuracy for cirrhosis was: FS: 90.6%, ARFI: 79.5%, SSI: 75.4% (p<0.001, FS vs others: p<=0.001).

CONCLUSION

ARFI and SSI have better feasibility and similar accuracy for the diagnosis of significant fibrosis than FS. However, FS has the best accuracy for the diagnosis of cirrhosis.

CLINICAL RELEVANCE/APPLICATION

Non-invasive diagnosis and evaluation of liver fibrosis in chronic liver diseases using acoustic based elastography.

SSJ09-05 Fibrosis in Nonalcoholic Fatty Liver Disease: Noninvasive Assessment Using CT Volumetry

Tuesday, Dec. 1 3:40PM - 3:50PM Location: E350

Participants
Nobuhiro Fujita, MD, PhD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
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Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukihisa Takayama, MD, Fukuoka, Japan (*Abstract Co-Author*) Research Grant, FUJIFILM Holdings Corporation
Daisuke Okamoto, MD, Fukuoka City, Japan (*Abstract Co-Author*) Nothing to Disclose
Koichiro Morita, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To elucidate the morphological change in nonalcoholic fatty liver disease (NAFLD) with fibrosis stage using CT volumetry and to evaluate its diagnostic performance of CT volumetry for discriminating fibrosis stage in patients with NAFLD.

METHOD AND MATERIALS

A total of 38 patients with NAFLD (F0, 11; F1, 5; F2, 1; F3, 9; and F4, 12) who underwent contrast-enhanced CT were enrolled. On the basis of CT imaging, the volumes of total, left lateral segment, left medial segment, caudate lobe, and right lobe of the liver were calculated automatically and manually with a dedicated liver application. The relationship between the volume percentage of each area and fibrosis stage was analyzed using Spearman's rank correlation coefficient. Receiver operating characteristic (ROC) curve analysis was performed to determine the accuracy of CT volumetry for discriminating fibrosis stage.

RESULTS

The volume percentages of caudate lobe and left lateral segment significantly increased with fibrosis stage ($r = 0.815$, $P < 0.001$, and $r = 0.465$, $P = 0.003$, respectively). Contrarily, the volume percentage of the right lobe significantly decreased with fibrosis stage ($r = -0.563$, $P < 0.001$). The volume percentage of caudate lobe had the best diagnostic accuracy for staging fibrosis and

the area under the ROC curve values for discriminating fibrosis stage were as follows: ≥F1, 0.896; ≥F2, 0.929; ≥F3, 0.955; and ≥F4, 0.923. The best cut-off for advanced fibrosis (F3-F4) was 4.789% with sensitivity of 85.7% and specificity of 94.1%.

CONCLUSION

The volumes of caudate lobe and left lateral segment increase, and that of right lobe volume decreases with fibrosis stage in NAFLD. The volume percentage of caudate lobe calculated by CT volumetry is a useful diagnostic parameter for staging fibrosis in patients with NAFLD.

CLINICAL RELEVANCE/APPLICATION

CT volumetry is a powerful clinical tool to help diagnose fibrosis stage in NAFLD noninvasively. It may be useful in monitoring and making treatment decisions in patients with NAFLD.

SSJ09-06 Application of Ultrasound Texture Analysis For Detection of Liver Fibrosis

Tuesday, Dec. 1 3:50PM - 4:00PM Location: E350

Participants
David Podhaizer, MD, Boston, MA (*Presenter*) Nothing to Disclose
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Baojun Li, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Soto, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stephan W. Anderson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Avneesh Gupta, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the ability of ultrasound texture analysis to predict varying degrees of hepatic fibrosis in patients with known chronic liver disease.

METHOD AND MATERIALS

Following IRB approval, a retrospective chart review was performed on patients who underwent non-targeted ultrasound guided liver biopsies to include 29 patients with chronic liver disease (20 males, 9 females, mean age of 52 years old, range of 19 to 81 years old). For each patient, a single region of interested (ROI) was selected on two to three separate sonographic images that were obtained from the ultrasound guided liver biopsy examinations and the results were averaged. The ROIs were selected from the right lobe of the liver and excluded vessels and bile ducts. Texture analysis was performed on the ROIs using an in-house MATLAB-based program that extracted 45 texture features. Pearson product-moment correlation coefficients were calculated comparing texture features and degrees of hepatic fibrosis.

RESULTS

Of the 29 patients with chronic liver disease, the following Ishak fibrosis stages were represented, based on liver biopsy: Ishak 0, n=4; Ishak 1, n=4; Ishak 2, n=4; Ishak 3, n= 4; Ishak 4, n=4; Ishak 5, n=4; Ishak 6, n=5. Comparisons of the texture features with the degrees of hepatic fibrosis demonstrate strong correlations between Ishak fibrosis stage and Histogram texture features (r-values ranging up to -0.89), GLRL features (r-values ranging up to 0.80), Laws' features (r-values ranging up to 0.93), and GLGM features (r-values ranging up to -0.80). Weak correlation between texture features and degrees of fibrosis were demonstrated with 2-D features (r-values ranging up to 0.36) and GLCM features (r-values ranging up to -0.47).

CONCLUSION

Sonographic texture features demonstrate strong correlation with Ishak liver fibrosis scores. This suggests that texture analysis of ultrasound images has the potential to non-invasively predict varying degrees of hepatic fibrosis.

CLINICAL RELEVANCE/APPLICATION

Texture analysis can potentially be applied to ultrasound as a non-invasive method to diagnose and monitor progression of liver fibrosis.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jorge A. Soto, MD - 2013 Honored Educator
Jorge A. Soto, MD - 2014 Honored Educator
Jorge A. Soto, MD - 2015 Honored Educator

SSJ10

Genitourinary (Prostate Intervention)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: E353C

GU IR MR US

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Aytekin Oto, MD, Chicago, IL (*Moderator*) Research Grant, Koninklijke Philips NV; ; ;
Temel Tirkes, MD, Indianapolis, IN (*Moderator*) Nothing to Disclose

Sub-Events

SSJ10-01 MR-guided In-bore versus MRI/Ultrasound Fusion Plus TRUS-guided Prostate Biopsy: A Prospective Randomized Trial in Patients with Prior Negative Biopsies

Tuesday, Dec. 1 3:00PM - 3:10PM Location: E353C

Awards
Trainee Research Prize - Resident

Participants
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Peter Albers, MD, PhD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study prospectively compares the PCa detection rate (PCa-DR) of MR-guided in-bore biopsy (IB-GB) alone and MRI/ultrasound fusion-guided biopsy combined with a systematic TRUS-GB (FUS+TRUS-GB) in patients with at least one negative TRUS-GB and PSA level ≥4ng/ml.

METHOD AND MATERIALS

253 patients were included in this study. After multiparametric prostate MRI (T2WI, DWI, DCE-MRI) at 3T patients with any PI-RADS sum score ≥10 were prospectively randomized to IB-GB or FUS+TRUS-GB. Analysis of detection rates for PCa and significant PCa (Gleason score ≥7), highest Gleason score, number of biopsy cores to detect one (significant) PCa, positivity rate of biopsy cores, and tumor involvement per biopsy core were performed.

RESULTS

210 patients met all study requirements and were prospectively randomized, 106 patients receiving IB-GB and 104 patients FUS+TRUS-GB (age 65.3±7.1 vs. 66.7±6.8 years; median PSA 10.0 vs. 10.8 ng/ml, IQR 7.8-14.9 vs. 7.4-15.5 ng/ml). Mean number of cores was 5.61±0.80 vs. 17.38±1.17; p<0.001. PCa-DR for IB-GB was 36.8% (29.2% for significant PCa) and for FUS+TRUS-GB 39.4% (31.7%); p=0.776 and p=0.765. Mean highest Gleason score of 7.24±0.96 vs. 7.46±1.01; p=0.233. Positivity rate per biopsy core was 20.7% (123/595) vs. 11.6% (210/1,808); p<0.001. Number of biopsy cores needed to detect one PCa or one significant PCa was 15.3 vs. 44.1 and 19.2 vs. 54.8.

CONCLUSION

The combined biopsy approach did not significantly improve the overall PCa-DR compared to targeted IB-GB alone, but required significantly more cores. A prospective comparison of MR-targeted biopsy alone to systematic TRUS-GB is justified.

CLINICAL RELEVANCE/APPLICATION

We did not observe a difference between IB-GB and FUS+TRUS-GB to detect PCa.

SSJ10-02 Accuracy of Targeted Prostate Biopsy Using MR-ultrasound Fusion to Guide Biopsies Directed to Focal Lesions Suspicious for Malignancy: A Retrospective Study of 286 Patients

Tuesday, Dec. 1 3:10PM - 3:20PM Location: E353C

Participants
Guilherme C. Mariotti, MD, Jundiai, Brazil (*Presenter*) Nothing to Disclose
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Ronaldo H. Baroni, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Demonstrate an increase in the accuracy of targeted prostate biopsy using MR-ultrasound fusion to guide biopsies directed to focal

Demonstrate an increase in the accuracy of targeted prostate biopsy using MR-ultrasound fusion to guide biopsies directed to focal lesions suspicious for malignancy in a retrospective study of 286 patients.

METHOD AND MATERIALS

A single-institutional, IRB approved retrospective analysis of 286 patients in our database, which underwent targeted prostate biopsies using MR-ultrasound fusion from August 2013 to January 2015.We included all patients with suspected prostatic cancer based on clinical or laboratory findings (positive digital rectal examination or high PSA) submitted to multiparametric MRI and US-MRI fusion prostate biopsy.We excluded 7 patients with MRI-biopsy interval >= 6 months, 17 patients that underwent biopsy for staging of known cancer or active surveillance and 1 patient for whom clinical data was unavailable.

RESULTS

A total of 261 patients were included. Of these, 45 patients (17%) underwent previous negative transrectal US-guided biopsies. Table 1 summarizes demographic data of our casuistic.Pre-procedure MRI followed a Likert scale for suspition: Likert 1: 1 patient (0,4%); Likert 2: 18 patients (6,9%); Likert 3: 100 patients (38,3%); Likert 4: 75 patients (28,7%); Likert 5: 67 patients (25,7%).Overall positivity of the biopsies for tumors was 59% (154 cases), with 79% (123 cases) significant cancer (Gleason>=7), 19% (30 cases) non-significant cancer (Gleason 6) and 1 case of STUMP. Analyzing only the Likert 4 and 5 cases, in a total of 142 cases, the overall positivity was 76% (108 cases), with 90% (96 cases) significant cancer (Gleason>=7), 10% (11 cases) non-significant cancer (Gleason 6) and 1 leiomyoma. In our institution, the positivity of US-guided random biopsies, in a large sample of other patients in the same period (331 patients), was around 52%.

CONCLUSION

Our study demonstrates a significant improvement in the performance of prostate biopsy with US- MRI fusion compared to random US-guided biopsies, with potential clinical impact.

CLINICAL RELEVANCE/APPLICATION

Random prostate biopsies performed on a sextant-basis have a high incidence of false-negative results, and often diagnose microfocal lesions with low clinical significance. Targeted prostate biopsies using MR-ultrasound fusion have shown to detect clinically significant lesions and increase the accuracy of the procedure, with better clinical outcomes.

SSJ10-03 Targeted MR-guided Prostate Biopsy: Are Two Biopsy Cores per MRI Lesion Required?

Tuesday, Dec. 1 3:20PM - 3:30PM Location: E353C

Participants
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Peter Albers, MD, PhD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study evaluates the efficiency and potential benefit of taking two biopsy cores per MRI lesion when performing targeted MR-guided prostate biopsy.

METHOD AND MATERIALS

1545 biopsy cores of 774 intraprostatic lesions (two cores per lesion) in 290 patients (66.2±7.8 years; median PSA 8.2 ng/ml; IQR 6.0-12.0 ng/ml) were retrospectively evaluated regarding PCa detection, Gleason score, and tumor infiltration of the first (FBC) compared to the second biopsy core (SBC). All patients received previously a multiparametric (mp)-MRI (T2WI, DWI, DCE) of the prostate at 3T and all lesions were histologically verified by MR-guided in-bore biopsy.

RESULTS

491 biopsy cores were prostate cancer (PCa) positive, 239 of 774 (30.9%) FBC and 252 of 771 (32.7%) SBC (p=0.446). 61 FBC vs. 78 SBC detected significant PCa with a Gleason score ≥4+3=7 (25.5% vs. 31.0%; p=0.125). 687 SBC (89.1%) showed no histologic difference to the FBC. 74 SBC resulted in a higher tumor involvement per core when detecting the same Gleason sore (38.1%). In total 29.9% of the PCa lesions were Gleason-upgraded by SBC. 40 SBC detected PCA by negative FBC (5.2%). 43 SBC resulted in a Gleason upgrade (5.6%). 20 SBC showed a Gleason upgrade from a Gleason score 3+3=6 to ≥3+4=7 (2.6%) and 4 SBC to a Gleason score ≥4+3=7 (0.5%). 14 SBC showed a Gleason upgrade from 3+4=7 to ≥4+3=7 (1.8%).

CONCLUSION

The benefit of a second targeted biopsy core per suspicious MRI lesion is likely minor, especially regarding a significant Gleason upgrade. Therefore a further reduction of biopsy cores is feasible when performing a targeted MR-guided in-bore prostate biopsy.

CLINICAL RELEVANCE/APPLICATION

Provided a correct biopsy position was documented a second biopsy core per MRI lesion may be omitted for targeted MR-guided in-bore biopsy.

SSJ10-04 Prostate Cancer Aggressiveness: Correlation Between Multiparametric MRI and Molecular Stagging Using the CCP Score (Prolaris™ test)

Tuesday, Dec. 1 3:30PM - 3:40PM Location: E353C

Participants
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Marc O. Bitker, Paris, France (*Abstract Co-Author*) Nothing to Disclose
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Olivier Cussenot, Paris, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To correlate the ESUR-PI-RADS components as prognostic imaging biomarkers in localized prostate cancer to the Gleason score and the molecular CCP score (Prolaris™) .

METHOD AND MATERIALS

107 patients who had a multiparametric (mp) MRI before (RP) were selected. The largest lesion (index lesion) was measured on T2-MRI (Fig 1A) and ADC map and was classified with the ESUR-PI-RADS scoring system. A region of interest (ROI) was drown in the center of each target, on the ADC map . A single ADC ROI was correlated to histologically index proven lesion. The index lesions pointed out by mp MRI were matched on RP specimens and were run in Myriad's Research Laboratory in accordance with the Prolaris™ protocol in order to perform CCP score

RESULTS

For each index lesion the Pearson's correlations between, pretherapeutic CAPRA score, compoments of the ESUR-PIRADS score, including the maximal diameter (Tmax) and the topography of the index tumor were compared with the histo-pathological observations on the RP specimen.ESUR-PI RADS score and its components were tested with logistic regression model in oreder to assess their predictive value for Gleason's grade 4, CCP score value on the index lesion.On one hand, significant negative correlation was found between mean ADCs and diameter of the index lesion with Gleason's grade 4 (p=0.0078). The logistic regression model including Tmax (over 10mm) and ADC (under 800) predict with confidence Gleason'grade 4 in the index lesion (Fig 3). On the other hand, The Tmax or ADC size of the index lesion, remains unable to point out the aggressiveness of 7 tumours defined by CCP score. Among those, six were Gleason 6 (3+3) with a median Tmax of 8mm, and one of 8 mm was Gleason 7(3+4)

CONCLUSION

By mapping image features to gene expression data we were able to show that diffusion imaging and tumor size offer a potential for in vivo non invasive assessment of prognostic cancer aggressiveness.However CCP score related to high risk of lethal cancer did not, completely match with the mpMRI tumour map and Gleason score in 7% of patients. These results previosuly suggested by large scale genomic analysis suggest that the further management of early stages PCa could strongly beneficed of targeted biopsy with moelcular analysis

CLINICAL RELEVANCE/APPLICATION

This radio genomic correlation suggest that management of PCa could strongly benefit from both MRI targeted biopsy and subsequent molecular analysis.

SSJ10-05 Multi-parametric MRI (MpMRI) Findings after Focal Laser Ablation for Prostate Cancer (Pca)

Tuesday, Dec. 1 3:40PM - 3:50PM Location: E353C

Participants
Aytekin Oto, MD, Chicago, IL (*Presenter*) Research Grant, Koninklijke Philips NV; ; ;
Shiyang Wang, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Xiaobing Fan, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Stephen Thomas, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Ambereen Yousuf, MBBS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Gregory S. Karczmar, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Tatjana Antic, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Scott Eggener, Chicago, IL (*Abstract Co-Author*) Research Grant, Visualase, Inc Speakers Bureau, Johnson & Johnson

PURPOSE

To describe the quantitative and qualitative MpMRI findings following focal laser ablation of Pca

METHOD AND MATERIALS

27 patients with 36 cancer foci on baseline MRI, underwent MRI guided focal laser ablation were prospectively followed with, immediate (36/36 sites), 3-month (36/36 sites) and 12-month (24/36 sites) post-procedure 3T MpMRI and TRUS guided biopsy at 12 months. Qualitative and quantitative MpMRI findings including size and appearance of ablation defect, ADC, K(trans) and Ve were recorded and compared between the follow-up studies and between patients with and without residual disease.

RESULTS

36 cancer foci were ablated in 27 patients. Ablation defect was clearly visible on 36/36, 11/36 and 0/24 sites on the immediate, 3-month and 12-month post-contrast DCE-MR images respectively, with a gradual decrease in size on 3 month MRI even in visible cases. Focal atrophy/scarring was noted at the site of ablation in 10/36 and 20/24 sites on 3-month and 12-month MRI. Mean K(trans) values were significantly lower on post-procedure MRI`s compared to baseline values ($p<0.05$). Mean ADC values on 3-month MRI were significantly higher than the baseline ADC values ($p<0.05$). There was not significant change in Ve ($p>0.05$). In 2/4 cases with residual cancer, focal early enhancement was noted on 12-month DCE-MR Images. Other than 1 case with residual cancer, no focal lesion (other than diffuse and ill-defined changes secondary to ablation) was noted at the ablation site on 12-month T2 and ADC images.

CONCLUSION

Immediate post-contrast MR images are helpful for identification of the ablation defect. Quantitative MR parameters such as ADC and K (trans) change significantly following ablation. Early focal enhancement on DCE-MR Images at the ablation zone at 12-month

MRI is a suspicious finding for residual tumor.

CLINICAL RELEVANCE/APPLICATION

Follow-up MR images can be obtained at 12 months after laser ablation and early focal enhancement at the ablation zone can be considered suspicious for residual cancer.

Honored Educators

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Aytekin Oto, MD - 2013 Honored Educator

SSJ10-06 Primary and Secondary Prostate Biopsy Settings: Differences When Performing Targeted MR-guided Biopsies

Tuesday, Dec. 1 3:50PM - 4:00PM Location: E353C

Participants
Frederic Dietzel, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Lars Schimmoeller, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Quentin, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Dirk Blondin, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Arsov, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Hiester, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Robert Rabenalt, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Erhard Godehardt, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Albers, MD, PhD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study evaluates the MR-guided in-bore biopsy (IB-GB) in patients, who were either biopsy naive (primary biopsy) or who had undergone at least one previous negative trans-rectal ultrasound-guided biopsy (secondary biopsy) with regard to cancer detection rate, tumor localization and lesion size.

METHOD AND MATERIALS

In total, 1,602 biopsy cores from 297 patients (66.1±7.8y; median PSA 8.2ng/ml; prostate volume 58±30ml) in primary (n=160) and secondary (n=137) prostate biopsies settings were evaluated in this retrospective study. All patients received diagnostic prostate MRI (T2WI, DWI, DCE) at 3T. All lesions described on MRI were biopsied with IB-GB and examined histologically.

RESULTS

In 148 patients 511 cores were positive for prostate cancer (PCa). Clinically significant PCa was found in 82.4% (any Gleason pattern ≥4). PCa detection rate for patients with primary biopsies was 55.6% and 43.1% for secondary biopsies. In patients with primary vs. secondary biopsies, PCa was located peripherally in 62.5% vs. 49.5% (p=0.04), in the transition zone in 27.3% vs. 27.5% (p=0.53), and in the anterior stroma in 10.2% vs. 22.9% (p<0.01). Higher grade PCa (Gleason score ≥4+3=7) occurred apically in 38.5% (p=0.01). PCa detection rates for patients with smaller prostate volumes (<30ml vs. 30-50ml vs. >50ml; p<0.01) or larger lesion sizes (>0.5cm3 vs. 0.5-0.25cm3 vs. <0.25cm3; p<0.01) were significantly higher.

CONCLUSION

In primary and secondary prostate biopsies PCa detection rates were significantly higher for larger lesions and smaller prostate glands. In secondary biopsies, PCa was anteriorly located at a significantly more frequent rate. Higher grade PCa was detected in both settings in an apical location more often.

CLINICAL RELEVANCE/APPLICATION

MRI-guided in-bore biopsy led to high detection rates, especially of clinically significant PCa, in primary and secondary prostate biopsies.

SSJ11

Genitourinary (Multimodality Imaging of Pregnancy and Pelvic Floor)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: E353B

GU MR US

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Elizabeth A. Sadowski, MD, Madison, WI (*Moderator*) Nothing to Disclose
Mary C. Frates, MD, Sharon, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSJ11-01 Dynamic Contrast-enhanced MRI Combined with Diffusion Weighted Imaging in Differential Diagnosis of Malignant Gestational Trophoblastic Neoplasia and Postpartum Retained Placental

Tuesday, Dec. 1 3:00PM - 3:10PM Location: E353B

Participants
Kangkang Xue, Zhengzhou, China (*Presenter*) Nothing to Disclose
Jingliang Cheng, MD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yong Zhang, DO, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Tianxia Bei, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the application value of dynamic contrast-enhanced MRI (DCE-MRI) combined with diffusion weighted(DW-MRI) in the differential diagnosis of malignant gestational trophoblastic neoplasia(MGTN) and postpartum retained placental tissue(RPT).

METHOD AND MATERIALS

The institutional review board approved this retrospective stuty and waived the requirement for informed consent. 74 cases(median age, 30.6 years; age range, 20-48 years) of MGTN and RPT confirmed clinically were retrospectively analyzed, all patients underwent DCE-MRI and DW-MRI(500 and 1000 mm^2/s) at 3.0T. Types of time signal-intensity curves(TIC) and quantitative analysis of time to peak(TTP), maximum contrast enhancement ratio(MCER) and ADC values of each case were performed. Differences in TTP, MCER, and ADC values between MGTN and RPT were evaluated using the independent samples t-test respectively.The sensitivity, specificity and accuracy of dynamic contrast-MRI, DW-MRI and combination of the two methods in diagnosing MGTN and RPT were calculated.

RESULTS

There were 39 MGTN, of which 13 lesions were invasive mole and 26 lesions were choriocarcinoma. There were 35 RPT, of which 14 lesions were normal retained placenta, 6 lesions were adherent placenta and 15 lesions were implanted placenta. The mean ADC value and TTP of MGTN($1.38\pm0.11\times10\text{-}3mm^2/s$, 37.84 ± 3.73 s) were significantly different($p<0.01$) from that of RPT($2.03\pm0.56\times10\text{-}3mm^2/s$, 102.11 ± 9.14 s).The MECR of MGNT($248.58\pm19.28\%$) was not significantly different ($P>0.05$) from that of RPT($236.45\pm16.77\%$) statistically. The sensitivity, specificity and accuracy in diagnosing MGTN and RPT was 84.62%, 85.71%, 85.13% for DCE-MRI; 89.74%, 88.57%, 89.19% for DW-MRI; 94.87%, 94.29%, 94.59% for combination of the two methods.

CONCLUSION

MGTN and RPT has different features in DCE-MRI and DW-MRI respectively, and the combination of the two methods can provide high application value for the differential diagnosis of MGTN and RPT.

CLINICAL RELEVANCE/APPLICATION

The clinical issues and standard imaging features of malignant gestational trophoblastic neoplasia and postpartum retained placental tissue are similar, and the combination of DWI and dynamic-enhanced MRI can help clinician distinguish them, so as to decide treatment plans.

SSJ11-02 Variable Sonographic Features and Imaging Underdiagnosis of Partial Molar Pregnancy

Tuesday, Dec. 1 3:10PM - 3:20PM Location: E353B

Participants
Julia Savage, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Katherine E. Maturen, MD, Ann Arbor, MI (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc; Medical Advisory Board, GlaxoSmithKline plc
Erika Mowers, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Katherine Pasque, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Ashish P. Wasnik, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Vanessa Dalton, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Jason Bell, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The goal of this study is to describe the ultrasound findings in histopathologically proven molar pregnancies and to correlate these findings with clinical parameters including serum beta-hCG levels and partial vs. complete molar pregnancy.

METHOD AND MATERIALS

Retrospective chart review revealed 72 women with failed pregnancy or elective termination with histopathologic diagnosis of molar

pregnancy and available ultrasound images between January 1, 2001 to December 31, 2011. Clinical data, ultrasound images and reports were reviewed.

RESULTS

Mean age of women was 30.45 ± 6.97 years of age (range: 16-49), with 1.25 ± 1.49 prior pregnancies (range: 1-11). Mean gestational age (GA) by last menstrual period was 74.45 ± 19.07 days (range: 39-138) and median serum beta-hCG was 64,400 (range: 447-662,000), with expected positive correlations between mean sac diameter (MSD) vs. beta-hCG (r=0.45, p=0.004) and MSD vs. GA (r=0.54, p<.0001). Pathologic results showed 49 partial and 23 complete moles. By imaging, partial moles were more commonly described as having a discrete gestational sac (85.7 vs 21.7%, p<.0001), yolk sac (48.9 vs. 4.6%, p=0.0003), or fetal pole (57.1 vs. 0%, p<.0001), while complete moles were more likely to show clearly abnormal tissue in the uterus (82.6 vs. 20.8%, p<.0001) and to be prospectively diagnosed as molar pregnancy by the dictating radiologist (86.9 vs. 40.82%, p=0.0002).

CONCLUSION

Partial molar pregnancy is associated with a highly variable sonographic appearance and frequent detection of recognizable products of conception, which may contribute to its underdiagnosis by imaging. Complete molar pregnancy is more strikingly abnormal and thus recognizable by imaging, and commonly diagnosed prospectively.

CLINICAL RELEVANCE/APPLICATION

Suspicion of hydatidiform mole in failed pregnancy has impacts on clinical management including: need for uterine evacuation, submission of products of conception to pathology, and serum b-hCG surveillance; failure to prospectively suggest or diagnose molar pregnancy may negatively impact patient care.

Honored Educators

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Katherine E. Maturen, MD - 2014 Honored Educator

SSJ11-03 Performance of Translabial Ultrasound versus Pelvic Floor MRI in the Detection of Transvaginal Mesh Implant Complications

Tuesday, Dec. 1 3:20PM - 3:30PM Location: E353B

Participants
Karoly Viragh, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Seth A. Cohen, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Shlomo Raz, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Steven S. Raman, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The goal of the study was to determine the efficacy of 2D and 3D dynamic translabial ultrasound versus pelvic floor MRI in the detection of transvaginal mesh implant complications.

METHOD AND MATERIALS

With IRB approval and HIPAA compliance, a retrospective observational study was performed to correlate the intraoperative findings of transvaginal mesh implant complications (perforation, extrusion, fluid collections) with the standard pre-operative translabial ultrasound and pelvic floor MRI evaluations in women who were treated with suburethral transvaginal mesh implant for stress urinary incontinence or pelvic organ prolapse. The pre-operative translabial ultrasound and MRI examinations were reviewed with attention to technical details. The sensitivity of ultrasound in identifying complications was calculated. The location of the transvaginal mesh with respect to the bladder and urethra was also evaluated (extraluminal, intramural, intraluminal). Factors for technical improvement were identified.

RESULTS

The study cohort included 200 women (mean age 55 years) with transvaginal mesh implants for who underwent 2D and 3D dynamic translabial ultrasound, pelvic floor MRI and mesh excision at our institution between 2007 and 2013. Descriptive statistics were provided. 17 patients were found to have perforation into the urethra and/or bladder during surgery. None were found to have extrusion or significant fluid collections. Translabial ultrasound had a sensitivity of (12/17) 70.5%, whereas detection of mesh fragments by MRI was challenging even in retrospect. Limitations were due to suboptimal visualization of the mesh fragments, which could be improved with pre-procedural hydration for bladder distention and the use of vaginal gel to better image the suburethral space.

CONCLUSION

2D and 3D dynamic translabial ultrasound is a powerful real-time method for transvaginal mesh localization and for visualizing complications, most importantly perforation into the urethra and/or bladder, which allows for better surgical planning and pre-operative patient counseling.

CLINICAL RELEVANCE/APPLICATION

Translabial ultrasonography is a powerful real-time diagnostic technique for the evaluation of female pelvic floor dysfunction and is more sensitive than MR in detecting transvaginal mesh perforation.

SSJ11-04 To Determine the Ultrasound Predictors of Successful Treatment of Ectopic Pregnancy Using a Single Dose Methotrexate Protocol: Preliminary Results

Tuesday, Dec. 1 3:30PM - 3:40PM Location: E353B

Participants
Margarita V. Revzin, MD, Wilton, CT (*Presenter*) Nothing to Disclose
Dennis Toy, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Regina J. Hooley, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Leslie M. Scoutt, MD, New Haven, CT (*Abstract Co-Author*) Consultant, Koninklijke Philips NV

PURPOSE

Uncomplicated ectopic pregnancy (EP) usually is managed with methotrexate (MTX) and other non-surgical interventions. There is limited data on the expected US findings of MTX treated EPs. The aim of the present study is to identify US predictors of successful treatment with MTX.

METHOD AND MATERIALS

This is a retrospective IRB approved and HIPAA compliant cohort study, exempt from informed consent. The medical records of 121 women (mean age of 29 + 5.3 years) who were diagnosed with an EP and underwent a single dose treatment with MTX were reviewed. Only those subjects who had a visible EP without heart activity on US prior to treatment and who had a follow up US after treatment were included in the study (n=52). Post treatment EP were evaluated with respect to the change in size, shape, echogenicity of the EP, presence of a gestational and yolk sac, fetal heart rate, vascularity, and hemoperitoneum after treatment. Results were correlated with patient b-hCG levels, clinical symptoms and necessity for surgical intervention. Qualitative and quantitative parameters were analyzed using parametric and nonparametric tests.

RESULTS

Separate assessment of the US findings with respect to their sensitivity(Ss), specificity (Sp), NPV and PPV respectively are as follows: EP change in size 53%, 57%, 45%, 55%, shape 89%, 75%, 85%, 78%, echogenicity 87%, 78%, 85%, 90%, avascularity 79%, 90%, 85%, 88%; and absent or small hemoperitoneum 90%, 86%, 87%, 78% ; A combination of at least three of these findings was most accurate with Ss 95%, Sp 96%, PPV 95%, NPV 90%.Presence of fetal heart activity, increased size of yolk sac and gestational sac, large amount of hemoperitoneum were strong US predictors of failure of MTX treatment with Ss 100%, Sp 100%, PPV 100%, NPV 99%

CONCLUSION

A combination of at least three US findings including stable shape and echogenicity, avascularity and absence or small amount of hemoperitoneum are best US predictors of successful MTX treatment of EPs. Detection of fetal heart activity, large hemoperitoneum, and increase in size of gestational and yolk sac are strong US predictors of a failure of MTX treatment. Change in size of the EP after MTX treatment is not a reliable predictor of either treatment success or failure.

CLINICAL RELEVANCE/APPLICATION

US findings aid in prediction of successful treatment of ectopic pregnancy using a single dose methotrexate protocol

Honored Educators

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Leslie M. Scoutt, MD - 2014 Honored Educator

SSJ11-05 Accuracy of MRI in the Prenatal Diagnosis of the Abnormally Adherent Placenta: Comparison with Findings at the Time of Delivery

Tuesday, Dec. 1 3:40PM - 3:50PM Location: E353B

Participants
Sherelle L. Laifer-Narin, MD, Englewood, NJ (*Presenter*) Nothing to Disclose
Sidney Z. Brejt, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sarah Goodman, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jason Wright, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jeffrey H. Newhouse, MD, Bronxville, NY (*Abstract Co-Author*) Research Consultant, PAREXEL International Corporation

PURPOSE

To evaluate the accuracy of magnetic resonance imaging in diagnosing invasive placentation.

METHOD AND MATERIALS

A retrospective review of all patients referred for MRI of the placenta from December 2004 to December 2014 was performed. Indications for MRI included abnormal appearance of the placenta on ultrasound, history of prior cesarean delivery, and history of prior uterine surgery. MRI reports were reviewed for placental location, presence or absence of abnormal placentation according to established MRI findings, and suspicion for parametrial involvement. Criteria included the presence of dark intraplacental bands, heterogeneous signal intensity, abnormal vascularization and thickened nodular contour along the urinary bladder surface, uterine bulging into the bladder, and loss of the myometrial margin. MRI was considered positive even if only one of these criteria were present. Comparison was made with findings at either delivery or operation, and pathology reports.

RESULTS

256 MRI exams were reviewed. 144 exams were negative both on MRI and delivery/pathology. 8 exams interpreted as normal on MRI underwent hysterectomy with pathology demonstrating placenta accreta. 80 exams were interpreted as positive for abnormal

placentation, and were diagnosed as accreta, increta, or percreta on delivery/pathology. 24 cases interpreted as positive on MRI had normal placental delivery and pathology. MR diagnosis of abnormal placentation had a sensitivity of 91%, specificity of 86%, PPV of 77%, NPV of 95%, and an accuracy of 87.5%.

CONCLUSION

Placental adhesive disorder is a significant cause of maternal morbidity and mortality. Prenatal MRI is accurate in evaluating invasive placentation in patients at high risk for this condition.

CLINICAL RELEVANCE/APPLICATION

MRI can provide topographic information specifically in cases with lateral extension into the parametrical regions. Identification of abnormal placentation assists the clinician in planning the mode of delivery, extent and location of surgical incision, and determining the need for multidisciplinary involvement and assistance.

SSJ11-06 3T Pelvic MRI Thresholds for Pelvic Organ Prolapse before and after First Childbirth

Tuesday, Dec. 1 3:50PM - 4:00PM Location: E353B

Participants
Mark E. Lockhart, MD, Birmingham, AL (*Presenter*) Nothing to Disclose
Holly Richter, MD, Birmingham, AL (*Abstract Co-Author*) Research Grant, Pelvalon, Inc; Consultant, Pelvalon, Inc; Consultant, Kimberly-Clark Corporation; Royalties, UpToDate, Inc
Gordon W. Bates, MD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Timothy M. Beasley, PhD, Birmingham, AL (*Abstract Co-Author*) Nothing to Disclose
Desiree E. Morgan, MD, Birmingham, AL (*Abstract Co-Author*) Research support, General Electric Company

PURPOSE

To evaluate the usefulness of published 3T MRI parameters suggesting pelvic organ prolapse before and after first childbirth

METHOD AND MATERIALS

In this IRB-approved HIPAA-compliant prospective cohort study, patients presenting for reproductive assistance were recruited to complete validated questionnaires, clinical pelvic exams, baseline dynamic 3T MRI, and repeat MRI 6 months after delivery. Subjects were nulliparous women, at least 19 years age, and asymptomatic by Pelvic Floor Distress Inventory-20. Predetermined published thresholds or 2 SD beyond means in the literature for pelvic prolapse on MRI were evaluated. Also, a 10% change from baseline to postpartum was considered a significant change. Using 120 cc rectal gel and pelvic phased array coil over the pelvis, static 3mm axial and coronal T2 FSE sequences were followed by 10 mm thick dynamic sagittal HASTE at rest and during strain. The 10 mm sagittal sequence then evaluated pelvic floor mobility during evacuation of the rectal gel. MRI parameters were measured by a fellowship-trained radiologist, blinded to clinical data.

RESULTS

19 subjects (mean age 31 years) completed baseline clinical and MRI studies, and 10 (mean age 30.5 years) of them completed postpartum clinical and MRI studies. None developed significant pelvic floor symptoms by the PFDI-7 and PISQ-12 questionnaires after childbirth. None had levator tears at baseline; two subjects developed tears postpartum. Mean pelvic floor mobility was increased in patients after childbirth and 17 pelvic soft tissue parameters increased by greater than 10% postpartum. At baseline 7/133 (5.3%), 8/209 (3.8%), and 79/209 (37.8%) of pelvic soft tissue measurements exceeded published thresholds (indicating prolapse) at rest, strain, and evacuation, respectively, majority in the anterior compartment. After pregnancy and childbirth, 4/70 (5.7%), 6/110 (5.5%), and 51/110 (46.4%) exceeded thresholds at rest, strain, and evacuation, respectively, in this asymptomatic population. Osseous parameters remained unchanged.

CONCLUSION

Although published soft tissue parameters work well for rest and strain MR imaging, their values in evacuatory series are frequently exceeded, even in asymptomatic nulliparous and primiparous women.

CLINICAL RELEVANCE/APPLICATION

In nulliparous and primiparous women, the evacuatory phase will commonly exceed published MRI thresholds for pelvic organ prolapse and therefore results should be used with caution.

SSJ14

Molecular Imaging (Prostate/Neuroendocrine Tumors)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: S504CD

GU BQ MI MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Peter L. Choyke, MD, Rockville, MD (*Moderator*) Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura Biosciences, Inc
Vikas Kundra, MD, PhD, Houston, TX (*Moderator*) License agreement, Introgen Therapeutics, Inc

Sub-Events

SSJ14-01 Promising Role of Ga-68 PSMA PET/CT over Conventional Imaging in Staging and Restaging of Carcinoma Prostate

Tuesday, Dec. 1 3:00PM - 3:10PM Location: S504CD

Participants
Venkatesh Rangarajan, MBBS, Mumbai, India (*Presenter*) Nothing to Disclose
Archi Agrawal, MBBS, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Rasika Kabnurkar, MBBS, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Nilendu C. Purandare, DMRD, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Sneha A. Shah, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

1) To study the utility of Ga-68 Prostate Specific Membrane Antigen (PSMA) Positron Emission Tomography/Computed Tomography (PET/CT) for staging and restaging of Carcinoma Prostate (CaP).2) To compare the efficacy of Ga-68 PSMA PET/CT with Contrast Enhanced Computed Tomography (CECT) and F18 Sodium Fluoride (NaF) PET/CT for lesion detection

METHOD AND MATERIALS

Retrospective audit of prospectively maintained data of 25 patients of CaP (3 for staging and 22 with biochemical failure for restaging) who underwent Ga-68 PSMA PET/CT, CECT and F18 NaF PET/CT scan. The imaging findings were analyzed on lesion-lesion and patient-patient basis for concordance and discordance.

RESULTS

All the 3 cases imaged for staging evaluation demonstrated Ga-68 PSMA uptake at the site of primary while CECT demonstrated lesion in only 1 patient. In cases with suspected biochemical failure, local recurrence was detected in 59% (13/22) patients on Ga-68 PSMA PET/CT as against 9 % (2/22) detected on CECT. In 25 patients studied, Ga-68 PSMA PET/CT detected 43 metastatic nodes compared to 29 detected on CECT. Ga-68 PSMA detected additional metastases in sub cm sized nodes in 24% (6/25) patients. Ga-68 PSMA had incremental value in detecting occult extranodal metastases involving urinary bladder, pararectal nodule and peritoneal deposit in 8% (2/25) patients .In 25 patients, 109 skeletal lesions were detected on Ga-68 PSMA while F18 NaF PET/CT demonsrated147 lesions. Concordance in imaging findings of Ga-68 PSMA PET/CT and F 18 Fluoride PET/CT was noted in 68% (17/25) patients. Ga-68 PSMA PET/CT had an incremental value in staging of 1 patient where it detected lytic and marrow metastases. In restaging group, 7 patients showed additional lesions on F18 NaF PET/CT.

CONCLUSION

Ga-68 PSMA PET/CT is superior in detection of primary, nodal and soft tissue metastases as compared to conventional imaging techniques. However, F18 NaF PET/CT appears to detect more skeletal lesions in patients with biochemical failure in our study and further prospective trials are warranted to confirm these findings.

CLINICAL RELEVANCE/APPLICATION

Ga-68 PSMA PET/CT has an incremental value as a one stop shop in staging and restaging of carcinoma prostate

SSJ14-02 18F-fluoro-4-thia-palmitate (18F-FTP) PET Imaging for Evaluation of Exogenous Fatty Acid Metabolism in Prostate Cancer: Implications for Treatment Optimization

Tuesday, Dec. 1 3:10PM - 3:20PM Location: S504CD

Participants
Pedram Heidari, MD, Boston, MA (*Presenter*) Nothing to Disclose
Shadi A. Esfahani, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Giorgia Zadra, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael S. Placzek, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Benjamin Larimer, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Jacob M. Hooker, PhD, Charlestown, MA (*Abstract Co-Author*) Nothing to Disclose
Massimo Loda, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Umar Mahmood, MD, PhD, Charlestown, MA (*Abstract Co-Author*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;

PURPOSE

Upregulation of de novo lipogenesis is a major metabolic change in PCa development, and correlates with tumor progression and poor prognosis. Differentiation of diet-derived versus de novo fatty acid (FA) utilization in PCa is essential in designing anti-lipogenic therapeutics. We aim to evaluate the use of 18F-fluoro-4-thia-palmitate (18F-FTP) PET for assessment of exogenous FA utilization by PCa.

METHOD AND MATERIALS

14C incorporation into lipids of LNCaP cells by a glucose donor (marker of de novo lipogenesis) was measured by a beta-counter after treatment with vehicle, IPI-9119, or C75. Growth inhibition rescue of LNCaP cells was performed using Cell Titer Glo assay after incubation with IPI-9119 alone or in the presence of BSA or of BSA-conjugated palmitate. For in-vitro 18F-FTP uptake study LNCaP cells were incubated with IPI-9119, C75, Etomoxir, SSO, DMSO, and combination of IPI-9119 with Etomoxir or C75 for 24 hours. The cells were then incubated with 18F-FTP and harvested to measure retained activity corrected for cell count. IACUC approval was obtained. Mice with subcutaneous LNCaP xenografts were fasted. PET data was acquired in list mode after injection of 18F-FTP. The SUVmean and tracer influx constant were measured.

RESULTS

14C incorporation in lipids decreased to approximately 25% of control using both IPI-9119 and C75 indicating FASN inhibition. LNCaP growth inhibition was aborted by BSA-conjugated palmitate. 18F-FTP uptake significantly increased with IPI-9119 treatment, while C75, etomoxir, SSO treatment reduced 18F-FTP uptake. 18F-FTP PET demonstrated significantly decreased uptake in LNCaP tumors following treatment with C75 and etomoxir compared to control (SUVmean=0.20±0.01, 0.25±0.2, and 0.40±0.02, respectively).

CONCLUSION

We demonstrated that metabolic imaging using 18F-FTP can be used to assess the exogenous FA utilization by PCa. As expected, IPI-9119 (selective FASN inhibitor) increased the exogenous FA (18F-FTP) uptake while C75, which induces a host of metabolic modulations other than FASN inhibition paradoxically reduces 18F-FTP uptake. Etomoxir (FAO inhibitor) and SSO (FA transporter inhibitor) reduce 18F-FTP uptake as expected.

CLINICAL RELEVANCE/APPLICATION

Understanding the effect of exogenous lipid availability on therapeutic potential of targeting de novo lipogenesis is critical in prostate cancer treatment. This could lead to treatment strategies that result in maximal efficacy.

SSJ14-03 Feasibility of Hyperpolarized 13C-Pyruvate Magnetic Resonance Spectroscopy for Pancreatic Cancer Diagnostic Imaging

Tuesday, Dec. 1 3:20PM - 3:30PM Location: S504CD

Participants
Stephanie K. Carlson, MD, Rochester, MN (*Presenter*) Royalties, Medspira, LLC
Alan Penheiter, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Prasanna K. Mishra, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Fergus J. Couch, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Slobodan I. Macura, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
John D. Port, MD, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Malgorzata Marjanska, PhD, Minneapolis, MN (*Abstract Co-Author*) Nothing to Disclose
Claire E. Bender, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Hyperpolarized (HP) 13C magnetic resonance spectroscopic imaging (MRSI) is a recently developed technique that allows the detection of injected 13C-labeled agents and their metabolites in real-time. The purpose of this study was to identify and explore potential metabolic pathways in pancreatic ductal adenocarcinoma (PDAC) that could be targeted with HP-13C MRSI to increase the diagnostic accuracy of pancreatic cancer imaging.

METHOD AND MATERIALS

We performed gene expression profiling using laser capture microdissection and RNAseq on histologically-confirmed primary PDAC tumors and normal pancreas tissue from 21 patients. A promising, highly upregulated and imageable metabolic pathway (the conversion of pyruvate to lactate) was identified. To further explore this pathway in vivo, mice bearing genetically-engineered PDAC tumors were injected with 200 microliters of 80 mM [1-13C]-pyruvate. Tumors were quench-frozen and excised 30 s post-injection. Spectroscopic data on tumor lysates was obtained using 1H and 13C nuclear magnetic resonance. Studies were approved by our IRB and IACUC.

RESULTS

Gene expression studies showed that transcripts encoding transporters and enzymes responsible for cellular import of pyruvate, export of lactate, and conversion of pyruvate to lactate are almost universally upregulated in PDAC compared to normal pancreas, while competing pathways of mitochondrial pyruvate metabolism and cytoplasmic pyruvate to alanine conversion are consistently low. NMR analysis of PDAC tumors showed a tumor metabolic signature consistent with a very high lactate concentration and high lactate-to-alanine ratio. Quantitative analysis after injection of [1-13C]-pyruvate showed a 4.8-fold enrichment of intratumoral [1-13C]-lactate over natural abundance, indicating that ~5% of the total lactate in the tumor at 30 s post-injection was derived from the injected [1-13C]-pyruvate.

CONCLUSION

PDAC tumors have a pyruvate-lactate metabolic signature that can be quantitated with 13C-pyruvate NMR. Further exploration of HP-13C-pyruvate MRSI for PDAC is warranted.

CLINICAL RELEVANCE/APPLICATION

A new molecular imaging strategy for PDAC used in conjunction with existing morphological imaging could transform patient management in clinically-challenging scenarios.

SSJ14-04 Evaluation of Fast Non-enhanced PET/MR Examination Protocols in a Fully Integrated PET/MR

System for Patients with Neuroendocrine Tumours: Direct Comparison to Multiphase Contrast-enhanced PET/CT

Tuesday, Dec. 1 3:30PM - 3:40PM Location: S504CD

Participants
Ferdinand F. Seith, BSC, Tuebingen, Germany (*Presenter*) Nothing to Disclose
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Christina Pfannenberg, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Nina Schwenzer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Christina Schraml, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In patients with neuroendocrine tumours (NET), kidney failure is a common complication of radionuclide therapy. It is known that multiphase contrast-enhanced PET/CT is superior to non-enhanced PET/CT in diagnosing metastases with low or no tracer uptake as well as small lesions especially in the liver. However, due to the superior soft tissue contrast of MRI it is possible that non-enhanced PET/MR offers the same information as contrast-enhanced PET/CT. The aim of the study was therefore to evaluate a fast protocol in PET/MR without contrast agent in direct comparison to multiphase contrast-enhanced PET/CT as gold standard.

METHOD AND MATERIALS

39 Patients (22 female, 58±13 years) were examined in multiphase contrast-enhanced 68Ga-DOMITATE-PET/CT in a clinical setup and in PET/MR subsequently. 2 blinded readers investigated PET/MR examinations of the abdomen with 3 different setups: T2HASTE+PET (30min), T2HASTE+TSET2+PET (35min) and T2HASTE+TSET2+DWI+PET (35min). The T2HASTE was acquired under free breathing with continuous table move. DWI was acquired with two b-values (0, 800 s/mm2). Metastatic lesions were defined as functional and/or morphological suspicious lesions or lymph nodes. The results were compared with the contrast-enhanced PET/CT, follow-up examinations and histopathology, if available.

RESULTS

T2HASTE sequences were of diagnostic quality in all patients. DWI suffered from artefacts especially in the upper regions of the liver. Compared with contrast-enhanced PET/CT high agreement was found with T2HASTE+TSET2+DWI+PET.

CONCLUSION

A protocol for PET/MR including T2HASTE, TSET2, DWI and PET seems to provide comparable results compared with multiphase contrast-enhanced PET/CT. With an estimated time of 35 min for a whole body examination, this might serve as a legitimate alternative to contrast-enhanced PET/CT for patients with kidney failure in the future.

CLINICAL RELEVANCE/APPLICATION

In patients with neuroendocrine tumours (NET) and kidney failure, fast non-enhanced PET/MR protocols can serve as a legitimate alternative to multiphase contrast-enhanced PET/CT examinations.

SSJ14-05 Qualitative and Quantitative Comparison of 68Ga-DOTATATE PET/CT and PET/ MRI in Neuroendocrine Tumours

Tuesday, Dec. 1 3:40PM - 3:50PM Location: S504CD

Participants
Francesco Fraioli, MD, London, United Kingdom (*Presenter*) Nothing to Disclose
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Evangelia Skoura, Athens, Greece (*Abstract Co-Author*) Nothing to Disclose
Rizwan Syed, MBBS, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sofia Michopoulou, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Jamshed Bomanji, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Ashley M. Groves, MBBS, Hitchin, United Kingdom (*Abstract Co-Author*) Investigator, GlaxoSmithKline plc; Investigator, General Electric Company; Investigator, Siemens AG; ; ;

PURPOSE

Many Neuroendocrine tumours (NET) show high somatostatin receptor avidity. The aim of this study is to compare 68Ga-DOTATATE PET/CT with 68Ga-DOTATATE PET/MRI imaging in patients with known NET, and assess the confidence in anatomic lesion detection and localization. Furthermore, the value of each sequence of MRI was separately evaluated.

METHOD AND MATERIALS

We analysed the data of 38 NET patients. Cross over of both 68Ga-DOTATE PET/CT and PET/MRI scans were performed. MR protocol was as follow: T1 MPR, pre and post gadolinium injection, T2 haste, DW1 (b0, 500, 1000). Two observers for 68Ga-DOTATATE PET/MRI and one observer for 68Ga-DOTATATE PET/CT, independently, reviewed the images and inter observer and inter modality correlation was assessed by using interclass correlation.

RESULTS

Our initial data showed good inter modality correlation between 68Ga-PET/CT and PET/MRI. All lesions considered as malignant in PET/CT were equally depicted in PET/MRI in the compared regions. Both modalities, revealed liver metastases in the same number of patients (18 patients), and bone metastases in 7 patients. However, counting the number of liver lesions in each patient, 68Ga-DOTATATE PET/MRI was able to recognize more lesions in 3 patients. On the other hand, more lung lesions were detected in the lung in the CT component compared to MRI component (7 lesions versus 4). The contrast and DWI sequence of PET/MRI did not have a significant effect on final outcome, but in a selected number of cases these images confirmed and helped to further characterize and detect more lesions. Inter observer reliability was equally very good in both modalities.

CONCLUSION

This study demonstrates the potential of 68Ga-DOTATOC PET/MRI in patients with NET, with special advantages in the characterization of liver lesions.

CLINICAL RELEVANCE/APPLICATION

68Ga-DOTATOC PET/MRI can help in diagnosis and staging of patients with NET, with special advantages in the characterization of liver lesions.

SSJ14-06 68Ga-DOTATOC Uptake in Somatostatin Expressing Tumors is Directly Related to Specific Activity: Implications for Receptor Quantitation Imaging

Tuesday, Dec. 1 3:50PM - 4:00PM Location: S504CD

Participants
Pedram Heidari, MD, Boston, MA (*Presenter*) Nothing to Disclose
Dominik Berzaczy, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Alicia Leece, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Shadi A. Esfahani, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Umar Mahmood, MD, PhD, Charlestown, MA (*Abstract Co-Author*) Research Grant, Sabik Medical Inc; Advisory Board, Blue Earth Diagnostics Limited;

PURPOSE

The importance of specific activity (SA) has been previously shown in functional PET imaging studies. We hypothesized that tracer uptake, measured using semiquantitative (SUV) or quantitative (Patlak plot) parameters, would vary considerably according to SA in cancer receptor imaging. This study aims to evaluate the effect of SA on PET parameters used for quantitation of 68Ga-DOTATOC uptake in somatostatin receptor (SSTR) tumor models.

METHOD AND MATERIALS

In-vitro, SSTR2 expression level was assessed using Western blot across multiple cancer lines including IMR32, Capan1, A549 and AR42J, and was normalized for B-actin expression. The SSTR2/B-actin ratio was correlated to in-vitro 68Ga-DOTATOC uptake normalized for cell counts. AR42J and IMR32 normalized 68Ga-DOTATOC uptake was plotted against 68Ga-DOTATOC SA ranging from 0.2 to 20 Ci/g and correlation was assessed. The in-vitro studies were performed in triplicate. For in-vivo studies Institutional Animal Care and Use Committees approval was obtained. Subcutaneous AR42J xenografts were implanted in Nu/Nu mice. Dynamic PET scans in list mode were acquired following injection of 68Ga-DOTATOC with a wide range of SAs (0.3 - 50 Ci/g). Net tracer influx (Ki), SUVmax and SUVmean were plotted against the SA to establish the correlation between quantitative parameters and SA. Patlak-plot was used to calculate the tracer influx constant for the tumor ((Ki= (k1 × k3 / k2 + k3)).

RESULTS

We observed a consistent ratio between 68Ga-DOTATOC uptake per cell and SSTR2/B-actin level across the cell lines ($R2=0.95$, $p<0.024$). In-vitro we demonstrated a linear correlation between SA and 68Ga-DOTATOC uptake per cell in IMR32 ($R2=0.98$, $P<0.015$) and AR42J ($R2=0.99$, $P<0.005$). We found that Ki, SUVmax, and SUVmean decreased in a linear fashion with reduction in SA. Quantitative 68Ga-DOTATOC PET parameters had a direct linear correlation with SA ($R2=0.89$, $p<0001$ for Ki, $R2=0.66$, $p<0.0001$ for SUVmax and $R2=0.82$ and $p<0.0001$ for SUVmean).

CONCLUSION

68Ga-DOTATOC uptake is strongly correlated to SSTR2 expression for each given SA. However, 68Ga-DOTATOC uptake in SSTR-expressing tumors increases in a linear fashion with increase in SA, over the range studied.

CLINICAL RELEVANCE/APPLICATION

68Ga-DOTATOC uptake by tumors can vary widely with change in specific activity. Quantitation for radiotherapy dosimetry and response assessment is improved with correction for specific activity.

SSJ15

Musculoskeletal (Quantitative MR Applications)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: E451A

MK BQ MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Martin Torriani, MD, Boston, MA (*Moderator*) Nothing to Disclose
Gregory Chang, MD, New York, NY (*Moderator*) Speaker, Siemens AG

Sub-Events

SSJ15-01 Quantitative MRI Perfusion Analysis of Osteoid Osteomas Pre- and Post Microwave Ablation using an Open Source Software Tool (UMMPerfusion)

Tuesday, Dec. 1 3:00PM - 3:10PM Location: E451A

Participants
Michael Kostrzewa, MD, Mannheim, Germany (*Presenter*) Nothing to Disclose
Patricius Diezler, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Henzler, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Nils Rathmann, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan O. Schoenberg, MD, PhD, Mannheim , Germany (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Steffen J. Diehl, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To quantitatively evaluate blood perfusion of osteoid osteomas prior and after percutaneous microwave (MW) ablation in time-resolved imaging with stochastic trajectories (TWIST) MRI sequences using an open source software tool.

METHOD AND MATERIALS

In 17 patients (11 males, 6 females, mean age 26y) with osteoid osteomas percutaneous, CT guided, MW ablation was performed (Medwaves, San Diego, California, USA). Lesions measured on average 5 ± 2mm in diameter. Lesion diameter dependent MW ablation parameters were: 16 Watts, 915MHz, 80°C for 45 to 160 seconds. Prior to and after MW ablation 3D dynamic contrast enhanced MRI imaging was performed with 3D TWIST gradient echo sequences (Siemens Healthcare). Mean plasma flow (PF, ml/100ml/min), mean volume of distribution (VD, ml/100ml) and mean transit time (MTT, sec) were measured within the lesion in the pre and post MW ablation MRI TWIST data using an open source software tool for quantitative MRI perfusion analysis (UMMPerfusion, OpossUMM, Germany).

RESULTS

16 patients were free of symptoms within one week after treatment, one patient had decreased but persisting symptoms after MW ablation. No minor or major adverse events were observed according to SIR criteria. Mean PF, VD and MTT were 253 ± 226ml/100ml/min, 63 ± 60ml/100ml and 17 ± 7sec prior to ablation and 55 ± 64ml/100ml/min, 23 ± 39ml/100ml and 17 ± 12sec after ablation respectively. In a paired t-test there was no statistically significant change in MTT prior to and after ablation ($p>0.05$), whereas PF ($p=0.002$) and VD ($p=0.02$) decreased significantly. In the patient with persisting symptoms continuously high values for PF (229ml/100ml/min) and VD (118ml/100ml) were found in the MRI after MW ablation in a small portion of the lesion, this was attributed to imprecise needle placement and to too short ablation time.

CONCLUSION

Treatment success of percutaneous MW ablation of osteoid osteomas can be reliably quantified by MRI perfusion analysis, especially by evaluating pre and post procedural PF and VD within the lesion. MRI perfusion analysis helps to identify small remnants of perfused osteoid osteoma tissue after MW ablation.

CLINICAL RELEVANCE/APPLICATION

Quantitative MRI perfusion analysis is clinically valuable in the evaluation of treatment success of percutaneous MW ablation for osteoid osteomas.

SSJ15-02 A Phase I Study to Assess the Feasibility of Quantitative Molecular Imaging of ACL Grafts

Tuesday, Dec. 1 3:10PM - 3:20PM Location: E451A

Participants
Katherine Binzel, PhD, Columbus, OH (*Presenter*) Nothing to Disclose
Robert Magnussen, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Wenbo Wei, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Melanie U. Knopp, Malibu, CA (*Abstract Co-Author*) Nothing to Disclose
David Flanigan, MD, Columbus, OH (*Abstract Co-Author*) Consultant, Vericel; Consultant, Smith & Nephew plc
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Christopher C. Kaeding, MD, Columbus, OH (*Abstract Co-Author*) Consultant, Biomet, Inc

PURPOSE

Injury to the anterior cruciate ligament (ACL) commonly requires reconstruction with a graft to restore stability and function. The rate at which graft ligamentization occurs is not well delineated by magnetic resonance imaging (MRI). This initial study aims to

demonstrate the feasibility of combined MRI with dynamic positron emission tomography (PET) in order to evaluate the graft healing process following reconstructive surgery.

METHOD AND MATERIALS

MRI was performed on a 3T Achieva on 20 patients post-ACL reconstruction. Dynamic PET/CT was acquired on a Gemini TF 64 and/or new digital detector PET/CT system, Vereos TF (all Philips Healthcare, Cleveland, OH). An in-house fabricated cushion was used to match positioning during PET acquisitions to that of the dedicated MRI knee coil. A single bed position centered on the knees was acquired continuously for 75 minutes using an ultra-low dose 3 mCi 18F-fluorodeoxyglucose (FDG) protocol. Patients were grouped according to time since surgery, 0-6 months, 6-12 months, 12-24 months, and 24 months or greater. Standardized uptake values (SUVmax) were measured for regions of interest placed over the proximal, middle, and distal portions of the graft, the femoral and tibial tunnels, the posterior cruciate ligament (PCL), and quadriceps muscle for reference. Matched ROIs were drawn in the contralateral knee.

RESULTS

Dynamic PET images were readily co-registered to MRI for all patients. In the 0-6 month group, the average slope of the metabolic uptake curve was 0.20 in the distal graft, 0.21 in the mid graft, 0.27 in the proximal graft, and 0.28 in the femoral tunnel. In the 24+ month group the averages were 0.06, 0.05, 0.07, and 0.03, respectively. In addition to decreasing slopes of the uptake curves over time, patients with longer recovery times were seen to have SUVs more comparable to those in healthy knees than those who more recently had ACL repair.

CONCLUSION

We demonstrated that the quantitative evaluation of ACL graft ligamentization and healing is feasible by molecular PET imaging co-registered to MRI. Digital PET appears to enable further FDG dose reduction making a combined molecular imaging PET/MRI approach to assess ACL graft viability clinically feasible.

CLINICAL RELEVANCE/APPLICATION

A first-in-human study evaluating ACL graft healing with quantitative molecular imaging using combined PET/MRI

SSJ15-03 MRI Defined Ecologic Habitats in Extremity Soft Tissue Sarcomas: Characterization and Quantification of Tumor Heterogeneity and Potential Implications on Patient Outcomes-Early Experience

Tuesday, Dec. 1 3:20PM - 3:30PM Location: E451A

Participants
Meera Raghavan, MD, Tampa, FL (*Presenter*) Nothing to Disclose
Hamidreza Farhidzadeh, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Lawrence O. Hall, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Dmitry Goldgof, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Robert J. Gillies, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Robert A. Gatenby, MD, Tucson, AZ (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We propose a novel computer-aided, spatially-explicit image analysis of magnetic resonance (MR) examinations to classify extremity STS based on radiologically defined spatial sub-regions, or "habitats." The identification of spatially distinct habitats can quantify and characterize the ecologic basis of intratumoral heterogeneity and may be helpful to guide targeted biopsy, tailor therapeutic options and offer prognostic information.

METHOD AND MATERIALS

T1-w gadolinium enhanced and fluid-sensitive MR images were assessed from pretreatment scans of 36 patients with extremity STS. There were three main steps: tumor segmentation based on pixel signal intensity; pixel and texture analysis within each distinctive habitat; and prediction of metastatic disease and histologic therapy response. Patient outcomes such as progression free survival (PFS), overall survival (OS), and presence of metastases were also assessed.

RESULTS

Habitat color maps (HCM) demonstrated spatially distinct intratumoral subregions (Fig. 1). Metastatic disease was classified correctly with 86.11% accuracy based on five texture features, and histologic necrosis with 75.75% accuracy based on four features. Specific subregions were also predictive for metastatic disease and histologic response to therapy. The post contrast T1 high/T2 low subregion was prognostic for overall survival ($p = 0.036$).

CONCLUSION

This technique can define distinct habitats within each STS based on MR imaging features and allows spatial variations to be assessed and quantified. We demonstrate the role of advanced clinical image analysis in providing critical insight into the evolutionary and ecologic landscape of STS. The preliminary results presented here show that distinct intratumoral subregions or habitats within STS can be identified and quantified and give useful clinical and prognostic information which can shape personalized and adaptive therapeutic regimens.

CLINICAL RELEVANCE/APPLICATION

Change in size alone does not accurately not reflect response to therapy and tumor biology of STS. We have developed an image analysis technique to non-invasively characterize and quantify tumor subregions on MR imaging. The identification of these radiologically defined habitats can give insight into the evolutionary and ecologic dynamics which are the basis of heterogeneity in STS. This can in turn offer more tailored personalized treatments to patients.

SSJ15-04 Quantitative Magnetic Resonance Imaging of Meniscal Pathology

Tuesday, Dec. 1 3:30PM - 3:40PM Location: E451A

Participants

Anthony S. Tadros, MD, San Diego, CA (*Presenter*) Nothing to Disclose
Sheronda Statum, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Karen C. Chen, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Won C. Bae, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Reni Biswas, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Betty Tran, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Jiang Du, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Eric Y. Chang, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Christine B. Chung, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the capability of conventional and UTE quantitative MR values to detect meniscal pathology in cadaveric meniscal samples.

CLINICAL RELEVANCE/APPLICATION

Quantitative MR values may correlate with structural and biochemical meniscal alterations, complementing currently limited techniques in early diagnosis and postoperative evaluation of the meniscus.

SSJ15-05 Correlation of Age Dependent Whole Body Fat and Whole Body Skeletal Muscle Volume on DIXON MR Sequences in a Healthy Population with Normal BMI

Tuesday, Dec. 1 3:40PM - 3:50PM Location: E451A

Participants
Erika J. Ulbrich, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Daniel Nanz, PhD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Olof Dahlqvist Leinhard, PhD, Linkoping, Sweden (*Abstract Co-Author*) Consultant, AMRA AB
Magda Marcon, MD, Udine, Italy (*Abstract Co-Author*) Nothing to Disclose
Michael A. Fischer, MD, Stockholm, Sweden (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To test a correlation of age- and gender-dependent reference standards of MR normative values of total adipose tissue (TAT), abdominal subcutaneous adipose tissue (ASAT) with the corresponding lean muscle tissue (LMT).

METHOD AND MATERIALS

Fat and water MR whole body images were acquired with a 2-point mDIXON sequence (Repetition time/echo time, 4,2 msec/1.2 msec, 3.1 msec) at 3 Tesla (Ingenia, Philips) in 80 healthy volunteers with normal BMI (18.5 to 25.5 kg/m2) aged between 20 and 60 years (10 men/10 women per decade). Volumes were measured from TAT, ASAT and LMT by a semi-automatic segmentation algorithm allowing separate quantification of each compartment (Advanced MR Analytics, AMRA, Linköping, Sweden). Pearson and Spearman correlations between Volume and several body measures were calculated. ANOVA was used to test for Volume differences among age subgroups. Prospective IRB approved study with written informed consent.

RESULTS

Overall mean Volume (liter) ± standard deviation for women/men: 20.8±5.2/19.5±6.3 (TAT) and 15.7±2.2/23.2±2.3 (LMT). TAT/height2 and LMT/height2 didn`t show any age dependency for women/men ($p = 0.973/0.557$ and $p = 0.483/0.539$, respectively) nor TAT/height2 and LMT/height2 differences among age subgroups for both gender. There was significant correlation between TAT/height2 and body mass index (BMI) for women/men ($p < 0.001$ both), but not between LMT/height2 and BMI ($p = 0.276/0.634$). LMT/height2 correlated with TAT/height2 ($p = 0.038/0.005$) and ASAT/height2 ($p = 0.011/0.002$), but not with VAT/height2 ($p = 0.205/0.252$).

CONCLUSION

Women had higher TAT and lower LMT than men, but without significant age dependence. LMT/height2 correlated with TAT/height2 and ASAT/height2, but not with BMI.

CLINICAL RELEVANCE/APPLICATION

Normative values of LMT allow to determine muscular trophic in patients and might help to diagnose myopathy. Side Note for reviewer only please: Volunteers of this abstract are identical to Abstract number 15013444, but as the topic of fat quantification is very complex, we decided to put the data in two abstracts with the first dealing with the age dependent different fat volumes and the second abstract dealing with the correlation of the skeletal muscle volumes and the different fat volumes

SSJ15-06 Effect of Iterative Reconstruction Algorithms on Measurement of Trabecular Bone Microstructure with Clinical MDCT: A Cadaver Study Using Micro-CT as the Reference Standard

Tuesday, Dec. 1 3:50PM - 4:00PM Location: E451A

Participants
Miyuki Takasu, MD, Hiroshima, Japan (*Presenter*) Nothing to Disclose
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Masao Kiguchi, RT, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Chihiro Tani, MD, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoko Kaichi, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD, Hiroshima, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Reseach Grant, DAIICHI SANKYO Group; Medical Advisor, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Nemoto-Kyourindo; ; ; ; ;
Nobuhito Nango, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Masafumi Machida, Musashimurayamashi, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Clinical multidetector computed tomography (MDCT) has been used to evaluate bone quality. The purpose of this study was to determine the efficacy of iterative reconstruction (IR) for measuring bone architecture through a comparison with micro-computed tomography (micro-CT) as the gold standard.

METHOD AND MATERIALS

L1 and L2 vertebrae of 10 fresh human cadavers were scanned by 64-section MDCT (LightSpeed VCT; reconstruction kernel, BONEPLUS; IR, ASiR; collimation, 64×0.625 mm), 80-section MDCT (Aquilion One Vision Edition; FC30, ADIR3D, 80×0.5 mm), and micro-CT (TOSCANER). Reconstructed voxel sizes were 0.2 × 0.2 × 0.16 mm for MDCT and 0.052 × 0.052 × 0.072 mm for micro-CT. Images were reconstructed using standard filtered back-projection and IR algorithms. Four patterns of CT images were reconstructed: without IR (IR (0%)), with 25-30% of IR (weak), with 50% of IR (mild), and with high-dose protocol without IR (120kV and 250mAs, HD).Trabecular parameters and tissue bone mineral density (tBMD) of the central 10-mm-thick portion of the vertebrae were calculated. Relationships between MDCT- and micro-CT-derived trabecular indices were compared using Pearson's correlation coefficient.

RESULTS

Metric parameters and tBMD measured by 64-section MDCT correlated better with micro-CT values with IR (mild) (r=0.611-0.948) than with IR (0%) (r=0.703-0.945). The correlation coefficients were significantly different ($p<0.05$). Non-metric parameters showed better correlations with micro-CT values with IR (0%) (r=0.712-0.883) than by IR (30% and 50%) (r=0.694-0.871). For 80-section MDCT, five of seven morphological parameters and tBMD correlated better with micro-CT values with IR (0%) (r=0.698-0.914) than with IR (25% and 50%) (r=0.663-0.888, $p<0.05$). For three of eight parameters by 64-section MDCT and six out of eight parameters with 80-section MDCT, the correlation coefficients were lowest with the HD protocol.

CONCLUSION

IR improved the correlation between 64-section MDCT and micro-CT-derived metric parameters. In the assessment of trabecular microstructure, IR algorithms showed different strengths according to the vendor and category of trabecular parameters.

CLINICAL RELEVANCE/APPLICATION

To ensure the accurate measurement of trabecular bone microstructure by clinical MDCT, it is important to select the appropriate reconstruction algorithm and imaging protocol.

SSJ16

Musculoskeletal (Bone Strength, Fragility and Stress Fractures)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: E450B

MK MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Bruce B. Forster, MD, Vancouver, BC (*Moderator*) Travel support, Siemens AG; Travel support, Toshiba Corporation;
Leon Lenchik, MD, Winston-Salem, NC (*Moderator*) Nothing to Disclose

Sub-Events

SSJ16-01 3 T MRI-based Metrics of Proximal Femur Microarchitecture and Strength Can Discriminate between Subjects with and without Fragility Fractures When BMD Cannot

Tuesday, Dec. 1 3:00PM - 3:10PM Location: E450B

Participants
Hamza Alizai, MD, New York, NY (*Presenter*) Nothing to Disclose
Chamith Rajapakse, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Stephen Honig, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Cheng Chen, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose
Punam K. Saha, PhD, Iowa City, IA (*Abstract Co-Author*) Nothing to Disclose
Gregory Chang, MD, New York, NY (*Abstract Co-Author*) Speaker, Siemens AG

PURPOSE

Dual-energy x-ray absorptiometry (DXA) measurement of areal bone mineral density (BMD) poorly discriminates between subjects with and without fragility fractures. We investigated whether magnetic resonance imaging (MRI)-derived proximal femur microarchitectural parameters can discriminate between these two groups.

METHOD AND MATERIALS

This study had institutional review board approval. We recruited 22 females with fragility fractures (mean age=67.1±6.1 years) and 22 healthy female controls without fracture (mean age=64.1±6.5 years). All subjects underwent high-resolution 3T MRI of the non-dominant hip. We performed digital topological and finite element analyses within 10x10x10 mm3 femoral neck volumes-of-interest to assess: trabecular number, thickness, plate-to-rod ratio, connectivity; and elastic modulus (metric of bone strength). All subjects underwent DXA of the same hip. We performed receiver operating characteristics (ROC) analyses to assess discriminatory performance.

RESULTS

For MRI, femoral neck elastic modulus, trabecular plate-to-rod ratio, and connectivity could discriminate between subjects with and without fractures (area under the curve (AUC)=0.75-0.87, $p<0.05$), but trabecular thickness and number could not (AUC=0.46-0.53, $p>0.78$). For DXA, femoral neck and total hip BMD T-scores could not discriminate between the two groups (AUC=0.47-0.49, $p>0.80$).

CONCLUSION

Metrics of proximal femur microarchitecture and strength may be able to detect high fracture risk individuals even when BMD cannot.

CLINICAL RELEVANCE/APPLICATION

MRI based analysis of bone microarchitecture and strength may provide better measures of bone quality than Dual-Energy x-ray absorptiometry (DXA)

SSJ16-02 Long-term Radiographic Follow-up of Bisphosphonate-related Femur Fractures

Tuesday, Dec. 1 3:10PM - 3:20PM Location: E450B

Participants
Jennifer L. Favinger, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Alice S. Ha, MD, Seattle, WA (*Abstract Co-Author*) Grant, General Electric Company

PURPOSE

Although the initial appearance of atypical femur fractures associated with bisphosphonate use has been well documented, there are no prior studies evaluating long-term radiographic follow up of how these fractures change over time. It has been shown that bisphosphonates remain in bone for years after drug discontinuation, suggesting these fractures might not heal with the same pattern as normal bone.

METHOD AND MATERIALS

In this retrospective study, bisphosphonate-related fracture radiographs and CTs were reviewed by two radiologists for presence of a fracture line, callus, and the characteristic cortical beak. Indications of healing were defined as the fracture line or cortical beak appearing distinctly less conspicuous, though not necessary absent, compared to the prior study. Kaplan-Meier (KM) curves were used to analyze the time to first indication of healing. KM curves were compared between groups using the logrank test.

RESULTS

47 femurs with a bisphosphonate-related femur fracture were identified in 28 women, average age 65 years. 85% took a bisphosphonate for greater than 5 years, 59% for greater than 10 years. Median follow up time was 1.7 years with a median of 6 exams per femur. Median time to beak healing was 265 weeks. Median time to fracture line healing was 56 weeks in the 31 femurs with a baseline fracture. Healing rates of the beak ($p = 0.03$) and fracture line ($p = 0.07$) tended to be higher in those who discontinued bisphosphonate by 1 week after the initial exam compared to those who discontinued later. However, even in this group that discontinued earlier, only 53% demonstrated fracture line healing and 24% demonstrated beak healing at 6 months follow up.

CONCLUSION

Despite drug discontinuation, bisphosphonate-related fractures fail to show normal radiographic healing patterns in long-term follow-up, in keeping with recent pathology studies that showed persistent intraosseous drug presence years after drug discontinuation. These fractures demonstrate abnormally long healing time with less than 5% of patients showing any form of fracture healing at 6 weeks, and less than 50% showing any healing at 26 weeks. Therefore, these patients remain at high risk for displaced fractures and non-union.

CLINICAL RELEVANCE/APPLICATION

Atypical femur fractures are associated with significant morbidity and demonstrate abnormal or incomplete healing even years after drug discontinuation.

SSJ16-03 Does Intravenous Contrast Administration Affect Bone Mineral Density Assessment Using Multi-detector Computed Tomography?

Tuesday, Dec. 1 3:20PM - 3:30PM Location: E450B

Participants
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Mohd. Khalid, MBBS, MD, Aligarh, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of our study was to evaluate whether contrast media administration has significant influence on Computed tomography (CT) derived bone density measurements by comparing the unenhanced and contrast enhanced CT examinations.

METHOD AND MATERIALS

89 patients (47 Males and 42 Females; Mean age ± SD, 53 ± 10.6) who underwent both unenhanced and contrast enhanced CT examinations in the same setting between January 2014 and January 2015 were retrospectively selected. The only exclusion criterion was patients less than 40 years of age. CT attenuation values in Hounsfield units were measured in the first lumbar (L1) vertebra (using simple non-angled ROI) in both the unenhanced and contrast enhanced examinations. Comparisons were made between the measurements using appropriate statistical methods.

RESULTS

The mean CT attenuation value in the contrast enhanced phase (Mean ± SD, 186.7 ± 49.7) was significantly higher as compared to the unenhanced phase (170.1 ± 52.2, $p = 0.000$). The mean CT attenuation values were higher in males as compared to females in both unenhanced (Males vs Females; 180.8 ± 52.1 vs 158.2 ± 50.1, $p=0.04$) and contrast enhanced phases (192.2 ± 50.9 vs 180.5 ± 48.1, $p = 0.27$). When a threshold of 160HU or less is used to define osteoporosis, measurements in the contrast enhanced phase resulted in 8% false negatives.

CONCLUSION

Our study demonstrates that intravenous contrast administration significantly affects the Bone Mineral density assessment using CT. This must be factored in, when CT is used as a screening tool for osteoporosis.

CLINICAL RELEVANCE/APPLICATION

There are significant differences in CT attenuation values depending on the phase of image acquisition and therefore standardized image acquisition protocols must be used for bone density assessment.

SSJ16-04 Multi-modality Imaging for Tumor Localization in Patients with Tumor-induced Osteomalacia: A Retrospective Analysis of Five Cases

Tuesday, Dec. 1 3:30PM - 3:40PM Location: E450B

Participants
Kersten Peldschus, MD, Hamburg, Germany (*Presenter*) Nothing to Disclose
Thomas Brunkhorst, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Wisotzki, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Thorsten Derlin, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Amling, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan Breer, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this retrospective study was to evaluate imaging findings of patients with tumor-induced osteomalacia who underwent multi-modality imaging to localize the underlying tumor.

METHOD AND MATERIALS

Five patients who were successfully treated after suffering up to several years from tumor-induced osteomalacia and who underwent multi-modality imaging to localize the tumor were included in the analysis. All patients underwent 111In-octreotide scintigraphy and 68Ga DOTATATE PET/CT for somatostatin receptor imaging as well as MRI and additional CT (only 3 patients) of suspicious lesions from radionuclide imaging to further characterize the tumors for surgical treatment planning. Tumors were evaluated regarding tracer accumulation, size and contrast enhancement. Data sets were analyzed in consensus by experienced radiologists and nuclear medicine specialists.

RESULTS

Out of the five patients (50.4±7.3 y/o, 3 female, 2 male) 111In-octreotide scintigraphy revealed a suspicious lesion in 2 patients, whereas 68Ga DOTATATE PET/CT demonstrated tumor suspicious tracer enhancement in all 5 patients (mean SUVmax 14.9±10.0). Contrast-enhanced MRI could confirm tumorous lesions (mean diameter 2.5±1.6 cm) in all cases. After surgical removal histopathological analysis revealed three mesenchymal tumors of mixed connective tissue variant and two odontogenic fibroma, endothelium rich type. On MRI the mean size of tumors identifiable with 111In-octreotide scintigraphy was 4.5±0.6 cm versus 1.2±0.1 cm for tumors detectable only with 68Ga DOTATATE PET/CT. Complete surgical removal was achieved in all patients, no recurrence was observed during 1-year follow-up.

CONCLUSION

In patients with tumor-induced osteomalacia 68Ga DOTATATE PET/CT was able to detect significantly smaller tumors than 111In-octreotide scintigraphy. Subsequent MRI (and CT) were required to further characterize the tumors for surgical treatment planning.

CLINICAL RELEVANCE/APPLICATION

In patients with suspected tumor-induced osteomalacia 68Ga DOTATATE PET/CT may allow the detection of small tumors that are negative on 111In-octreotide scintigraphy.

SSJ16-05 The Effect of Body Mass Index on Bone Mineral Density and Trabecular Bone Score

Tuesday, Dec. 1 3:40PM - 3:50PM Location: E450B

Participants
Cristian G. Monaco, MD, San Donato Milanese,, Italy (*Presenter*) Nothing to Disclose
Carmelo Messina, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
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Giovanni Di Leo, San Donato Milanese, Italy (*Abstract Co-Author*) Travel support, Bracco Group
Luca Maria Sconfienza, MD, PhD, San Donato Milanese, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco Sardanelli, MD, San Donato Milanese, Italy (*Abstract Co-Author*) Speakers Bureau, Bracco Group Research Grant, Bracco Group Speakers Bureau, Bayer AG Research Grant, Bayer AG Research Grant, IMS International Medical Scientific

PURPOSE

Trabecular Bone Score (TBS) measured on lumbar spine dual energy x-ray absorptiometry (DXA) provides an indirect index of trabecular microarchitecture. According to proponents, TBS is adjusted to the patient's body mass index (BMI). In obese patient, bone mineral density (BMD) is usually increased due to image noise related to soft tissue superimposition. Our aim was to investigate the effect of BMI on BMD and TBS.

METHOD AND MATERIALS

After ethics committee approval, we retrospectively reviewed the last 197 DXA examinations performed at our institution. For each patient, data on TBS, BMI, and BMD were registered. An experienced reader evaluated all examinations. TBS and BMD were automatically averaged from L1 to L4. T-score was categorized according the WHO criteria. The presence of osteoarthrosis was determined when a difference of more than a 1.0 T-score was found between two adjacent vertebrae, in agreement to the International Society for Clinical Densitometry guidelines. Correlation was estimated using the Pearson coefficient and multivariate regression using TBS as dependent variable. Data were presented as mean±standard deviation.

RESULTS

T-score diagnosis was normal in 54 patients (27.4%), osteopenia in 95 (48.2%), and osteoporosis in 48 (24.4%). Overall, BMI was 26±5 kg/m2; BMD 0.877±0.153 g/cm2; TBS 1.224±0.117 mm-1. Osteoarthrosis was evident in 55 (28%) patients. Bivariate correlation analysis between TBS and BMI was significant (r= -0.396, P<.001); this correlation was higher in patients with BMI≥30 kg/m2 (r= -0.501, P=.015) than in those with BMI<30 kg/m2 (r= -0.207, P=.006). The correlation between TBS and BMD was: r=0.313 (P<.001), overall; r=0.431 (P=.040), in patients with BMI≥30 kg/m2; r=0.408 (P<.001), in patients with BMI<30 kg/m2. Multivariate regression analysis confirmed that BMI and BMD are independently associated to TBS (P<.001), both overall and only in patients without osteoarthrosis.

CONCLUSION

The higher the BMI the lower the TBS. BMI and BMD were independent predictors of TBS.

CLINICAL RELEVANCE/APPLICATION

TBS evaluation may be impaired in patients with high BMI, especially when BMI≥30 kg/m2.

SSJ16-06 Stress Fracture Diagnosis on Conventional Radiography and MRI: Variations Based on Fracture Location, Patient Age, and Time to MRI

Tuesday, Dec. 1 3:50PM - 4:00PM Location: E450B

Participants
Gregory S. Matthews, MD, Winston-Salem, NC (*Presenter*) Nothing to Disclose
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Maha Torabi, MD, Winston Salem, NC (*Abstract Co-Author*) Nothing to Disclose
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Kristen Beavers, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Leon Lenchik, MD, Winston-Salem, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if the diagnosis of stress fracture on conventional radiographs (CR) and MRI is influenced by fracture location, age of patient, and time between CR and MRI.

METHOD AND MATERIALS

Imaging studies of patients with suspected stress fractures over a five year period were evaluated. Only patients with CR and MRI studies less than 3 months apart were included. Stress fractures were categorized into three anatomic regions: 1) foot/ankle, 2) tibia/distal femur, 3) pelvis/proximal femur. Sensitivity and specificity of CR was determined by region. Odds ratios (95% CI) between patient age and positive CR and MRI diagnosis were determined. Also, odds ratio between days between CR and MRI and positive diagnosis of fracture was determined.

RESULTS

285 patients (mean age, 41 years; age range, 4-91 years) with clinical suspicion of stress fracture were evaluated with both CR and MRI. Based on CR, stress fractures were diagnosed (or highly suspected) in 61/295 (20.7%) of patients, including 25/144 (17.4%) in foot/ankle, 19/49 (38.8%) in tibia/distal femur, and 17/91 (18.7%) in pelvis/proximal femur. Based on MRI, stress fracture or stress reaction was diagnosed in 133/295 (45.1%) of patients, including 82/144 (56.9%) in foot/ankle, 26/49 (53.1%) in tibia/distal femur, and 25/91 (27.5%) in proximal femur/pelvis. Sensitivity of CR was 23% in foot/ankle, 31% in tibia/distal femur, and 12% in pelvis/proximal femur. Specificity of CR was 90% in foot/ankle, 52% in tibia/distal femur, and 79% in pelvis/proximal femur. For each decade of life, the odds of a positive CR diagnosis increased by 21% (OR: 1.21; 95% CI: 1.04,1.40], whereas the odds of a positive MRI diagnosis decreased by 14% (OR: 0.86; 95% CI: 0.76,0.97). There was no significant relationship between days between CR and MRI and positive diagnosis of fracture.

CONCLUSION

The diagnosis of stress fracture varies by fracture location and age of patient.

CLINICAL RELEVANCE/APPLICATION

Approach to imaging of stress fractures should take into account fracture location and age of patient.

SSJ18

Neuroradiology (Advances in Intracranial CT, MR Angiography and Perfusion)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: N226

NR CT MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Rajan Jain, MD, Northville, MI (*Moderator*) Nothing to Disclose
Pina C. Sanelli, MD, Manhasset, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSJ18-01 A Task-Driven Parameter Optimization Method for Cerebral CT Perfusion Imaging

Tuesday, Dec. 1 3:00PM - 3:10PM Location: N226

Participants
Ke Li, PhD, Madison, WI (*Presenter*) Nothing to Disclose
Kai Niu, MS, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Yijing Wu, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
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Howard A. Rowley, MD, Madison, WI (*Abstract Co-Author*) Research Consultant, Bracco Group; Research Consultant, Guerbet SA; Research Consultant, General Electric Company; Consultant, F. Hoffmann-La Roche Ltd; Consultant, W.L. Gore & Associates, Inc; Consultant, Lundbeck Group; ; ; ; ; ;
Guang-Hong Chen, PhD, Madison, WI (*Abstract Co-Author*) Research funded, General Electric Company; Research funded, Siemens AG

PURPOSE

CT perfusion (CTP) imaging offers great opportunities in improving patient selection for endovascular therapy of acute ischemic stroke due to its potential in differentiating ischemic penumbra from the infarct core. However, several challenges in CTP such as poor image quality and high radiation dose have severely reduced its clinical value. This work introduces a task-driven framework to optimize CTP system parameters for improved imaging performance and reduced radiation dose.

METHOD AND MATERIALS

The proposed framework quantitatively relates image quality metrics (e.g., noise power spectrum or NPS) of the final CTP functional maps with CTP system parameters such as radiation dose and post-processing filter strength. This was achieved by developing a cascaded chain model for the CTP imaging system. To address the limitation of zero-frequency metrics such as the contrast-to-noise ratio (CNR), the framework used the task-based detectability index to quantify the CTP imaging performance. Using this framework, optimization of the post-processing denoising filter was performed for different radiation dose levels, and the optimized system parameters were validated using an in vivo canine stroke model.

RESULTS

The NPS predicted by the proposed framework had excellent agreement with the experimental data (relative RMSE<2% for all CTP maps). This indicates that the "noisiness" of the CTP maps can be quantitatively related to CTP system parameters and dose levels. Compared with the CNR that favored the strongest spatial filters, the task-based detectability led to much more reasonable optimal filter selection. With these optimized protocols, numerical simulation results demonstrate a relative increase of 101% (95% CI: [23%, 179%]), 172% (95% CI: [67%, 277%]), or 256% (95% CI: [76%, 436%]) in terms of detectability index for CBV, CBF, and MTT maps, respectively. Visual inspection of the in vivo canine results agreed with the simulation results.

CONCLUSION

The task-driven framework has successfully guided the optimization of CTP imaging systems, potentially enabling a fundamental improvement in the quality and reliability of CTP-based parametric perfusion measurements.

CLINICAL RELEVANCE/APPLICATION

It is highly desirable for endovascular therapy, which has demonstrated its benefits in recently published clinical trials, to be able to reliable distinguish the penumbra from the infarct core during patient selection.

SSJ18-02 Diagnostic Value of Computed Tomography Perfusion and Computed Tomography Angiography Source Images for Detection of Acute Ischemic Stroke in the Posterior Circulation: A Review of 198 Consecutive Patients

Tuesday, Dec. 1 3:10PM - 3:20PM Location: N226

Participants
Peter Sporns, MD, Munster, Germany (*Abstract Co-Author*) Nothing to Disclose
Tarek Zoubi, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose
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Sebastian Zimmer, MD, Munster, Germany (*Abstract Co-Author*) Nothing to Disclose
Walter L. Heindel, MD, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose
Wolfram Schwindt, MD, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Niederstadt, MD, Munster, Germany (*Abstract Co-Author*) Nothing to Disclose
Uta Hanning, MD, Muenster, Germany (*Presenter*) Nothing to Disclose

PURPOSE

Still no consent could be agreed about imaging of Acute Ischemic Stroke (AIS) in the posterior circulation. To our knowledge there exist only two studies investigating the efficacy of Computed Tomography Perfusion (CTP) for stroke detection in the posterior circulation. A recent study proposes an increase of diagnostic accuracy by additional CTP to protocols including only computed tomography angiography (CTA) and noncontrast computed tomography (NCCT), where another blinded study recognized no significant difference in the detection of supratentorial and infratentorial stroke lesions. However patient populations were relatively small. We therefore conducted a research containing a large number of consecutive patients to evaluate the diagnostic value of CTP in acute posterior circulation stroke.

METHOD AND MATERIALS

We retrospectively evaluated data of consecutive ischemic stroke patients admitted between January 1st 2012 and March 31st 2015 at a tertiary care center. The inclusion criteria for this study were (1) suspected ischemic stroke of the posterior circulation as defined in the Oxfordshire classification; (2) NCCT, CTA and CTP performed on admission; and (3) CT performed <9 hours after symptom onset. For statistical analysis we used three logistic regression models: (1) NCCT, (2) NCCT + CTA-SI and (3) NCCT + CTA-SI + CTP.

RESULTS

198 patients with suspected posterior circulation stroke fulfilled the inclusion criteria. Admission NCCT detected 26 (19%), CTA-SI 65 (48%), and CTP 109 (80%) of the 136 patients with an infarct in the posterior circulation on follow up imaging. Model 3 (area under the curve (AUC) from the receiver operating characteristic curve (ROC-curve)=0.90; 95% CI, 0.85-0.94) predicted an infarct in the posterior circulation territory better than models 1 (AUC from ROC-curve=0.597; 95% confidence interval, 0.52-0.67) and 2 (AUC from ROC-curve =0.74; 95% confidence interval, 0.67-0.81).

CONCLUSION

Our findings in a large cohort of consecutive patients show that CTP detects significantly more ischemic strokes in the posterior circulation than CTA and NCCT alone.

CLINICAL RELEVANCE/APPLICATION

Computed Tomography Perfusion should be added to standard CT- protocols for detection of ischemic stroke in the posterior circulation.

SSJ18-03 Optimal Acquisition and Modeling Parameters for Accurate Assessment of Low Ktrans Blood Brain Barrier Permeability Using Dynamic Contrast-Enhanced MRI

Tuesday, Dec. 1 3:20PM - 3:30PM Location: N226

Participants
Samuel Barnes, PhD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
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Axel Montagne, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Eu-Meng Law, MBBS, Los Angeles, CA (*Abstract Co-Author*) Speakers Bureau, Toshiba Corporation; Medical Advisory Board, Bayer AG; Medical Advisory Board, Bracco Group; Medical Advisory Board, FUJIFILM Holdings Corporation;
Berislav Zlokovic, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Russell E. Jacobs, PhD, Pasadena, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to determine optimal parameters for acquisition and processing of DCE-MRI to detect small changes in near normal low BBB permeability in the human brain.Dynamic contrast-enhanced (DCE) MRI gives quantitative and semi-quantitative information about the integrity of the blood-brain barrier (BBB). Subtle changes of BBB integrity has been implicated in conditions such as Alzheimer's disease, traumatic brain injury and Multiple Sclerosis. The parameter of interest in BBB integrity is the transfer constant Ktrans, which describes the transfer rate of molecules from plasma space into interstitial space; however, optimal methods to collect and analyze DCE data in order to detect subtle changes to BBB integrity remain unclear.

METHOD AND MATERIALS

A contrast-to-noise ratio metric (K-CNR) was developed to evaluate for Ktrans precision and accuracy estimation as a function of imaging parameters commonly encountered in a DCE-MRI study. Using the K-CNR, the effects of kinetic model selection, scan duration, temporal resolution, signal drift and length of baseline on the estimation of low permeability values were evaluated with clinically consistent simulations.

RESULTS

The Patlak model was shown to give the highest K-CNR at low Ktrans. The Ktrans transition point, above which other models gave superior results, was highly dependent on scan duration and tissue extravascular extracellular volume fraction (ve). The highest K-CNR for low Ktrans was obtained when Patlak model analysis was combined with long scan times (10-30 minutes), modest temporal resolution (<60 seconds/image), and long baseline scans (1-4 minute). Signal drift as low as 3% was shown to affect the accuracy of Ktrans estimation with Patlak analysis.

CONCLUSION

DCE acquisition and modeling parameters are interdependent and should be optimized together for the tissue being imaged. Appropriately optimized protocols can detect even the subtlest changes in BBB integrity and may be used to probe the earliest changes in neurodegenerative diseases such as traumatic brain injury, Alzheimer's disease and Multiple Sclerosis.

CLINICAL RELEVANCE/APPLICATION

We analyzed the effects of DCE-MRI acquisition parameters and model selection to detect subtle changes in blood-brain barrier permeability, which are implicated in several neurodegenerative diseases.

SSJ18-04 Choosing the Right Arterial Input Function Selection Mode for T1-DCE MRI in the CNS

Tuesday, Dec. 1 3:30PM - 3:40PM Location: N226

Participants
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Dariusch R. Hadizadeh Kharrazi, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans H. Schild, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Anna M. Vogelgesang, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

When applying T1-DCE MRI in the CNS, the right selection technique for the arterial input function (AIF) is a disputed question. AIF selection bias is a major obstacle for clinical implementation of the method. This study is aimed to determine the AIF selection mode that allows the most coherent and robust results of T1-DCE parameters.

METHOD AND MATERIALS

76 patients with various brain lesions underwent a T1-DCE scan MRI at 3.0 T (Philips Achieva TX, 8-channel head coil): 36 axial slices, TE=1.7 ms, 2 dual flip angle series, dynamic sequence: 50 scans; 12 scans/min.; contrast agent (CA) gadobutrol (0.1 mmol/kg BW; Bayer Healthcare). T1-DCE parameters Ktrans and ve were calculated with Intellispace software (Philips Healthcare). Regions of interest (ROI) were placed in different image slices. The manual AIF was derived from a 7x7 pixel ROI. 4 classical AIF selection modes were tried: (1) a Parker model based selection (MB), manual AIF selection in (2) the terminal ACI, (3) the blood vessel closest to the lesion (CV) and (4) the superior sagittal sinus (SSS, Fig. 1). Reliability of the AIF was approximated by presence of the expected curve shape, peak CA concentration and plausibility of calculated ve (< 100%). Ktrans values resulting from all AIF selection methods were compared for consistency between cases.

RESULTS

1085 ROI in brain tissue were the basis of all calculations. Using the SSS AIF, ve is significantly less overestimated compared to ACI or CV AIF ($p < 0.001$). ROI CA peaks falsely exceed AIF peaks significantly more often in ACI or CV AIF than in SSS AIF ($p<0.0001$). CA peaks are significantly higher in SSS AIF ($p < 0.001$). For glioma, the range of Ktrans values based on SSS AIF correlates best with expected ranges. Peak CA values correlate poorly between AIF selection methods except for ACI and CV AIF ($r=0.515$); T1-DCE parameters differed highly depending on AIF selection method ($p < 0.001$).

CONCLUSION

A ROI placement in the SSS for manual AIF selection produces significantly more trustworthy results compared other selection methods in T1-DCE MRI. ROI placements in the ACI and the CV frequently underestimate the peak arterial concentration of contrast agent and consecutively distort T1-DCE parameters.

CLINICAL RELEVANCE/APPLICATION

This technical analysis study of effects of AIF selection on T1-DCE parameters is of value for all radiologists using T1-DCE MRI in the CNS concerning interpretation and validation of their results.

SSJ18-06 Acceleration-selective Arterial Spin Labeling (ASASL) MR Angiography for Visualization of Distal Cerebral Arteries in Moyamoya Disease

Tuesday, Dec. 1 3:50PM - 4:00PM Location: N226

Participants
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Kazufumi Kikuchi, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Makoto Obara, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Time-of-flight (TOF)-MR angiography (MRA) frequently fails to visualize distal arteries to the steno-occlusive lesion because of the slow or retrograde flow. In this study, we evaluated the utility of acceleration-selective arterial spin labeling (ASASL)-MRA in depiction of distal arteries in moyamoya disease.

METHOD AND MATERIALS

Fifteen patients with moyamoya disease (age 26.1 ± 23.9 year-old; 6 males, 9 females) were examined with both TOF- and ASASL-MRA on a 3T MR scanner. All patients underwent cerebral digital subtraction angiography (DSA). The ASASL-MRA consists of control (T2-preparation without motion-sensitized gradient: MSG) and label (with MSG) parts followed by 3D T1-weighted gradient-echo sequence. In the label part, MSG employs a motion compensation design to selectively detect spins with acceleration component in arteries. The TOF-MRA was obtained in the same geometry and acquisition time (6min13sec) as ASASL-MRA. In both MRAs, the number of distal MCA branches (#vessel) was counted by a line profile analysis and the contrast-to-noise ratio (CNR) was measured in peripheral branches in each hemisphere on an image of maximum intensity projection with 90mm thickness. Based on the DSA findings, the degree of steno-occlusion of ICA or the development of leptomeningeal anastomosis (LMA) was classified into two grades. The #vessel and CNR were compared between the two MR methods. Increment in #vessel between the two MR methods (#vesselASASL-#vesselTOF) was evaluated based on the DSA findings.

RESULTS

The average #vessel obtained with ASASL-MRA (16.9±4.9, $P<0.0001$) was larger than that with TOF-MRA (7.2±4.5). The average CNR with ASASL-MRA (20.4±8.0, $P<0.0001$) was higher than that with TOF-MRA (9.2±9.2). The increment in #vessel was higher in hemispheres with severe IC stenosis (11.0±4.0, $P<0.01$) than those with mild stenosis (6.8±2.4). The increment in #vessel was higher in hemispheres with well-developed LMA (11.4±3.9, $P<0.01$) than those with mildly developed LMA (6.8±2.2).

CONCLUSION

The ASASL-MRA improved the visualization of peripheral arteries distal to the steno-occlusive site reflecting collateral flow via LMA in moyamoya disease.

CLINICAL RELEVANCE/APPLICATION

ASASL-MRA serves as a non-invasive technique to evaluate the status of branches distal to the affected main trunk representing the LMA collateral flow. The method might be useful in the planning of bypass surgery.

SSJ19

Neuroradiology/Head and Neck (ENT Oncology)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: N228

HN NR MR RO US

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Ashley H. Aiken, MD, Atlanta, GA (*Moderator*) Nothing to Disclose
Barton F. Branstetter IV, MD, Pittsburgh, PA (*Moderator*) Nothing to Disclose

Sub-Events

SSJ19-01 Lymph Node Imaging Reporting and Data System for Ultrasound and Real-time Elastography of Cervical Lymph Node: A Pilot Study

Tuesday, Dec. 1 3:00PM - 3:10PM Location: N228

Participants
Kyeong Hwa Ryu, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kwanghwi Lee, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jiyeon Baik, MD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ji-Hwa Ryu, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Hee Son, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To analyze ultrasound (US) and real-time elastography (RTE) features of cervical lymph node and propose a structural reporting system for lymph node.

METHOD AND MATERIALS

Between 2013 and 2014, 291 consecutive patients underwent US guided biopsies and follow-up for cervical lymph nodes were enrolled in a single institution. US features were analyzed as follows; shape, margin, echogenicity, echogenic hilum, gross necrosis, calcification, matting and vascular pattern. RTE features were analyzed; elasticity score and strain ratio. By logistic regression analysis, a score for each significant factor was assigned and multiplied by the β coefficient, and then fitted probability of malignancy was calculated. The risk of malignancy of lymph node was determined, based on the number of suspicious features.

RESULTS

Imaging features to be significantly associated with malignancy were round shape, not circumscribed margin, hyperechogenicity, absence of hilum, presence of gross necrosis and calcification, peripheral/mixed vascularity, elasticity score 3 and 4, and high strain ratio ($p < 0.05$). The fitted probability and risk of malignancy increased, as a number of suspicious features increased. Lymph node imaging reporting and data system (LNRADS) was established using a 5-point scale; 1 (probably benign), 2 (low suspicion for malignancy), 3 (moderate suspicion for malignancy), 4 (high suspicion for malignancy), and 5 (highly suggestive for malignancy). The risk of malignancy according to LNRADS categories was as follows; 1: 3.3%, 2: 10.9%, 3: 26.7%, 4: 51.8%-74.4%, 5: 90.6%-98.8%.

CONCLUSION

LNRADS was proposed using risk stratification of cervical lymph node according to the number of suspicious US and RTE features.

CLINICAL RELEVANCE/APPLICATION

LNRADS will help to determine the optimal strategies for management of cervical lymph node.

SSJ19-02 How Can We Differentiate Follicular Nodular Lesions with Ultrasonographic Features?

Tuesday, Dec. 1 3:10PM - 3:20PM Location: N228

Participants
Sun Hye Jeong, MD, Bucheonsi, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hyun-Sook Hong, MD, PhD, Bucheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Hye Lee, MD, Bucheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bora Lee, Bucheon-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We retrospectively evaluated the ultrasonographic (US) features used to differentiate follicular nodular lesions of thyroid gland (or follicular cell-derived thyroid nodules) and tried to identify specific US features of nodular hyperplasia (NH).

METHOD AND MATERIALS

The study included 178 patients (mean age 46.6 (range 17-82) years) with surgically confirmed NH (n=100), follicular adenoma (FA) (n=56), or follicular carcinoma (FC) (n=22). Two radiologists retrospectively analyzed the US features. To determine the predictors of follicular-patterned lesions, univariate and multivariate multinomial logistic regression analyses were conducted. Receiver operating characteristic (ROC) analyses were performed to determine the effectiveness of the final model at predicting NH, FA, and FC. The inter-observer agreement was calculated.

RESULTS

Tumor diameter, margin, echotexture, cystic changes, calcification, hypoechoic rim, and vascularity were significant in the

univariate analyses. The multivariate multinomial logistic regression analyses revealed that tumor diameter (FA: p=0.002, odds ratio (OR) =1.75, 95% confidence interval (CI) 1.22, 2.51; FC: p=0.001, OR=2.02, 95% CI 1.32, 3.10), absence of cystic changes (FA: p=0.127, OR=2.21, 95% CI 0.80, 6.13; FC: p≤0.001, OR=17.74, 95% CI 4.00, 78.73), and spongiform appearance (FA: p=0.234, OR=0.31, 95% CI 0.04, 2.15; FC: p<0.001, OR=1673.46, 95% CI 671.35, 4171.38) differed significantly among the three follicular nodular lesions, with NH as a reference group. The area under the curve (AUC) for NH, FA, and FC was 0.844, 0.858, and 0.705, respectively. The sensitivity for NH, FA, and FC was 0.698, 0.868, and 0.755, respectively, and the specificity was 0.820, 0.690, and 0.580. Using this model, the diagnostic accuracy of the original data was 72.6%. The inter-observer agreement was moderate to almost perfect.

CONCLUSION

Tumor diameter, cystic changes and spongiform appearance differed significantly among follicular nodular lesions. Using the US criteria, there was moderate diagnostic ability for NH, FA, and FC.

CLINICAL RELEVANCE/APPLICATION

Tumor diameter and the presence of cystic changes differed significantly among NH, FA, and FC (or follicular nodular lesions).

SSJ19-03 The Added Diagnostic Value of DW-MRI to Conventional Parameters in Characterization of Cervical Lymphadenopathy

Tuesday, Dec. 1 3:20PM - 3:30PM Location: N228

Participants
A M Aboelsouad, MSc, Assiut, Egypt (*Presenter*) Nothing to Disclose
Haisam A. Atta, MD, Assiut, Egypt (*Abstract Co-Author*) Nothing to Disclose
Mohamed M. Abd Ellah, MD, Innsbruck, Austria (*Abstract Co-Author*) Nothing to Disclose
Hisham M. Imam, MBBCH, MD, Assiut, Egypt (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess what can DW-MRI add to conventional parameters (Short axis diameter, presence or absence of hilum and presence or absence of necrosis) in prediction of malignant cervical lymphadenopathy.

METHOD AND MATERIALS

The study population included 72 patients having cervical lymphadenopathy underwent MRI with diffusion on 1.5T machine before they underwent biopsy. The cutoff short axis diameter (determined by ROC curve and Youden index), presence or absence of hilum, presence or absence of necrosis and cutoff ADC value (determined by ROC curve and Youden index) were assessed and finding their ability to predict malignant cervical lymphadenopathy each parameter alone, all parameters and comparing DW-MRI efficacy with that of conventional parameters.

RESULTS

The short axis diameter achieved 72.13%,45.45 %,88%,22.73% and 68.06% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. Absent hilum criterion achieved 63.9%,27.3%, 83%,12% and 58.3% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. Present necrosis criterion achieved 21.3%,72.7%,81.3%,14.3% and 29.2% sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. Combined conventional criteria achieved 86.9%,0%,82.8%,0% and 73.6%sensitivity, specificity, positive predictive value, negative predictive value and accuracy respectively. The DWI with its cutoff ADC achieved 80.33%,63.64%, 92.45%,36.84% and 83.33%sensitivity, specificity, positive predictive value,negative predictive value and accuracy respectively. The combined conventional parameters and DWI achieved 98.4%,0%,84.5%,0% and 83.3% sensitivity,specificity,positive predictive value,negative predictive value and accuracy respectively.

CONCLUSION

DWI is carrying the highest sensitivity, specificity and accuracy among all conventional parameters, each alone and nearby lower sensitivity with higher specificity and accuracy than combined conventional parameters, thus use of DWI added significant diagnostic value to the ability of conventional parameters to predict malignant cervical lymphadenopathy with no extra time consuming.

CLINICAL RELEVANCE/APPLICATION

DW-MRI is non invasive and non time consuming method that can predict malignancy in cervical lymphadenopathy and its addition to conventional paramters increases their senstiivty with no significant extra time consuming.

SSJ19-04 Proposal for an MRI-based Score to Differentiate Pleomorphic Adenoma and Warthin Tumor in Patients with Benign Parotid Neoplasms

Tuesday, Dec. 1 3:30PM - 3:40PM Location: N228

Participants
Beatrice Sacconi, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Angelo Iannarelli, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Renato Argiro, Rome, Italy (*Presenter*) Nothing to Disclose
Marta Bottero, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Emanuela Basile, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Piero Cascone, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Mario Bezzi, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic efficacy of an MRI-based score in the differential diagnosis between parotid pleomorphic adenoma (PA) and Warthin tumor (WT).

METHOD AND MATERIALS

Twenty patients (M=10, F=10; mean age=63.5 years, range=35-87) complaining of long-standing (stable for at least 3 months) painless parotid mass underwent a 3T MR (Discovery MR750, GE); T2-weighted, DWI and T1-weighted sequences before and after contrast administration (Gadobenic acid, 0,1 ml/Kg) were performed. The lesions were evaluated by three radiologists in consensus using a complex score based on three-point scales rating four different MR features (T2-signal intensity, Apparent Diffusion Coefficient values, enhancement pattern, bilateral/multiple location); total scores of ≤3 and >3 were respectively considered as suggestive of PA or WT. Final diagnosis was based on pathology reports after US-guided fine-needle-aspiration cytology (FNAC) or surgical resection.

RESULTS

Twenty-four lesions were imaged; three lesions were excluded because of MR features suggesting less common histotypes (lipoma, sialolipoma, haemangioma, all confirmed at surgery). Radiologists correctly identified 6/6 PAs and 13/13 WTs; two lesions, defined as PAs, revealed to be an oncocytoma and a granulomatous lymph node (diagnostic accuracy 90.5%).

CONCLUSION

The score allowed the differential diagnosis in all cases of PAs and WTs; an oncocytoma and a granulomatous lymph node were misdiagnosed, but the incidence of benign lesions other than PA and WT is expected to be low. These data need to be confirmed in larger patient cohorts.

CLINICAL RELEVANCE/APPLICATION

In case of benign parotid lesions, the surgical plan depends on histology. MRI can suggest tumor histology in case of uncertain cytologic diagnosis and provide information over the entire neoplasm.

SSJ19-05 Parotid Gland Tumors: Diagnostic Value of Combining Conventional MR Imaging, Diffusion-weighted MR Imaging and Dynamic Contrast Enhanced MR Imaging

Tuesday, Dec. 1 3:40PM - 3:50PM Location: N228

Participants
Gongxin Yang, Shanghai, China (*Presenter*) Nothing to Disclose
Yu Qiang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Pingzhong Wang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Yingwei Wu, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
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Xin Gong, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Weiqing Gao, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic value of the combination of echo-planner diffusion-weighted MR imaging (DWI), dynamic contrast enhanced MR imaging (DCE-MRI) and conventional MR imaging in the characterization of solid neoplasms from parotid gland.

METHOD AND MATERIALS

148 subjects (101 benign and 47 malignant) involved with parotid gland tumors were recruited in the study. Prior to surgery and pathologic verification, conventional maxillofacial MR imaging, DWI with b factor of both 0 and 1000 s/mm2 and DCE-MRI were performed on each subject. Logistic regression analysis was performed to see differences of morphological MR features (margin,shape,envelope and signal intensity of masses) between benign and malignant groups. Mean ADC value was calculated from ADC map, and then ADC threshold values between benign and malignant tumors was obtained. Time-intensity curve (TIC) with parameters were obtained from DCE-MRI. Sensitivity, specificity, accuracy, and positive and negative predictive values were calculated for the combination of relative parameters.

RESULTS

Ill-defined margin,irregular shape, no envelope, ADC value lower than cut-off point of 1.12×10-3mm2/s and TIC pattern with time to peak less than 120s and low washout ratio(<30%)were the valuable parameters for predicting malignancy (P=0.005, 0.004, 0.001, <0.001, <0.001, respectively). However, no significant difference was found in signal intensity of tumors between benign and malignant lesions. A combination of ADC value and TIC pattern yielded a sensitivity, specificity and diagnostic accuracy of 91.5%, 97.0% and 95.3%, respectively. Positive and negative predictive value for distinguishing benign and malignant tumors was 93.5% and 96.1% respectively.

CONCLUSION

Conventional MR imaging combined DWI and DCE-MRI has the ability to improve the diagnostic accuracy in distinguishing between benign and malignant parotid gland tumors.

CLINICAL RELEVANCE/APPLICATION

It will be helpful for clinical diagnosis of Parotid gland tumors

SSJ19-06 Intravoxel Incoherent Motion Diffusion-weighted Magnetic Resonance Imaging for Monitoring of ZD6474 Therapy in Human Nasopharyngeal Carcinoma Xenografts

Tuesday, Dec. 1 3:50PM - 4:00PM Location: N228

Participants
Yanfen Cui, Shanghai, China (*Presenter*) Nothing to Disclose
Caiyuan Zhang, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Huanhuan Liu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Dengbin Wang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the value of intravoxel incoherent motion (IVIM) diffusion-weighted (DW) imaging biomarkers for monitoring the early response to ZD6474 in an experimental tumor model by quantitative assessments of tumor microcirculation parameters with histopathological validation.

METHOD AND MATERIALS

Twenty-four female BALB/c nude mice bearing human nasopharyngeal carcinoma xenografts were scanned at baseline and after 1, 3, and 7 days of treatment with ZD6474 (n = 12) or vehicle (n = 12) at a 3T magnetic resonance imager using a custom-built 8-channel receiver coil with 2.5cm inner diameter. For IVIM DW imaging, parameters including apparent diffusion coefficient (ADC), true diffusion coefficient (D), perfusion fracture (f), and blood pseudodiffusion coefficient (D*) were measured with 12 b-values ranging from 0 to 2000 s/mm2. All IVIM DW imaging parameters at different time points were compared between the treated and control groups using Student's t tests or Mann-Whitney tests. Parameters were also analyzed within the treated group by one-way analysis of variance (ANOVA). The relationships between histopathological staining for Ki-67, TUNEL, or CD31 and all IVIM parameters were evaluated by Spearman's rank correlation.

RESULTS

The percent change of the perfusion-related parameters f and D* decreased significantly in the treated group as early as the 1-day follow-up compared with those in the control group . In contrast, the diffusion-related parameters ADC and D were significantly higher in the treated group compared with the control group beginning on day 3 ($P < 0.05$). The substantial decreases in f at day 1 and D* at day 3 were moderately correlated with the smaller increase in tumor size over the week-long study ($r = 0.66$ and 0.58, respectively; $P < 0.05$ for both). Moderate correlations were found between microvessel density and the perfusion-related parameters f and D* and between increased TUNEL index or decreased Ki-67 index and the diffusion-related parameters ADC and D.

CONCLUSION

IVIM DW imaging was sensitive to ZD6474-induced changes in the tumor microenvironment. In particular, the f parameter had the potential to allow early prediction of tumor response to anti-angiogenic treatment.

CLINICAL RELEVANCE/APPLICATION

IVIM DW imaging was sensitive to ZD6474-induced changes in the tumor microenvironment. In particular, the f parameter had the potential to allow early prediction of tumor response to anti-angiogenic treatment.

SSJ20

Neuroradiology (Neuro-Oncology)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: N229

NR MR RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Chad A. Holder, MD, Atlanta, GA (*Moderator*) Nothing to Disclose
Adam E. Flanders, MD, Penn Valley, PA (*Moderator*) Nothing to Disclose

Sub-Events

SSJ20-01 Non-invasive Detection IDH1 Gene Status in Astrocytoma by DSC MRI: A Retrospective Study of 91 Leisons

Tuesday, Dec. 1 3:00PM - 3:10PM Location: N229

Participants
Wen Li Tan, MD, Shanghai, China (*Presenter*) Nothing to Disclose
Dao Ying Geng, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Songhua Zhan, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Ji Xiong, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Wei Yuan Huang, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Jin Song Wu, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the value of dynamic susceptibility contrast (DSC) magnetic resonance imaging (MRI) in the noninvasive evaluation of isocitrate dehydrogenase (IDH) 1 status in astrocytoma.

METHOD AND MATERIALS

We retrospectively analyzed the preoperative DSC MRI data of 91 lesions with pathologically confirmed astrocytoma. We obtained the normalized maximum ratios of relative cerebral blood volume (rCBV) of tumor parenchymata. The enrolled astrocytoma patients were divided into six groups according to the World Health Organization (WHO) classification method and IDH1 gene status. We compared the differences in the rCBV ratio of tumor parenchyma between the IDH1 gene mutant and wild-type groups of WHO grades II, 3 and IV and plotted receiver operating characteristic (ROC) curves for imaging indicators showing statistically significant differences.

RESULTS

The IDH1 gene mutant and wild-type groups of WHO grades II, II and IV astrocytoma showed statistically significant differences in the rCBV ratio. In WHO grade II astrocytoma, the area under the ROC curve value for the rCBV ratio was 0.83, and the cutoff value was 2.20; in WHO grade III astrocytoma, the area under the ROC curve value for the rCBV ratio was 0.86, and the cutoff value was 3.14; in WHO grade IV astrocytoma, the area under the ROC curve value for the rCBV ratio was 0.94, and the cutoff value was 5.63.

CONCLUSION

The rCBV ratio value provided by DSC MRI provides a new imaging method for the noninvasive evaluation of the IDH1 status in astrocytomas of various WHO grades.

CLINICAL RELEVANCE/APPLICATION

DSC MRI can noninvasively judge the IDH1 gene status of astrocytomas.

SSJ20-02 IDH Mutation Status in Human Glioma is Associated with Differential Activation of Hypoxia and Angiogenesis Related Signaling and is Non-invasively Predictable with rCBV-imaging

Tuesday, Dec. 1 3:10PM - 3:20PM Location: N229

Participants
Philipp Kickingereder, Heidelberg, Germany (*Presenter*) Nothing to Disclose

PURPOSE

The recent identification of isocitrate dehydrogenase (IDH) mutations in gliomas and several other cancers suggests that this pathway is involved in oncogenesis; however effector functions are complex and yet incompletely understood. To study the regulatory effects of IDH on hypoxia-inducible-factor 1-alpha (HIF1A), a driving force in hypoxia-initiated angiogenesis, we performed mRNA-expression and functional, as well as genotype/imaging phenotype correlation analysis.

METHOD AND MATERIALS

We studied differential mRNA-expression profiles from 288 samples with low-grade and anaplastic gliomas from The Cancer Genome Atlas (TCGA) of HIF1A and related downstream signaling on a single-gene and pathway level, as well as upstream biological causes and probable downstream effects between mutant and wild-type IDH tumors. Genotype/imaging phenotype correlation analysis was performed in a separate (local) dataset with relative cerebral blood volume (rCBV) MRI - an estimate of tumor angiogenesis - in 72 treatment-naive patients with low-grade and anaplastic gliomas.

RESULTS

We show decreased expression of HIF1A-target genes on a single-gene and pathway level, strong inhibition of upstream regulators such as HIF1A and downstream biological functions such as angio- and vasculogenesis in IDH-mutant tumors. Our radiogenomic imaging approach revealed increased levels of rCBV in IDH wild-type tumors, where a one-unit increase in rCBV corresponded to a two-third decrease in the odds for an IDH-mutation and correctly predicted IDH mutation status in 87% of patients.

CONCLUSION

Together, these findings show that IDH-mutation status is associated with a distinct angiogenesis transcriptome signature which correlates with rCBV-imaging findings and highlight the potential future role of radiogenomics for noninvasive profiling of cancer genomic key events.

CLINICAL RELEVANCE/APPLICATION

IDH-mutation status in human glioma is associated with a distinct angiogenesis transcriptome signature which correlates with rCBV-imaging findings and highlight the potential future role of radiogenomics for noninvasive profiling of cancer genomic key events.

SSJ20-03 The Added Prognostic Value of ADC in Glioblastomas Treated with Temozolomide: Correlation with MGMT Promoter Methylation Status and Survival Analysis

Tuesday, Dec. 1 3:20PM - 3:30PM Location: N229

Participants
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Mina Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Soo Ahn, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jinna Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung-Koo Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The prognostic value of ADC in patients with glioblastoma treated with temozolomide, and relationship between ADC and MGMT promoter methylation status are controversial. We investigated the added prognostic value of ADC in combination with MGMT in glioblastomas treated with temozolomide, and the association between ADC and MGMT promoter methylation status, using histogram analysis.

METHOD AND MATERIALS

This retrospective study consisted of 72 consecutive patients who underwent preoperative DTI for glioblastoma, and operation followed by CCRT with temozolomide. The histogram parameters of ADC, including mean, minimum, 5th (p5), 25th (p25), 50th (p50), 75th (p75), 95th (p95) percentile and maximum values, skewness and kurtosis were calculated from entire enhancing tumors. Univariate analyses for overall survival (OS) were performed with ADC parameters according to MGMT methylation status and other clinical factors. Multivariate Cox regression was performed to build prognostic models with and without ADC parameters. The performance of each model was compared using Harrell's concordance index. In addition, the difference of ADC histogram parameters according MGMT promoter methylation status was assessed using Student t-test.

RESULTS

In univariate analysis, only lower p75 of ADC was significantly associated with worse OS in overall patients, and lower mean and p75 of ADC in patients with unmethylated MGMT. No parameters of ADC were significantly prognostic in patients with methylated MGMT. Other significant prognostic factors were age and enhancing tumor volume, as well as MGMT methylation status. In multivariate analysis, mean and p75 of ADC were independently prognostic in patients with unmethylated MGMT. The performance of prognostic models were significantly improvmed when mean and p75 of ADC were added to dichotomize the patients with unmethylated MGMT. Any of ADC parameters was significantly different according MGMT methylation status.

CONCLUSION

Lower ADC histogram parameters were associated with worse prognosis of glioblastoma treated with temozolomide, especially those with unmethylated MGMT. ADC histogram parameters may have the added prognostic value in combination with MGMT in patients with glioblastoma.

CLINICAL RELEVANCE/APPLICATION

Preoperative ADC histogram analysis has the added prognostic value in combination with MGMT methylation status, in patients with glioblastoma treated with temozolomide.

SSJ20-04 The Role of Advanced CT and MRI Perfusion Imaging in Differentiating Diagnosis between Gliomas Masquerading as Acute Cerebral Stroke- Eight-year Experience in a Single Institution

Tuesday, Dec. 1 3:30PM - 3:40PM Location: N229

Participants
Xiang Liu, MD, Rochester, NY (*Presenter*) Nothing to Disclose
Wei Tian, MD, PhD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Sven E. Ekholm, MD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Stroke mimics could account for 3 - 13% of patients primarily diagnosed and treated as acute stroke, thrombolysis in stroke mimics is not only unnecessary and costly, but will delay a correct diagnose/treatment and may result in complications, including hemorrhage. Gliomas could present similar clinical symptom and conventional neuroimaging finding as acute brain stroke. The purpose of this study is to evaluate the value of advanced CT and MRI perfusion imaging in such differential diagnosis.

METHOD AND MATERIALS

CT and/or MR perfusion imaging findings in 1096 cases with suspected acute stroke onset in eight years of period were reviewed.

There were 22 cases with pathology confirmed gliomas, presenting acute onset of symptoms and conventional neuroimaging findings similar as acute stroke. The ratios of relative cerebral blood volume (rCBV), relative cerebral blood flow (rCBF), and mean transit time (MTT) were evaluated and compared with these stroke patients.

RESULTS

These 22 stroke-mimicking gliomas are malignant, including 13 Anaplastic astrocytomas, WHO grade III; and 9 glioblastomas, WHO Grade IV. All these gliomas showed non-enhancement or mild enhancement in post-contrast T1WI, and increased rCBV, rCBF and MTT compared to contralateral references, ($p<0.001$, paired t-test). The mean rCBV, rCBF and MTT values of ischemic stroke lesions were significantly lower than contralateral hemisphere ($p<0.001$, paired t-test). The ischemic lesions with re-perfusion could present mixed decreased and increased perfusion within the lesions. The maximal rCBV ratio (1.83±0.57, $p=0.022$) and rCBF ratio (2.91±0.82, $p<0.001$) of gliomas were significantly higher than ischemic lesions with re-perfusion (maximal rCBV ratio 1.16±0.13, maximal rCBF ratio 1.35±0.18; mann-whitney U test)

CONCLUSION

Our study shows that the gliomas mimicking symptom and imaging of acute stroke present higher perfusion than acute cerebral ischemic lesions. Carefully interpretation of multi-parameters derived from advanced CT and MRI perfusion imaging is useful in differentiating between gliomas mimicking acute stroke lesions.

CLINICAL RELEVANCE/APPLICATION

The perfusion imaging is important and adjuvant tool for accurate diagnosis in differentiating between gliomas mimicking acute stroke lesions.

SSJ20-05 Clinical Performance Characteristics of Multivoxel Magnetic Resonance Spectroscopy in Distinguishing Between True Progression and Pseudoprogression in a Series of Patients with High-Grade Glial Neoplasm

Tuesday, Dec. 1 3:40PM - 3:50PM Location: N229

Participants
Jason M. Johnson, MD, Houston, TX (*Presenter*) Nothing to Disclose
Rutvij J. Shah, MBBS, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Leena M. Ketonen, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Dawid Schellingerhout, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Komal B. Shah, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Norman E. Leeds, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Ashok J. Kumar, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Rivka R. Colen, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Rates of psuedoprogression (PsP) following chemoradiotherapy can be as high as 30% and can present a significant clinical and diagnostic burden. Early differentiation between true progression (TP)and PsP affects management decisions particularly in the era of progressive individualized treatments. We sought to review the clinical performance characteristics of MRS in a group of high-grade glial based neoplasm presenting for differentiation of PsP from TP.

METHOD AND MATERIALS

66 patients with high-grade glial neoplasm (GBM or AA) imaged during 2014 with MRI of the brain including multivoxel MRS with TE of 144 ms were evaluated. Patients were required to have either pathology follow-up or six-months of clinical and imaging follow-up to assess for accuracy.MRS solely was assessed for choline to NAA ratio within suspicious tissue as well as relative choline within suspicious tissue to normal brain parenchyma. A threshold of 2 for Cho/NAA and of >1.5 for relative choline concentrations were used as a guideline. Prior imaging and concurrent anatomic brain sequences were not reviewed.

RESULTS

Out of the 66 cases reviewed 23 patients were removed from further analysis due to unreliable MRS data. Of the remaining 33 cases (mean age 56 years, 19 males), high-grade glial neoplasm was suspected in 16 cases and not suspected in 17 cases. 15 out of 16 cases suspicious for TP were correct. MRS not thought to be consistent with TP was correct in 16/17 cases. Sensitivity = 93.8% ; Specificity = 94.1% ; PPV = 93.8% ; NPV= 94.1%.The majority of excluded cases were due to calvarial lipid contamination into the shim box. Modest choline elevations were seen in many voxels of suspicious tissue.

CONCLUSION

High-quality multivoxel MRS is an excellent predictor of high-grade glial neoplasm versus pseudoprogression. Rigorous choline elevation thresholds for tumor versus radiation necrosis must be applied due to the common presence of modestly elevated choline concentrations in the post-treated tissue. Relying upon choline to NAA ratios alone should be done cautiously when a comparative voxel of normal appearing brain is not available for review.

CLINICAL RELEVANCE/APPLICATION

High quality multivoxel MRS at TE of 144 can provide a high level of accuracy and additional confidence in the evaluation of the post-treatment brain for recurrent high-grade glial based neoplasm.

SSJ20-06 Investigating Dynamic Susceptibility-weighted Contrast-enhanced (DSC) Perfusion MR Imaging in Posterior Fossa Tumors: Differences and Similarities with Supratentorial Tumors

Tuesday, Dec. 1 3:50PM - 4:00PM Location: N229

Participants
Matia Martucci, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Simona Gaudino, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Annibale Botto, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Anna D'Angelo, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Tommaso Tartaglione, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Emma Gangemi, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Emanuela Ruberto, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Rosellina Russo, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Cesare Colosimo, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

DSC perfusion is routinely used in brain tumor imaging, for its added value in glioma grading and tumor differentiation. However, compared to supratentorial tumors (ST), there are only few data about its reliability and its cut-off values for infratentorial tumors (IT). Thus, the aims of our study were:1-to assess the accuracy of DSC perfusion in the evaluation of IT, for glioma grading and tumor differentiation2- to evaluate differences and similarities with ST.

METHOD AND MATERIALS

This retrospective study included 114 patients (3-85 years) with a pathologically proven diagnosis of brain tumor (40 IT, 70 ST), divided in 4 groups: high grade glioma (HGG), low grade glioma (LGG), metastases (MET), primary central nervous system lymphoma (PCNSL). rCBV, mean and min PSR were calculated. For statistical analysis lesions were divided according to the location and histology. Mann-Whitney U test was used to test the differences; accuracy, sensitivity, specificity, PPV and NPV for rCBV and PSR were calculated from ROC curves.

RESULTS

For IT, rCBV had high accuracy in differentiating HGG from LGG ($p<0.001$) and PSR (mean and min) resulted significantly higher in PCNSL and HGG compared to MET ($p<0.001$), showing a good accuracy (AUC>0,9). Comparing IT with ST, some perfusion parameters resulted similar: high rCBV in HGG, high mean PSR in PCNSL, low mean PSR in MET. Main differences between ST and IT were: the optimum threshold value of rCBV (3.05 for ST, 1.89 for IT), the mean PSR significantly higher in LGG than in HGG in ST ($p=0.001$) and a trend of higher perfusion values in ST. Exchanging of rCBV threshold values between ST and IT decreased both sensitivity and specificity.

CONCLUSION

rCBV and PSR are helpful in grading and differentiating IT. The overall behaviour of perfusion parameters was similar between ST and IT, but some differences in rCBV and PSR were demonstrated. The difference of rCBV threshold value between ST and IT -to distinguishing HGG from LGG- might be of high clinical relevance, and in our opinion deserves consideration.

CLINICAL RELEVANCE/APPLICATION

Our study suggests that different rCBV cut-off values should be applied in IT. In fact, our results demonstrated a different optimum threshold value of rCBV for IT (1.89) compared to ST (3.05).

SSJ23

Physics (MRI II-New Development)

Tuesday, Dec. 1 3:00PM - 4:00PM Location: S404AB

MR PH

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
R. Jason Stafford, PhD, Houston, TX (*Moderator*) Nothing to Disclose
Ho-Ling Liu, PhD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SSJ23-01 Accelerated Real-Time Cardiac MRI Using Iterative SENSE Reconstruction: Comparing Performance in Sinus Rhythm and Atrial Fibrillation

Tuesday, Dec. 1 3:00PM - 3:10PM Location: S404AB

Participants
Bradley D. Allen, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Maria Carr, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Varun Chowdhary, MD, BS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Michael Zenge, PhD, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG
Michaela Schmidt, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG
Mariappan S. Nadar, PhD, Princeton, NJ (*Abstract Co-Author*) Employee, Siemens AG
Bruce Spottiswoode, Chicago, IL (*Abstract Co-Author*) Employee, Siemens AG
Jeremy D. Collins, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
James C. Carr, MD, Chicago, IL (*Abstract Co-Author*) Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA

PURPOSE

To compare accelerated real-time CMR using sparse sampling in space and time and non-linear iterative SENSE reconstruction (RT IS SENSE) with standard real-time CMR (RT) and standard segmented CMR (SEG) in a cohort of patients in persistent atrial fibrillation (AF), sinus rhythm, and healthy volunteers.

METHOD AND MATERIALS

A total of n=27 patients were included: 11 patients with AF (age: 67 ± 8 years), 10 patients in sinus rhythm (age 64 ± 12 years), and 6 healthy volunteers (age: 38 ± 11 years). CMR was performed at 1.5T (MAGNETOM Aera and Avanto, Siemens, Germany). Short axis 2D bSSFP cine images covering the left ventricle with 10 mm interslice gaps were acquired with the SEG (GRAPPA accel factor 2, TR 42msec, 1.8x1.8x6 mm3), RT (GRAPPA accel factor 3, TR 62msec, 3.0x3.0x9x7 mm3), and RT IS SENSE (accel factor 9.9-12, TR 42msec, 2.0x2.0x7mm3). Quantitative left ventricular (LV) functional analysis was performed. A reviewer blinded to acquisition type scored images for overall image quality and artifact using a 5-point Likert scale. All findings were compared using a repeated measures ANOVA with Bonferonni post-hoc correction for the entire cohort and AF and sinus subgroups.

RESULTS

In the combined cohort, RT IS SENSE image quality was superior to RT (4.4±0.8 vs. 3.7±0.5, p = 0.01), with a trend toward superiority relative to SEG (3.9±1.2, p = 0.10). There was no difference in artifact between RT IS SENSE (4.4±07) and RT (4.9±0.3,p = 0.18) or SEG (3.9±1.4, p = 0.16). In the sinus subgroup, RT IS SENSE image quality was higher than RT (4.9±0.3 vs 3.5±0.5, p = 0.001) and trended higher than SEG (4.3±1.1, p = 0.10). In the AF subgroup, RT IS SENSE image quality was superior to SEG (4.7±0.5 vs. 3.0±1.1, p <0.001) and trended toward superiority relative to RT (3.9±0.3, p = 0.09). There was reduced artifact in RT IS SENSE compared to SEG (4.4 ±0.7 vs. 3.0±1.2, p = 0.002). For the complete cohort and in subgroups, there was no significant difference between LV ejection fraction (p = 0.66) or cardiac volumes between any of the acquisitions.

CONCLUSION

Highly accelerated real-time CMR using sparse sampling with iterative SENSE reconstruction results in improved image quality and reduced artifact, especially in patients with persistent AF.

CLINICAL RELEVANCE/APPLICATION

Real-time CMR using sparse sampling and iterative SENSE reconstruction provides high image quality and improved temporal/spatial resolution relative to standard real-time CMR.

SSJ23-02 Fast Field-Cycling MRI: Demonstration of New Technology for T1-Dispersion Contrast

Tuesday, Dec. 1 3:10PM - 3:20PM Location: S404AB

Participants
David Lurie, Aberdeen, United Kingdom (*Presenter*) Nothing to Disclose
Lionel M. Broche, PhD, Aberdeen, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Gareth R. Davies, MSc, DPhil, Aberdeen, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Nicholas R. Payne, BSC, Aberdeen, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Peter J. Ross, BSC,MSc, Aberdeen, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Vasileios Zampetoulas, BSC,MSc, Aberdeen, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We have designed and constructed two prototype human-scale scanners which use Fast Field-Cycling (FFC) to measure the

variation of tissues' spin-lattice relaxation time (T1) as a function of magnetic field strength ("T1-dispersion"), in the range 0.001 T to 0.1 T. T1-dispersion is shown to be sensitive to disease state.

METHOD AND MATERIALS

In an FFC-MRI scanner the magnetic field B0 is switched between three levels during the scan. Initially B0 is set at a high level in order to polarize the spins. It is then switched to a low value for a time of the order of T1, so that the spins evolve. B0 is then switched back to a high value, gradients are applied and NMR signals detected. By repeating the pulse sequence at different "evolution" B0 values, T1-dispersion can be measured and employed as a contrast generator. Detection always occurs at the same field, so no retuning of radiofrequency coils is needed.The FFC-MRI scanner used was designed and constructed in-house, using commercially-available and home-built modules. The whole-body magnet uses a double coaxial design, in which the polarization and detection B0 fields are generated by a Halbach-ring permanent magnet (59 mT). This field is opposed by an inner "offset" resistive magnet in order to generate the lower, evolution B0 values. The evolution field is controlled by changing the current in the offset coil; switching between field levels can be done in ca. 30 ms.Measurements were made on healthy volunteers and on surgically-excised tissues from patients undergoing joint-replacement surgery (normal and osteoarthritic (OA) joints) and resection of breast and musculoskeletal tumours. Full ethical approval was granted, and patient consent was obtained.

RESULTS

Measurements on healthy volunteers show that good quality FFC-MRI images can be obtained. The figure shows inversion-recovery calculated-T1 FFC-MRI images of a volunteer's brain, at 49 mT and 59 mT evolution B0 values; total acquisition time was 28 min.T1-dispersion plots (T1 versus evolution B0) showed significant differences between normal and diseased tissues, in both OA and in cancer.

CONCLUSION

This work shows that FFC-MRI is a new imaging modality which can, for the first time, use T1-dispersion as an endogenous MR contrast mechanism which is invisible in conventional MR. Early results show sensitivity of T1-dispersion to disease state.

CLINICAL RELEVANCE/APPLICATION

Study shows relevance to osteoarthritis and cancer.

SSJ23-03 A Piecewise Model for Diffusion-weighted Imaging of Prostate at 1.5T

Tuesday, Dec. 1 3:20PM - 3:30PM Location: S404AB

Participants
Debo Zhi, BS, Hefei, China (*Presenter*) Nothing to Disclose
Nan He, Hefei, China (*Abstract Co-Author*) Nothing to Disclose
Fenfen Li, BS, Hefei, China (*Abstract Co-Author*) Nothing to Disclose
Bensheng Qiu, PhD, Hefei, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study was to investigate four diffusion-weighted imaging (DWI) models, including monoexponential diffusion model, biexponential diffusion model, statistical diffusion (SDM) model and diffusion kurtosis imaging (DKI) model, and to design a new piecewise model to precisely fit DWI signals of healthy prostate at 1.5 Tesla.

METHOD AND MATERIALS

DWI of prostate with multiple b-values ranging from 0 to 3000 s/mm² at 1.5 T was performed on 11 healthy young men. DWI signals were fitted into four diffusion models in the full range and three segments of b-values respectively. The fitness degrees of the four diffusion models in the full range and the three segments of b-values were calculated for comparison, and then a new piecewise model for prostate DWI with different b-values was proposed.

RESULTS

In the full range of b-values, the calculated fitness results showed that the diffusion kurtosis and statistical diffusion model were better fitting than the monoexponential diffusion model. The biexponential diffusion model was as good as the diffusion kurtosis and statistical models and was better fitting than the monoexponential diffusion model. In the three b-value segments, the results showed that the biexponential diffusion model was better than the kurtosis and statistical models with b-values smaller than 500 s/mm2 and larger than 1000 s/mm2, and the kurtosis and statistical model were better than the biexponential diffusion model with b-value ranging from 500 to 1000 s/mm².

CONCLUSION

The four mathematical models revealed different diffusion behaviors on the three b-value segments, and can be combined into a piecewise diffusion model that can fit DWI signals of prostate more precisely. This new model could potentially reveal more biological characteristic that would be helpful for the diagnosis of prostate diseases.

CLINICAL RELEVANCE/APPLICATION

A piecewise model was proposed to precisely fit DWI decay signals, and could be applied to the data analysis, attributing to improvement of sensitivity and accuracy of diagnosis of prostate cancer.

SSJ23-04 Reduction in Metal Susceptibilty Artifact from Hip Prostheses Using QISS with Fast Low Angle Shot Readout

Tuesday, Dec. 1 3:30PM - 3:40PM Location: S404AB

Participants
Ian Murphy, MBBCh, MRCS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Ioannis Koktzoglou, PhD, Evanston, IL (*Abstract Co-Author*) Research support, Siemens AG
Shivraman Giri, PhD, Chicago, IL (*Abstract Co-Author*) Employee, Siemens AG
Robert R. Edelman, MD, Evanston, IL (*Abstract Co-Author*) Research support, Siemens AG Royalties, Siemens AG

Marcos P. Botelho, MD, Chicago, IL (*Presenter*) Nothing to Disclose

PURPOSE

Quiescent-interval single-shot (QISS) magnetic resonance angiography (MRA) has been shown to be an accurate non-contrast technique for the evaluation of peripheral arterial disease (PAD). QISS MRA applies RF pulses to suppress background and venous signal and then relies on the quiescent interval to allow refreshment of arterial spins. The standard QISS technique uses a bSSFP readout. Unfortunately, the bSSFP readout is highly sensitive to off-resonance effects, which is problematic when QISS is used to evaluate elderly patients with PAD who also have prostheses, such as the one for hip or knee. In these patients, QISS MRA may be severely degraded in the vicinity of the prosthesis. We hypothesized that QISS MRA using a fast low angle shot (FLASH) readout would reduce these artifacts and thereby improve the depiction of the arteries located near the prosthesis.

METHOD AND MATERIALS

The study was approved by the IRB and used written, informed consent. Imaging was performed on 1.5 Tesla system (MAGNETOM Avanto, Siemens AG, Erlangen, Germany). A standard body phantom with a femoral component hip prosthesis placed above the phantom was imaged to test the potential of QISS FLASH for reducing magnetic susceptibility artifact. No fat suppression was applied. Imaging was then carried out on patients with and without arterial disease.

RESULTS

A marked reduction was observed in the extent of the distortion caused by the metallic artifact using QISS with FLASH readout compared with bSSFP readout in 6 patients scanned at 1.5T (Figure 1). In two cases it allowed visualization of a vessel which was otherwise uninterpretable.

CONCLUSION

QISS using a high bandwidth FLASH readout reduces magnetic susceptibility artifact and improves image quality near metallic prostheses as compared with QISS using a bSSFP readout. Although the use of a high-bandwidth readout requires multiple signal averages to boost the signal-to-noise ratio, overall study time is only modestly increased since the FLASH readout is just needed for a limited region near the prosthesis.

CLINICAL RELEVANCE/APPLICATION

This new technique may allow non-contrast MRA evaluation of vessels and stenoses that would otherwise be obscured by artifact from hip prostheses and other metallic implants

SSJ23-05 Comparison of Different Mathematical Models of Diffusion-weighted Imaging of Normal Prostate at 1.5 T and 3.0 T

Tuesday, Dec. 1 3:40PM - 3:50PM Location: S404AB

Participants
Debo Zhi, BS, Hefei, China (*Presenter*) Nothing to Disclose
Yuping Chen, Hefei, China (*Abstract Co-Author*) Nothing to Disclose
Bensheng Qiu, PhD, Hefei, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To find out which diffusion-weighted imaging (DWI) model, including the monoexponential model, the biexponential model, the statistical diffusion model, the diffusion kurtosis model and the stretched-exponential model, can fit diffusion-weighted signals of healthy prostate precisely at 1.5T and 3.0T.

METHOD AND MATERIALS

Eighteen health subjects (ten subjects at 1.5T, eight subjects at 3.0T) were included in this study. DWI of prostate was performed with multiple b-values ranging from 0 to 2100s/mm^2. Region of interests (ROIs) were drawn on the transition zone of prostate guided by T2-weighted images. Five DWI models were fitted to diffusion-weighted decay signals using a nonlinear squares fitting algorithm of Levenberg-Marquardt. The degree of fitness and parameters of the five DWI models were calculated for comparison.

RESULTS

The fitting curves for prostate DWI signals of the five models showed that the diffusion-weighted signals at 3.0T decreased faster than that at 1.5T. The adjusted R-squares showed that compared with the monoexponential model, R-squares of the other four models were larger and the R-square of the biexponential model was the largest at both 1.5T and 3.0T. Parameters of the five models showed that the parameters at 3.0T were bigger than those at 1.5T, except the parameters of statistical diffusion model and diffusion kurtosis model.

CONCLUSION

Our study demonstrated the biexponential model, the statistical diffusion model, the diffusion kurtosis model and the stretched-exponential model fitted better than the monoexponential model and the biexponential model showed best fitness for the diffusion-weighted signals of healthy prostate at extended b-values at both 1.5T and 3.0T. The parameters of the other four models except for the monoexponential model maybe reveal more biological characteristic.

CLINICAL RELEVANCE/APPLICATION

Through the comparison of the five DWI models at 1.5T and 3.0T, we can find out which model fit the diffusion-weighted signals better and provide more parameters for diagnosis of prostate diseases.

SSJ23-06 Increasing SNR in MRI with Multi-Tesla Pre-polarization Pulses

Tuesday, Dec. 1 3:50PM - 4:00PM Location: S404AB

Participants
Aleksandar Nacev, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
Ryan Hilaman, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose

Irving N. Weinberg, MD, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Pavel Y. Stepanov, MS, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Jose M. Benlloch Baviera, Valencia, Spain (*Abstract Co-Author*) Stockholder, ONCOVISION
Stanley Fricke, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Lamar O. Mair, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Juan P. Rigla, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Improving signal-to-noise ratio (SNR) for MRI systems has traditionally been accomplished by increasing the static magnetic field, which increases the magnitude of the magnetization vector. Safety and manufacturing considerations limit the possibilities of constructing clinical MRI systems with very high static fields. An alternative approach to increasing SNR would be to apply a polarizing magnetic pulse prior to the application of a short imaging pulse sequence. Altering magnetic polarization prior to the application of an MR imaging pulse sequence with a pulsed electromagnet has long been used in earth-field (e.g., F Melton and VL Pollak, Rev Sci Instrum 1971) and field-cycling experiments (DJ Lurie et al , Mag Res. Imag. 2005). In those prior studies, the applied polarization field has either been low (e.g., been on the order of 50mT for earth field MRI) or has subtracted field strength from the main static field (in the case of field-cycling). In either prior case, the pre-poalrization pulse would not lead to significant increases in SNR when added to a clinical MRI system. Alternatively, pulsed-power techniques with desktop-sized modules have attained high magnetic field magnitudes (e.g., 26T, see GS Nusinovich et al , J Infrared Milli Terahz Waves 2011), and therefore might be well suited for the development of compact clinical MRI high-performance systems that employed rapid magnetic pre-polarization.

METHOD AND MATERIALS

A cooled copper coil (energized by three car batteries) was switched with insulated-gate bipolar transistor crowbar circuitry (Eagle Harbor Technologies, Seattle WA) in order to yield 1,000 amps for several seconds, attaining transient fields of up to 4 T with adiabatic decay, followed by a spin-echo pulse sequence generated with a Radioprocessor-G system (SpinCore, Gainesville FL) in an 0.34-T static magnetic field.

RESULTS

SNR increased in expected concordance with the Bloch equation (r=0.95) with strength and duration of the pre-polarizing pulses.

CONCLUSION

Pre-polarized pulsed power techniques applied to low-static-field systems could yield SNR values comparable to high-field MRI devices, with low cost and physical foot-print.

CLINICAL RELEVANCE/APPLICATION

Cost-effective compact high-performance organ-specific MR systems (e.g., prostate, breast, brain) could be implemented with the addition of multi-Tesla pre-polarizing pulsed-power modules.

MSES34

Essentials of Cardiac Imaging

Tuesday, Dec. 1 3:30PM - 5:00PM Location: S100AB

CA CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

MSES34A CMR Basics - Patterns of Enhancement

Participants
Nikhil Goyal, MD, Staten Island, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the basic components of a post contrast Cardiac MRI (CMRI) examination. 2) Understand the concept of myocardial nulling and its role in delayed enhancement CMRI. 3) Learn the patterns of delayed enhancement associated with ischemic and nonischemic cardiac disease.

MSES34B Congenital Anomalies of the Coronary Arteries with Pathologic Correlation

Participants
Seth J. Kligerman, MD, Denver, CO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize various congenital anomalies of the coronary arteries on cross-sectional imaging. 2) Learn which anomalies are benign and which can lead to adverse cardiac events. 3) Understand how anomalies in the origin, course, and termination of the coronary arteries can lead to a abnormal perfusion of the myocardium.

MSES34C Cardiac CT and MRI: Seeing the Unseen

Participants
Musturay Karcaaltincaba, MD, Ankara, Turkey, (musturayk@gmail.com) (*Presenter*) Speaker, General Electric Company; Speaker, Koninklijke Philips NV

LEARNING OBJECTIVES

1) To describe the cardiac CT and MRI findings that can not be seen or characterized by echocardiography and catheter angiography. 2) To depict imaging features of mild atherosclerosis, napkin ring sign, bypass grafts, interatrial septal and myocardial pathologies. 3) To elucidate our understanding of cardiac pathologies (such as fibrosis, iron overload and amyloidosis) than can be diagnosed without biopsy.

RC404

Muscle-Tendon-Entheseal Unit: Form, Function, and Dysfunction with Emphasis on MR

Tuesday, Dec. 1 4:30PM - 6:00PM Location: E451B

MK MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Donald L. Resnick, MD, San Diego, CA (*Director*) Nothing to Disclose
Donald L. Resnick, MD, San Diego, CA (*Presenter*) Nothing to Disclose
Mini N. Pathria, MD, San Diego, CA (*Presenter*) Nothing to Disclose
Christine B. Chung, MD, San Diego, CA (*Presenter*) Nothing to Disclose
Brady K. Huang, MD, San Diego, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how variations in the macroscopic architecture of muscle relate to its physiological function, affect its risk of injury, and determine the pathoanatomy and imaging appearance following muscle strain. 2) Understand anatomy and histology of tendon, its normal and abnormal imaging appearances, and common patterns of tendon pathology based on anatomic location. 3) Review the anatomy of the tendon-entheseal unit with emphasis on the types of lesion that affect the region of the footprint, with emphasis on MR imaging.

RC405

Preoperative Brain Tumor Imaging

Tuesday, Dec. 1 4:30PM - 6:00PM Location: N227

NR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jay J. Pillai, MD, Baltimore, MD (*Moderator*) Medical Advisory Board, Prism Clinical Imaging, Inc; Author with royalties, Springer Science+Business Media Deutschland GmbH; Author with royalties, Reed Elsevier
Haris I. Sair, MD, Baltimore, MD (*Moderator*) Research support, Carestream Health, Inc

LEARNING OBJECTIVES

1) To understand, based on anatomic considerations, how to localize lesions along the brain surface. 2) To become familiar with DTI techniques, their limitations and their applications to neurosurgical planning. 3) To understand the value of BOLD fMRI in presurgical mapping of brain functional systems and appreciate the types of paradigms that are in clinical use.

ABSTRACT

State-of-the-art preoperative brain tumor imaging will be described from the standpoint of neurosurgical planning. The lectures included in this course will cover gyral and other anatomic considerations for lesion localization, as well as the role that both diffusion tensor imaging (DTI) and blood oxygen level dependent (BOLD) functional MRI (fMRI) play in the delineation of eloquent cortex and white matter tracts. The importance of both DTI and BOLD fMRI in the accurate assessment of brain functional networks will be stressed in the context of presurgical mapping. The value, as well as limitations, of each of these approaches will be discussed.

Sub-Events

RC405A Localization of Lesions Along the Brain Surface

Participants
Thomas P. Naidich, MD, New York, NY (*Presenter*) Nothing to Disclose

RC405B Preoperative Diffusion Tensor Imaging: Toward Improving Neurosurgical Outcomes

Participants
John L. Ulmer, MD, Milwaukee, WI, (julmer@mcw.edu) (*Presenter*) Stockholder, Prism Clinical Imaging, Inc Medical Advisory Board, General Electric Company

LEARNING OBJECTIVES

1) To become familiar with DTI technique, visualization strategies, and limitations, as well as to identify strategies for defining spatial relationshps between lesion borders and functional brain networks in order to guide Neurosurgical decision making.

ABSTRACT

Presurgical mapping has revolutionized the neurosurgical care of brain tumor patients. Maximizing resections more safely can improve the accuracy diagnosis, optimized treatment algorithms, and most importantly, decrease the incidence of devasting postoperative deficits associated with injury to functional brain networks. Presurgical mapping in tumor and epilepsy patients is clearly a multi-parameter process, but diffusion tensor imaging (DTI) has had the most significant impact in reducing postoperative neurological complications and warrants focus. At the same time, the technique is among the available, easy to acquire, and easily translatable to clinical practice. By understanding the DTI technique, data visualization methods, effects of pathological processes, and technical limitations, and combining the DTI data with expertise in functional white matter anatomy, physicians can create patient-specific neurosurgical plans that define spatial relationships between lesion borders and functional brain networks. This, in turn, can impact surgical decision making, guide intraoperative assessments, and improve post-operative outcomes. Through case illustrations, this presentation provides strategies to translate DTI and fiber tracking, with all of their limitations, to clinical presurgical brain mapping. The presentation emphasizes the emerging and powerful clinical application of pre-surgical DTI.

RC405C Identification of Eloquent Cortex Using BOLD FMRI

Participants
Jay J. Pillai, MD, Baltimore, MD (*Presenter*) Medical Advisory Board, Prism Clinical Imaging, Inc; Author with royalties, Springer Science+Business Media Deutschland GmbH; Author with royalties, Reed Elsevier

LEARNING OBJECTIVES

1) Understand the value of Blood Oxygen Level Dependent functional magnetic resonance imaging (BOLD fMRI) in presurgical mapping in patients with resectable brain lesions. 2) Describe the functional systems that can be reliably activated using BOLD fMRI in the clinical setting. 3) Appreciate the types of BOLD fMRI paradigms that are typically utilized for presurgical mapping.

ABSTRACT

This lecture will provide a basic overview of Blood Oxygen Level Dependent functional magnetic resonance imaging (BOLD fMRI) and how it can be used to effectively map eloquent cortex in various functional systems. Specifically, applications of BOLD fMRI to sensorimotor mapping, vision mapping as well as mapping of the language network will be described. The value that clinical BOLD fMRI has added to current state-of-the-art presurgical planning will be emphasized. In particular, the specific value that BOLD fMRI can add to standard structural brain MRI in the setting of resectable brain lesions such as brain tumors that distort classical

functional anatomic landmarks will be discussed.

RC412

Advanced Vascular Imaging Techniques and Applications

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S504AB

VA CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC412A Cardiovascular 3D Printing

Participants
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Presenter*) Research Grant, Toshiba Corporation;

LEARNING OBJECTIVES

1) To understand the difference between 3D visualization and 3D printing as related to cardiovascular diagnoses. 2) To review the different 3D printing technologies that have impacted and will impact cardiovascular care. 3) To review the clinical impact of current 3D modelling in both cardiovascular diagnoses and intervention.

ABSTRACT

While advanced visualization in cardiovascular imaging is instrumental for diagnoses and communication with referring clinicians, there is an unmet need to render DICOM images as 3D printed models capable of providing both tactile feedback and tangible depth information of both anatomic and pathologic states. 3D printed models are being rapidly embraced in cardiovascular diagnoses. The purpose of this this lecture is to review and summarize the numerous studies to date that support such benefits from cardiovascular 3D printing, as it is expected that the number of 3D printed models generated from DICOM images for planning intervention and fabricating implants will grow exponentially. 3D printing has closed the gap on the unmet need for true 3D visualization in cardiovascular surgical planning. Source image data is primarily contrast-enhanced MRI and CT. Various approaches have been used to develop a hollow STL model, including segmenting the blood pool and printing vessels with a high-resolution technology to achieve a smooth lumen. Growing data supports the use of models to capture complex anatomy including congenital heart disease requiring surgery. Applications have included acquired cardiac abnormalities such as ventricular aneurysms and cardiac tumors. Models have been useful to plan high-risk valve cases and for intra-operative navigation. Electrocardiographic (ECG) gated CT studies for Trans-catheter Aortic Valve Replacement (TAVR) planning enable 3D printed models of the aortic annulus and surrounding structures for potentially safer valve deployment. Incorporation of patient-specific elasticity of the normal versus calcified aorta will likely be an important area of future research. Models of the aorta and other smaller vessels, including the coronary arteries, enable studies of blood flow dynamics that otherwise would not be possible in vivo.

RC412B Renal MRA and Functional MRI

Participants
Ulrike I. Attenberger, MD, Mannheim, Germany (*Presenter*) Research Consultant, Bayer AG

LEARNING OBJECTIVES

1) To describe the technical pre-requisites for successful contrast and non-contrast-enhanced renal MRA (i.e. signal-to-noise-ratio, scan time, spatial resolution, voxel size). 2) To review contrast-agent dose optimization strategies. 3) To understand the basics of functional renal MR imaging techniques and to illustrate their potential implications on patient care.

RC412C Functional CTA in Athletes

Participants
Richard L. Hallett II, MD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify anatomic and functional lesions that predispose to vascular entrapment and fibrotic syndromes in athletes. 2) Describe methods to assess vascular entrapment and fibrotic syndromes in athletes using dynamic, functionally challenged CTA and MRA. 3) Describe the imaging findings for diagnosis and follow-up of affected athletes.

ABSTRACT

While exercise is a mainstay in preventing and treating atherosclerotic peripheral vascular disease, some vascular disorders manifest primarily in athletes. Both recreational and competitive athletes are at risk for development of non-atherosclerotic vascular diseases. These disease entities range from iliac endofibrosis in cyclists, popliteal entrapment syndrome in running sports, and thoracic inlet / outlet syndromes in "overhead" athletes. Recently, computed tomography angiography (CTA) and magnetic resonance angiography (MRA) have become valuable diagnostic options for many vascular diseases that can occur in the athlete. Optimum imaging in these disorders requires the ability to tailor the exam protocol to the specific disease entity and vascular territory in question. By combining rapid CT image acquisition with functional, physiologic provocative maneuvers, diagnostic information can be maximized. Newer blood-pool MR contrast agents also allow functional assessment without ionizing radiation exposure.This session will review the pathophysiology, risk factors, diagnosis, and classification of vascular diseases seen in the athlete. Logical protocol development utilizing (when necessary) provocative maneuvers will be reviewed. Interpretation strategies for interacting with these resulting large, dynamic datasets will also be reviewed.

Active Handout:Richard Lee Hallett

http://abstract.rsna.org/uploads/2015/15003230/ACTIVE RC412C.pdf

RC412D Aortic Imaging - Beyond Diameters

Participants
Michael D. Hope, MD, San Francisco, CA, (michael.hope@ucsf.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Explain why imaging approaches beyond assessment of vessel diameter are needed for improved risk stratitifcation of aortic disease. 2) List potential aortic imaging targets for improved evaluation of disease progression. 3) Appraise the merits of advanced aortic imaging techniques including the use of MRI and PET for the evaluation of aortic hemodynamics and vessel wall inflammation.

RC415

Breast MR Imaging (An Interactive Session)

Tuesday, Dec. 1 4:30PM - 6:00PM Location: E450A

BR MR SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC415A Image Quality and Interpretation

Participants
Debra M. Ikeda, MD, Stanford, CA (*Presenter*) Consultant, F. Hoffmann-La Roche Ltd; Consultant, Bracco Group

LEARNING OBJECTIVES

1) To review standard MRI acquisition parameters recommended by ACR Breast MRI BI-RADS. 2) To review MRI Interpretation according to ACR Breast MRI BIRADS terminology.

RC415B MR BI-RADS 3

Participants
Debra L. Monticciolo, MD, Temple, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the current literature for BIRADS 3 in the MR setting. 2) To understand interpretations for which BIRADS 3 would or would not be appropriate.

ABSTRACT

Discussion will include the current literature on use of BIRADS 3, with attention to the MR setting. Cases where BIRADS 3 would be considered as well as cases not appropriate for BIRADS3 at MR will be shown.

RC415C Challenging Cases

Participants
Sujata V. Ghate, MD, Durham, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify challenging cases on breast MRI. 2) Recognize MR imaging findings of unusual breast lesions. 3) Review do's and don't of the breast MRI report. 4) Recommend appropriate management for difficult or esoteric lesions seen on MRI.

ABSTRACT

This lecture will review challenging cases on breast MRI. Participants will learn to identify MR imaging features of common breast diseases, recognize unusual and esoteric lesions, understand the importance of a clear and concise MRI report, and manage difficult cases seen on breast MRI. A total of 12 cases will be reviewed and imaging findings and appropriate management for each case will be discussed. At the conclusion of the case conference, audience participants will have the opportunity to ask questions and discuss unusual cases.

RC417

Emerging Breast Imaging Strategies

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S505AB

BR DM MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Catherine J. Moran, PhD, Stanford, CA (*Moderator*) Research support, General Electric Company

Sub-Events

RC417A Diffuse Optical Spectroscopy of Breast Cancer

Participants
David R. Busch, PhD, Philadelphia, PA, (drbusch@sdf.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe light transport through tissue. 2) Describe the current applications of diffuse optics in medicine and technological limitations. 3) Summarize applications of diffuse optics to breast cancer, including cutting edge work and implications for future clinical applications.

ABSTRACT

Diffuse optics utilizes near-infrared light to probe tissue without ionizing radiation. These tools permit rapid and pain-free assessment of endogenous cancer signatures, including oxygenated and deoxygenated hemoglobin, lipid, and water concentrations. Relatively inexpensive instrumentation can monitor the progress of neoadjuvant chemotherapy in a clinic, rather than an imaging suite, using convinient hand-held probes, even in radiologically dense breasts. Very recently, similar optical monitoring tools have been developed to measure microvascular blood flow. More elaborate diffuse optical imaging systems construct three dimensional tomograms of multiple tissue constituants, permitting multi-parameter computer aided detection and localization of tumors.In addition to endogenous chromophores, these optical measurements are exquisitly sensitive to contrast agents, holding significant promise for imaging of highly specific contrast agents at pico- or femto-molar concentrations. Diffuse optical instrumentation can readily be combined with other imaging techinques. These multi-modality data sets provide the opportunity to combine the advantageous aspects of both techniques. We will discuss recent advances in optical monitoring, imaging, and combinations with other modalities.

URL

www.sas.upenn.edu/~drbusch/rsnaHandout-DiffuseOptics-Breast.pdf

RC417B Contrast Enhanced Mammography and Tomosynthesis

Participants
John M. Lewin, MD, Denver, CO (*Presenter*) Consultant, Hologic, Inc; Research Grant, Hologic, Inc; Consultant, Novian Health Inc

LEARNING OBJECTIVES

1) To discuss the indications and utility of contrast-enhanced mammography (CEM) and contrast-enhanced tomosynthesis (CET). 2) To understand the feasibility, limitations, and technical issues of CEM / CET. 3) To compare the utility of CEM and CET against non-contrast techniques and discuss future directions.

Active Handout:John Morton Lewin

http://abstract.rsna.org/uploads/2015/13029341/RC417B.pdf

Active Handout:John Morton Lewin

http://abstract.rsna.org/uploads/2015/13029341/Active RC417B.pdf

RC417C High Resolution Dynamic Contrast Enhanced Breast MRI

Participants
Catherine J. Moran, PhD, Stanford, CA (*Presenter*) Research support, General Electric Company

LEARNING OBJECTIVES

1) Be able to select appropriate spatial and temporal resolution parameters to run a dynamic contrast-enhanced (DCE) breast MRI sequence. 2) Explain to colleagues the difference between temporal resolution and temporal footprint for fast DCE scans. 3) List 3 different approaches to fat suppression, and be able to set up a scan protocol using at least one of these on the learner's scanner.

ABSTRACT

This talk will provide an overview of high-resolution breast MRI techniques. Initially, MRI concepts including parameter tradeoffs, contrast mechanisms, and parallel imaging will be reviewed. Fat suppression techniques are essential for high-quality breast MRI, and include further tradeoffs. Finally, techniques for high spatiotemporal resolution sampling to resolve rapid contrast kinetics while also offering sharp images will be described.

URL

RC429

Hepatocellular Carcinoma in the Cirrhotic Liver and LI-RADS (An Interactive Session)

Tuesday, Dec. 1 4:30PM - 6:00PM Location: S402AB

GI MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC429A LI-RADS Overview, Current Status, and Future Directions

Participants
Cynthia S. Santillan, MD, San Diego, CA, (csantillan@mail.ucsd.edu) (*Presenter*) Consultant, Robarts Clinical Trials Research Group

LEARNING OBJECTIVES

1) To teach participants how to apply the Liver Imaging Reporting and Data System (LI-RADS) to their interpretation of imaging studies for the evaluation of hepatocellular carcinoma in at-risk patients. 2) To inform radiologists about the various online resources available via the ACR LI-RADS website, including an atlas, lexicon, reporting templates, and flashcards. 3) To update radiologists about future content in LI-RADS, including ultrasound and treatment response assessment guidelines.

ABSTRACT

RC429B LI-RADS Imaging Features: What´s the Evidence?

Participants
An Tang, MD, Montreal, QC (*Presenter*) Speaker, Boehringer Ingelheim GmbH; Speaker, Siemens AG, ; Advisory Board, Imagia

LEARNING OBJECTIVES

1) To review the major and ancillary CT and MRI features used in LI-RADS categorization for assessment of hepatocellular carcinoma (HCC). 2) To highlight the scientific literature supporting the major imaging features and criteria. 3) To summarize the evidence supporting ancillary features.

ABSTRACT

The Liver Imaging Reporting and Data System (LI-RADS) relies on major and ancillary CT and MRI features to categorize observations for assessment of hepatocellular carcinoma (HCC). The major features include arterial phase enhancement, diameter, "washout" appearance, "capsule" appearance and threshold growth. In this course, we will discuss the scientific literature supporting the major imaging features. This will include estimates of diagnostic performance, and intra- and inter-reader agreement. LI-RADS also includes ancillary imaging features that modify the likelihood of HCC. We will provide a brief overview of the evidence supporting these ancillary features.

RC429C LI-RADS and Hepatobiliary Agents

Participants
Kathryn J. Fowler, MD, Chesterfield, MO (*Presenter*) Research support, Bracco Group

LEARNING OBJECTIVES

1) To provide an overview of LI-RADS content that refers to hepatobiliary contrast agents. 2) To review the ancillary features that are described with hepatobiliary contrast agents. 3) To present case examples to illustrate the role of hepatobiliary contrast agents in the diagnosis of hepatocellular carcinoma.

ABSTRACT

Hepatobiliary contrast agents are routinely used in practice for diagnosing and staging HCC. Despite the potential diagnostic benefits, the role of hepatobiliary phase imaging has not been well defined in diagnostic algorithms. LI-RADS provides information on the use of these agents, their role in diagnosis, and potential pitfalls. The aim of this presentation is to provide an overview of hepatobiliary content included in the current version of LI-RADS.

RC429D LI-RADS LR-5 versus LR-M

Participants
Thomas A. Hope, MD, San Francisco, CA, (thomas.hope@ucsf.edu) (*Presenter*) Advisory Committee, Guerbet SA; Research Grant, General Electric Company

LEARNING OBJECTIVES

1) Understand the LR-M categorization and its role in LI-RADS. 2) Review imaging features that suggest LR-M. 3) Apply LI-RADS categorizations in cases of LR-5 and LR-M.

ABSTRACT

In at patients at risk for hepatocellular carcinoma (HCC), the diagnosis of malignancies other than HCC can be difficult. LI-RADS provides a categorization (LR-M), which should be used to indicate lesions that may represent malignancies other than HCC. In this

course, we will review the LI-RADS categorization LR-M and its relationship to LR-5. We will discuss findings that suggest LR-M and provide case examples where the diagnosis of LR-M and LR-5 should be made. We will also discuss how a LR-M categorization may affect clinical decision making.

MSES41

Essentials of Genitourinary Imaging

Wednesday, Dec. 2 8:30AM - 10:00AM Location: S100AB

GU MR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

MSES41A Catching Ovarian Cancer

Participants
Elizabeth A. Sadowski, MD, Madison, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the types of ovarian epithelial neoplasm seen on imaging. 2) Assess the risk of ovarian cancer based on imaging appearance of an adnexal lesion and clinical information. 3) Emphasize the role of MRI in further evaluation of adnexal lesions.

ABSTRACT

There is a spectrum of ovarian epithelial neoplasms ranging from benign to malignant. Current theories regarding the precursor lesions are debated; however, the pathway from benign epithelial neoplasm to low grade carcinoma follows an indolent course and is distinctly different from the aggressive evolution of high grade carcinoma. An understanding of the pathogenesis of low grade versus high grade ovarian epithelial neoplasms can be helpful to radiologists, when they are faced with an adnexal lesion. Identifying the imaging features suggestive of benign, intermediate and worrisome lesions can triage adnexal lesions into follow up versus treatment. The purpose of this presentation is to review the imaging features of benign, indeterminate and worrisome adnexal lesions and to discuss the appropriate follow up in each case.

MSES41B US and MRI: Imaging of Chronic Pelvic Pain in Women

Participants
Mostafa Atri, MD, Toronto, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review MRI and US features of adenomyosis and their correlation with pathology. 2) To discuss staging and US and MRI features of endometriosis and their role in the management of this condition. 3) To familiarize imagers with US features of diverticulosis/diverticulitis and how to differentiate it from colitis.

ABSTRACT

Chronic pelvic pain constitutes 10-40% of gynecology visits at a total cost of 39 billion dollars/year in USA. The most common etiologies are gynecological with GI, urology and MSK conditions being the other causes. During this presentation, imaging features of adenomyosis, endometriosis, pelvic congestion, and US features of diverticulosis/diverticulitis are reviewed. Both adenomyosis and endometriosis are common conditions affecting women. They are frequently seen as an incidental finding that can be accurately evaluated by MRI and US in symptomatic patients. There is close correlation between pathology and imaging features of adenomyosis. The main role of imaging in the evaluation of endometriosis is in the staging of the disease to plan for surgery. US features of uncomplicated diverticulitis are discussed. Transvaginal US can accurately diagnose diverticulosis/diverticulitis that should be sought for in women undergoing US to evaluate for chronic pelvic pain.

Handout:Mostafa Atri

http://abstract.rsna.org/uploads/2015/15001868/IMAGING CHRONIC PELVIC PAIN FINAL RSNA 2015 FINAL.pdf

MSES41C Imaging of the Bladder and Ureters

Participants
Manjiri K. Dighe, MD, Seattle, WA (*Presenter*) Research Grant, General Electric Company

LEARNING OBJECTIVES

1) Review embryology and discuss congenital anomalies of the bladder and ureter. 2) Classify and discuss imaging appearance of ureteric and bladder disease. 3) To discuss the protocols and imaging appearance of bladder and ureteric pathology on various modalities. 4) Review the staging of bladder and ureteric malignancies. 5) Discuss the imaging appearance of various stages of bladder and ureteric cancer. 6) Illustrate the newer techniques for imaging of bladder and ureter.

ABSTRACT

The ureter is an extra-peritoneal structure surrounded by fat.; The ureter is divided into three portions: the proximal ureter (upper) is the segment that extends from the ureteropelvic junction to the area where the ureter crosses the sacroiliac joint, the middle ureter courses over the bony pelvis and iliac vessels, and the pelvic or distal ureter (lower) extends from the iliac vessels to the bladder. It is a dynamic organ and not a simple conduit through which urine flows. Benign and malignant lesions can affect the ureter and these maybe due to contiguous involvement from the kidney or bladder. The ureter can be imaged by a variety of modalities including computed tomography (CT), magnetic resonance imaging (MR), direct pyelography (DP) both antegrade (AP) and retrograde (RP), nuclear medicine diuretic scan and voiding cystourethrography (VCUG). Benign lesions like endometriosis,

Ureteritis, Ureteritis cystica can affect the ureter as well. Transitional cell carcinoma in the ureter is usually diagnosed on imaging. Bladder carcinoma is the fourth most common cancer in men and women. Knowledge of imaging options and appearance is necessary for both radiologists and urologists. Transitional cell carcinoma (TCC) is the most common bladder neoplasm with squamous cell and adenocarcinoma found in less than 10% of cases.; Benign lesions are uncommon but some can be suggested by their imaging appearance. Cystoscopy allows tissue diagnosis and treatment of superficial lesions. Although magnetic resonance imaging (MRI) and computed tomography (CT) both have limitations in detailing depth of muscle invasion, both have a prominent role helping to define the lesion and in staging. This presentation illustrates the role of MR and CT in evaluating bladder and ureter with a discussion of the newer techniques of MR Diffusion Weighted Imaging (DWI) and virtual cystoscopy by CT or MR.

RC503

Adult Structural and Congenital Heart Disease (An Interactive Session)

Wednesday, Dec. 2 8:30AM - 10:00AM Location: S103AB

CA CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants

ABSTRACT

Sub-Events

RC503A Systematic Approach to CT Interpretation in Congenital Heart Disease

Participants
Suhny Abbara, MD, Dallas, TX (*Presenter*) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG

LEARNING OBJECTIVES

1) To understand the systematic segmental approach to congenital heart disease. 2) To recognize the CT specific imaging findings that relate to each step in the segmental approach to congenital heart disease.

ABSTRACT

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Suhny Abbara, MD - 2014 Honored Educator

RC503B Tailoring CT Scan Acquisitions to Specific Indications

Participants
Brian B. Ghoshhajra, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the different indications for cardiac CT, including calcium scoring, coronary CT angiography, electrophysiology procedural planning, structural heart disease interventions (including TAVR), congenital heart disease, myocardial evaluation, and mass workup. 2) To review the differences between various available equipment, and how available equipment might affect a given protocol. 3) To review basic protocols for each of the above exam types, and review specific features of each exam type. 4) To review the advantages and disadvantages of individualized settings within each of the above protocols.

Active Handout:Brian Burns Ghoshhajra

http://abstract.rsna.org/uploads/2015/14000914/RC503B Tailoring CT Scan Acquisitions to Specific Indications - Ghoshhajra Handout.pdf

RC503C Imaging of Cardiac Shunts

Participants
Harold I. Litt, MD, PhD, Philadelphia, PA (*Presenter*) Research Grant, Siemens AG ; Research Grant, Heartflow, Inc;

LEARNING OBJECTIVES

1) Describe MR imaging methods for detection and quantification of intra and extracardiac shunts. 2) Describe CT imaging methods for detection and quantification of intra and extracardiac shunts. 3) Plan an optimized protocol for CT or MR imaging of shunts.

RC503D Role of MRI in Adult CHD Management

Participants
Mini V. Pakkal, MBBS, FRCR, Toronto, ON, (mini.pakkal@uhn.ca) (*Presenter*) Nothing to Disclose

Active Handout:Mini Vithal Pakkal

http://abstract.rsna.org/uploads/2015/14000924/RC503D RSNA final2015.pdf

RC504

Musculoskeletal Series: Current Trends in Musculoskeletal Imaging

Wednesday, Dec. 2 8:30AM - 12:00PM Location: E451B

MK MR

ARRT Category A+ Credits: 4.00
AMA PRA Category 1 Credits ™: 3.25

FDA Discussions may include off-label uses.

Participants
Mark D. Murphey, MD, Reston, VA, (MMurphey@acr.org) (*Moderator*) Nothing to Disclose
Christine B. Chung, MD, San Diego, CA (*Moderator*) Nothing to Disclose

Sub-Events

RC504-01 Imaging Diagnosis of Atypical Infection

Wednesday, Dec. 2 8:30AM - 8:55AM Location: E451B

Participants
Mark D. Murphey, MD, Reston, VA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the typical imaging features suggesting atypical musculoskeletal infection. 2) Understand the pathological basis for the imaging patterns of atypical musculoskeletal infection. 3) Detect imaging features that allow differentiation of atypical musculoskeletal infection from neoplastic lesions and virulent infection.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Mark D. Murphey, MD - 2015 Honored Educator

RC504-02 MRI of Total Knee Arthroplasty: Synovial Patterns Predictive of Disease

Wednesday, Dec. 2 8:55AM - 9:05AM Location: E451B

Participants
Angela E. Li, MBBS, MMed, New York, NY (*Presenter*) Nothing to Disclose
Darryl B. Sneag, MD, Chestnut Hill, MA (*Abstract Co-Author*) Nothing to Disclose
Harry G. Greditzer IV, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Christine C. Johnson, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Kara Fields, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Douglas E. Padgett, MD, New York, NY (*Abstract Co-Author*) Consultant, Stryker Corporation;
Theodore T. Miller, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hollis G. Potter, MD, New York, NY (*Abstract Co-Author*) Research support, General Electric Company

PURPOSE

To determine the sensitivity and specificity of various synovial appearances on MRI in patients with a painful total knee arthroplasty (TKA).

METHOD AND MATERIALS

With IRB approval, 101 consecutive patients who had knee MRI within 1 year prior to revision TKA were identified from our hospital registry of retrieved TKA implants. All MR scans were performed on a 1.5T magnet. Axial, coronal and sagittal PD, sagittal inversion recovery and MAVRIC PD MR images were retrospectively reviewed blinded to the ultimate diagnoses and the cases were categorized by the appearance of the synovium as one of the following: bulky hypertrophied synovium (suggestive of particle induced synovitis), lamellated and hyperintense (suggestive of infection), globally thickened and contracted (suggestive of arthrofibrosis), and mildly thickened with a homogenous effusion (suggestive of non-specific synovitis). The MR appearances were then compared with operative reports, microbiology, and pathology reports.

RESULTS

Bulky hypertrophied synovium had 69% sensitivity, 89% specificity and 94% PPV for particle induced synovitis with implant particles seen at histopathology, and 98 % sensitivity, 78% specificity and 75% PPV for an operative diagnosis of aseptic loosening, severe polyethylene wear, or osteolysis. Lamellated synovitis had 85% sensitivity, 99% specificity and 94% PPV for infection. A contracted and globally thickened synovium had 75% sensitivity, 98% specificity and 60% PPV for arthrofibrosis. A mildly thickened synovial appearance had 63% sensitivity, 93% specificity, and 79% PPV for stiffness, instability, and nonspecific pain as the reason for revision TKA.

CONCLUSION

In patients with a painful TKA, MRI appearance of the synovium can be used to differentiate between cases of particle induced wear, infection, arthrofibrosis and non-specific synovitis.

CLINICAL RELEVANCE/APPLICATION

MRI is predictive of various synovial pathologic conditions in TKA and may be valuable in the diagnostic workup of patients with a painful TKA.

RC504-03 The Value of Simultaneous 18F-FDG-PET/MRI for the Detection of Spondylodiscitis: A Feasibility Study

Wednesday, Dec. 2 9:05AM - 9:15AM Location: E451B

Participants
Benjamin Friedrich, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Jeanette Fahnert, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Sandra Purz, MD, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Jens Gulow, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas K. Kahn, MD, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Henryk Barthel, Leipzig, Germany (*Abstract Co-Author*) Consultant, Siemens AG Consultant, The Piramal Group Travel support, Siemens AG Travel support, The Piramal Group Speaker, Siemens AG Speaker, The Piramal Group
Osama Sabri, MD, Leipzig, Germany (*Abstract Co-Author*) Research Consultant, The Piramal Group; Research Consultant, Siemens AG;
Patrick Stumpp, MD, Leipzig, Germany (*Presenter*) Nothing to Disclose

PURPOSE

The diagnosis of infectious spondylodiscitis is often challenging. Alterations seen in MRI are quite sensitive, but lack specificity and the distinction from osteochondrosis is often difficult. The aim of the present study was to assess the diagnostic value of simultaneous 18F-FDG-PET/MRI in cases of suspected spondylodiscitis.

METHOD AND MATERIALS

In a prospective study 25 patients with suspected spondylodiscitis were enrolled. All patients underwent a simultaneous whole spine simultaneous 18F-FDG-PET/MRI scan including standard MRI sequences with-/-out contrast. Image datasets were evaluated by two radiological residents with 1-5 years experience and one board certified nuclear medicine physician independently and finally in consensus. For all suspected spinal discs as well as a healthy disc SUVmean and SUVmax were determined. The diagnostic certainty of MRI data was evaluated on a five-point Likert Scale. The consensus decision was dichotomized into spondylodiscitis - no spondylodiscitis.

RESULTS

The inter-rater agreement between the two radiologists in regard of the MRI scans was moderate with a weighted κ=0.67 and an absolute diagnostic certainty in just 10%. With addition of the PET data, the agreement between the radiologists rose to κ=0.95 and an absolute diagnostic certainty in 50%. In one case the diagnosis changed due to the additional PET data. The final histological analysis was in all cases identical with the imaging diagnosis. There was a strong correlation between the SUVmax ratio of healthy/sick disc and the 5-point MRI rating with a R2=0.52; $p<0.001$. In a ROC analysis a SUVmax ratio of 2.89 had a 100% specificity and sensitivity with an AUC of 1 for the correct diagnosis. Neither level of CRP nor leukocyte count could show a significant correlation to the spondylodiscitis diagnosis.

CONCLUSION

Simultaneous 18F-FDG-PET/MRI for the detection of Spondylodiscitis seems to be feasable and is increasing the diagnostic certainty in an often challenging imaging diagnosis.

CLINICAL RELEVANCE/APPLICATION

18F-FDG-PET/MRI can be safely used for the detection of Spondylodiscitis.

RC504-04 Assessing the Effect of Football Play on Knee Articular Cartilage Using Delayed Gadolinium-Enhanced MRI of Cartilage (dGEMRIC)

Wednesday, Dec. 2 9:15AM - 9:25AM Location: E451B

Participants
Wenbo Wei, Columbus, OH (*Presenter*) Nothing to Disclose
Becky Lathrop, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Guang Jia, PhD, Baton Rouge, LA (*Abstract Co-Author*) Nothing to Disclose
David Flanigan, MD, Columbus, OH (*Abstract Co-Author*) Consultant, Vericel; Consultant, Smith & Nephew plc
Ajit M. Chaudhari, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Alan Rogers, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Jason E. Payne, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Articular cartilage injuries are very common among NFL players. In retired NFL players, early onset of OA was found to be three times higher than the general population. Delayed gadolinium-enhanced MRI of cartilage (dGEMRIC) has been shown to quantify regional variations of glycosaminoglycan (GAG) concentrations within the cartilage. The goal of this pilot study is to determine the cumulative effects of multiple years of play on cartilage microarchitecture assessed by GAG concentration variation using dGEMRIC.

METHOD AND MATERIALS

The MR images of both of each athlete's knee joints were acquired using an 8-channel knee coil at a 3T system (Achieva, Philips). dGEMRIC was performed at pre- and post-contrast injection periods using a set of five fast field echo pulse sequences with multiple flip angles (4, 8, 12, 16, 20 degrees). Sagittal slices were obtained with the imaging parameters as TR/TE = 6.3/3.2 ms, resolution = 0.37 x 0.37 mm^2, slice thickness = 4 mm, NSA = 2. The contrast agent Magnevist was injected intravenously at a standard dose of 0.2 mmol/kg body weight. To help the contrast efficiently diffuse into the cartilage, subjects were instructed to perform joint movement for 100 minutes. The total procedure time was around 3.5 hours.

RESULTS

Except the MTP of the right knee at the pre-season, subjects with more years of football play retained relatively higher volume of contrast at all cartilage compartments in both pre- and post-season. At the pre-season and post-season, one year collegiate football players presented pre-season with 0.116 mM and initial post session with 0.117 mM average contrast concentration. In players with more years of experience, the measurements were elevated to 0.139 mM and 0.140 mM, respectively, both with a 20% increase. The p-value generated from student t-test did not present any significant difference at the pre-season which is probably due to the limited sample size.

CONCLUSION

In conclusion, playing collegiate football for a longer period of time may lead to microstructural alterations, like GAG concentration changes within the knee cartilage. The decreased GAG concentration may be indicative of a higher risk factor for articular cartilage degradation and potential development of OA.

CLINICAL RELEVANCE/APPLICATION

dGEMRIC can be a quantitative imaging technique to identify micro-architectural changes in cartilage health that are not observed with standard cartilage MR sequences.

RC504-05 Use of Combined Dynamic and Quantitative MRI to Investigate the Influence of Cartilage Contact on Cartilage Morphology, Composition, and Ultra-Structure

Wednesday, Dec. 2 9:25AM - 9:35AM Location: E451B

Participants
Jarred Kaiser, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Fang Liu, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Darryl Thelen, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Richard Kijowski, MD, Madison, WI (*Presenter*) Nothing to Disclose

PURPOSE

To investigate the relationship between cartilage contact and cartilage morphology, composition, and ultra-structure using combined dynamic and quantitative MRI.

METHOD AND MATERIALS

Four young asymptomatic volunteers underwent combined dynamic and static MRI on a 3.0T scanner. Dynamic SPGR images were continuously acquired while the subjects actively flexed and extended their knee at 0.5 Hz for 5 minutes in a custom-made loading device. Static 3D-FSE and mcDESPOT bi-component T2 mapping sequences were also performed. Reconstructed kinematics were used to compute tibia contact maps which were defined as the maximum depth of penetration of the tibia cartilage mesh into the femoral cartilage mesh through the flexion-extension cycle. 3D-FSE was used to create tibia cartilage thickness maps, while mcDESPOT was used to create tibia cartilage single-component T2 relaxation time (T2) maps and cartilage fast relaxing water fraction (FF) maps, the latter of which is thought to represent water bound to proteoglycan. The maps were sub-divided into 10 equal-sized regions of interest (ROI) on the medial and lateral tibia. ROI-based Pearson correlation analysis was performed between cartilage contact and cartilage quantitative MRI parameters.

RESULTS

Cartilage contact was greater on the medial tibia than the lateral tibia for all subjects with larger areas of positive penetration of the tibia cartilage mesh into the femoral cartilage mesh and greater maximum depth of penetration. Higher FF values were also noted in the medial tibia in all subjects, while no visible differences in the cartilage thickness and cartilage T2 maps between the medial and lateral tibia could be identified. The degree of cartilage contact was positively correlated with cartilage thickness ($r=0.341$, $p=0.001$) and cartilage FF ($r=0.417$, $p<0.001$) and negatively correlated with cartilage T2 ($r=-0.211$, $p=0.04$).

CONCLUSION

Cartilage is a tissue well-adapted to withstand higher compressive forces with areas exposed to greater contact being thicker and having lower T2 (likely reflecting a thicker radial zone comprised of perpendicularly oriented collagen fibers) and higher FF (likely reflecting greater proteoglycan content).

CLINICAL RELEVANCE/APPLICATION

Combined dynamic and quantitative MRI may be useful for investigating how biomechanical factors within the knee joint influence normal cartilage physiology and cartilage degeneration in patients with osteoarthritis.

RC504-06 Functional Cartilage Imaging in Clinical Practice

Wednesday, Dec. 2 9:35AM - 10:00AM Location: E451B

Participants
Christine B. Chung, MD, San Diego, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Emphasize the biochemical composition of articular cartilage and its relationship to intrinsic MR property. 2) Describe the normal morphologic and quantitative MR signature of articular cartilage on various pulse sequences. 3) Describe MR and clinical cartilage grading systems. 4) Identify indications and appropriate MR protocols for cartilage evaluation, including primary chondral/ osteochondral evaluation versus cartilage evaluation as a surrogate for meniscal function.

RC504-07 Osteochondral Injuries

Wednesday, Dec. 2 10:10AM - 10:30AM Location: E451B

Participants

Carol L. Andrews, MD, Pittsburgh, PA (*Presenter*) Author, Reed Elsevier; Author, Informa PLC

LEARNING OBJECTIVES

1) Describe the findings of imaging of acute bone injury including radiography and MRI. 2) Recognize the bone and marrow changes see on MRI in osteopenia and hyperemia. 3) Identify the imaging findings of osteonecrosis. 4) Accurately describe the entity typically referred to as "osteochondral lesion".

RC504-08 Grade 1 Cartilage Lesions in the Knee are Precursors of More Severe Cartilage Damage - Data from the Osteoarthritis Initiative

Wednesday, Dec. 2 10:30AM - 10:40AM Location: E451B

Participants
Benedikt J. Schwaiger, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Alexandra S. Gersing, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
John Mbapte Wamba, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Michael C. Nevitt, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Charles E. McCulloch, San Francisco, CA (*Abstract Co-Author*) Instructor, F. Hoffmann-La Roche Ltd Expert Witness, Mallinckrodt plc Consultant, Mallinckrodt plc
Thomas M. Link, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Research funded, General Electric Company; Research funded, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

PURPOSE

The significance of MR cartilage signal abnormalities with or without cartilage swelling (grade 1 lesions) is not well understood and previous reports in the literature are inconclusive. Purpose of our study was therefore to assess the natural evolution of different types of grade 1 cartilage lesions (G1CL) in subjects without radiographic evidence of knee osteoarthritis (OA) over 48 months in comparison to matched controls without lesions.

METHOD AND MATERIALS

Subjects from the Osteoarthritis Initiative (n=59; age 56.6±8.3; 56% women) with G1CL diagnosed on 3T MRIs of the right knee but without focal defects of cartilage and without radiographic evidence of OA (KL scores 0-1) were frequency matched for age, sex, baseline KL and BMI with 52 controls without any cartilage lesion (age 54.8±6.5; 58% women). Individual G1CL (n=76) on intermediate-weighted fast spine echo sequences were categorized into 4 subgrades: A=hypointense, B=inhomogeneous, C=hyperintense, D=hyperintense with swelling. After 48 months progression of cartilage and subchondral bone marrow changes was assessed. Fisher's exact test was used for group and subgrade comparisons.

RESULTS

At baseline G1CL were detected significantly more frequently in the patellofemoral than in the tibiofemoral joint (48 vs. 28, P=0.022), and subgrades A or B were more frequent than C or D (n=65 vs. 11, P<0.001). Across compartments, G1CL progressed in 48-67% to focal cartilage lesions, while only 2-6% of controls showed incidental focal lesions (patella: 48 vs. 6%, P<0.001; trochlea: 52 vs. 2%, P<0.001; medial femur: 67 vs. 2%, P<0.001; lateral femur: 50 vs. 2%, P=0.011; medial tibia: 50 vs. 2%, P<0.001; lateral tibia: 47 vs. 6%, P<0.001). No significant differences in progression were found between G1CL subgrades (P>0.05). Incidental bone marrow abnormalities were associated with G1CL lesions in the patella (39 vs. 2% in the controls, P<0.001), trochlea (36 vs. 2%, P<0.001) and lateral tibia (47 vs. 2%, P<0.001).

CONCLUSION

G1CL are precursors of more severe structural cartilage abnormalities. Reporting these signal abnormalities is therefore crucial to identify patients at risk for progressive cartilage degeneration and may impact patient management.

CLINICAL RELEVANCE/APPLICATION

Grade 1 cartilage lesions often progress to more severe cartilage degeneration, and diagnosis therefore may have an impact on patient management, including life style changes and cartilage repair.

RC504-09 MR Bone Morphometry Predicts Biomechanical Property

Wednesday, Dec. 2 10:40AM - 10:50AM Location: E451B

Participants
Betty Tran, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Sheronda Statum, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Reni Biswas, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Kyu-Sung Kwack, MD, PhD, Suwon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Robert Healey, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Won C. Bae, PhD, San Diego, CA (*Presenter*) Nothing to Disclose
Christine B. Chung, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Subchondral trabecular bone is often involved during knee injury and joint degeneration. MR evaluation of articular cartilage, as well as subchondral bone, would be useful clinically. Purpose of this study was to determine if MR morphometric measures of subchondral trabecular bone correlates with shear biomechanical failure.

METHOD AND MATERIALS

Nine 8.5-mm diameter osteochondral cores were harvested (Fig.A) from tibial plateau of cadaveric donors (age range 60 to 86 years old) and imaged at 3T (Fig.C) using 3D spoiled gradient echo without fat suppression at 200 micron isotropic resolution. Cores were cut axially, while recording force and displacement to determine shear energy (Fig.B). MR data was cropped to 1-mm thickness near each cut location, region of interest was selected to exclude artifacts, and standard bone morphometric analysis was performed (Fig C). Total of 19 cut locations were analyzed.

RESULTS

From MR data, 3D structure of trabeculae could be discerned (Fig.C). Many of morphometric measures, including bone volume fraction, trabecular thickness, and structure model index, correlated significantly with biomechanical shear energy (Fig.D), suggesting that higher density, thicker, and plate-like properties of the trabeculae correlated with higher shear energy needed to cut through the sample.

CONCLUSION

High resolution MRI is a useful modality not only for soft tissue evaluation, but also for quantitative evaluation of trabecular bone, which may serve as a surrogate for bone strength.

CLINICAL RELEVANCE/APPLICATION

This study has implications for evaluation of human bone structure using non-ionizing MRI modality, with applications for conditions such as subchondral bone insufficiency fracture.

RC504-10 The Role of Mechanical Stress on the Vascularization of Subchondral Bone in the Femoral Head: A DCE-MRI Study

Wednesday, Dec. 2 10:50AM - 11:00AM Location: E451B

Participants
Jean-Francois Budzik, MD,PhD, Lille, France (*Presenter*) Nothing to Disclose
Guillaume Lefebvre, MD, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Helene Behal, Lille, France (*Abstract Co-Author*) Nothing to Disclose
Sebastien Verclytte, MD, Marcq en Baroeul, France (*Abstract Co-Author*) Nothing to Disclose
Pierre Hardouin, Boulogne-Sur-Mer, France (*Abstract Co-Author*) Nothing to Disclose
Anne Cotten, MD, Lille, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the normal perfusion pattern of subchondral bone in the femoral head with Dynamic Contrast Enhanced (DCE)-MRI and to study the influence of mechanical stress.

METHOD AND MATERIALS

This prospective study was approved by our Institutional Review Board. Informed Consent was obtained. DCE-MRI of the right hip was performed in sixty adults (32 women, 28 men) between April and September 2014. Mean age was 37.5 (±12.5). Regions of interest (ROI) were deposed in the center and in subchondral areas of the femoral head. Semi-quantitative and pharmacokinetic parameters were calculated. Perfusion parameters were compared between ROIs using a linear mixed model. Associations of each perfusion parameter with age, sex, body mass index (BMI) were studied using analysis of covariance models; age and sex were systematically introduced into models.

RESULTS

Semi-quantitative and pharmacokinetic parameters were different between the center of the femoral head and supero-lateral, antero-superior and posterior subchondral zones ($p \leq 0.028$). Parameters in the inferior zone differed from those of the supero-lateral and antero-superior zones ($p \leq 0.029$).BMI was negatively correlated with Time To Peak in all zones ($p \leq 0.041$). BMI was positively correlated with Ktrans and Ve values in all zones except the inferior ($p \leq 0.035$). Ve values were inferior in women in every zone ($p \leq 0.039$).Ktrans and Ve values were negatively correlated with age in posterior and inferior zones ($p \leq 0.039$).

CONCLUSION

This study demonstrates that the perfusion of subchondral bone is not homogeneous within the femoral head. Our results suggest that mechanical stress influences the microvascular properties of subchondral bone marrow.

CLINICAL RELEVANCE/APPLICATION

The proposed role of mechanical stress on the microvascularization of subchondral bone offers new opportunities in osteoarthritis research.

RC504-11 Metatarsophalangeal Joint Instability

Wednesday, Dec. 2 11:00AM - 11:25AM Location: E451B

Participants
Hilary R. Umans, MD, Ardsley, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

Overview of lesser metatarsophalangeal joint (MPJ) plantar plate (PP) and capsular degeneration and tear and discuss how it relates to MPJ instability Lesser MPJ Anatomy Symptoms / Exam MPJ region pain Sub-metatarsal Tenderness, esp plantar lateral base toe proximal phalanx Webspace Toe deformity Deviation, esp tibial +/- splaying 2nd-3rd toes Hyperextension at MPJ Etiology of PP and Capsular ligament degeneration + tear Chronic stress >> common than acute trauma Hyperextension + Axial loading high heels Crowding narrow toebox HAV + 2nd metatarsal (MT) protrusion Synovitis stretches MPJ capsule, leading to laxity and MPJ instability degeneration at the phalangeal insertion of the MPJ PP Traumatic tear less common PP tear pattern esp 2nd toe MPJ esp lateral insertion Frequent assoc'd tear of the lateral capsule Clinical grading MPJ instability Vertical stress test Digital Purchase Paper pull-out test Toe deformity Deviation, splaying, hyperextension Natural history: worsening deformity and dysfunction Imaging MRI Without vs with IV gadolinium Bright T2 signal defect at insertion +/- enhancement Enhancing defect +/- corresponding bright T2 signal defect Normal midline Hi Signal zone up to 2.5 mm Elongation = pathologic US Tear = hypoechoic defect at insertion Normal midline hypoechoic zone = 2.5mm Widens with degeneration + tear MRI vs US MRI Static exam Global Overview Can evaluate the capsule More easily DDx b/t pericapsular reactive soft tissue thickening (fibrosis +/or edema) + web space neuroma US Dynamic exam Assess focal tenderness + MPJ instability Technically challenging / learning curve Image incrementally from medial - lateral insertion DDx pericapsular fibrosis from webspace neuroma US Pitfalls Mostly anisotropy due to non-parallel imaging Can mistake midline hypoechoic zone for tear Limitations Sensitive, Not specific Difficult to differentiate degeneration vs tear MPJ capsule

cannot be evaluated Tx Options Conservative measures Taping Padding Rest NSAIDs Avoid steroid injection near the plantar plate insertion Surgery 2 approved surgical devices / approaches for repair of the PP via a doral incision Mini-Scorpion Device Incorporates Weil osteotomy with Plantar Plate repair Limited favorable outcomes Hat-trick System No osteotomy Unilateral or Bilateral Recently approved

ABSTRACT

Active Handout:Hilary Ruth Umans

http://abstract.rsna.org/uploads/2015/15001725/RC504-11.pdf

RC504-12 Chronic Wrist Symptoms in Correlation with Abnormal Scapholunate Joint Kinematics in Four-Dimensional CT Examinations: Initial Clinical Experience

Wednesday, Dec. 2 11:25AM - 11:35AM Location: E451B

Participants
Nima Hafezi Nejad, MD, MPH, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
John N. Morelli, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Uma Thakur, MD, Watchung, NJ (*Abstract Co-Author*) Nothing to Disclose
Scott D. Lifchez, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Kenneth R. Means JR, MD, Baltimore, MD (*Abstract Co-Author*) Speakers Bureau, Auxilium Pharmaceuticals, Inc Faculty, Integra LifeSciences Holdings Corporation
Jaimie Shores, MD, Baltimore, MD (*Abstract Co-Author*) Consultant, AxoGen, Inc Stockholder, MDConnectME
Shadpour Demehri, MD, Baltimore, MD (*Presenter*) Research support, General Electric Company; Researcher, Carestream Health, Inc; Consultant, Toshiba Corporation

PURPOSE

Using Four Dimensional CT scan (4D-CT) we aimed at showing abnormal kinematics of Scapholunate (SL) interval in symptomatic wrists with inconclusive radiographic findings, compared to 4D-CT examinations of asymptomatic contralateral wrists.

METHOD AND MATERIALS

This is an IRB approved, HIPPA complaint, retrospective study of wrist 4D-CT scans of patients who were referred for further evaluation of chronic wrist pain (> 3 months). In all, 12 symptomatic wrists (11 subjects) with chronic symptoms and inconclusive radiographs and 10 asymptomatic contralateral wrists were scanned using 4D-CT. SL interval was measured during three wrist motions: relaxed to clenched fist, flexion to extension, and radial to ulnar deviation. Change in SL interval measurements after each motion was recorded using double-oblique multiplanar reformation technique.

RESULTS

We extracted the normal limits of SL interval during active motion in symptomatic and asymptomatic wrists. While the SL interval is expected to be smaller than 1 mm in asymptomatic wrists (except for the clenched fist: 0.51 - 1.34 mm), symptomatic wrists present with SL interval of larger than 1 mm. In fact in clenched fists (2.53 ± 1.19 mm), or during extension (2.54 ± 1.48 mm) or ulnar deviation (2.06 ± 1.12 mm), average expected SL interval in symptomatic wrists is more than 2 mms. No change in SL interval measurements was detected during all the three wrist motions in asymptomatic contralateral wrists. In contrast, SL intervals increased while moving from relaxed to clenched (0.70; 0.24 - 1.16 mm; p= 0.01), from flexion to extension (1.04; 0.26 - 1.81 mm; p= 0.01) and from radial to ulnar deviation (0.48; - 0.03 - 1.00 mm; p= 0.06). There was a moderate correlation between SL interval change and presence/absence of symptoms (Spearman Rho: 0.45 - 0.65)

CONCLUSION

Compared to asymptomatic wrists, SL interval measurements significantly increase during active motion in symptomatic wrists with inconclusive plain radiographs using 4D-CT examination.

CLINICAL RELEVANCE/APPLICATION

4D CT of the wrist is suitable and clinically feasible to detect subtle motion abnormality suggestive of SLIL insufficiency in patients with chronic wrist pain.This study shows how SL motion abnormalities is associated with presence of symptoms. Moreover, it reports different SL interval limits that are expected in asymptomatic and symptomatic wrists.

RC504-13 Dynamic Ultrasound of Upper Extremity

Wednesday, Dec. 2 11:35AM - 12:00PM Location: E451B

Participants
Mary M. Chiavaras, MD, PhD, Ancaster, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

To understand indications, learn technique, and review associated anatomy for dynamic ultrasound imaging of the shoulder, elbow, wrist, and hand.

RC505

Neuroradiology Series: Brain Tumors

Wednesday, Dec. 2 8:30AM - 12:00PM Location: E451A

NR BQ MR

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.50

Participants
Rivka R. Colen, MD, Houston, TX, (rcolen@mdanderson.org) (*Moderator*) Nothing to Disclose
James G. Smirniotopoulos, MD, Bethesda, MD (*Moderator*) Nothing to Disclose

Sub-Events

RC505-01 Beyond Enhancement and Histology: Molecular Markers for Diagnosis

Wednesday, Dec. 2 8:30AM - 8:55AM Location: E451A

Participants
James G. Smirniotopoulos, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

Active Handout:James G. Smirniotopoulos

http://abstract.rsna.org/uploads/2015/15000013/RC505-01 Smirniotopoulos(1).pdf

RC505-03 Radiogenomics Defines Key Genomic Network Driving GBM Invasion

Wednesday, Dec. 2 9:05AM - 9:15AM Location: E451A

Participants
Rivka R. Colen, MD, Houston, TX (*Presenter*) Nothing to Disclose
Markus Luedi, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Sanjay K. Singh, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Islam S. Hassan, MBBCh, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Joy Gummin, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Erik P. Sulman, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Frederick F. Lang, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Pascal O. Zinn, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Clinical care and outcome in Glioblastoma (GBM) remains challenging due to the tumor's invasive grwoth. To establish personalized treatment options in GBM, discovery of genetic mechanisms essential for the tumor's invasion is needed. We have previously described radiogenomic approaches to diagnose gene networks non invasively by analyzing genomic data from TCGA. The purpose of the current reseach is to identify a genetic network that drives GBM invasion and can be targeted specifically.

METHOD AND MATERIALS

Using Kaplan-Meier statistics, the data of the two independent databases TCGA and REMBRANDT were used to validate the genetic netowork's impact on clinical outcome. The genes' staus was assessed in a panel of human glioma stem cells (GSCs) and conventional proneural, classical and mesenchymal GBM cell lines using RT-PCR. Differentiation potential (Tuj1+ve, S100A+ve, and GFAP+ve), self-renewal (limiting dilution assays), invasion (Boyden chamber) and proliferation (BrdU) were assessed. Gain (lentiviral vectors) and loss (SMARTchoice Inducible shRNA) of function experiments were performed. Orthotopic xenograft models (nude mice) were used to characterize the genes impact in vivo. Potential FDA approved therapeutics were identified using connectivity map.

RESULTS

Texture analysis based on radiogenomics significantly predicted the genes responsible for invasion of GBM in a non-invasive manner. Invasion in both, in vitro and in vivo was significantly decreased upun downregulation of this gene network. Transcriptome micro-array analysis showed that an upregulation of the described genes results in class switching from proneural to mesenchymal sub-types. Cmap derived therapeutics could significantly inhibit the gene network's activitiy and hence invasion.

CONCLUSION

The describend genes could be essential drivers of molecular subtypes and invasion in GBM. The therapeutics defined with cmap offer a targetted therapy to adress these key features of GBM pathogenesis. Noninvasive radiogenomics-based identification of tumor subgroups and potential treatment approaches can significantly contribute to personalized therapy.

CLINICAL RELEVANCE/APPLICATION

The described gene network seems to be key for GBM pathogenesis. Noninvasive, radiogenomics-based subgroup identification and specific novel treatment approaches can significanty contribution to personalized GBM therapy.

RC505-04 Radiogenomic Analysis of TCGA/TCIA Diffuse Lower Grade Gliomas by Molecular Subtype

Wednesday, Dec. 2 9:15AM - 9:25AM Location: E451A

Participants
Chad A. Holder, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Laila M. Poisson, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Lee Cooper, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

Erich Huang, PhD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
James Y. Chen, MD, San Diego, CA (*Abstract Co-Author*) Research Consultant, EBM Technologies, Inc Research Consultant, Banyan Biomarkers, Inc
Scott N. Hwang, MD, PhD, Memphis, TN (*Abstract Co-Author*) Nothing to Disclose
Sugoto Mukherjee, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Leo J. Wolansky, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Brent D. Griffith, MD, Detroit, MI (*Abstract Co-Author*) Nothing to Disclose
Kristen W. Yeom, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Michael Iv, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Max Wintermark, MD, Lausanne, Switzerland (*Abstract Co-Author*) Advisory Board, General Electric Company;
Rivka R. Colen, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Rajan Jain, MD, Northville, MI (*Abstract Co-Author*) Nothing to Disclose
Justin Kirby, Bethesda, MD (*Abstract Co-Author*) Stockholder, Myriad Genetics, Inc
John B. Freymann, BS, Rockville, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Rubin, MD, MS, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
C. Carl Jaffe, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Daniel J. Brat, MD, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Adam E. Flanders, MD, Penn Valley, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate relationships between imaging phenotype and genetic classification of LGGs in the TCGA/TCIA database, we analyzed semi-quantitative MR features and IDH/1p19q classifications.

METHOD AND MATERIALS

Pre-operative MRIs of 72 TCGA/TCIA LGGs were reviewed by 3 neuroradiologists blinded to molecular status, using the VASARI LGG feature-set (standardized set of 26 MRI features). Data were compiled across 3 readers to define a single measure per sample. Clinical and molecular classifications were obtained from the LGG-AWG marker paper (TCGA Research Network.NEJM;2015, in press). Associations with histology, WHO grade and molecular type were assessed by Fisher's exact test (categorical features) and ANOVA/t-test (continuous features).

RESULTS

Of 70 tumors with IDH/1p19q classification, 16 were IDHmut-codel, 34 were IDHmut-non-codel, and 19 were IDHwt. IDHmut-codel tumors were preferentially centered in the frontal lobes (75%, FET p=0.026). IDHmut-non-codel tumors tended to arise in frontal (41%) and temporal lobes (41%), while IDHwt tumors did not show preference. Nonenhancing tumor margins were more well-defined for IDHmut LGGs (56% and 76% were well-defined) than for IDHwt tumors (32%, FET p=0.027). 66% of LGGs had an enhancing region, but this was not associated with molecular class (FET p=0.286), although enhancement was more likely in grade III than grade II (FET, p=0.043). 23% of these grade II/III tumors had MRI evidence of necrosis, with presence equally likely in any of the 3 molecular classes (FET p=0.931); however, 5/16 (31%) of LGGs with necrosis on MRI were grade II. IDHwt tumors tended to be smaller than IDHmut tumors (23.0 cm2 vs 39.7cm2, respectively, for maximal area, t-test p<0.001). Further differences were found in T1/FLAIR ratio (FET p=0.030), T2/FLAIR signal crossing the midline (FET p=0.007), and presence of hemorrhage (FET p=0.009), cysts (FET p=0.006), or satellites (FET p=0.030).

CONCLUSION

Review showed differential MR features between LGG molecular classes. IDHwt LGGs had association with aggressive features (e.g., small dimension with poorly-defined non-contrast-enhanced borders). Lack of association with necrosis or presence of an enhancing region suggests that the IDHwt class is not simply underdiagnosed GBM. An investigation of imaging profiles that align with molecular type or define further subclasses is underway.

CLINICAL RELEVANCE/APPLICATION

Differential MR features exist between LGG molecular classes.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Daniel L. Rubin, MD, MS - 2012 Honored Educator
Daniel L. Rubin, MD, MS - 2013 Honored Educator

RC505-05 The Triple-Negative Low-Grade Glioma: MR Imaging Correlates of Aggressive Molecular Phenotype

Wednesday, Dec. 2 9:25AM - 9:35AM Location: E451A

Participants
Javier Villanueva Meyer, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Byung Se Choi, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Matthew Wood, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Tarik Tihan, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Soonmee Cha, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Low-grade gliomas (LGGs) are a heterogeneous group of tumors with distinct clinical behavior and prognosis. One strategy to improve their characterization is with molecular biomarkers: P53, IDH 1/2, and 1p19q. These objective markers correlate with histologic classification and clinical outcomes. Specifically, the absence of IDH1/2 mutation or 1p19q deletion have been identified as indicative of a poor prognosis. The purpose of our study was to determine MR imaging parameters that can discriminate a, recently-described, aggressive subtype of LGG that is characterized by an absence of all three of these genetic alterations.

METHOD AND MATERIALS

A retrospective review of our medical records from 2010 to 2014 yielded 105 cases of pathologically-confirmed LGG that had molecular testing for P53 mutation, IDH1/2 mutation, and 1p/19q deletion. The MR imaging characteristics including tumor location, volume, infiltration pattern, cortical involvement, hemorrhage, contrast-enhancement, and quantitative diffusion and perfusion were assessed. Additionally, clinical data of patient treatment, disease course, and survival was collected.

RESULTS

There were 24 diffuse astrocytomas (23%), 36 oligoastrocytomas (34%) and 45 oligodendrogliomas (43%). P53 mutation was found in 21 (20%), IDH1/2 mutation was found in 70 (67%), and 1p19q deletion was found in 45 (43%). Thirteen cases (12%) did not have any of these genetic alterations. Triple-negative tumors showed a lower incidence of cortical involvement ($p<0.05$) and lower mean and minimum apparent diffusion coefficient (ADC) values (1.25 vs 1.45x10^-3 mm^2/s; 0.89 vs 1.09x10^-3 mm^2/s, $p<0.01$). Multiple logistic regression analysis showed low ADC value as an independent predictor of triple-negative LGG. With a cut-off of 1.0x10^-3 mm^2/s, ADC value provides a 73% sensitivity and a 72% specificity with an odds ratio of 7.0 ($p<0.01$). In cases with available clinical follow-up, triple-negative LGGs were found to have disease progression within 2 years in 50% compared to 16% in the non-triple-negative cohort.

CONCLUSION

Triple-negative LGGs are a clinically and biologically aggressive phenotype that exhibit lower mean ADC values and lack of cortical involvement on MR imaging.

CLINICAL RELEVANCE/APPLICATION

MR imaging features can be used alongside molecular biomarkers to assess the aggressiveness and prognosis of LGGs and subsequently may provide a means of guiding management as patient-tailored therapy.

RC505-06 Do Macrocyclic Gadolinium Based Contrast Agents(GBCA) Deposit Gd in Normal Brain Tissue in Patients Receiving Contrast Enhanced MRI?

Wednesday, Dec. 2 9:35AM - 9:45AM Location: E451A

Participants
Nozomu Murata, MD, PhD, Seattle , WA (*Presenter*) Nothing to Disclose
Luis F Gonzalez-Cuyar, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Kiyoko Murata, MD,PhD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Corinne L. Fligner, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Russell Dills, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Kenneth R. Maravilla, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Based on T1 shortening on noncontrast MR, recent studies have suggested that small amounts of gadolinium(Gd) may accumulate in brain even in patients with normal renal function. Recently McDonald confirmed Gd deposition in postmortem human brain tissue. To date, studies have shown Gd brain deposition only with Group 1 linear agents. The purpose of this study was to determine whether Gd is deposited in brain among patients receiving more stable macrocyclic agents using postmortem tissue analysis with inductively coupled plasma mass spectrometry (ICP-MS).

METHOD AND MATERIALS

This study was approved by the IRB. Brain tissue was collected at autopsy from decedents with available medical records that document past history of MRIs with or without GBCA exposure. Decedents with no prior MRI or only nonGd MRI served as controls. Tissue samples were collected from white matter, putamen, globus pallidus, caudate nucleus, pons and dentate nucleus and analyzed for Gd using ICP-MS. Bone tissue from rib was also analyzed as a reference tissue in each case. Results were correlated with types of agent received, cumulative dose, time since dosing and clinical and laboratory data.

RESULTS

Among 21 cases obtained to date, 15 cases with normal renal function received 1 or more GBCA exposures and 6 cases had no exposure. ICP-MS showed measurable amounts of Gd deposition (range 0.003-3.54ng/mg) in all 15 cases receiving GBCA.A subset of these ,4 cases received only a macrocyclic GBCA(1 Gadavist ; 3 ProHance) with doses ranging from 10 to 126 ml and Gd was also detected in all macrocyclic cases (0.006-0.188 ng/mg). Gd in brain was detected after only a single dose and deposition was present among all brain regions sampled. Gd deposition in rib was also positive in all 15 cases and showed significantly higher levels than brain in each case. By comparison there was no detectable Gd in any control cases.

CONCLUSION

Gd deposition occurs in normal brain tissue in patients with normal renal function with a past history of GBCA exposure even in those receiving only macrocyclic agents. The clinical significance remains undetermined and we are pursuing further investigation.

CLINICAL RELEVANCE/APPLICATION

Gd deposition is present in normal brain tissue after only one dose even with macrocyclis agents. This important observation needs further investigation to determine potential toxic effects.

Handout:Nozomu Murata

http://abstract.rsna.org/uploads/2015/15004555/RSNA2015 RC505-06WF.pptx

RC505-07 Post-therapy Brain Tumors: Imaging Pitfalls and Strategy

Wednesday, Dec. 2 9:45AM - 10:10AM Location: E451A

Participants

Soonmee Cha, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss biologic and pathologic complexity of post-therapy brain tumors. 2) Present latest advances in imaging methods to differentiate recurrent tumor and treatment effect. 3) Review strengths and pitfalls of imaging post-therapy brain tumors. 4) Describe imaging strategy to improve diagnosis and management of patients with treated brain tumor.

RC505-08 Directions, Protons and Flows - Practical Advanced Brain Tumor Imaging

Wednesday, Dec. 2 10:30AM - 10:55AM Location: E451A

Participants
Jeffrey L. Sunshine, MD, PhD, Pepper Pike, OH (*Presenter*) Research support, Siemens AG Travel support, Siemens AG Travel support, Koninklijke Philips NV Travel support, Sectra AB Travel support, Allscripts Healthcare Solutions, Inc

RC505-10 A Multiparametric Voxel-level Model for Prediction of Cellularity in Glioblastoma

Wednesday, Dec. 2 11:05AM - 11:15AM Location: E451A

Participants
Peter Chang, MD, Bronx, NY (*Presenter*) Nothing to Disclose
Daniel S. Chow, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Timothy Ung, New York City, NY (*Abstract Co-Author*) Nothing to Disclose
Jennifer Soun, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Christopher G. Filippi, MD, Grand Isle, VT (*Abstract Co-Author*) Research Consultant, Regeneron Pharmaceuticals,Inc; Research Consultant, Syntactx
Angela Lignelli-Dipple, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Peter Canoll, New York City, NY (*Abstract Co-Author*) Nothing to Disclose
Lawrence H. Schwartz, MD, New York, NY (*Abstract Co-Author*) Committee member, Celgene Corporation; Committee member, Novartis AG; Committee member, ICON plc; Committee member, BioClinica, Inc

PURPOSE

To create a robust multiparametric model for prediction of cellular density in glioblastoma (GBM) using voxel-by-voxel analysis of T1W-postcontrast, FLAIR and ADC intensity values calibrated to biopsy-proven histopathologic data.

METHOD AND MATERIALS

As part of an IRB-approved protocol, MR-localized biopsies of GBM patients were obtained from both contrast-enhancing tumor (CE) and nonenhancing (nCE) peritumoral edema using Brainlab referenced to T1W-postcontrast images. Total cell counts were obtained after HandE slide preparation scanned at 400x magnification. FLAIR and ADC data were interpolated and coregistered to the reference T1W volume using affine transformation and a mutual information cost function.For each biopsy site, corresponding mean intensity was obtained on T1W-postcontrast, FLAIR and ADC sequences. Univariate linear regression was used to determine correlation between cell count and intensity for each MR sequence. Two multivariate linear regression models, one each for CE and nCE regions, were used to combine data from each MR sequence into a robust model for tumor cellularity.

RESULTS

A total of 58 biopsy sites were obtained. Overall, cellularity demonstrated moderate linear correlation with T1W-postcontrast ($r = 0.76$), FLAIR ($r = 0.62$) and ADC ($r = 0.64$, within nCE region only). Multiple linear regression combining all three variables yielded a model highly predictive of cellularity, both within the nCE ($r = 0.93$) and CE ($r = 0.76$) region. Within the nCE region, the model weighted ADC ($p = 0.0072$) and FLAIR ($p = 0.058$) more significantly than T1W ($p = 0.83$), as determined by analysis of variance (ANOVA). Within the CE region, T1W ($p < 0.001$) and FLAIR ($p = 0.12$) were weighted more significantly than ADC ($p = 0.21$).

CONCLUSION

A multiparametric model combining T1W-postcontrast, FLAIR and ADC values strongly predicts cell counts in GBM, notably with correlation >90% in the nCE region. By applying this model at each voxel within the tumor volume, a noninvasive map of cellular density can be generated.

CLINICAL RELEVANCE/APPLICATION

Cellularity maps of the peritumoral region in GBM localize tumor microinvasion and may be used as a tool to guide extended surgical resection or biopsy and to assess infiltrative tumor burden.

RC505-11 Receiver Operating Characteristic (ROC) and Logistic Fit Analysis for Detecting Brain Tumor Based on OEF Measurements Obtain by PET and MR

Wednesday, Dec. 2 11:15AM - 11:25AM Location: E451A

Participants
Parinaz Massoumzadeh, PhD, Saint Louis, MO (*Presenter*) Nothing to Disclose
Jonathan E. McConathy, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc
Andrei Vlassenko, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Yi Su, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Hongyu An, DSc, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Charles F. Hildebolt, DDS, PhD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Marcus, PhD, Saint Louis, MO (*Abstract Co-Author*) Owner, Radiologics, Inc
Keith M. Rich, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose
Tammie S. Benzinger, MD, PhD, Saint Louis, MO (*Abstract Co-Author*) Research Grant, Eli Lilly and Company; Investigator, Eli Lilly and Company; Investigator, F. Hoffmann-La Roche Ltd;

PURPOSE

Receiver operating characteristic (ROC) curve and logistic fit analysis for detecting brain tumors using cerebral oxygen extraction fraction (OEF) measurement obtained by [15]O positron emission tomography (PET) and oxygen sensitive magnetic resonance (MR) imaging.

METHOD AND MATERIALS

30 participants (20 with brain tumors) were recruited. MRI included standard clinical sequences plus OEF-MR1; a two-dimensional multi-echo gradient spin echo sequence. Concurrent with the MR acquisition, subjects with brain tumors underwent PET scanning, which included 2 sets of 3 scans with serial inhalation of air with 40-75 mCi [15]O labeled carbon monoxide , 40-75 mCi [15]O labeled oxygen , and injection of 25-50 mCi [15]O labeled water. MR and PET data were post-processed off line and registered to the anatomic T1 pre-and post-contrast images. Regions of interest were drawn based upon contrast-enhancing tumor areas, contra-lateral normal white matter (NWM), and normal gray matter (NGM) Ratios of OEF (rOEF) were obtained for lesions compared to normal tissue. Statistical analyses,including Bland-Altman plot, ROC, and logistic fit, were performed.

RESULTS

Bivariate analyses results are: between two rOEF-PET measurements of all selected regions R=0.92 and P <0.0001, and tumor type R=0.68 and p<0.0001; and similarly betweenr rOEF-MR and rOEF-PET all selected regions R=0.3 and P <0.0413, and tumor type R=0.39 and p<0.173. Based on Bland-Altman analysis both MR and PET methods of obtaining OEF are in agreement (the measurements lie within range ±1.96xSD). However, the coefficient obtain for rOEF-MR covers much larger range which may not not be clinically acceptable. Area under ROC curve (AUC) has much higher value for PET (0.95) than MR (0.58).

CONCLUSION

Both MR and [15]O PET can measure OEF in brain tumors and in peritumoral edema. Variable OEF measurements for tumor and edema may be implication for tumor grade and prognosis. BOLD MR fails in regions with signal loss on SWI or T2*. Area under ROC Curve (AUC) has much higher value for PET (0.95) than MR (0.58). Based on logistic fit probablity of distingusing tumor with PET is much higher than MR.

CLINICAL RELEVANCE/APPLICATION

Both MR and PET techniques have tremendous potential and may offer new insight into the underlying physiology of brain tumors and their response to therapy without requiring radiation or injected contrast. BOLD MR fails in regions with signal loss on SWI or T2*.

RC505-12 What Does the Black Box Tell us? Risk and Benefit of Ferumoxytol as an MRI Contrast Agent

Wednesday, Dec. 2 11:25AM - 11:35AM Location: E451A

Participants
Csanad G. Varallyay, MD, PhD, Portland, OR (*Presenter*) Nothing to Disclose
Rochelle Fu, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Joao Prola Netto, MD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose
Edward Neuwelt, MD, Portland, OR (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Ferumoxytol, an ultrasmall iron oxide nanoparticle (USPIO) has been marketed as Feraheme® for iron replacement therapy in patients with chronic kidney disease. Due to its magnetic properties, and long plasma half-life, ferumoxytol uniquely allows MR imaging of the intravascular space early after injection, which is beneficial for high-resolution blood volume mapping of brain lesions. Delayed (24h) ferumoxytol enhancement may help in differential diagnosis. As of March 30, 2015, the FDA added a boxed warning to Feraheme® package insert, which strengthens existing warnings regarding potential fatal and serious hypersensitivity reactions including anaphylaxis, even in patients who received Feraheme® previously. It emphasizes the importance of trained personnel, monitoring at least 30 min post injection to properly treat hypersensitivity reactions.

METHOD AND MATERIALS

Our institution has been actively doing imaging research with ferumoxytol for over 10 years. In this study we evaluated early adverse events (occurring within 1 day), potentially related to ferumoxytol administration hypersensitivity, and qualitatively compared it with published data.

RESULTS

At the time writing this abstract we have analyzed a total of 553 ferumoxytol infusions in 298 patients and have not recorded any severe (grade 3, 4 or 5) hypersensitivity reactions occurring within 1 day. Early grade 1 and 2 reactions, were present, such as nausea/vomiting (5.1%), hypertension (3.3%), pruritus (1.3%). In published data, the frequency of severe hypersensitivity of Feraheme® was equivalent to ionic iodinated contrast media, and about 10x higher than gadolinium MR contrast agents and nonionic iodinated contrast agents.

CONCLUSION

Our results suggest less frequent severe hypersensitivity reactions compared to published data, and it may be due to the difference in patient population. A detailed toxicity evaluation of our data is in progress. The intended purpose of change in labeling by the addition of the boxed warning is to strengthen the warnings in the label and to mitigate the risk of serious hypersensitivity reactions including anaphylaxis in order to enhance patient safety.

CLINICAL RELEVANCE/APPLICATION

Ferumoxytol remains safe for MRI in the vast majority of patients, with a very small risk of serious adverse event, and personnel should be prepared to treat such reactions if they were to occur.

RC505-13 Moving Towards Quantitative Brain Tumor Imaging

Wednesday, Dec. 2 11:35AM - 12:00PM Location: E451A

Participants

Thomas L. Chenevert, PhD, Ann Arbor, MI (*Presenter*) Consultant, Koninklijke Philips NV

RC507

Bladder, the Forgotten Organ: Role of CT, MRI, and PET in Diagnosis, Staging, and Surveillance of Cancer

Wednesday, Dec. 2 8:30AM - 10:00AM Location: N229

GU CT MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Stuart G. Silverman, MD, Brookline, MA, (sgsilverman@partners.org) (*Coordinator*) Author, Wolters Kluwer nv
Andrew B. Rosenkrantz, MD, New York, NY (*Presenter*) Nothing to Disclose
Homer A. Macapinlac, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the latest developments on the role of CT, MRI, and PET/CT in the detection, diagnosis, staging, and surveillance of patients with bladder cancer. 2) Learn currently recommended CT, MRI, and PET/CT techniques and protocols and how to implement them in clinical practice. 3) Learn how to interpret CT, MRI, and PET/CT scans of the bladder with an emphasis on case review and diagnostic pitfalls.

ABSTRACT

The urinary bladder is the most common site of malignancy of the urinary tract and is imaged by radiologists on many abdominal imaging exams. However, historically the bladder has been a 'forgotten' organ and thought to be largely the purview of the urologist due to the central role that cystoscopy has played in both the diagnosis and local staging of bladder cancer. Recent advances in CT, MRI, and PET have emerged that now allow radiologists to play an important role in the detection, diagnosis, staging, and surveillance of patients with or suspected of having bladder cancer. This course will detail these advances and explain how, when, and why radiologists should be using these three modalities in clinical practice today. Using illustrative case examples, advances in knowledge such as how CT urography can be used to detect bladder cancer, how MR urography can be used to distinguish muscle-invasive from superficial tumors and evaluate the upper tracts, and how PET/CT (and the newly introduced PET/MRI) can be used to stage and follow patients. With additional advances in low dose CT, emerging MRI techniques, and novel PET agents, radiology will play an increasingly vital role in the care of patients with bladder cancer in the future.

RC513

Pediatric Series: Pediatric Oncology and Nuclear Medicine

Wednesday, Dec. 2 8:30AM - 12:00PM Location: S102AB

MR NM RO PD

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.50

FDA Discussions may include off-label uses.

Participants
Sue C. Kaste, DO, Memphis, TN (*Moderator*) Nothing to Disclose
Heike E. Daldrup-Link, MD, Palo Alto, CA (*Moderator*) Nothing to Disclose
Stephan D. Voss, MD, PhD, Boston, MA (*Moderator*) Nothing to Disclose
Robert Orth, MD, PhD, Houston, TX (*Moderator*) Research support, General Electric Company;
Whal Lee, MD, PhD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose

Sub-Events

RC513-01 Bone Mineral Density Changes in Survivors of Childhood Cancer

Wednesday, Dec. 2 8:30AM - 8:50AM Location: S102AB

Participants
Sue C. Kaste, DO, Memphis, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Participants will learn risk factors for bone mineral density deficits in patients having been treated for childhood malignancies.

RC513-02 Bone Marrow Edema on MRI as an Indicator of Impending Bone Collapse in Pediatric Cancer Patients on High Dose Corticosteroid Therapy

Wednesday, Dec. 2 8:50AM - 9:00AM Location: S102AB

Participants
Preeti Sukerkar, MD, PhD, Palo Alto, CA (*Presenter*) Nothing to Disclose
Shanshan Bao, MD, Winston Salem, NC (*Abstract Co-Author*) Nothing to Disclose
Sandhya Kharbanda, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose
Stuart Goodman, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Heike E. Daldrup-Link, MD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Osteonecrosis (ON) is a devastating complication of pediatric cancer therapy with high dose corticosteroids, with 20 % of cases progressing to bone collapse, at which point joint conservation therapy may no longer be possible. It was recently shown in adult ON patients that the presence of bone marrow edema (BME) adjacent to epiphyseal ON is correlated with the presence of micro- or macro-fractures on histopathology, and the puprose of out study is to determine whether BME correlates with eventual bone collapse in pediatric cancer patients to help identify high risk patients who would benefit from early interventions.

METHOD AND MATERIALS

We retrospectively reviewed imaging studies of 18 pediatric leukemia patients who underwent high dose corticosteroid therapy and had findings of epiphyseal ON on magnetic resonance imaging (MRI). Two radiologists evaluated the presence of BME. Follow up imaging was reviewed to determine lesion progression. Using Fisher's exact test, the presence of BME was compared to the patient's outcome.

RESULTS

Of the 18 patients, 12 were found to have pre-collapse ON lesions with sufficient follow up imaging. A total of 36 weight-bearing and 2 non-weight-bearing lesions were identified, of which 13 progressed to collapse and 22 remained stable or improved. The presence of BME was found to be significantly correlated with eventual bone collapse, with 100% of patients who progressed to collapse demonstrating BME on initial imaging ($p < 0.0001$). The absence of BME initially was associated with lesion stability or even improvement ($p < 0.0001$). 3 lesions were identified that progressed slightly but did not collapse, of which none had BME on initial scans.

CONCLUSION

The absence of BME early on is an indicator of future stability or even improvement of an ON lesion, while the presence of BME appears to precede bone collapse. These results suggest that the presence or absence of BME can be used to help identify high-risk patients earlier so they may receive joint preserving therapies. This study is ongoing to evaluate out findings in a larger patient cohort.

CLINICAL RELEVANCE/APPLICATION

Presence or absence of edema on MRI predicts osteonecrosis progression in pediatric cancer patients and is recommended for stratifying high-risk patients for joint preservation therapy.

RC513-03 To Assess the Added Value of Intravenous Gadolinium for Pre-Surgical Evaluation of Osteosarcoma in Long Bones in Pediatric Patients and Young Adults

Wednesday, Dec. 2 9:00AM - 9:10AM Location: S102AB

Participants
Theodore T. Pierce, MD, Boston, MA (*Presenter*) Nothing to Disclose
Randheer Shailam, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Santiago Lozano Calderon, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Pallavi Sagar, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Osteosarcoma, a malignant bone tumor, is routinely evaluated using magnetic resonance imaging (MRI) with and without intravenous (IV) gadolinium prior to surgical intervention, typically both at initial staging and following neoadjuvant chemotherapy to determine tumor extent for operative planning. A paucity of data exists showing the utility of preoperative contrast enhanced MRI for operative planning and, so far, gadolinium does not reliably help in differentiating post treatment changes from residual disease. Preoperative parameters such as intramedullary tumor length and transphyseal tumor extension are best evaluated on non-contrast T1 or STIR sequences. Uncertainty remains as to the benefit of IV contrast for evaluating neurovascular bundle involvement (NBI) and intra-articular extension (IAE), key parameters for pre-surgical evaluation.

METHOD AND MATERIALS

At 2 time points, 2 pediatric radiologist independently analyzed MRI examinations of patients between the ages of 0-25 years with pathology proven extremity osteosarcoma for two parameters, NBI and IAE. Initial evaluation analyzed these parameters using non-contrast MRI images only (PRE) and, after 1 week, subsequent evaluation included both the pre and post contrast images (POST). Inter-rater discrepancies were resolved by consensus. Cohen's Kappa and McNemar's test were calculated to assess agreement between PRE and POST image interpretations of NBI and IAE.

RESULTS

56 patients with 90 preoperative MRI examinations were analyzed. PRE and POST interpretations agreed on 47 cases of NBI, 39 cases without NBI, and had 4 discordant cases. There were 63 cases with IAE, 25 without IAE, and 2 were discordant. Kappa was 0.91 for NBI and 0.95 for IAE. McNemar's test did not show a difference between PRE and POST imaging (p=0.61 NBI; p=0.48 IAE).

CONCLUSION

No statistical difference between PRE and POST image interpretation was found. A high level of agreement between PRE and POST image interpretation suggests that non-contrast enhanced MRI may be sufficient for pre-surgical planning for long bone osteosarcoma in pediatric patients.

CLINICAL RELEVANCE/APPLICATION

Avoiding unnecessary gadolinium use limits adverse reaction risk, obviates the need for intravenous access and shortens image acquisition, all of which are of particular benefit in pediatric patients.

RC513-04 Whole Body MRI including Diffusion-weighted Imaging as the Sole Staging and Follow-up Imaging Procedure in Pediatric Tumors - Comparison with Established Imaging Modalities

Wednesday, Dec. 2 9:10AM - 9:20AM Location: S102AB

Participants
Guenther K. Schneider, MD, PhD, Homburg, Germany (*Presenter*) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Research Grant, Bracco Group;
Stefan R. Rick, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Fries, MD, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander Massmann, MD, Homburg/Saar, Germany (*Abstract Co-Author*) Nothing to Disclose
Arno Buecker, MD, Homburg, Germany (*Abstract Co-Author*) Consultant, Medtronic, Inc Speaker, Medtronic, Inc Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG

PURPOSE

In 58 pediatric pts. with malignant tumors whole body MRI was evaluated as the sole staging procedure in comparison to established methods such as FDG-PET, MIBG or bone scintigraphy, CT and ultrasound. Findings in follow-up whole body MRI were used for evaluation of tumor response and tumor recurrence, again compared against other established imaging methods. Of particular interest was the detection of late recurrence (> 18 month post initial diagnosis) at time points, at which FDG-PET or MIBG scintigraphy are routinely not available based on actual imaging recommendations.

CONCLUSION

Whole body MRI performed with the described technique can correctly stage and diagnose a variety of malignant tumors in pediatric patients and late recurrence of disease is detected with a high accuracy at time points, at which PET or scintigraphy is routinely not performed.

CLINICAL RELEVANCE/APPLICATION

Inferior accuracy of whole body MRI using only STIR sequences or just DWI was recently published, this study demonstrates the potential of whole body MRI using more advanced techniques. Detection of late recurrence only in MRI highlights the need for advanced MRI in follow-up of pediatric malignancies.

RC513-05 Is the Whole Body MR Imaging Necessary in the Management of Children with Acute Myeloid Leukemia?

Wednesday, Dec. 2 9:20AM - 9:30AM Location: S102AB

Participants
Hee Mang Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jin Seong Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ah Young Jung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Ah Cho, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Chong Hyun Yoon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Whole body MR imaging has been frequently used for the management of children with acute myeloid leukemia (AML) because it can provide additional information besides bone marrow evaluation. In this regard, we assess the use of the whole body magnetic resonance (MR) imaging in the management of the children with AML to validate its usefulness.

METHOD AND MATERIALS

Sixty nine whole body MR scans of 40 consecutive pediatric patients with AML were evaluated by two radiologists in consensus. Whole body MR imaging was acquired for the following purposes: work-up for initial diagnosis, work-up for relapsed AML, work-up for stem cell transplant, work-up for a new sign or symptom, or follow-up of pre-existing abnormality. We estimated the presence of abnormal findings including extramedullary granulocytic sarcoma (EGS), clinically occult lesions, and lesions explaining the patient's clinical symptoms, except the bone marrow involvement by AML.

RESULTS

Total 76 EGSs were identified in eleven of 40 patients (27.5 %). Nine of eleven patients (81.8%) had multiple EGSs. Thirty eight EGSs were incidentally detected on 9 whole body MR scans in seven patients (17.5 %). Positive findings were most commonly observed on whole body MR scans performed as work-up for a new sign or symptom (14 of 15 MR scans, 93.3%). Six clinically occult non-EGS lesions found on whole body MR scans were small intracranial hemorrhage (n=1), bilateral otomastoiditis (n=1), pneumonia (n=1), knee joint inflammation with effusion (n=1) and disseminated infection/inflammation (n=2). Multiple lesions at anatomically distant regions were successfully evaluated with 18 whole body MR scans (26.1%) in a single session head-to-toe imaging.

CONCLUSION

Whole body MR imaging could be helpful to detect multiple EGSs or clinically occult lesions and be used as a problem solving tool in children with a new sign or symptom by AML in a single session study.

CLINICAL RELEVANCE/APPLICATION

Whole body MR imaging is a useful imaging modality in management of the pediatric AML patients considering tendency for multiplicity of EGSs and prevalent occult lesions as well as the intrinsic advantages of whole body MR imaging.

RC513-06 Defining Optimal Dose Regimes for Pediatric Whole-body 18F-FDG-PET/MRI

Wednesday, Dec. 2 9:30AM - 9:40AM Location: S102AB

Participants
Sergios Gatidis, MD, Tubingen, Germany (*Presenter*) Nothing to Disclose
Holger Schmidt, PhD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian la Fougere, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Nina Schwenzer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Juergen F. Schaefer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To find optimal tracer dose regimes for pediatric whole-body 18F-FDG PET/MRI with minimal radiation exposure and sufficient diagnostic quality.

METHOD AND MATERIALS

Whole-body PET data sets of 30 pediatric patients (14 female, mean age 12±6 [1-18] years) were retrospectively analyzed. PET data were acquired in list mode on a combined PET/MR scanner (Biograph mMR, Siemens) 65±14 min after injection of 3.1±0.5 MBq 18F-FDG per kg bw for 4 min per bed position.Based on the acquired list mode data, PET images of lower tracer doses (0.25 to 2.5 MBq/kg bw 18F-FDG) were simulated by retrospective undersampling of PET list mode data.Resulting data sets were analyzed quantitatively by measurement of standardized uptake values (SUVs) in healthy organs (liver, lungs, blood pool) and pathologic lesions by volume-of-interest (VOI) analysis.Qualitative analysis was performed independently by two readers experienced in pediatric nuclear medicine. To this end, PET-data sets were analyzed beginning with the lowest simulated tracer dose (0.25 MBq/kg bw) and gradually increasing tracer doses up to the original acquired PET image. Conspicuity of organ structures (such as brain, thymus, muscle, heart etc.) and detectability of focal PET lesions were recorded and finally compared to the original full-dose data set.

RESULTS

Image quality steadily improved with increasing simulated tracer doses. SUVs showed higher relative deviations of about 10 % at tracer doses below 1 MBq/kg bw. Conspicuity of physiologic organ structures improved steadily with increasing simuloatead tracer doses and was equivalent with the original acquired PET data set at simulated doses of 1-1.5 MBq/kg bw. Detectability of focal PET lesions increased continuously with increasing simultated tracer doses; all focal lesion that were detectable in the original full-dose PET were already detectable at 1.5 MBq/kg bw.

CONCLUSION

Tracer doses can be significantly reduced in pediatric PET/MRI compared to existing standard regimes. Our results suggest that doses of 1.5 MBq/kg bw FDG are sufficient for accurate diagnostic quality of PET. These results have to be validated in larger clinical studies.

CLINICAL RELEVANCE/APPLICATION

Reduced tracer doses will result in lower diagnostic radiation exposure in pediatric patients. Variation of PET acquisition times may enable further reduction of tracer doses.

RC513-07 PET/MR Compared to PET/CT in the Assessment of Pediatric Histiocytoses

Wednesday, Dec. 2 9:40AM - 9:50AM Location: S102AB

Participants
Andrew Sher, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Danial S. Bokhari, MD, Houston, TX (*Presenter*) Nothing to Disclose
Matthew Goette, PhD, Houston, TX (*Abstract Co-Author*) Support, Koninklijke Philips NV
Rajesh Krishnamurthy, MD, Houston, TX (*Abstract Co-Author*) Research support, Koninklijke Philips NV; Research support, Toshiba Corporation
Victor J. Seghers, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Compare lesion based analysis of 18F-FDG PET/MR to 18F-FDG PET/CT in pediatric Langerhans Cell Histiocytosis (LCH) and Rosai Dorfman Disease (RD).

METHOD AND MATERIALS

This prospective, HIPAA compliant study had IRB approval. Following written informed consent 18 18F-FDG PET/CT and PET/MR examinations were performed on 9 patients (6 male, 3 female, mean age 6; range: 7 months to 16 years) following a single-injection dual-imaging protocol. The indication was LCH in 11 exams and RD in 7 exams. Two readers blinded to clinical history assessed the anonymized data for metabolically active disease by consensus read. PET/CT and PET/MR were viewed simultaneously and volumes of interest were drawn over lesions, with lesions defined as non-physiologic uptake above background. SUV maximum values were recorded. Lesion detection rates and classification agreement between modalities were analyzed and compared to the reference standard (all available examinations and clinical history).

RESULTS

94 metabolically active lesions were identified on PET/MR versus 100 on PET/CT. Of the 94 lesions identified on both exams there was concordant classification in 93 (99%), representing excellent agreement, $\kappa = .97$ ($p < .001$), 95% CI (0.94-1.0). 6 lesions were identified on PET/CT but not PET/MR, 3 were foci of active disease, 1 was an inflammatory lymph node, and 2 were artifactual or physiologic. Per the standard of reference, 101 metabolically active lesions were available for analysis (80 were active disease while 21 were benign). Compared to the reference standard, the overall sensitivity (93% vs. 96%, $p>.05$) and specificity (100% vs. 95%, $p > .05$) of PET/MR vs. PET/CT, respectively, demonstrated no significant difference. The accuracies of PET/MR and PET/CT measured 94% and 96%, respectively. SUV analysis demonstrated lesions on PET/MR measuring 11% lower on average than PET/CT ($p<.001$). There was a strong correlation ($\rho = .76$) between the SUVs of the two modalities.

CONCLUSION

PET/MR demonstrates no statistical difference to PET/CT for lesion detection and classification in patients with LCH or RD. PET/MR imaging is a promising lower-radiation alternative to PET/CT for this patient population.

CLINICAL RELEVANCE/APPLICATION

PET/MR evaluation for pediatric histiocytoses demonstrates no statistical difference in sensitivity, specificity, or accuracy of lesion detection compared to PET/CT and can contribute to patient management with lower radiation dose.

RC513-08 Whole Body Imaging in Pediatric Oncology

Wednesday, Dec. 2 9:50AM - 10:10AM Location: S102AB

Participants
Stephan D. Voss, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The participant should understand the various whole body multi-modality imaging techniques used in Pediatric Oncology2) The participant should be able to discuss strategies and opportunities for radiation dose reduction when performing multi-modality whole body examinations3) The audience should understand the appropriate indications for whole body imaging in pediatric oncology, including the role of whole body imaging in tumor surveillance and evaluation of patients with cancer predisposition syndromes.

ABSTRACT

RC513-09 Neuroblastoma - Imaging and Therapy Update

Wednesday, Dec. 2 10:30AM - 10:50AM Location: S102AB

Participants
Adina L. Alazraki, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the common indications for I-131 MIBG in pediatric patients. 2) Describe the necessary considerations for pediatric patients prior to I-131 MIBG therapy. 3) Discuss imaging protocols and typical pre and post therapy imaging appearance as part of monitoring of response to therapy.

RC513-10 PET/MR Imaging in Pediatric Sarcomas and Malignant Soft Tissue Tumors: Is There a Clinical Impact?

Wednesday, Dec. 2 10:50AM - 11:00AM Location: S102AB

Participants
Juergen F. Schaefer, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose
Sergios Gatidis, MD, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ilias Tsiflikas, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Guido Seitz, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose

Martin Ebinger, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian la Fougere, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias Reimold, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nina Schwenzer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG

PURPOSE

To evaluate the clinical impact of PET/MRI in pediatric sarcomas and malignant soft tissue tumors.

METHOD AND MATERIALS

43 examinations in 30 patients (11 female, mean age 11.1 y ± 5.4 y) with diagnoses of Ewing sarcoma (n=6), osteosarcoma (n=4), rhabdomyosarcoma (n=6), NF 1 suspected for MPNST (n=9), others (n=5) were included. Written informed consent was obtained. Two protocols were performed: In group A, 11 examinations were carried out using PET/CT (Biograph mCT, Siemens) and PET/MRI (Biograph mMR, Siemens). Data were acquired on the same day after administration of 161±88 MBq 18F-FDG. In group B, 32 examinations were performed using PET/MRI only, after administration of 114±67 MBq 18F-FDG. Additionally, if indicated an additional low dose chest CT was carried out. In Group A, image analysis was performed by two experienced rater teams blinded for the respective different modality. In group B, image analysis was performed by an experienced rater team: first MRI followed by PET-MRI. Histopathology and follow-up served as reference standard. Findings of PET/MRI were reevaluated by the institutional pediatric tumorboard regarding further clinical management (e.g. change of diagnostic or therapeutic regime).

RESULTS

Group A: The rate of focal uptake on PET/MRI was equivalent to PET/CT (52 vs. 53). Local staging (4/11), anatomic allocation (2/11) and relevant additional findings were improved by MRI. Group B: Findings of PET/MRI affecting clinical management were found in 8 /32 examinations (e.g. change of surgical approach or no additional radiation). Compared to chest CT, PET/MRI detected equal numbers of metastases in 5 patients and lower numbers in 5 patients. MRI was negative in 4 patients with nodules smaller than 4 mm who had no evidence of metastases in follow-up. There was no evidence of pulmonary metastasis in 16 patients.

CONCLUSION

Simultaneous PET/MRI in pediatric sarcomas allows a comprehensive diagnostic for both, local and systemic tumor spread. PET/MR substantially affected the clinical management. The lower detection rate of small pulmonary nodules by MRI needs to be discussed with respect to clinical importance.

CLINICAL RELEVANCE/APPLICATION

PET/MRI improves the clinical management in pediatric soft tissue tumors and both, local and systemic staging is possible in a single approach.

RC513-11 Brain Exams in Pediatric Epilepsy: PET/MRI Compared to PET/CT

Wednesday, Dec. 2 11:00AM - 11:10AM Location: S102AB

Participants
Matthew Goette, PhD, Houston, TX (*Presenter*) Support, Koninklijke Philips NV
Erica Yang, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Nadia F. Mahmood, MD, Sugar Land, TX (*Abstract Co-Author*) Nothing to Disclose
Jeremy Y. Jones, MD, Bellaire, TX (*Abstract Co-Author*) Nothing to Disclose
Wei Zhang, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Victor J. Seghers, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Andrew Sher, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Michael J. Paldino, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

PET/MR offers the potential for diverse image contrasts in a single examination. To reach its full potential, this technology will require robust attenuation correction (AC) algorithms. The goal of this study was to compare the diagnostic accuracy of FDG-PET images of the brain processed according to MR-based AC (MRAC) with that of images obtained using traditional CT-based AC (CTAC).

METHOD AND MATERIALS

IRB approval and informed consent were obtained for this study. All patients referred for clinical FDG-PET/CT exams of the brain were prospectively recruited to undergo an additional FDG-PET acquisition on a Philips Ingenuity PET/MR system. A bootstrap power calculation was used to determine the number of patients required to detect a 10% difference in diagnostic accuracy (power: 0.8). Raw FDG-PET images were processed according to vendor-provided MRAC or CTAC algorithms. Five expert readers were blinded to the method of AC and all other clinical/imaging data. Consensus between readers at unblinded re-review of all data was considered the gold standard. Any potential difference in the accuracy of PET/MR compared to PET/CT was assessed using McNemar's test. Cohen's kappa was calculated to measure agreement between each reader's interpretation of MRAC and CTAC.

RESULTS

The study population comprised 35 patients referred for a diagnosis of epilepsy (mean age: 11y; range: 2-18y), with a paired PET/CT and PET/MR exam. Compared to the reference gold standard, the overall sensitivity (71.6% and 70.2%, p>0.05) and specificity (74.7% and 85.1%, p>0.05) of the blinded interpretation of the PET/MR and PET/CT images, respectively, demonstrated no significant difference. The accuracy of MRAC-processed images did not differ significantly from those obtained using CTAC (74.7% and 76.6%, respectively, p>0.3). Overall, there was good intra-reader agreement between the interpretation of PET/MR and PET/CT (κ range: 0.55-0.78).

CONCLUSION

The accuracy of FDG-PET images generated by an MRAC algorithm was comparable to that of FDG-PET images processed by traditional CTAC. These results further support the use of integrated PET/MR systems in clinical practice.

CLINICAL RELEVANCE/APPLICATION

The evaluation of pediatric brain exams for the diagnosis of epilepsy using PET/MR demonstrated no statistical difference in sensitivity, specificity, or accuracy compared to PET/CT, and support the use of PET/MR in patient management with lower radiation dose.

RC513-12 What is the Optimal Way to Measure Neuroblastoma Response to Chemotherapy?

Wednesday, Dec. 2 11:10AM - 11:20AM Location: S102AB

Participants
Lindsey R. Klingbeil, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Andrew T. Trout, MD, Cincinnati, OH (*Abstract Co-Author*) Advisory Board, Koninklijke Philips NV
Alex Towbin, MD, Cincinnati, OH (*Abstract Co-Author*) Author, Reed Elsevier; Consultant, Reed Elsevier; Shareholder, Merge Healthcare Incorporated; Consultant, Guerbet SA; Grant, Guerbet SA
Daniel von Allmen, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The current recommendation for determining primary neuroblastoma tumor size and response to chemotherapy is to use 3D (anteroposterior, transverse, craniocaudal) measurements. This is in contrast to the 1D measurements recommended in RECIST 1.1 and the 2D measurements recommended for Hodgkin lymphoma. There is little evidence specific to neuroblastoma to show superiority of one measurement technique. The purpose of this study was to assess the correlation between the various measurement methods and actual tumor volume in terms of response assessment.

METHOD AND MATERIALS

We retrospectively analyzed the radiographic data of intermediate and high-risk neuroblastoma patients with either Stage 3 or 4 disease who were diagnosed between 2003 and 2012. Primary tumors were measured in 1D, 2D and 3D at the time of diagnosis and following chemotherapy with 2D and 3D measurements expressed as a product. True tumor volume at each time point was also measured by manual segmentation of the tumor. Tumor response for each measurement method was expressed in terms of a fraction of tumor size at diagnosis. Comparisons were based on Bland-Altman analyses with agreement expressed in terms of correlation coefficients.

RESULTS

Imaging from 34 patients was included in the study with comparison of tumor response to true volumes for 50 1D, 50 2D, and 39 3D measurements. A statistically significant correlation was seen between both the 2D ($p<0.05$) and the 3D ($p<0.01$) measurements and the volumetric method of tumor response assessments with the best correlation ($r=0.47$ versus 0.31) for the 3D measurements. 1D measurements had poor correlation with the volumetric response assessment ($r=0.04$). The mean difference in tumor response relative to volumetric assessment was higher for 2D measurements than 3D measurements (19% ±16% versus 10%±15%).

CONCLUSION

Correlation between single and multiplanar measurements and true tumor volume for assessment of neuroblastoma response to therapy is moderate at best likely reflecting the irregular shape and infiltrative character of these tumors. 3D measurements had the highest correlation with volumetric assessments but may over- or underestimate tumor response by 40%.

CLINICAL RELEVANCE/APPLICATION

Accurately determining the primary tumor response to chemotherapy using imaging is critical for making therapeutic decisions and surgical planning for neuroblastoma patients.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Alex Towbin, MD - 2014 Honored Educator

RC513-13 Evaluation of the Predictive Value of Doppler Ultrasonography in Children with Clinically Suspicious Hepatic Veno-occlusive Disease after Hematopoietic Stem Cell Transplantation

Wednesday, Dec. 2 11:20AM - 11:30AM Location: S102AB

Participants
Ji-Eun Park, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Young Hun Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Suk Cho, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yu Jin Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung-Eun Cheon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Sun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
In-One Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the predictive value of Doppler ultrasonography in children with clinically suspicious hepatic veno-occlusive disease (VOD) after hematopoietic stem cell transplantation (HSCT).

METHOD AND MATERIALS

From January 2012 to January 2015, among 216 children who underwent HSCT, 56 children underwent Doppler ultrasonography for clinical suspicion of hepatic VOD (M:F = 22:34; mean age, 8.3years; age range 8months-20years). Among 56 patients, fifteen patients were confirmed as having VOD later (VOD group), while 41 patients turned out to have other conditions (acute graft-

versus-host disease, n=10; cytomegalovirus hepatitis, n=4; other virus hepatitis, n=6; aspergilosis, n=3; unrevealed cause, n=18; non-VOD group). Doppler ultrasonography was retrospectively reviewed for the following findings: hepatomegaly, splenomegaly, gall bladder(GB) wall edema, ascites, Doppler spectral parameters of the left portal vein (peak velocity, trough velocity, pulsatile index, flow inversion), Doppler spectral parameters of the left hepatic artery (peak systolic velocity, end systolic velocity, resistance index) and phasicity of the middle hepatic vein. The Doppler US findings were compared between two groups using Student t-test, Chi square test. Multivariate logistic regression was performed to reveal the significant predictor of VOD.

RESULTS

The VOD group showed significantly higher incidences of hepatomegaly (9/15, 60% vs. 10/41, 24%, p=0.016), GB wall edema (9/12, 80% vs. 9/41, 22%, p < 0.001) and ascites (12/15, 80% vs. 9/41, 22%, p < 0.001), relative to the non-VOD group. The peak systolic velocity of the left hepatic artery was significantly higher in VOD patients compared with non-VOD patients (73±33cm/sec vs. 49±21cm/sec, p=0.002). Other findings showed no statistically significant difference between the two groups. Multivariate analysis revealed that only ascites was significantly associated with VOD (ß=0.345).

CONCLUSION

The presence of hepatomegaly, GB wall edema, ascites and increased peak systolic velocity of the hepatic artery were significantly associated with progression to definite VOD in pediatric HSCT patients with clinically suspicious VOD.

CLINICAL RELEVANCE/APPLICATION

Hepatic VOD is one of the most feared complications of HSCT. Our study identified Doppler ultrasonographic findings that could be helpful in predicting progression to definite VOD.

RC513-14 Correlation between Diffusion-weighted Imaging Combined with Conventional Magnetic Resonance Imaging Parameters and Histopathologic Findings in Eyes Primarily Enucleated for Advanced Retinoblastoma: A Retrospective Study

Wednesday, Dec. 2 11:30AM - 11:40AM Location: S102AB

Awards
Trainee Research Prize - Medical Student

Participants
Yanfen Cui, Shanghai, China (*Presenter*) Nothing to Disclose
Dengbin Wang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Huanhuan Liu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Caiyuan Zhang, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

to evaluate the diagnostic accuracy of conventional MR imaging in detecting tumor invasion of intraocular retinoblastoma and to correlate ADC values with high-risk pathological prognostic parameters of retinoblastoma.

METHOD AND MATERIALS

The accuracy of MR imaging in detecting invasion extent of 63 tumors were determined. Furthermore, ADC value with b factors of 0 and 1000 seconds/mm2 were calculated and correlated with high risk pathological prognostic parameters. Additionally, the correlation of Ki-67 expression with ADC value were analysed.

RESULTS

The accuracy of conventional MRI in detecting prelaminar and postlaminar optic nerve invasion was 85.7% , focal and massive choroidal invasion 61.9%, scleral invasion 98.4% and ciliary body invasion was 95.2%. The ADC value of well-differentiated retinoblastoma were significantly different from poorly or undifferentiated tumors (p < 0.002). There was no significant difference in the ADC value between bilateral and unilateral retinoblastomas (P=0.09) and different growth pattern (P=0.74). The ADC value of postlaminar optic nerve invasion has significantly different with no optic nerve invasion (P=0.04). There was significant difference in the ADC of retinoblastoma with or without scleral invasion (P=0.007), but has no difference in chorodial invasion (P=0.629) or ciliary body invasion (P=0.532). Additionally, the ki-67 index was inversely correlated with the ADC value (p < 0.002).

CONCLUSION

Routine MRI has limitations in reliably predicting microscopic infiltration of the retinoblastoma, where ADC correlated well with high-risk pathological prognostic parameters and Ki-67 index for retinoblastoma and may serve as a noninvasive prognostic parameter for assessment of newly diagnosed retinoblastoma.

CLINICAL RELEVANCE/APPLICATION

Routine MRI has limitations in reliably predicting microscopic infiltration of the retinoblastoma, whereas ADC correlated well with high-risk pathological prognostic parameters and Ki-67 index for retinoblastoma and may serve as a noninvasive prognostic parameter for assessment of newly diagnosed retinoblastoma.

RC513-15 Imaging of Tumor Syndromes

Wednesday, Dec. 2 11:40AM - 12:00PM Location: S102AB

Participants
Andrew T. Trout, MD, Cincinnati, OH, (andrew.trout@cchmc.org) (*Presenter*) Advisory Board, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Recognize some of the tumor predisposition syndromes that present in children/young adults. 2) Name the relevant tumors for the discussed syndromes. 3) Implement currently accepted imaging protocols for the discussed syndromes.

ABSTRACT

RC524

Dialogue with The Joint Commission: New Diagnostic Imaging Standards for CT and MR

Wednesday, Dec. 2 8:30AM - 10:00AM Location: S404AB

CT MR HP

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Ehsan Samei, PhD, Durham, NC (*Director*) Nothing to Disclose
Ehsan Samei, PhD, Durham, NC (*Moderator*) Nothing to Disclose
Ehsan Samei, PhD, Durham, NC (*Presenter*) Nothing to Disclose
Alec J. Megibow, MD, MPH, New York, NY (*Presenter*) Consultant, Bracco Group
Richard C. Semelka, MD, Chapel Hill, NC, (richsem@med.unc.edu) (*Presenter*) Research support, Siemens AG.; Consultant, Guerbet SA.
Fergus V. Coakley, MD, Lake Oswego, OR (*Presenter*) Nothing to Disclose
Andrea D. Browne, PhD, Oakbrook Terrace, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe areas addressed by the new and revised imaging standards. 2) Understand why The Joint Commission made changes to and/or revised the diagnostic imaging standards. 3) Describe how compliance with the new and revised imaging standards will be evaluated during the on-site survey. 4) Describe ways to demonstrate compliance with the new and revised imaging standards to promote patient safety and patient care.

ABSTRACT

This presentation will provide an overview of the new and revised diagnostic imaging standards. These new standards impact both Ambulatory Care and Hospital diagnostic imaging customers of the Joint Commission. Topics to be covered include: Background on the new and revised diagnostic imaging standards; an overview of the new and revised diagnostic imaging standards; a description of how compliance with the new and revised diagnostic imaging standards will be evaluated during the on-site survey. It will also provide practical insights and suggestions regarding implementation of the new and revised diagnostic imaging standards to promote patient safety and improve patient care in Joint Commission accredited organizations.

RC529

Body MRI: Technical Challenges (An Interactive Session)

Wednesday, Dec. 2 8:30AM - 10:00AM Location: E353B

MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC529A Motion Control Techniques in Body MRI

Participants
Hersh Chandarana, MD, New York, NY (*Presenter*) Equipment support, Siemens AG; Software support, Siemens AG; Consultant, Bayer, AG;

LEARNING OBJECTIVES

1) Understand basic concepts of k-space and acquisition time. 2) Discuss various methods to accelerate acquisition by k-space undersampling. 3) Discuss motion robust acquisition schemes including non-Cartesian k-space sampling.

ABSTRACT

ABSTRACT: Assessment of multiple post-contrast phases after gadolinium contrast injection is essential for lesion detection and characterization, and thus is a routine component of abdominopelvic MRI. Contrast-enhanced multiphase MR examination is usually performed using a T1-weighted fat-saturated 3D volumetric interpolated sequence with Cartesian k-space sampling in a breath-hold. However, this method is sensitive to respiratory motion and can result in suboptimal images in patients who cannot adequately breath-hold. Techniques to overcome this major limitation include rapid imaging to decrease acquisition time and motion robust acquisition schemes. Concept of acquisition time and k-space will be discussed followed by discussion of techniques to perform rapid and motion robust imaging.

RC529B Which Contrast Agent Should I Use?

Participants
Matthew S. Davenport, MD, Cincinnati, OH, (matdaven@med.umich.edu) (*Presenter*) Book contract, Wolters Kluwer nv; Book contract, Reed Elsevier;

LEARNING OBJECTIVES

1) Review common gadolinium-based contrast agents (GBCA). 2) Understand the strengths and weaknesses of various GBCA. 3) Learn the incidence and significance of various risks associated with GBCA administration.

ABSTRACT

This presentation will review the strengths and weaknesses of a variety of modern gadolinium-based contrast agents. Controversies, risks, and benefits will be presented. Practice optimization with respect to selection of a GBCA formulary will be discussed.

RC529C Optimizing Diffusion-Weighted Imaging at 1.5 and 3T

Participants
Dow-Mu Koh, MD,FRCR, Sutton, United Kingdom (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand how to get the best body diffusion-weighted MRI at 1.5T and 3.0T by optimizing image signal-to-noise and minimizing image artefacts. 2) To appreciate the additional challenges of body diffusion-weighted MRI at 3.0T. 3. To review newer imaging techniques that can be applied at 3.0T to improve body diffusion-weighted MRI including combinatorial fat suppression schemes, image-based shimming, reduced field-of-view acquisitions and readout-segmented echo-planar imaging techniques.

ABSTRACT

Body diffusion-weighted MRI (DWI) is now widely applied for disease evaluation, especially in oncology. DWI is relatively quick and easy to perform using single-shot echo-planar imaging (EPI) technique. However, imaging optimisation is important to ensure that high quality images are consistently attained. At both 1.5T and 3.0T, parameter optimization is necessary to maximize signal-to-noise (such as by reducing echo-times, using coarser matrix, thicker partition thickness, multiple signal averages) of the acquired images and to minimize potential artefacts (e.g. motion, chemical shift, eddy currents, Nyquist ghosting, susceptibility and G-noise) that will degrade image quality.Although body DWI is generally more robust at 1.5T, recent advances at 3.0T allow high quality DWI images to be obtained, including whole body studies. Imaging at 3.0T has the advantage of higher image signal-to-noise; but is more prone to artefacts arising from chemical shift (suboptimal fat suppression), susceptibility effects and image distortion. Hence, meticulous optimisation of fat suppression (e.g. using combinatorial fat suppression schemes) and avoidance of regions with high susceptibility effects are important. More recently, the introduction of image-based shimming has helped to improve DWI quality at 3.0T, particular for large field-of-view imaging. Image distortion and susceptibility artifacts can be reduced using read-out segmented EPI techniques. The higher signal-to-noise at 3.0T also allows for high spatial resolution reduced field-of-view techniques to be applied.At 3.0T, there is also an opportuity to perform DWI studies on a hybrid PET-MRI system. To maximise

information gained from such studies, protocol design and clinical workflow are important.

RC551

Pearls and Pitfalls in MSK Radiology

Wednesday, Dec. 2 8:30AM - 10:00AM Location: N227

MK MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC551A MRI of Arthroplasty: How to Do It

Participants
Hollis G. Potter, MD, New York, NY (*Presenter*) Research support, General Electric Company

LEARNING OBJECTIVES

1) To become familiar with different patterns of abnormal synovial response around implants. 2) To become familiar with protocols using standardized and newer sequences which optimize tissue contrast and provide accurate diagnosis.

ABSTRACT

MRI characteristics of adverse local tissue reactions, periprosthetic infection, and component loosening will be reviewed. Characteristics of osteolysis will also be discussed, as well as additional complications of joint arthroplasty.

Active Handout:Hollis G. Potter

http://abstract.rsna.org/uploads/2015/15001917/Active RC551A.pdf

RC551B MRI of Bone Marrow: What's Normal What's Not?

Participants
Miriam A. Bredella, MD, Boston, MA, (mbredella@mgh.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Differentiate normal variations in MRI appearance of bone marrow from malignant marrow infiltrative disorders. 2) Become familiar with the MRI appearance of age-related and post-treatment changes of bone marrow.

ABSTRACT

MRI characteristics of normal bone marrow will be reviewed, including changes related to aging and therapy. Imaging examples of benign and malignant disorders affecting bone marrow will be reviewed including pitfalls in MRI interpretation of bone marrow.

RC551C Tumors and Tumor-like Lesions of the Musculoskeletal System: Pearls and Pitfalls for the General Radiologist

Participants
Behrang Amini, MD, PhD, Houston, TX, (bamini@mdanderson.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with the imaging appearance of common and uncommon presentations of benign and malignant musculoskeletal lesions. 2) Know how to manage indeterminate focal bone and soft tissue abnormalities.

ABSTRACT

Radiologists are often challenged by the overlap in the imaging appearance of benign and malignant musculoskeletal lesions. The imaging appearance of challenging bone and soft tissue lesions will be reviewed. Suggestions will be made for management with the aim of balancing patient safety with the burden of further investigation or intervention.

SSK04

Cardiac (General Topics)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: S504AB

CA CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Pamela K. Woodard, MD, Saint Louis, MO (*Moderator*) Research Consultant, Bristol-Myers Squibb Company; Research Grant, Astellas Group; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Bayer AG; Research agreement, Siemens AG; Research Grant, Actelion Ltd; Research Grant, Guerbet SA; ; ;
Robert J. Herfkens, MD, Stanford, CA (*Moderator*) Nothing to Disclose
Istvan Battyani, MD, PhD, Pecs, Hungary (*Moderator*) Nothing to Disclose

Sub-Events

SSK04-01 Dynamic First Pass CT Perfusion Imaging of the Myocardium vs. Intracoronary Transluminal Attenuation Gradient in Coronary CT Angiography for the Assessment of Coronary Artery Stenosis

Wednesday, Dec. 2 10:30AM - 10:40AM Location: S504AB

Participants
Bettina M. Gramer, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Isabella Baur, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Rasper, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander W. Leber, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Johannes Rieber, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Ellen Hoffmann, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Mani Vembar, MS, Cleveland, OH (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Armin M. Huber, MD, Munchen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic accuracy of dynamic first pass CT perfusion (CTP) imaging and the transluminal attenuation gradient derived from coronary CT angiography in the assessment of coronary artery stenosis.

METHOD AND MATERIALS

34 patients with suspicion of coronary artery disease, who underwent invasive coronary angiography (CA) and assessment of intermediate coronary artery lesions (50-75% diameter reduction) by an invasive pressure wire examination (FFR) were included. All patients underwent a coronary CTA and a dynamic CTP examination under adenosine stress at a 256 slice CT scanner with an 8 cm wide detector. Myocardial blood flow was determined using the dynamic first pass CTP data. Transluminal attenuation gradient (TAG) was calculated as the linear regression coeffcient between luminal attenuation and the distance of the location in the coronary artery from its origin. MBF and TAG were compared with the results CA and FFR. ROC curves were calculated. Sensitivity and specificity were calculated using Youden´s index.

RESULTS

The area under the ROC curve was 0.92 (0.80 to 0.95) for MBF and 0.64 (0.46 to 0.793) for TAG (p=0.002). The optimal threshold using Youden´s index was 1.51 for TAG and 1.21 for MBF. Sensitivity and specificity for detection of hemodynamically relevant coronary artery lesions were 71.4 (41.9- 91.4) and 73.2 (57.1- 85.8) for TAG. Sensitivity and specificity were 90.9 (58.7- 98.5) and 84.6 (65.1- 95.5) for MBF.

CONCLUSION

MBF derived from dynamic CTP imaging of the myocardium is superior compared to the TAG derived from coronary CTA for the assessment of coronary artery stenosis.

CLINICAL RELEVANCE/APPLICATION

In spite of being inferior compared to the MBF the TAG can be used as additional functional parameter in the assessment of coronary artery stenosis derived from coronary CTA without additional contrast agent or radiation exposure and may contribute to improve diagnostic accuracy of CTA.

SSK04-02 Detection and Differentiation of Ischemic Myocardial Lesions with Quantitative Post-mortem Cardiac 1.5T MRI

Wednesday, Dec. 2 10:40AM - 10:50AM Location: S504AB

Participants
Wolf-Dieter Zech, MD, Bern, Switzerland (*Presenter*) Nothing to Disclose
Nicole Schwendener, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Anders Persson, MD, PhD, Linkoping, Sweden (*Abstract Co-Author*) Nothing to Disclose
Marcel Warntjes, Linkoping, Sweden (*Abstract Co-Author*) Employee, SyntheticMR AB
Christian Jackowski, MD, Bern, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MR quantification of T1 and T2 relaxation times and proton density (PD) is feasible for characterizing tissue lesions. Since quantitative T1 and T2 values are dependent on magnetic field strength and temperature there is a need for evaluation of

quantitative values with regard to magnetic field strength and tissue temperatures. The purpose of this study was to assess the quantitative T1, T2 and PD values of ischemic myocardial lesions for a post-mortem 1.5T application and to relate quantitative values to tissue temperature.

METHOD AND MATERIALS

Eighty forensic postmortem short axis cardiac 1,5T MR examinations were quantified using a quantification sequence prior to autopsy. During the MR examination the temperature of corpses was assessed. Quantitative T1, T2 and PD values of myocardial lesions were assessed in synthetically calculated cardiac MR images. The quantitative values were related to temperature and correlated with autopsy and histology findings.

RESULTS

A total of 95 ischemic lesions were detected at histology and autopsy (early acute n=61, acute n=14, subacute n=10, chronic n=10). Of 61 histologically confirmed early acute lesions a total of 22 lesions (36.1 %) were not visible in conventional PMMR images. These lesions were targeted in MR images at the location of histologic specimens and presented with quantitative T1 and T2 values that differed significantly from the quantitative values of normal myocardium. ANOVA revealed that the quantitative values of all assessed ischemic lesions and normal myocardium differed significantly from each other. Temperature correction of quantitative values led to lower standard deviations and better differentiability of all lesions.

CONCLUSION

Postmortem 1,5T MR quantification is feasible for detection and diagnosis of different age stages of myocardial ischemia and enables to assess early acute myocardial ischemia not visible in conventional MR images. The quantification approach provides a base for computer aided detection and diagnosis of ischemic myocardial lesions.

CLINICAL RELEVANCE/APPLICATION

If quantitative values are extrapolated to 37°C diagnostic criteria validated in quantitative cardiac PMMR scans may be applied for the detection of myocardial ischemia in living patients.

SSK04-03 Imaging for Suspected Coronary Artery Disease: Recent Utilization Trends Point Downward

Wednesday, Dec. 2 10:50AM - 11:00AM Location: S504AB

Participants
David C. Levin, MD, Philadelphia, PA (*Presenter*) Consultant, HealthHelp, LLC; Board of Directors, Outpatient Imaging Affiliates, LLC
Laurence Parker, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Vijay M. Rao, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In recent years, appropriate use criteria have been developed for cardiac imaging by both the ACR and the American College of Cardiology. Our purpose was to attempt to determine if these criteria affected utilization of the 3 major imaging tests for suspected coronary artery disease (CAD) - nuclear myocardial perfusion imaging (MPI), stress echocardiography (SE), and coronary CT angiography (CCTA).

METHOD AND MATERIALS

The nationwide Medicare Part B databases from 2001 through 2013 were studied. The CPT codes for primary MPI, SE, and CCTA were selected. Procedure volumes were tabulated for all places of service, and utilization rates per 1000 Medicare fee-for-service beneficiaries were calculated. Medicare specialty codes were used to ascertain the relative roles of radiologists and cardiologists.

RESULTS

The utilization rate per 1000 of MPI increased from 63.4 in 2001 to a peak of 88.0 in 2006, then declined to 61.9 in 2013 (-30% vs 2006 peak). In 2013, cardiologists did 77% of the MPIs; radiologists did 17%; the rest were done by other physicians. The utilization rate of SE was 12.5 in 2001 and remained relatively stable through 2010, then declined to 10.8 by 2013 (-14% vs 2010). Radiologists had essentially no role in SE. CCTA utilization could only be tracked since 2006, the first complete year codes were available for that study. The rate per 1000 that year was 1.0. It went up to 2.1 the following year, but then declined every year thereafter to 1.1 in 2013 (-48% vs peak). In 2013, radiologists did 49% of CCTAs; cardiologists did 46%; other physicians did the rest. That year, 56 times as many MPIs as CCTAs were performed.

CONCLUSION

The utilization rate of noninvasive imaging in patients with suspected CAD is declining. The cause is likely multifactorial. The decline is more pronounced in MPI than in SE. The use of CCTA has also dropped, but its rate is far lower than that of MPI and SE. CCTA is probably underused in comparison to those 2 techniques. Radiologists have no role in SE, a relatively small role in MPI, but an important role in CCTA.

CLINICAL RELEVANCE/APPLICATION

n/a

SSK04-04 Automated 3D MRI Volumetry of the Pulmonary Arteries: Evaluation in Patients with Pulmonary Arterial Hypertension and Potential for Predicting Pulmonary Hypertension

Wednesday, Dec. 2 11:00AM - 11:10AM Location: S504AB

Awards
Trainee Research Prize - Resident

Participants
Fabian Rengier, MD, Heidelberg, Germany (*Presenter*) Nothing to Disclose
Stefan Woerz, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Claudius Melzig, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Sebastian Ley, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

Christian Fink, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Nicola Ehlken, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Sasan Partovi, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Hendrik Von Tengg-Kobligk, MD, Bern, Switzerland (*Abstract Co-Author*) Research Grant, W. L. Gore & Associates, Inc
Karl Rohr, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans-Ulrich Kauczor, MD, Heidelberg, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Bayer AG; Speakers Bureau, Boehringer Ingelheim GmbH; Speakers Bureau, Siemens AG; Speakers Bureau, Novartis AG; Speakers Bureau, GlaxoSmithKline plc ; Speakers Bureau, Almirall SA
Ekkehard Gruenig, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Increased pulmonary artery diameters have been shown to indicate pulmonary hypertension, but 2D diameter measurements are only a limited representation of 3D geometry. Purpose of this study was to demonstrate feasibility of 3D volumetry of pulmonary arteries based on magnetic resonance angiography (MRA), to assess pulmonary artery volumes in patients with pulmonary arterial hypertension compared to healthy volunteers, and to investigate its potential for predicting pulmonary hypertension (PH).

METHOD AND MATERIALS

MRA of the pulmonary arteries was acquired at 1.5T in 37 subjects (mean age 42+/-14 years) with a slice thickness of 1.6mm and in-plane resolution of 1.3x1.3mm². 20 patients had pulmonary arterial hypertension (WHO classification Group 1) confirmed by right heart catheterization, 17 healthy volunteers had no history of cardiovascular disease. Using in-house developed 3D model-based image analysis software, main, right and left pulmonary arteries (mPA, rPA and lPA) were automatically segmented after placement of seed points. Volumes for mPA, rPA and lPA were computed and corrected for body surface area (BSA). For comparison purposes, diameter of mPA was manually measured on axial reconstructions by an experienced radiologist.

RESULTS

Volumes for patients/volunteers were (in mm³/m² BSA): mPA 25570/13927 (p=0.002), rPA 10484/3807 (p<0.001) and lPA 7533/3899 (p<0.001). ROC analysis of volumes showed: mPA AUC 0.874 (95% CI 0.748-0.999, p=0.001), rPA AUC 1.0 (95% CI 1.0-1.0, p<0.001) and lPA AUC 0.889 (95% CI 0.774-1.0, p=0.001). Sensitivity, specificity, positive predictive value and negative predictive value for predicting PH were highest for rPA volume with 100%, 100%, 100% and 100% using 6000mm³/m² BSA as sex-independent cut-off, compared to 95%, 78%, 82% and 93% for mPA diameter using 29/27mm as cut-off for males/females as suggested by the Framingham Heart Study.

CONCLUSION

MRA-based 3D volumetry of pulmonary arteries is feasible and demonstrated significantly increased volumes for main, right and left pulmonary arteries in patients with pulmonary arterial hypertension compared to healthy volunteers. Volume of right pulmonary artery might be an accurate predictor for PH but validation in a larger study population is warranted.

CLINICAL RELEVANCE/APPLICATION

3D pulmonary artery volumes might be more accurate than 2D diameter measurements in the prediction and evaluation of pulmonary hypertension.

SSK04-05 Pulmonary Arterial Hypertension is Associated with Increased T1 Relaxation Times and Decreased Left Ventricular Performance in Spite of Preserved Left Ventricular Function

Wednesday, Dec. 2 11:10AM - 11:20AM Location: S504AB

Participants
Rami Homsi, Bonn, Germany (*Presenter*) Nothing to Disclose
Julian A. Luetkens, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Dirk Skowasch, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Julia Meyer zur Heide, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Juergen Gieseke, DSc, Bonn, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Hans H. Schild, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Claas P. Naehle, MD, Bonn, Germany (*Abstract Co-Author*) Consultant, Medtronic, Inc

PURPOSE

Pulmonary arterial hypertension (PAH) mainly affects the right (RV), but also the left ventricle (LV). Strain analysis allows for detection of ventricular dysfunction even in patients with preserved ventricular function. Cardiac magnetic resonance (CMR) mapping techniques with determination of T1 and T2 relaxation times (T1 resp T2) may allow for discrimination between healthy myocardium and diffuse fibrosis in PAH patients. This study was performed to evaluate the association between myocardial changes assessed by strain analysis and by native T1 and T2 map in patients with PAH.

METHOD AND MATERIALS

16 Patients with PAH (8 men, 8 women, mean age 63.75y ± 13.85) and 17 healthy volunteers (8 men,9 women, mean age 57.56y ± 12.45) were examined on a 1.5 Tesla MR system (Ingenia, Philips). Native T1s were assessed using the modified Look-Locker inversion recovery sequence and T2s were assessed using a GraSE sequence. RV and LV longitudinal strain was assessed during postprocessing of standard SSFP Cine images by CMR feature tracking using a dedicated software (Diogenes, TomTec, Unterschleissheim, Germany). LV and RV function were assessed by volumetric analysis.

RESULTS

LV ejection fraction did not differ between PAH patients and healthy volunteers (61.26 ± 7.13 vs. 61.53 ± 6.48; p>0.05). Left ventricular T1 s however were significantly higher in patients with PAH (1050.17 ± 47.90 vs. 980.72 ± 45.5; p<0.01). LV longitudinal strain was significantly lower in patients with PAH (-17.01 ± 5.34 vs. -23.05 ± 3.57, p<0.01). RV longitudinal strain and RV-Ejection fraction were both significantly lower in patients with PAH. There were no significant differences in T2 relaxation times, age, body mass index, or sex.

CONCLUSION

LV myocardial fibrosis as indicated by increased T1 reduces LV strain despite of normal LV function in patients with PAH

LV myocardial fibrosis as indicated by increased T1 reduces LV strain despite of normal LV function in patients with PAH.

CLINICAL RELEVANCE/APPLICATION

Increased T1 as an indicator for LV involvement in PAH may be useful to identify patients at risk and to determine the intensity of treatment even when myocardial function is preserved.

SSK04-06 Cardiac Effects of Prolonged Apnea in Elite Divers Investigated with Comprehensive Cardiac Magnetic Resonance

Wednesday, Dec. 2 11:20AM - 11:30AM Location: S504AB

Participants
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Lars Eichhorn, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Jean-Marc Lunkenheimer, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Julian A. Luetkens, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Juergen Gieseke, DSc, Bonn, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Rainer Meyer, 53115, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Hoeft, 53105, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans H. Schild, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Claas P. Naehle, MD, Bonn, Germany (*Abstract Co-Author*) Consultant, Medtronic, Inc

PURPOSE

Apnea diving is getting more and more popular as a recreational sport activity and performance of apnea divers has been constantly rising in the recent years. Prolonged apnea leads to the so-called diving response (i.e. bradycardia, reduced cardiac output, peripheral vasoconstriction) which burdens the heart and leads to changes in circulation. This study investigated the effects of prolonged apnea to the heart and hemodynamic alterations using comprehensive cardiac magnetic resonance imaging (CMR).

METHOD AND MATERIALS

We investigated 17 (15 male, 2 women) elite divers using CMR at 1,5T before, during, and after apnea in air. Subjects performed two sessions: in the first cardiac function (left ventricular end-diastolic volume (LV-EDV), end-systolic volume (LV-ESV), ejection fraction (LV-EF), fractional shortening (FS)) was repeatedly measured using steady state free precision (SSFP) imaging in SAX and VLA; in the second blood flow was measured in both common carotid arteries (ACC) using phase contrast imaging. Apnea was performed in maximal inspiration.

RESULTS

Mean breath hold duration was 297s±52 in the cardiac session and 276s±78 in the flow session. Maximal apnea time reached was 8:03min. Over time, apnea (AP) resulted in a progressive increase of LV-EDV (baseline: 131ml±33; AP: 190ml±35; $p<0.0001$), slight decrease of LV-EF (baseline: 63%±10; AP: 58%±8; $p=0.0112$) and a consecutive increase of LV-ESV (baseline: 49ml±20; AP: 80ml±18;$p<0.0001$). FS as a parameter of regional function also decreased significantly during apnea (baseline: 35%±5; AP: 25%±5; $p<0.0001$). Flow measurement revealed an increase of blood-flow to the brain (left ACC; baseline: 5.0ml±2.0; AP: 12.8ml±6.4; $p=0.0026$; right ACC; baseline: 5.1ml±2.2; AP: 12.4ml±6,3; $p=0.0009$).

CONCLUSION

This work reveals that prolonged apnea results in massive hemodynamic changes to the heart and an increase of blood-flow to the brain as expected from the diving reflex. In particular, apnea leads to a transient cardiac dilation, decrease of LV-EF and fractional shortening, a similar pattern as seen in patients with systolic heart failure.

CLINICAL RELEVANCE/APPLICATION

This study shows that prolonged apnea has tremendous effects to the heart and the vascular system; therefore moderate trained subjects, especially with known medical conditions, should perform maximal apnea with caution.

SSK04-07 Is it Possible to Investigate Archeological Hearts Using CT and MRI? About Five Archeological Hearts

Wednesday, Dec. 2 11:30AM - 11:40AM Location: S504AB

Participants
Fatima-Zohra Mokrane, MD, Toulouse, France (*Presenter*) Nothing to Disclose
Rozenn Colleter, Cesson-Sevigne, France (*Abstract Co-Author*) Nothing to Disclose
Sylvie Duchesne, MSc, Saint Orens de Gameville, France (*Abstract Co-Author*) Nothing to Disclose
Ramiro Moreno, MS, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
Anou Sewonu, PhD, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
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Norbert Telmon, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose
Fabrice H. Dedouit, MD, PhD, Toulouse, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Five archeological hearts were found in an archeological site last year. Several graves were found in the basement of a church. In addition to different archeological bones found, five heart shaped lead polls were discovered.These findings were found in vaults from elite class families.At the opening of the polls, findings were very interesting: five well conserved hearts dating form the end on the 16th century, to the beginning of the 17th century.

METHOD AND MATERIALS

Thanks to the embalming process, archeological hearts were well conserved. Each archeological heart has been studied with CT scanner and with MRI, before and after balm extraction, and after rehydration.CT parameters were standard, using a 16 row CT scanner. MRI parameters were difficult to optimize. This was due to lack of hydration of these archeological pieces.

RESULTS

First images acquired were very impressive, but with poor information. This was due to important vegetal embalming process. Hearts were first scanned with their balms. Then, they were carefully "cleaned". Finally, they were rehydrated.CT and MR examinations where performed for each heart.Because of an intra tissue lead diffusion, especially in infra epicardial fat, there was an impressive natural contrast on CT images. This element permitted to identify different heart structures like chambers, valves and coronary arteries.MRI images were hard to obtain because of lake of hydration. Therefore, images after rehydration were relevant and allowed to better identify myocardial muscles

CONCLUSION

Study of archeological smooth tissues like heart is possible using CT and MRI, but it requires a good knowledge of the embalming process and MR technical parameters.

CLINICAL RELEVANCE/APPLICATION

Until now, no radiological examination of archeological hearts was described in the literature data.

SSK04-08 Atherosclerotic Plaque Burden Assessment: Coronary CT Angiography versus Invasive Coronary Angiography

Wednesday, Dec. 2 11:40AM - 11:50AM Location: S504AB

Participants
Pal Maurovich-Horvat, MD,PhD, Budapest, Hungary (*Presenter*) Nothing to Disclose
Szilard Voros, Richmond, VT (*Abstract Co-Author*) Shareholder, Global Genomics Group; Employee, Global Genomics Group
Balint Szilveszter, MD, Budapest, Hungary (*Abstract Co-Author*) Nothing to Disclose
Marton Kolossvary, Budapest, Hungary (*Abstract Co-Author*) Nothing to Disclose
Istvan Edes, Budapest, Hungary (*Abstract Co-Author*) Nothing to Disclose
Zsolt Bagyura, Budapest, Hungary (*Abstract Co-Author*) Nothing to Disclose
Bela Merkely, MD,PhD, Budapest, Hungary (*Abstract Co-Author*) Speakers Bureau, Medtronic, Inc

PURPOSE

Strong relationship exists between atherosclerotic disease burden and risk for adverse events as assessed by coronary computed tomography angiography (CTA) and conventional invasive coronary angiography (ICA). Despite widespread use of CTA and ICA for coronary plaque burden assessment, few studies have compared coronary CTA and ICA regarding semi-quantitative plaque burden measurements.

METHOD AND MATERIALS

We enrolled 71 consecutive patients (mean age 60.8±11.7 yrs, 36.6% women) who underwent both 256-slice coronary CTA and conventional ICA within no more than 120 days. A total of 1016 coronary segments were evaluated for the presence of plaque and stenosis severity. On average, 32 [IQR:15-62.5] days passed between the two examinations. A total of 16 segments were excluded due to presence of a stent. We calculated the segment stenosis score (SSS), which describes the amount and severity of the stenosis (0-normal, 1-minimal, 2-mild 3-moderate 4-severe 5-occluded). The presence of plaques has been described by the segment involvement score (SIS) (0-intact, 1-plaque). The SSS index (SSSi)=SSS/all assessed segments and SIS index (SISi)=SIS/all assessed segments were also calculated. CTA and ICA scores were compared using Wilcoxon rank sum test (SPSS 22).

RESULTS

CT detected coronary artery plaques in 48.7% of all assessed segments (487/1000), whereas ICA showed coronary plaques in only 23.5% (235/1000) of 1000 segments ($p<0.001$). Importantly, CTA detected atherosclerotic plaque in 34.8 % (266/765) of coronary segments where the ICA was negative. Conversely, ICA detected plaques only in 2.7% (14/513) segments where CTA was negative. We found significant differences between the two methods for segment involvement and luminal stenosis indices, CTA versus ICA; SISi: 0.49±0.22 vs. 0.24±0.14 ($p<0.001$); SSSi: 1.17±0.64 vs. 0.67±0.50 ($p <0.001$).

CONCLUSION

Coronary CTA detected approximately twice as many coronary segments with atherosclerotic plaques as ICA. Our findings are in line with previous histological studies, according to which a significant number of plaques do not cause luminal stenosis. Using coronary CTA for atherosclerotic plaque burden assessment may allow for better risk stratification and improved patient outcomes.

CLINICAL RELEVANCE/APPLICATION

Coronary CTA for atherosclerotic plaque burden assessment may allow for improved risk stratification as compared to invasive coronary angiography.

SSK04-09 Effect of Calcium Blooming in Coronary Arteries at Different Monoenergetic Levels of a Novel Spectral Detector CT and Comparison with Polyenergetic Conventional Image

Wednesday, Dec. 2 11:50AM - 12:00PM Location: S504AB

Participants
Majid Chalian, MD, Cleveland Heights, OH (*Presenter*) Nothing to Disclose
Bahar Mansoori, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR, Cleveland, OH (*Abstract Co-Author*) Institutional Research Grant, Koninklijke Philips NV

PURPOSE

To evaluate the extent of calcium blooming in coronary arteries at different virtual monoenergetic levels of a novel spectral detector CT (SDCT) and compare with the conventional polychromatic image.

METHOD AND MATERIALS

This study included 59 patients who had coronary CTA using an SDCT prototype (Philips Healthcare, Cleveland, OH, USA). 17

patients were found to have coronary artery calcifications and recruited in the study. Two independent readers evaluated calcified plaques for plaque diameter, plaque area, luminal diameter, and percentage of stenosis. Measurements were performed at conventional polychromatic image as well as virtual monoenergetic images from 70 to 140 keV at 10 keV intervals. The images were also evaluated qualitatively for vascular enhancement, noise, and mage quality on a 5-point scale (1 -worst, 5-best). Repeated measure ANOVA test was used to compare differences at different energy levels. Intra-class correlation coefficient (ICC) was used to evaluate inter-observer reliability.

RESULTS

Diameter of calcification, area of calcification, and degree of stenosis demonstrated gradual statistically significant ($p<0.001$) decrease at different incrementally increasing monochromatic imaging keVs from 70 to 140 keV (3.41mm to 1.55mm, 9.96mm2 to 3.39 mm2, and 70% to 30% stenosis, respectively). Also, diameter and area of lumen demonstrated gradual ncrease at higher monochromatic energy levels (1.56mm to 2.74mm and 4.47mm2 to 8.61mm2, respectively, $p<0.001$). Comparison of monochromatic reconstructed images with conventional polychromatic imaging also demonstrated the same pattern of changes, with progressive improvement at higher energy levels. The monochromatic images at 80 keV provided the best image quality metrics. There was excellent inter-observer reliability between two readers (ICC> 0.970). Subjective analysis showed that the image quality progressively declined above 80 keV due to decreasing vascular enhancement, with the maximum image quality seen at 80 keV (4.8 at 80 keV to 2 at 140 keV).

CONCLUSION

Calcium blooming significantly decreases at higher monoenergy levels compared to polychromatic images with resultant increased luminal size and decreased stenotic grade. 80 keV is the best level due to declining image quailty at higher levels

CLINICAL RELEVANCE/APPLICATION

Use of monoenergetic images decreases the effect of calcium blooming in coronary arteries compared to polychromatic images.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Prabhakar Rajiah, MD, FRCR - 2014 Honored Educator

SSK06

ISP: Gastrointestinal (Colon Cancer Screening and Staging)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: E351

GI CT MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
David H. Kim, MD, Madison, WI (*Moderator*) Consultant, Viatronix, Inc; Co-founder, VirtuoCTC, LLC; Medical Advisory Board, Digital ArtForms, Inc; Stockholder, Cellectar Biosciences, Inc
Christine O. Menias, MD, Scottsdale, AZ (*Moderator*) Nothing to Disclose

Sub-Events

SSK06-01 Gastrointestinal Keynote Speaker: Update on Colon Cancer Screening and CTC

Wednesday, Dec. 2 10:30AM - 10:40AM Location: E351

Participants
David H. Kim, MD, Madison, WI (*Presenter*) Consultant, Viatronix, Inc; Co-founder, VirtuoCTC, LLC; Medical Advisory Board, Digital ArtForms, Inc; Stockholder, Cellectar Biosciences, Inc

SSK06-02 CT Colonography versus Flexible Sigmoidoscopy for Colorectal Cancer Screening. Outcomes of a Randomized Controlled Trial (RCT)

Wednesday, Dec. 2 10:40AM - 10:50AM Location: E351

Participants
Daniele Regge, MD, Candiolo, Italy (*Presenter*) Speakers Bureau, General Electric Company
Loredana Correale, PhD, Turin, Italy (*Abstract Co-Author*) Researcher, im3D SpA
Carlo Senore, MD, Torino, Italy (*Abstract Co-Author*) Nothing to Disclose
Cesare Hassan, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Gabriella Iussich, MD, Locarno, Switzerland (*Abstract Co-Author*) Consultant, im3D SpA
Nereo Segnan, Torino, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefania Montemezzi, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare detection rate (DR) of CT colonography (CTC) and flexible sigmoidoscopy (FS) for CRC screening.

METHOD AND MATERIALS

An invitation letter to participate in a multicenter randomized screening trial was mailed to people aged 58-60 years, living in the Piedmont Region, Italy and in Verona, Italy. Individuals with a history of CRC/adenomas, inflammatory bowel disease, recent colonoscopy, or two first-degree relatives with CRC were excluded from invitation by their general practitioners. Responders to the invitation were randomized to either CTC or FS and scheduled for screening procedure. CTC interpretations were remotely performed via telediagnosis, and were assisted by a Computer-aided detection software. Participants with polyps≥6-mm at CTC and those with "high-risk" distal lesions (i.e., adenomas>10-mm, or high-grade dysplasia, or villous component >20%, or >2 adenomas of any type) at FS were referred for colonoscopy (CC). The primary outcome was DR of advanced neoplasia (AN), namely, the number of participants with CRC or advanced adenomas relative to the total number of participants. Differences were expressed as relative risk (RR) with 95% CIs.

RESULTS

5412 people agreed to take part in the trial: 2738 randomly assigned to FS and 2674 to CTC. After excluding participants with inadequate bowel preparation, analysis included 2673 (1298 females) adequate FS examinations and 2595 (1266 females) diagnostic CTC exams. Of FS participants, 271 (10.1%) were referred to CC; compliance to CC was 86.7% (235). Of CTC participants. 264 (10.2%) were offered CC, of whom 260 (98.5%) performed the exam. DR of AN was 4.7% (127 including 9 CRCs) for FS vs. 5.1% (133 including 10 CRCs) for CTC [RR: 1.1; 95% CI: 0.9-1.4; P=0.524]. DR of distal AN was 4.1% (109) for FS and 2.9% (76) for CTC [RR: 0.72; 95% CI: 0.54-0.96; P=0.025]. DR of proximal AN was 1.3% (34) for FS and 2.7% (69) for CTC [RR: 2.06; 95% CI: 1.37-3.10; P<0.001]. Isolated proximal AN were present in 2.3% and 0.67% of CTC and FS participants, respectively.

CONCLUSION

No significant differences were seen in AN detection for the two screening groups. However, DR of distal AN was 30% lower in CTC than in FS screening, while DR of proximal AN was two times higher following screening with CTC than with FS.

CLINICAL RELEVANCE/APPLICATION

Our study supports the hypothesis that CTC screening may have a larger impact on reduction of proximal CRC incidence than FS.

SSK06-03 Natural Course of Medium-sized Polyps during a 3-year Surveillance Interval: Linear and Volumetric Assessment with CT Colonography in Correlation with Histology

Wednesday, Dec. 2 10:50AM - 11:00AM Location: E351

Participants
Charlotte J. Tutein Nolthenius, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose
Thierry N. Boellaard, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

Yung Nio, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Maarten G. Thomeer, MD, Rotterdam, Belgium (*Abstract Co-Author*) Nothing to Disclose
Shandra Bipat, MS, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Margriet de Haan, MD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
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Katharina Biermann, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Marc van de Vijver, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Ernst Kuipers, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Evelien Dekker, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jaap Stoker, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Research Consultant, Robarts Clinical Trials

PURPOSE

Volumetric growth assessment in medium-sized polyps has shown to be more reliable than linear measurements and it seems a promising biomarker for determination of clinical importance. This is however not standard practice in reporting on polyps with CT colonography (CTC) and more experience and research is needed.

METHOD AND MATERIALS

Ethics approval and written informed consent were obtained. After participating in an invitational population-based CTC screening trial 101 participants harbored one or two 6-9 mm polyps as the largest lesion(s) for which surveillance CTC was advised after 3 years. Participants with lesion(s) of ≥6 mm at surveillance CTC were offered colonoscopy and polypectomy. Volumetric and linear measurements were performed on index and surveillance CTC and polyps were classified into baseline growth categories according to ±30% volumetric change over the entire surveillance interval (>30% growth as progression, 30% growth to -30% decrease as stable and >-30% decrease as regression). Polyp growth was correlated to histopathological findings and other polyp characteristics.

RESULTS

Between July 2012 and May 2014, 78 of 101 patients underwent surveillance CTC (mean age 65.6 (SD 6.7); 51% male). After a mean surveillance interval of 3.3 years (SD 0.3; range 3.0-4.6 years) of 95 polyps 33 (35%) progressed, 36 (38%) remained stable and 26 (27%) regressed, including an apparent resolution in 13 (14%) polyps. Of 20 proven advanced adenomas, 14 (70%) progressed and 6 (30%) remained stable, compared to 13 (37%) and 16 (46%) of 35 non-advanced adenomas. No associations were found between growth categories and polyp morphology, location and size at index CTC. Other linear or volumetric thresholds used did not identify more advanced adenomas.

CONCLUSION

Volumetric assessment showed one-third of medium-sized polyps to progress over time emphasizing the importance of these polyps. However, growth assessment was not able to identify all advanced adenomas as one-third remained stable in size over a 3-year surveillance interval. These findings must be taken into account when deciding on proper colonoscopy referral guidelines.

CLINICAL RELEVANCE/APPLICATION

Volumetric assessment showed one-third of medium-sized polyps to progress over time emphasizing the importance of these polyps.

SSK06-04 Five Years of CT Colonography in One Institution - How Many Cancers Have We Missed?

Wednesday, Dec. 2 11:00AM - 11:10AM Location: E351

Participants
David Little, MBChB, FRCR, Bristol, United Kingdom (*Presenter*) Nothing to Disclose
Will Loughborough, MBChB,BSC, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Adam Youssef, BMedSc, BMBS, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Thomas Mendes da Costa, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Paul McCoubrie, MBBS, FRCR, Bristol, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT colonography is used in our institution in the diagnosis of colorectal carcinoma in both screening and symptomatic populations. The primary purpose of this study was to determine the sensitivity of CT colonography in our institution and compare with published evidence to ensure we are meeting quality standards.

METHOD AND MATERIALS

Our sample includes all patients with a diagnosis of colorectal carcinoma entered onto the cancer registry (the gold standard in UK cancer monitoring) between January 2010 and January 2015 who had previously had a CT colonography investigation. Each of these patients were reviewed on our radiological information system (RIS) to confirm whether CT colonography was used as part of the primary diagnosis. Demographic data and details about the tumour (such as location within the colon) were recorded. Any patients in which there was a suggestion that a carcinoma had been missed were reviewed in detail.

RESULTS

5058 CT colonography studies were performed in 4921 patients between January 2010 and January 2015 at our institution. 261 (5.1%) of these patients were identified as having a diagnosis of colorectal carcinoma on the cancer registry. 63 patients that underwent CT colonography following diagnosis (i.e. to look for synchronous tumour or as follow-up) were excluded. 198 (3.9%) of patients were diagnosed with colorectal carcinoma following a CT colonography investigation. In 3 (1.5%) of these patients the colorectal carcinoma was missed on CT colonography.

CONCLUSION

The sensitivity of CT Colonography for colorectal carcinoma in our institution is 98.5% which compares favourably with other published studies on CT colonography and colonoscopy. This confirms CT colonography as an important and valid tool in the diagnosis of colorectal carcinoma.

CLINICAL RELEVANCE/APPLICATION

Our study confirms that CT colongraphy is an important tool in the diagnosis of colorectal malignancy and is an example to other institutions in monitoring CT colonography outcomes and maintaining quality standards. During this presentation we will explore the common reasons for missed malignancy on CT colonography.

SSK06-05 CT Findings of Postpolypectomy Coagulation Syndrome in Patients Who Underwent Colonoscopic Polypectomy: Comparison with Those of Perforation

Wednesday, Dec. 2 11:10AM - 11:20AM Location: E351

Participants
Yoon Joo Shin, MD, Seongnam, Korea, Republic Of (*Presenter*) Nothing to Disclose
Young Hoon Kim, MD, PhD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yoon Jin Lee, MD, Seongnam-si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Ji Ye Sim, MD, MS, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe CT findings of postpolypectomy coagulation syndrome (PPCS) and to identify the features that can distinguish it from colonic perforation after colonoscopic polypectomy.

METHOD AND MATERIALS

From January 2011 to November 2014, a total of 5542 adult (age>40yr) patient who underwent colonoscopic polypectomy were found according to search through hospital database. After reviewing the patient's medical and imaging records, eight patients (0.14%) with PPCS and six patients (0.11%) with perforation were identified. Because five patients were excluded due to absence of CT examination, four (1 male; age range, 52-75 years with mean age, 69 years) with PPCS and five patients (5 male; age range, 46-67 years with mean age, 54 years) with perforation were finally included. Two abdominal radiologists reviewed the abdominal CT images in a consensus manner. The following CT findings were assessed: presence of pneumoperitoneum or pneumoretroperitoneum, presence of fluid collection, presence of colonic wall thickening, if present, patterns, thickness and length of an involved segment, enhancement pattern of an involved segment, presence of mural defect in an involved segment, and presence of surrounding infiltration around an involved segment. Clinical findings including patient's symptom and sign were also assessed.

RESULTS

Although three patients with perforation eventually underwent surgery, all patients with PPCS were completely recovered only with conservative management. The clinical presentation including presence of abdominal pain or leukocytosis was not different between two groups. On CT, an involved colonic wall was more longer and thicker in PPCS group (mean length and width: 124 ± 81.3 mm, 16 ± 4.9 mm) than perforation group (41.4 ± 11.8mm, 7.4 ± 1.5mm). In all four patients with PPCS, CT images showed a marked low attenuation wall thickening with severe pericolic infiltration around an involved segment. None of the patients with PPCS showed free air on CT.

CONCLUSION

PPCS, a very rare complication after colonoscopic polypectomy (prevalence of 0.14%), shows severe low attenuating mural thickening. In comparison with perforation, PPCS does not demonstrate free air in peritoneal or retroperitoneal space

CLINICAL RELEVANCE/APPLICATION

The imaging features on CT can be useful to promptly distinguish PPCS from colonic perforation.

SSK06-06 Extracolonic Findings at Screening CT Colonography: Analysis of Incompletely Characterized and Likely Insignificant (C-RADS E3) Findings

Wednesday, Dec. 2 11:20AM - 11:30AM Location: E351

Participants
Bryan D. Pooler, MD, Madison, WI (*Presenter*) Nothing to Disclose
David H. Kim, MD, Madison, WI (*Abstract Co-Author*) Consultant, Viatronix, Inc; Co-founder, VirtuoCTC, LLC; Medical Advisory Board, Digital ArtForms, Inc; Stockholder, Cellectar Biosciences, Inc
Perry J. Pickhardt, MD, Madison, WI (*Abstract Co-Author*) Co-founder, VirtuoCTC, LLC; Stockholder, Cellectar Biosciences, Inc; Research Consultant, Bracco Group; Research Consultant, KIT ; Research Grant, Koninklijke Philips NV

PURPOSE

To assess the incidence and outcomes of unexpected extracolonic findings at screening CTC which are likely insignificant and/or incompletely characterized (C-RADS E3), but may require further evaluation.

METHOD AND MATERIALS

7,952 consecutive patients (mean age 56.7±7.3 years, M:F 3,675:4,277) underwent first-time CTC screening over a 98-month interval. Persons with unsuspected C-RADS E3 findings were extracted and outcomes determined.

RESULTS

Previously unknown C-RADS E3 findings were identified in 9.2% (731/7,952; mean age 57.2±7.7 years; M:F 268:463) of the screening CTC population; 25 patients had multiple findings for a total of 757 E3 findings. Consideration for further imaging, if clinically appropriate, was suggested for 84% (634/757) of these findings, with clinical correlation suggested in the remainder. Dedicated follow-up imaging was obtained in 4.4% (353/7,952) of patients. Conditions requiring treatment or ongoing surveillance were diagnosed in 0.9% (72/7,952) of patients. Common extracolonic finding categories included: adnexal/uterine (24%, 185/757), lung (20%, 155/757), kidney/GU (20%, 149/757), and liver (11%, 85/757). Malignant or potentially malignant lesions were found in 0.2% (18/7,952) of patients, including renal cell carcinoma, lymphoma, breast cancer, and malignant/borderline ovarian cancer.

CONCLUSION

Likely insignificant/incompletely characterized (C-RADS E3) findings were found in 9.2% of patients undergoing screening CTC with consideration for additional imaging suggested in the majority. Follow-up imaging was actually obtained in 4.4%, with conditions ultimately requiring treatment or ongoing surveillance diagnosed in 0.9%. Malignant or potentially malignant lesions were found in 0.2% of the total cohort.

CLINICAL RELEVANCE/APPLICATION

Incompletely characterized and likely insignificant extracolonic (C-RADS E3) findings are uncommon, occurring in less than 10% of patients. Fewer than 1% of patients were diagnosed with conditions requiring treatment or continued surveillance. Extracolonic malignancies are rare in this group.

Honored Educators

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Perry J. Pickhardt, MD - 2014 Honored Educator

SSK06-07 Effect of Reducing Abdominal Compression during Prone CT Colonography on Ascending Colonic Rotation Occurring with Supine-to-prone Positional Change

Wednesday, Dec. 2 11:30AM - 11:40AM Location: E351

Participants
Jong Keon Jang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Seong Ho Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Seok Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Jin Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ah Young Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Kwon Ha, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Colonic rotation that mimics lesion mobility on CT colonography (CTC) can be particularly deceptive when it happens in unexpected locations such as the ascending colon. This study was to evaluate the effect of reducing abdominal compression during prone CTC on ascending colonic rotation that occurs with supine-to-prone positional change.

METHOD AND MATERIALS

Consecutive patients fulfilling following criteria were found from 1218 CTC cases (January 2013 to July 2014): a) prone CTC obtained with cushion blocks placed under the chest and pelvis to reduce abdominal compression, b) air-distended ascending colon on both supine and prone CTC, and c) colonoscopy-proven sessile polyps >=6mm in straight mid-ascending colon. Radial locations along the luminal circumference (°) of 24 polyps and 54 colonic teniae (3 teniae in each patient) in mid-ascending colon of 18 patients (M:F, 16:2; 65±12 years) were measured on supine and prone CTC images and supine-to-prone difference was determined. A coordinate system designed to offset effects of torso rotation was used. The supine-to-prone difference was given a value between -180° (- for internal rotation) and +180° (+ for external rotation). Degrees of abdominal compression (Abd comp) and posterior displacement of mid-ascending colon (Asc disp) in prone position were quantitatively measured and were correlated with the radial location change of ascending colonic polyps and teniae.

RESULTS

The radial location change was -22° to 61° (median, 10.4°) for the polyps and was similar for colonic teniae, which was considerably smaller than the reported ascending colonic rotation. However, 50-56% of the polyps and teniae still showed external rotation >10°. The radial location change was not significantly correlated with Abd comp (P =.131 to .287) but was correlated with Asc disp (r =.562 to .702; P =.001 to .015). Posterior displacement of the ascending colon still occurred in prone position due to gravitational anterior displacement of other mobile abdominal contents despite the lack of abdominal compression.

CONCLUSION

Ascending colonic rotation on CTC ocurring with supine-to-prone positional change was incompletely prevented by reducing abdominal compression during prone CTC.

CLINICAL RELEVANCE/APPLICATION

Careful confirmation of lesion mobility or lack of it is fundamental for accurate CTC interpretation although reducing abdominal compression during prone CTC may decrease the related pitfall in the ascending colon.

SSK06-08 Computer-aided Supine-only Reading in Full-cathartic CT Colonography: Observer Performance Study

Wednesday, Dec. 2 11:40AM - 11:50AM Location: E351

Participants
Yasuji Ryu, MD, Boston, MA (*Presenter*) Nothing to Disclose
Janne J. Nappi, PhD, Boston, MA (*Abstract Co-Author*) Royalties, Hologic, Inc; Royalties, MEDIAN Technologies;
Hiroyuki Yoshida, PhD, Boston, MA (*Abstract Co-Author*) Patent holder, Hologic, Inc; Patent holder, MEDIAN Technologies;

PURPOSE

To assess the performance of an advanced computer-aided "supine-only reading" of full-cathartic CTC in the detection of polyps in patients with average or high risk of colorectal cancer.

METHOD AND MATERIALS

A total of 266 CTC cases were sampled from a multi-center CTC trial for patients with average or high risk of colorectal cancer, in which patients underwent cathartic bowel preparation with 2L polyethylene glycol solution and 20mL sodium diatrizoate for tagging of residual fluid, followed by automated CO2 insufflation. A computer-aided detection (CADe) system that had been trained with cases independent from this study was used to review the CTC cases. One expert reader (≥600 cases reading experience) reviewed the cases in "supine-only reading" mode, in which only the supine scans of these cases were interpreted using CADe as a second reader, and recorded all detected lesions ≥6 mm. The per-patient sensitivities and the areas under the receiver operating curve (AUC) in the detection of adenomas and carcinomas were compared between unaided and CADe-aided readings, as well as between the supine-only reading and "conventional reading" result from the trial, in which both supine and prone scans were used for interpretation of the CTC cases.

RESULTS

There were 53 and 28 patients with adenomas and/or carcinomas ≥6 mm and ≥10 mm, respectively. Corresponding per-patient sensitivities (AUCs) for CADe-aided supine-only reading were 91% (.92) and 93% (0.96), respectively, whereas those of conventional reading were 90% (.91) and 93% (.96), respectively. The differences in sensitives and AUCs were not statistically significant (Fisher's exact test, P>.5). For 6-9 mm lesions, the per-patient sensitivity (AUCs) of CADe-aided supine-only reading was 83% (.88), which was higher (McNemar's test, P<.05) than those of unaided, supine-only reading of 69% (.81).

CONCLUSION

In full-cathartic CTC, CADe-aided supine-only reading may yield an equally high performance in the detection of adenomas and carcinomas as that of the conventional, supine-prone reading. CADe may also significantly improves the detection performance of polyps 6-9 mm in size in size in the supine-only reading

CLINICAL RELEVANCE/APPLICATION

Computer-aided supine-only reading has the potential to allow one-position scanning in CTC, thereby effectively reducing the radiation dose and reading time into a half of those of conventional reading.

SSK06-09 Observer Study for Detection of Lesions in Viewing CT Colonography Using a New Eye Gaze Tracking System

Wednesday, Dec. 2 11:50AM - 12:00PM Location: E351

Participants
Mitsuru Sato, Maebashi, Japan (*Presenter*) Nothing to Disclose
Toshihiro Ogura, PhD, Maebashi, Japan (*Abstract Co-Author*) Nothing to Disclose
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Yushi Hirano, Otaru, Japan (*Abstract Co-Author*) Nothing to Disclose
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Shoko Tsutsumi, Maebashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Kiyoshi Isobe, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsuko Torimoto, Otaru, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Monitoring the eye tracking of the observer in the detection of lesions is important in order to understand image interpretation process for CT colonography. Head-mount eye tracker system has been used to track observers' viewing points on radiological images. However, it is difficult to use this system casually due to a problem of an obtrusive device for observation. We investigated gaze points for image interpretation of CTC images by experts and non-experienced observers, and analyze the time and the gaze point for detection of lesions using a new eye gaze tracking system, which was designed to detect the pupil point and corneal reflection point in the dark pupil eye tracking by using two infrared cameras.

METHOD AND MATERIALS

Observers for CTC image reading commonly use virtual gross pathology (VGP) images which were obtained as a stretched views of the inner colonic surface. We used an eye gaze point sensing system (JVCKenwood Co.,Yokohama,Japan) which consisted of an eye tracking sensor with two infrared light emitting diode (LED) laser emitters combined with two infrared cameras. Observer studies were performed by two expert observers (over 13 years experience) and two non-experienced observers on nineteen VGP images including tumors, polyps and other abnormalities.

RESULTS

Eye gaze tracking data of the observers can be obtained without a device put on the head such as a headgear, with proper training of about 20 minutes. The average reading time (32.6sec) by expert observers was significantly shorter ($p<0.001$) than that (46.2sec) by non-experienced observers. The detection rates of target areas such as tumors by expert observers (84.18%) was higher than that of non-experienced observers (68.35%). Non-experienced observers in CTC reading were prolonged with low detection rates. On other hand, experienced observers provided shortened viewer's gaze dwells time on the target areas.

CONCLUSION

A new eye gaze tracking system for CTC images can be performed without a head-mount eye tracker. Although the reading time of expert observers was short, the target areas on VGP images were observed with a high detection rate.

CLINICAL RELEVANCE/APPLICATION

An eye gaze tracking analysis using infrared cameras can be set-up easily. Gaze points on CTC images by experts and non-experienced observers can be determined for understanding of image readings for detection of lesions.

SSK07

ISP: Gastrointestinal (Pancreas Benign Diseases)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: E353B

GI CT MR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Elizabeth M. Hecht, MD, New York, NY (*Moderator*) Nothing to Disclose
Koenraad J. Mortele, MD, Boston, MA (*Moderator*) Nothing to Disclose
Atif Zaheer, MD, Baltimore, MD (*Moderator*) Nothing to Disclose

Sub-Events

SSK07-01 Gastrointestinal Keynote Speaker: Update on Imaging Benign Pancreatic Diseases

Wednesday, Dec. 2 10:30AM - 10:40AM Location: E353B

Participants
Koenraad J. Mortele, MD, Boston, MA (*Presenter*) Nothing to Disclose

SSK07-02 Using T1 Mapping for the Diagnosis of Mild Chronic Pancreatitis

Wednesday, Dec. 2 10:40AM - 10:50AM Location: E353B

Participants
Temel Tirkes, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
Jordan K. Swensson, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose
Chen Lin, PhD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
Qun Zhong, MD, PhD, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Qiushi Wang, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
Evan Fogel, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
Fatih Akisik, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
Kumaresan Sandrasegaran, MD, Carmel, IN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if the pancreatic signal intensity on T1 mapping can be used to diagnose mild chronic pancreatitis.

METHOD AND MATERIALS

This retrospective study analyzed patients with suspected chronic pancreatitis who underwent MRI between March 2014 and December 2014. All MRI studies were performed on 3.0 T Magnetom Verio (Siemens Medical Solutions, Malvern, PA) scanner. T1 mapping was acquired with gradient echo sequence using TR 3.87 ms, TE 1.32, flip angles of 2° and 13°, NEX of 1 and matrix of 320x168. Of 127 patients scanned, patients < 18 years age, and those with acute pancreatitis, pancreatic neoplasm, iron overload, or cystic fibrosis were excluded from the analysis. Patients were grouped as normal or mild chronic pancreatitis based on secretin-enhanced MR pancreatography using the Cambridge classification. There were 55 normal and 21 patients with mild chronic pancreatitis. Region of interest (ROI) measurements (~1cm2) were drawn in the homogenous regions of the head, body and tail of the pancreas by two independent and blinded reviewers. The two-tailed t-test was used to determine differences of T1 relaxation times between the normal and mild CP patients. Receiver operating characteristic (ROC) curve analysis was performed to determine the accuracy of the T1 relaxation time as a differentiating criterion.

RESULTS

There was a significant difference ($p < 0.0001$) in the T1 relaxation times of the pancreas between the normal (mean 819 ms, 95%CI: 739-898) and mild chronic pancreatitis (mean: 1141 ms, 95%CI: 1027-1255) groups. T1 relaxation time cut off value of 1000 ms was 72% sensitive (95%CI: 48-89) and 75% specific (95%CI: 61-85) for the diagnosis of mild chronic pancreatitis (AUC=0.80, $p<0.0001$). There was substantial inter-observer agreement (kappa=0.74) of measured T1 relaxation times.

CONCLUSION

There is significant difference in the T1 relaxation times of the pancreas between the normal and mild chronic pancreatitis patients.

CLINICAL RELEVANCE/APPLICATION

T1-mapping may be a practical imaging technique for diagnosis of mild chronic pancreatitis.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Temel Tirkes, MD - 2013 Honored Educator
Temel Tirkes, MD - 2014 Honored Educator
Kumaresan Sandrasegaran, MD - 2013 Honored Educator
Kumaresan Sandrasegaran, MD - 2014 Honored Educator
Fatih Akisik, MD - 2014 Honored Educator

SSK07-03 Quantitative MRI Evaluation of the Pancreatic Parenchyma in Diabetes Mellitus

Wednesday, Dec. 2 10:50AM - 11:00AM Location: E353B

Participants
Fabio A. Uyeno, MD, Sao Carlos, Brazil (*Presenter*) Nothing to Disclose
Jorge Elias JR, MD, PhD, Ribeirao Preto, Brazil (*Abstract Co-Author*) Nothing to Disclose
Natalia P. Ito, MD, Ribeirao Preto, Brazil (*Abstract Co-Author*) Nothing to Disclose
Iana M. Araujo, Ribeirao Preto, Brazil (*Abstract Co-Author*) Nothing to Disclose
Adriana L. Carvalho, Ribeirao Preto, Brazil (*Abstract Co-Author*) Nothing to Disclose
Francisco A. Paula, Ribeirao Preto, Brazil (*Abstract Co-Author*) Nothing to Disclose
Valdair F. Muglia, MD, PhD, Ribeirao Preto, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the pancreatic fat fraction and ADC in healthy, obese and diabetic (type 1 and 2) subjects

METHOD AND MATERIALS

A retrospective study of abdominal MR images of 89 subjects (56 controls incluing obese subgroup; 33 diabetics) was carried out. Two radiologists reviewed all images independently and proceed the calculation of pancreatic fat fraction through in and out-of-phase GRE T1-weighted sequences, and the ADC through diffusion with maximum b=1000. Pancreatic fat fractions and average values of ADC were obtained and compared.

RESULTS

We observed significant differences between pancreatic fat fractions of diabetics type 2 (DM2) and healthy and diabetic type 1 (DM1) individuals, with p values of 0.01 and 0.02 for men and 0.02 and 0.01 for women, with good interobserver reliability (intraclass correlation coefficients > 0.8). Obese non-diabetic sujects showed high pancreatic fat fraction similar to DM2. There was also a significant difference in ADC values between DM2 and DM1 and healthy individuals (p: 0.02 and 0.03 in males; p: 0.002 and 0.001 in females), lower in DM2.

CONCLUSION

We observed significantly higher pancreatic fat fractions in DM2, when compared to healthy and DM1 subjects. This finding favors the hypothesis of fatty infiltration of the organ as a possible associated causal factor to the pancreatic beta cells failure, although obese subjects had pancreatic fat fractions similar to DM2.

CLINICAL RELEVANCE/APPLICATION

Pancreatic fatty infiltration ocurring can be evaluated by MRI and its role in Diabetes Mellitus need further assessment.

SSK07-04 Co-existing Liver and Pancreas Steatosis Related to Chronic Non-alcoholic Liver Diseases (NALD) but not to Viral Infection

Wednesday, Dec. 2 11:00AM - 11:10AM Location: E353B

Participants
Manuela Franca, MD, Porto, Portugal (*Presenter*) Nothing to Disclose
Angel Alberich-Bayarri, MD, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose
Luis Marti-Bonmati, MD, PhD, Godella, Spain (*Abstract Co-Author*) Nothing to Disclose
Joao A. Oliveira, Porto, Portugal (*Abstract Co-Author*) Nothing to Disclose
Francisca E. Costa, MD, Porto, Portugal (*Abstract Co-Author*) Nothing to Disclose
Jose Ramon Vizcaino Vazquez, Porto, Portugal (*Abstract Co-Author*) Nothing to Disclose
Helena Pessegueiro Miranda, Porto, Portugal (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Liver steatosis is related to metabolic syndrome but is also present in other diffuse liver diseases. Pancreas steatosis may be also present in association with steatohepatitis and metabolic syndrome. However, little is known about pancreas fat deposition in other diffuse liver diseases such as viral hepatitis.Our purpose was to assess the Proton Density Fat Fraction (PDFF) of the liver and pancreas, with a multiecho GRE MR sequence, in patients with diffuse liver diseases, and to evaluate the relationship between fat infiltration of both organs and the influence of the underlying liver disease.

METHOD AND MATERIALS

The study population included consecutive patients with diffuse liver disorders and clinically indicated liver biopsy, who underwent a 3T MR examination using a single breath-hold multiecho chemical shift GRE sequence with 12 echoes. PDFF quantification was performed with magnitude and phase reconstruction, T1 and T2* biases corrected, selecting a ROI in the biopsied liver segment and also in 3 pancreatic regions (head, body, tail). Differences of liver and pancreas PDFF between histologic grades were assessed by ANOVA tests. The relationship between liver and pancreas PDFF values and histologic grading was assessed with Spearman correlation analysis. Furthermore, the study population was categorized by clinical diagnosis (chronic viral hepatitis vs. chronic NALD).

CONCLUSION

We found a significant correlation between liver and pancreas PDFF quantification, in patients with NALD but not in patients with viral hepatitis.

CLINICAL RELEVANCE/APPLICATION

Fat deposition in liver and pancreas appears to be related in patients with chronic non-alcoholic disease but not in chronic viral hepatitis.

SSK07-05 Intravoxel Incoherent Motion Diffusion-weighted MR Imaging in Characterizing Tumorous and Inflammatory Pancreatic Diseases

Wednesday, Dec. 2 11:10AM - 11:20AM Location: E353B

Participants
Bohyun Kim, MD, Suwon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Seung Soo Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yu Sub Sung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyoung Jung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Ho Byun, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the feasibility of intravoxel incoherent motion (IVIM) parameters in differentiating acute pancreatitis, autoimmune pancreatitis (AIP), neuroendocrine tumor (NET), solid pseudopapillary tumor (SPT), pancreatic ductal adenocarcinoma (PAC), and normal pancreas.

METHOD AND MATERIALS

The institutional board approved this retrospective study, and informed consent was waived. We evaluated IVIM diffusion-weighted images (10 b values for 0 to 900 sec/mm^2) of 104 consecutive patients (mean age, 53.7 years; M:F=58:46) with pathologically confirmed pancreatic neoplasms (n =54; 15 NETs, 9 SPTs, and 30 PACs) > 2cm, acute pancreatitis (n =13), AIP (n =7), and normal pancreas (n =30). The slow diffusion coefficient (Dslow), fast diffusion coefficient (Dfast), and perfusion fraction (f) were measured on two consecutive sections covering the largest part of the lesions. The differences in IVIM parameters among the diagnoses of pancreatic lesions were compared using the ANOVA test and the post-hoc Bonferroni multiple comparisons test.

RESULTS

PAC had significantly lower f values (0.13 ± 0.06) than normal pancreas (0.24 ± 0.05), NET (0.21 ± 0.06), and acute pancreatitis (0.25 ± 0.01) and significantly lower Dfast values (20.0 ± 12.6 x 10^-3mm^2/sec) than normal pancreas (48.2 ± 23.9 x 10^-3mm^2/sec) (P<.05). For AIP, f value (0.14 ± 0.06) was significantly lower than that of normal pancreas (P<.05). Dfast values of acute pancreatitis (25.4 ± 14.6 x 10^-3mm^2/sec), NET (26.5 ± 19.9 x 10^-3mm2^/sec), and SPT (17.8 ± 9.5 x 10^-3mm^2/sec) were lower than that of normal pancreas. Although the Dslow of AIP (1.06 ± 0.19 x 10^-3mm^2/sec) were lower than normal pancreas (1.14 ± 0.15 x 10^-3mm^2/sec) and the other pancreatic diseases, the difference was not statistically significant.

CONCLUSION

Perfusion related parameters (f and Dfast) are more helpful in characterizing pancreatic diseases than Dslow . PAC and AIP are characterized by decreased perfusion fraction (f) compared with normal pancreas.

CLINICAL RELEVANCE/APPLICATION

IVIM is feasible for assessing the different perfusion and diffusion characteristics of pancreatic diseases.

SSK07-06 Evaluation of Pancreatic Exocrine Insufficiency by Cine-Dynamic MRCP Using Spatially Selective IR Pulse: Correlation with Severity of Chronic Pancreatitis based on Morphological Changes of Pancreatic Duct

Wednesday, Dec. 2 11:20AM - 11:30AM Location: E353B

Participants
Kazuya Yasokawa, Kurashiki, Japan (*Presenter*) Nothing to Disclose
Katsuyoshi Ito, MD, Okayama, Japan (*Abstract Co-Author*) Nothing to Disclose
Tsutomu Tamada, MD, PhD, Kurashiki, Japan (*Abstract Co-Author*) Nothing to Disclose
Akira Yamamoto, MD, Kurashiki, Japan (*Abstract Co-Author*) Nothing to Disclose
Akihiko Kanki, MD, Kurasiki, Japan (*Abstract Co-Author*) Nothing to Disclose
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Ayumu Kido, Kurashiki, Japan (*Abstract Co-Author*) Nothing to Disclose
Teruyuki Torigoe, Kurashiki, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recent study showed a significantly positive correlation between secretion grades of pancreatic juice at cine dynamic MRCP with a selective inversion recovery (IR) pulse and pancreatic exocrine function test. This study evaluated pancreatic exocrine insufficiency by cine-dynamic MRCP using spatially selective IR pulse in patients with chronic pancreatitis in correlation with the severity of morphological changes of pancreatic duct.

METHOD AND MATERIALS

41 patients with suspected chronic pancreatitis underwent cine-dynamic MRCP with a spatially selective IR pulse. Mean secretion grading score (5-point scale) based on the moving distance of pancreatic juice inflow on cine-dynamic MRCP was assessed. Based on the previous report, cutoff value of secretion grade less than 0.70 in cine-dynamic MRCP was used for the criterion of pancreatic exocrine insufficiency. Mean secretion grades were compared with Cambridge grade which defined the severity of chronic pancreatitis based on morphological changes of pancreatic duct.

RESULTS

In comparisons among patient groups with Cambridge grade1 (normal; n=6), 2 (equivocal; n=3), 3 (mild; n=6), 4 (moderate; n=9) and 5 (severe; n=17), median secretion grading score of Cambridge5 (score=0) was significantly lower than Cambridge1-4 (1.13, 0.55, 0.50, 0.15; P<0.001, P<0.015, P<0.002, P<0.028, respectively). In all 17 patients in Cambridge5, secretion grading score was less than 0.70. Median secretion grading score of Cambride1 was significantly higher than Cambridge3-5 (P<0.030, P<0.011, P<0.001, respectively). In Cambridge2-4, there were no significant differences in secretion grading score between any groups. In Cambridge2, secretion grading score was less than 0.70 in 2 (67%) of 3 patients showing pancreatic exocrine insufficiency. Conversely, in Cambridge3 and 4, secretion grading score was more than 0.70 in 3 (20%) of 15 patients showing normal pancreatic exocrine function.

CONCLUSION

It should be noted that the degree of morphological changes of pancreatic duct does not necessarily reflect the severity of pancreatic exocrine insufficiency at cine-dynamic MRCP in Cambridge grade 2-4 (equivocal to moderate) chronic pancreatitis.

CLINICAL RELEVANCE/APPLICATION

Cine-dynamic MRCP with selective IR pulse may have a potential to evaluate pancreatic exocrine insufficiency in patients with Cambridge grade 2-4 (equivocal to moderate) chronic pancreatitis.

SSK07-07 Imaging Evaluation of Ablative Margin and Index Tumor Immediately after Combined Treatment of TACE and RF Ablation for Hepatocellular Carcinoma: Comparison between Multi-detector CT and MR Imaging

Wednesday, Dec. 2 11:30AM - 11:40AM Location: E353B

Participants
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Sang Soo Shin, MD, Gwangju, Korea, Republic Of (*Presenter*) Nothing to Disclose
Suk Hee Heo, MD, Hwasun-Gun, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyo Soon Lim, MD, Jeollanam-Do, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jun Hyung Hong, Gwang-Ju, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Hoe Hur, Jeollanam-Do, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong-Yeon Jeong, MD, Chonnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively compare multi-detector CT and MR imaging in assessment of ablative margin (AM) and index tumor within ablation zones immediately after combined treatment of transcatheter arterial chemoembolization (TACE) and radiofrequency (RF) ablation for hepatocellular carcinoma (HCC)

METHOD AND MATERIALS

Based on our preliminary data, necessary number of patients was estimated to be at least 30 when an α error of 0.05 and a β error of 0.2 were applied. A total of 33 consecutive patients with 45 HCCs, who had successfully undergone contrast-enhanced CT and MR imaging after RF ablation combined with TACE, was enrolled in this study. CT and MR imaging were performed within 3 and 7 hours after completion of combined therapy of TACE and RF ablation, respectively. Both CT and MR images were reviewed in consensus by two radiologists in two separate sessions regarding visual discrimination between AM and index tumor and status of AM within ablation zones. The status of AM was classified as AM plus (AM completely surrounded tumor), AM zero (AM was partly discontinuous, without protrusion of tumor beyond postulated border of ablated area) and AM minus (AM was partly discontinuous, with protrusion of tumor). Any ablation zone with AM plus or AM zero was considered as imaging evidence to predict technical effectiveness, which was based on one-month follow-up CT, as well as to represent technical success.

RESULTS

With CT and MR imaging, visual discrimination between AM and index tumor was possible in 34 (75.6%) and 40 (88.9%) of 45 ablation zones, respectively (P = .1094). Among 34 and 40 ablation zones in which status of AM could be evaluated on CT and MR imaging, AM status was categorized into AM plus (n=25 and 31, respectively), AM zero (n=9 and 8, respectively) and AM minus (n=0 and 1, respectively). The technical effectiveness was noted in all of ablation zones on one-month follow-up CT. Based on CT and MR imaging, technical success and effectiveness were determined to be achieved in 34 (75.6%) and 39 (86.7%), respectively (P= .1797).

CONCLUSION

There was no significant difference in assessment of ablative margin and index tumor within ablation zones immediately after combined treatment of TACE and RF ablation between CT and MR imaging.

CLINICAL RELEVANCE/APPLICATION

CT and MR imaging have equivalent ability to evaluate technical success immediately after combined treatment of TACE and RFA. Thus, MR imaging may not be necessary.

SSK07-08 Methodology for True Dynamic Contrast-Enhanced MRI of Pancreatic Lesions

Wednesday, Dec. 2 11:40AM - 11:50AM Location: E353B

Participants
Eric Paulson, Milwaukee, WI (*Presenter*) Nothing to Disclose
Paul M. Knechtges, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Beth A. Erickson, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Dynamic contrast-enhanced (DCE) MR imaging offers promise to improve the diagnosis, therapy planning, and response assessment of pancreatic lesions. However, organ motion arising from respiration and peristalsis can challenge voxel-wise estimation of pharmacokinetic (PK) parameters in abdominal DCE-MRI. We introduce here a novel methodology to correct DCE-MRI datasets for inter-scan motion, facilitating true voxel-wise DCE-MRI in the abdomen.

METHOD AND MATERIALS

Five patients with pancreatic cancer were imaged at 3T. An anti-peristaltic agent (glucagon, 1mg IV) was administered to suppress bowel motion. Multi-flip angle breath hold images (2/5/15/25 deg) were acquired using a 3D Dixon VIBE sequence. A time series of 16 breath hold 3D Dixon VIBE images was then acquired before (3), during (1), and after (12) bolus administration of contrast (0.1 mmol/kg, Multihance). Deformable image registration (DIR) software was used to construct deformation vector fields (DVFs) required to align the fat-only Dixon (FD) images at each time point to one pre-contrast FD reference image. The DVFs were then applied to the corresponding water-only Dixon (WD) images at each time point to motion-correct the DCE-MRI time series. Baseline

T1 maps were estimated using a linearized Ernst model fit to the multi-flip angle WD images. PK parameters (Ktrans, kep, ve, vp) were estimated on a voxel-wise basis by fitting of the linearized Extended Tofts model to concentration-time curves constructed using the motion-corrected WD images.

RESULTS

FD images were robust against spatial and temporal variations in signal intensity arising from wash-in and wash-out of contrast, facilitating construction of DVFs. Applying the FD-derived DVFs to WD successfully corrected the WD images for inter-scan motion arising from inconsistent breath holds, facilitating voxel-wise PK parameter estimation for all patients studied. The methodology facilitated extraction of late-arterial phase images for conventional radiologic interrogation.

CONCLUSION

The novel use of Dixon and DIR facilitates voxel-wise estimation of PK parameters from abdominal DCE-MRI datasets. Future work will incorporate Dixon with radial k-space sampling to improve intra-scan motion robustness during breath hold acquisitions.

CLINICAL RELEVANCE/APPLICATION

Potential to improve disease diagnosis, therapy selection and planning, and response assessment of abdominal organs (e.g., pancreas, liver, kidneys, etc).

SSK07-09 Test-retest Reliability of 3D-EPI MR Elastography in Pancreas

Wednesday, Dec. 2 11:50AM - 12:00PM Location: E353B

Participants
He An, Shenyang, China (*Presenter*) Nothing to Disclose
Yu Shi, PhD, Shengyang, China (*Abstract Co-Author*) Nothing to Disclose
Qiyong Guo, MD, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of the study is to conduct a rigorous evaluation of the repeatability of pancreas stiffness assessed by 3D echo-planar-imaging magnetic resonance elastography (3D-EPI MRE) in healthy volunteers, patients with chronic pancreatitis and pancreatic ductal adenocarcinoma (PDAC).

METHOD AND MATERIALS

A repeatability study using 3D-EPI MRE was conducted in 5 healthy volunteers and 8 patients confirmed by histopathologic examinations (5 with PDAC and 3 with chronic pancreatitis). Subjects were scanned by using a GE 3.0 T MR scanner to assess the mean stiffness of the tumors in PDAC cases, the parenchyma of pancreas in chronic pancreatitis cases and healthy volunteers with a multi-slice EPI pulse sequence(timepoint 1). Direct inversion algrithm with 3D post-processing was used to estimate shear stiffness and generate stiffness maps. Subjects were re-evaluated one day later (timepoint 2).Stiffness was measured by 2 independent analysts (one with three and another with one year experience of MRE measurement).

RESULTS

For the 2 analysts, the mean stiffness in all subjects was highly reproducible with intraclass correlation coefficient (ICC) of 0.975(95% confidence interval [CI]: 0.944-0.989) across timepoints ($r=0.973, P<0.001$). Bland-Altman analysis showed mean stiffness difference was 0.01kPa(95% agreement limits:-0.54-0.55kPa). For the 2 timepoints, the ICC was 0.973(95% CI: 0.940-0.988) across the 2 analysts ($r=0.975, P<0.001$). Bland-Altman analysis showed the stiffness difference was 0.05kPa(95% agreement limits:-0.51-0.62kPa).The averaging stiffness value was 1.46±0.21kPa for chronic pancreatitis and 3.28±1.09kPa for PDAC, in contrast with 1.11±0.08kPa for normal pancreas.

CONCLUSION

3D MRE is a highly reproducible modality for assessing stiffness of pancreas.

CLINICAL RELEVANCE/APPLICATION

It is suggested to incorporate MRE into a standard MRI study, which offers stable and accurate stiffness of pancreas and pancreatic masses relatively.

SSK08

Genitourinary (Functional Imaging of the Kidneys)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: E450B

GU MR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Harriet C. Thoeny, MD, Bern, Switzerland (*Moderator*) Nothing to Disclose
Zhen J. Wang, MD, Hillsborough, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSK08-01 Assessing the Role of Quantification of Shear Wave Velocity and Tissue Elasticity in the Detection of Interstitial Fibrosis within the Transplant Kidney

Wednesday, Dec. 2 10:30AM - 10:40AM Location: E450B

Participants
David Ferguson, MBBCh, Vancouver, BC (*Presenter*) Nothing to Disclose
Amdad M. Ahmed, MBChB, FRCR, Birmingham, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Mohammed F. Mohammed, MBBS, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Caitlin Schneider, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Christopher Nguan, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose
Alison C. Harris, MBChB, Vancouver, BC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Novel ultrasound techniques allow for the assessment of tissue fibrosis. One such technique ('Virtual Touch IQ') allows for both qualitative and quantitative measurement of shear wave velocity to assess tissue strain and detect underlying fibrosis. Using this technique, in the setting of renal allograft failure, we aim to compare the gold standard of renal biopsy and histological grade with that of shear wave velocity measurement to evaluate for potential underlying interstitial fibrosis.

METHOD AND MATERIALS

Patients undergoing renal biopsy for renal graft dysfunction within the ultrasound department were enrolled prospectively over an eight-month period. In addition to routine routine renal ultrasound with Doppler imaging, shear wave velocity measurements using 'Virtual Touch IQ' were obtained from the target area for renal cortical biopsy. Sufficient magnitude of the shear wave was confirmed on quality display. Biopsies were performed and reviewed by a nephropathologist, blinded to the imaging results, with histological categorization according to the Banff classification.Shear wave velocities and histological grade were compared to determine significance. Statistical analysis was performed using the Mann Whitney test and Spearman-correlation-coefficient (rho).

RESULTS

Fourteen patients were identified and subcategorized according to the Banff category with respect to interstitial fibrosis as normal (n=4), grade 1(n=4), grade 2 (n=3) and grade 3(n=3). Median shear wave velocity was demonstrated to be significantly higher in renal transplants with biopsy proven interstitial fibrosis (median=2.512m/s) than those without interstitial fibrosis (median=1.925m/s) (Mann Whitney U=4, n1=4, n2=10, $p<0.05$). Positive correlation was also identified between the mean shear wave velocity and Banff categories (rho= 0.731, p=0.003).

CONCLUSION

Preliminary data indicates that shear wave velocity within cortex of the transplant kidney correlates significantly with interstitial fibrosis in the context of renal allograft failure.

CLINICAL RELEVANCE/APPLICATION

Shear wave velocity analysis is a potentially valuable non-invasive tool to assess for renal allograft interstitial fibrosis.

SSK08-02 Improved Temporal Resolution and Image Contrast for Kidney DCE-MRI by 3D Spoiled Gradient-recalled Echo Sequence with Compressed Sensing

Wednesday, Dec. 2 10:40AM - 10:50AM Location: E450B

Participants
Kai Zhao, PhD, Beijing, China (*Presenter*) Nothing to Disclose
Bin Chen, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jue Zhang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoying Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To verify the feasibility of combine Compressed Sensing (CS) technique in dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) of kidney

METHOD AND MATERIALS

Nine healthy New Zealand rabbits underwent kidney DCE-MRI studies on a clinical 3.0T MR scanner. 3D spoiled gradient-recalled echo sequence modified with CS scheme was scanned before and after the administration of 0.05 mmol/kg of Gd-DTPA with the following parameters: TR = 3.3ms, TE = 1.3ms, FA = 15°, slice thickness = 3 mm, matrix =128×128, FOV = 180mm and 16 slices were acquired. Four accelerations (2-x, 3-x, 4-x, 8-x) were scanned as well as the fully sampling every other day for each animal in

DCE MR imaging. The contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) of the reconstructed images of the kidney were analyzed and compared to that of the fully sampled images separately.

RESULTS

The images with 2-X, 3-X, 4-X, 8-X CS acceleration and fully sampled results were shown from row 1 to row 5. The 8-X accelerated images appeared blurring which may due to the loss of a mass of high frequency information (Figure 1).Signal intensity curves of cortex and medulla were represented in Figure 2. The reconstructions of 8-X were also blurring.Superior CNR performance between cortex and tissue CNR_ct, and medulla and tissue CNR_mt were found for all the time points after contrast administration. CNR_ct of CS reconstructed images were significantly larger than that of the conventional fully sampled images at all accelerations throughout the enhancement ($p<.01$ for 2-X; $p<.001$ for 3-X and 4-X). CNR_mt of CS reconstructed images were also significantly larger than that of the fully sampled images ($p<.01$ for 2-X; $p<.001$ for 3-X and 4-X). CNR_cm measured from cortical and medullary regions were larger in CS reconstructed images, especially at the initial time of enhancement: 44.00 10.0 for 2-X, 43.30 8.0 for 3-X and 49.78 14.9 for 4-X vs. 15.28 6.7 for 1-X ($p<.001$ for all) (Table 1).In SNR analysis, SNR-cortex (SNR_c) and SNR-medulla (SNR_m) of CS reconstructed images were all found statistically different from conventional fully sampled images ($p<.001$) (Table 2).

CONCLUSION

Compressed sensing is a feasible and promising acceleration method to improve temporal resolution and image contrast in renal DCE-MRI.

CLINICAL RELEVANCE/APPLICATION

CS is a promising imaging method with both improved temporal resolution and image contrast, which will be widely used in the future.

SSK08-03 Noninvasive Evaluation of Stable Renal Allograft Function Using Shear-Wave Elastography

Wednesday, Dec. 2 10:50AM - 11:00AM Location: E450B

Participants
Jung Jae Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chan Kyo Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Beom Jun Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byung Kwan Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Protocol renal allograft biopsies improve outcomes via early detection and treatment of subclinical rejection (SCR). Shear-wave elastography (SWE) assesses quantitatively the tissue elasticity. The aim of our study was to investigate the feasibility of SWE in evaluating patients with stable renal allograft function who underwent protocol biopsies.

METHOD AND MATERIALS

95 patients (mean age, 48.3 years; range, 21-73 years) with stable renal allograft function who underwent ultrasound (US)-guided protocol biopsies at 10 days or 1 year after transplantation were enrolled in this retrospective study. All US and elasticity examinations of renal allograft were performed by a commercial scanner using a convex transducer (C5-1 ElastoPQ, Philips iU 22). SWE was performed immediately before protocol biopsies. Tissue elasticity (kPa) in the cortex was measured for all renal allografts. Clinical and US variables were compared between patients with SCR and without SCR using the Student t -test. The correlation between estimated glomerular filtration rate (eGFR) and tissue elasticity was evaluated in all patients by Pearson correlation. Diagnostic performance of tissue elasticity to distinguish between patients with SCR and without SCR was analyzed using a receiver operating characteristics (ROC) curve analysis.

RESULTS

Acute rejection (AR) was pathologically confirmed in 34 patients. The mean tissue elasticity of ARs (31.0 ± 12.8 kPa) was statistically greater than that no ARs (24.5 ± 12.2 kPa) ($P < 0.001$), while the resistive index values did not show statistical difference between ARs and no ARs ($P = 0.112$). Clinical variables including age, kidney size, creatinine and eGFR revealed statistical differences between ARs and no ARs ($P < 0.05$). Tissue elasticity demonstrated a moderate negative correlation with eGFR (correlation coefficient= -0.604, $P < 0.001$). At ROC curve analysis, the area under the curve (AUC) of tissue elasticity was 0.651 and followed eGFR (AUC= 0.728).

CONCLUSION

SWE, as a noninvasive tool, may be feasible in distinguishing between allograft with SCR and without SCR in patients with stable renal function. Moreover, it may demonstrate functional state of renal allografts.

CLINICAL RELEVANCE/APPLICATION

As a feasible technique, shear-wave elastography may help to noninvasively assess functional state of patients with stable renal allograft function.

SSK08-04 Assessment of Renal Allograft Function Early after Transplantation Using Renal IVIM with Healthy as Control

Wednesday, Dec. 2 11:00AM - 11:10AM Location: E450B

Participants
Lihua Chen, Tianjin, China (*Presenter*) Nothing to Disclose
Tao Ren, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Wen Shen, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Panli Zuo, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Graft dysfunction is a common complication following transplantation,which is associated with allograft survial. Intravoxel incoherent

motion (IVIM) has potential to assess renal function in patients with renal and allograft dysfunction. The purpose of the current study in renal allografts early after transplantation was to investigate relationship between estimated glomerular filtration rate (eGFR) and diffusion and perfusion parameters calculated using IVIM imaging, compared with healthy kidney, and to gain the sensitive IVIM parameters for monitoring allograft function.

METHOD AND MATERIALS

A total of 71 subjects were performed on a 3.0T MRI scanner (MAGNETOM Trio, a Tim system, Siemens AG, Erlangen, Germany) using IVIM sequence with 11 b values(0, 10, 20, 40, 60, 100, 150, 200, 300, 500, and 700 s/mm2). Subjects were divided into 3 groups: group 1, healthy volunteers (n=19); group 2, allografts with good allograft function(eGFR≥60mL/min/1.73m2, n=33); group 3, allografts with impaired allograft function(eGFR<60mL/min/1.73m2, n=19).To separate the perfusion and diffusion, a bi-exponential fit was used to calculate the diffusion coefficient of slow (ADCslow); the diffusion coefficient of fast (ADCfast) and perfusion fraction (FP). Differences in IVIM parameters between the cortex and medulla in each group were compared using paired samples t test. Differences of IVIM parameters between three groups were compared using LSD test.Relationships between eGFR and IVIM parameters were assessed using spearman correlation coefficient.

RESULTS

The ADC, ADCslow, Fp values of renal cortex were significantly higher in group 1 and group 2 compared to group 3(all $p<0.01$). The ADC, ADCslow values of renal medulla were significantly higher in group 1 and group 2 compared to group 3(all $p<0.01$). For allografts, significant differences in ADC, ADCslow, FP values of renal cortex and ADC, ADCslow values of renal medulla were observed between group 2 and group 3. In renal allografts, there was a significant positive correlation between eGFR and ADC, ADCslow , Fp value of cortex, ADC, ADCslow value of medulla(all $p<0.05$).

CONCLUSION

The ADC, ADCslow, FP values of renal cortex and ADC, ADCslow values of renal medulla may be useful for detect renal allograft dysfunction. IVIM technique is a reliable imaging for evaluating and monitoring allograft function.

CLINICAL RELEVANCE/APPLICATION

IVIM technique can be used to evaluate and monitor allograft function

SSK08-05 Renal Hemodynamics and Oxygenation Evaluated by ASL, BOLD and Oxygen Extraction Fraction (OEF) Imaging in Animal Model of Diabetic Nephropathy

Wednesday, Dec. 2 11:10AM - 11:20AM Location: E450B

Awards
Trainee Research Prize - Medical Student

Participants
Rui Wang, PhD, Beijing, China (*Presenter*) Nothing to Disclose
Xiaoying Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xuedong Yang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Kai Zhao, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xueqing Sui, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhiyong Lin, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the feasibility of evaluating renal hemodynamics and oxygenation changes by arterial spin labeling (ASL), blood oxygen level dependent (BOLD) and oxygen extraction fraction (OEF) imaging in diabetic nephropathy (DN) rabbits.

METHOD AND MATERIALS

Seventeen New Zealand rabbits were divided into 2 groups: DN group, 12 rabbits with intravenously injection of alloxan at 100 mg/kg; and control group, 5 rabbits with injection of same dosage of 0.9% saline. At 72hr after the injection, blood glucose level was tested for all. Rabbits with blood glucose level higher than 16.0 mmol/L were considered as successfully established of diabetes mellitus (DM) model. MR examination was performed at 3T MR scanner (GE) with an 8-channel knee coil. For each rabbit, 2 times of MR exam were performed: baseline (before injection) and 72hr after model established successfully. ASL imaging was conducted with the labeling strategy of flow-sensitive alternating inversion recovery (FAIR) and BOLD was conducted with multiple gradient echo (mGRE) sequence. The measurement of renal OEF was derived from Yoblonsky's model with multi-echo gradient and spin echo (MEGSE) sequence. Then the rabbits were sacrificed for pathological study of the kidney. Quantitative RBF, R2* and OEF values were obtained within manually drawn ROIs, including cortex (CO) and outer medulla (OM). One-way ANOVA and paired-sample T test was performed to test the differences of RBF, R2* and OEF for inter- and inner-group.

RESULTS

Ten of 12 rabbits in DN group were successfully established DM model and renal pathological damages can be observed in these rabbits. There was no statistically significant difference of RBF, R2* or OEF between two groups at baseline ($p>0.05$). Compared with baseline, R2* and OEF in OM at 72 hr was significantly increased in DN group ($p=0.018$ and 0.048, respectively), while the control group was not ($p>0.05$). In CO, R2* also elevated significantly at 72 hr compared with baseline ($p=0.04$). For control group, there was no significant difference in CO or OM between baseline and 72 hr ($p>0.05$).

CONCLUSION

The combination of ASL, BOLD and OEF MRI may enable a comprehensive assessment of the functional status of early DN pathophysiological changes.

CLINICAL RELEVANCE/APPLICATION

It would be valuable for clinicians to early detect renal pathophysiological changes for diabetes without symptoms.

SSK08-06 Diffusion Weighted Imaging and Diffusion Tensor Imaging for Detection of Acute Kidney Injury in Patients Following Lung Transplantation

Wednesday, Dec. 2 11:20AM - 11:30AM Location: E450B

Participants
Susanne Tewes, MD, Hannover, Germany (*Presenter*) Nothing to Disclose
Gregor Warnecke, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Mi-Sun Jang, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Dagmar Hartung, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Matti Peperhove, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Marcel Gutberlet, Dipl Phys, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Christine Fegbeutel, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Bjoern Juettner, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Axel Haverich, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank K. Wacker, MD, Hannover, Germany (*Abstract Co-Author*) Research Grant, Siemens AG Research Grant, Pro Medicus Limited
Faikah Gueler, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Katja Hueper, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Loss of renal function is a frequent complication after lung transplantation (lutx) and is associated with higher morbidity. Thus, imaging biomarkers to noninvasively monitor renal damage and to guide treatment strategies to preserve renal function are of clinical relevance. The purpose was to evaluate diffusion weighted imaging (DWI) and diffusion tensor imaging (DTI) for detection of renal impairment in lutx-patients.

METHOD AND MATERIALS

54 patients 14±2 days after lutx and 12 healthy volunteers underwent MRI on a 1.5T scanner. Respiratory-triggered DWI (10 b-values, 0-1000 s/mm²) and DTI sequences (20 diffusion direction, b=0,600 s/mm²) were acquired. Maps of apparent diffusion coefficient (ADC) and fractional anisotropy (FA) were calculated. Renal function was monitored daily and acute kidney injury (AKI) was defined according to AKIN-criteria within 48h after surgery. Factors contributing to AKI such as duration of surgery, immunosuppressive drugs and blood product infusion were documented. Statistical analysis comprised ANOVA and correlation analysis. Values are given as mean±SEM.

RESULTS

59% (32/54) of lutx-patients developed AKI. ADC of renal medulla was significantly lower in patients with AKI compared to patients without AKI (2.07±0.03 vs 2.17±0.04*10-³ mm²/s, $p<0.05$) and to healthy volunteers (2.07±0.03 vs 2.21±0.03*10-³ mm²/s, $p<0.01$). FA-values of renal medulla were significantly reduced compared to healthy volunteers in both groups (AKI: 0.27±0.01, no AKI: 0.28±0.01, healthy: 0.33±0.02, $p<0.001$), and did not differ between patients with and without AKI. ADC and FA negatively correlated with the amount of blood product infusion ($r=-0.41$ and $r=-0.42$, $p<0.01$) and ADC was correlated with eGFR at the day of MRI ($r=-0.52$, $p<0.001$). No correlations with duration of surgery and tacrolimus levels at the day of the MRI were observed.

CONCLUSION

Diffusion imaging showed significant renal changes in lutx-patients compared to healthy volunteers irrespective of whether AKI was diagnosed according to standard criteria. ADC reduction was stronger in patients with AKI. Amount of blood product infusion correlated with MRI parameters and may be a contributing factor to renal damage following major surgery.

CLINICAL RELEVANCE/APPLICATION

Diffusion imaging detects renal damage following major surgery and may help to improve patient management to prevent further renal damage.

SSK08-07 Evaluation of Ultra-fast, Single Breath-Hold Renal ASL Perfusion-Preliminary Results of Healthy Volunteers

Wednesday, Dec. 2 11:30AM - 11:40AM Location: E450B

Participants
Melissa Ong, MD, Mannheim, Germany (*Presenter*) Nothing to Disclose
Thorsten Honroth, Bremen, Germany (*Abstract Co-Author*) Research funded, Siemens AG
Guenther Matthias, Bremen, Germany (*Abstract Co-Author*) Research funded, Siemens AG
Bernd Kuehn, PhD, Erlangen, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan O. Schoenberg, MD, PhD, Mannheim , Germany (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Daniel Hausmann, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evaluation of 3D ultra-fast, single breath-hold arterial spin labeling magnetic resonance imaging (ASL MRI) for the measurement of renal perfusion.

METHOD AND MATERIALS

We included 7 (5 male, mean age 29) healthy volunteers who did not suffer from any medical condition. A single-shot pulsed ASL (PASL) prototype sequence with a 3D GRASE readout using background suppression was implemented on a 3.0 Tesla Magnetom Skyra MRI scanner (Siemens Healthcare, Erlangen, Germany). 24 slices with a resolution of 4.7mm x 4.7mm x 4mm were acquired for 4 different inflow times (TI = 750ms, 1000ms, 1250ms, 1500ms) within a single breath-hold of 23s, including an integrated calibration scan (M0). The prototype sequence allowed a multi-slice measurement of the whole kidney in one exam. The exam was performed using a standard 18-channel body matrix coil. No contrast agent was applied. Subjective image quality was rated by two radiologists according to a 5-point Likert-scale (5=excellent; 1=non-diagnostic). Mean renal cortical and medullary blood flow was measured in the upper and lower pole of the kidney.

RESULTS

All images were rated as diagnostic. Overall image quality was rated as good (4; 25-75% quartile 3-4). Mean cortical perfusion values were 224±28 mL/100mL/min for the upper and 224±37 mL/100mL/min for the lower pole, mean medullary perfusion value

ranged between 107±16 mL/100mL/min and 101±14 mL/100mL/min for the upper and lower pole, respectively.

CONCLUSION

Ultra-fast, single breath-hold renal ASL perfusion in healthy volunteers shows promising results regarding image quality and feasibility.

CLINICAL RELEVANCE/APPLICATION

Ultra-fast, single breath-hold ASL perfusion facilitates contrast-free creation of parametric perfusion maps, which can be repeated arbitrarily and hence potentially serve to monitor therapy.

SSK08-08 Diffusion-weighted Magnetic Resonance Imaging of Kidneys in Patients with Chronic Kidney Disease

Wednesday, Dec. 2 11:40AM - 11:50AM Location: E450B

Participants
Katarzyna M. Sukowska, MD, Warsaw, Poland (*Presenter*) Nothing to Disclose
Piotr Palczewski, MD, Warsaw, Poland (*Abstract Co-Author*) Nothing to Disclose
Agnieszka Furmanczyk-Zawiska, Warsaw, Poland (*Abstract Co-Author*) Nothing to Disclose
Wojciech Szeszkowski, Warsaw, Poland (*Abstract Co-Author*) Nothing to Disclose
Dorota Piotrowska-Kownacka, Warsaw, Poland (*Abstract Co-Author*) Nothing to Disclose
Magdalena Durlik, Warsaw, Poland (*Abstract Co-Author*) Nothing to Disclose
Marek Golebiowski, Warsaw, Poland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the apparent diffusion coefficient (ADC) values of renal parenchyma in patients in different stages of chronic kidney disease (CKD). To correlate ADC measurements with creatinine blood level, estimated glomerular filtration rate (eGFR), and ADC values obtained from healthy subjects.

METHOD AND MATERIALS

20 healthy volunteers and 34 patients in different stages of CKD were examined on a 1.5 unit (Ingenia, Philips, The Netherlands). The inclusion criteria for patients with CKD were: biopsy proven CKD and no hydronephrosis or renal artery stenosis. Blood samples to assess the serum creatinine level were taken immediately before examination. The MR examination included two diffusion weighted sequences: one with 16 b values uniformly distributed from 0 to 750; the other one with 10 b values including 6 low (0-150) and 4 high (300-900) b values. ADC values were measured with whole-kidney manually placed region of interest. Statistical analysis was performed using the Statistica software (version 10.0; Statsoft, Inc., US). Unpaired Student's t-test were used to evaluate the differences in ADC. ROC curves were drawn to find out area under the curve for differentiation of CKD groups and cut-off ADC values were calculated so as to achieve the highest average sensitivity and specificity. To investigate the relationship between ADC values and serum creatinine / eGFR, Pearson's correlation coefficient was calculated by bivariate correlation. All P values <0.05 were taken as statistically significant.

RESULTS

A significant positive correlation between ADC and eGFR and a negative correlation between ADC and creatinine blood level was observed. There were statistical differences between ADC values in healthy individuals and patients in moderate and severe stage of CKD. Based on ADC measurements cut-off values were established allowing for identification of patients with eGFR higher than 60 ml/min/1.73m2 and lower then 30ml/min/1.73m2.

CONCLUSION

The DWI has a potential role in assessing renal function as ADC values correlate with eGFR and the level of renal damage in severe stages of CKD.

CLINICAL RELEVANCE/APPLICATION

The ability of DWI to noninvasively assess eGFR may provide an additional tool for monitoring the course of disease and for stratifying the risk of contrast medium administration in patients with CKD.

SSK08-09 Intravoxel Incoherent Motion MRI for Differentiating Renal Hypoperfusion from Increased Cellularity after Ischemia-Reperfusion

Wednesday, Dec. 2 11:50AM - 12:00PM Location: E450B

Participants
Mike Notohamiprodjo, Munich, Germany (*Presenter*) Nothing to Disclose
Katharina Stella Winter, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Staehler, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas D. Helck, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Olaf Dietrich, PhD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Moritz Schneider, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To differentiate hypoperfusion from inflammatory hypercellularity after renal ischemia-reperfusion due to partial nephrectomy using Intravoxel Incoherent Motion MRI.

METHOD AND MATERIALS

This IRB approved prospective study was performed according to the declaration Helsinki. 15 patients with renal tumors underwent MR at 3T (Magnetom Verio, Siemens Healthcare) directly before and one week after partial nephrectomy. Diffusion weighted imaging was acquired with an EPI-sequence (10 b-values 0-800 s/mm2, 3 averages, 6 directions). IVIM-analysis was performed with home-built software (PMI 0.4, IDL) by biexponential fitting of the tissue Dslow (mm2/s*10-3) and the pseudo-diffusion Dfast (mm2/s*10-3) as well as the perfusion component f (%). Apparent diffusion coefficient (ADC; mm2/s*10-3) was derived from monoexponential

analysis. To compare parameters between baseline and follow-up the paired Wilcoxon signed-rank test and to compare non-nephrectomized and partially nephrectomized kidneys the non-paired Mann-Whitney U test was used.

RESULTS

In the baseline examination prior to partial nephrectomy there were no significant differences between tumor bearing and contralateral kidney, whereas the follow-up measurement showed significant differences for ADC ($p<0.001$), Dfast ($p=0.02$) and most pronounced for f ($p<0.001$). Partially nephrectomized kidneys showed a significant decrease of ADC (2.5±0.3 vs. 2.3±0.2, $p<0.01$), Dfast (8.6±1.8 vs. 7.3±1.7, $p = 0.02$) and again most pronounced for f (19.2±3.0 vs. 13.7±4.4 $p < 0.01$). There were no significant differences for Dslow (operated kidney 2.0±0.2 vs. 2.0±0.2; contralateral kidney 2.1±0.2 vs. 2.0±0.1) Non-nephrectomized contralateral kidneys expressed a significant increase of ADC (2.5±0.2 vs. 2.7±0.3, $p < 0.01$), and f (19.3±2.6 vs. 21.5±4.0, $p = 0.03$). There was no significant correlation of the alteration of each parameter to clamping time.

CONCLUSION

IVIM detects significant changes, particularly of the perfusion fraction in the operated and contralateral kidney after partial nephrectomy suggesting that ischemia-reperfusion associated diffusion restriction is correlated to hypoperfusion rather than increasing inflammatory cellularity.

CLINICAL RELEVANCE/APPLICATION

IVIM MRI suggest that renal ischemia-reperfusion associated diffusion restriction is correlated to hypoperfusion rather than increasing inflammatory cellularity.

SSK09

Genitourinary (Prostate Imaging and Staging)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: N228

GU MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Andrew B. Rosenkrantz, MD, New York, NY (*Moderator*) Nothing to Disclose
Antonio C. Westphalen, MD, Mill Valley, CA (*Moderator*) Nothing to Disclose
Ronaldo H. Baroni, MD, Sao Paulo, Brazil (*Moderator*) Nothing to Disclose

Sub-Events

SSK09-01 Computed Very High B-Value Diffusion-Weighted Imaging of the Prostate: How High Should We Go?

Wednesday, Dec. 2 10:30AM - 10:40AM Location: N228

Participants
Nainesh Parikh, MD, New York, NY (*Presenter*) Nothing to Disclose
Justin M. Ream, MD, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Andrea S. Kierans, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Max X. Kong, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Samir S. Taneja, MD, New York, NY (*Abstract Co-Author*) Consultant, Eigen Consultant, GTx, Inc Consultant, Bayer AG Consultant, Healthtronics, Inc Speaker, Johnson & Johnson Investigator, STEBA Biotech NV Royalties, Reed Elsevier
Andrew B. Rosenkrantz, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the impact of a broad range of computed b-values (1,500-5,000 s/mm2) on prostate cancer detection.

METHOD AND MATERIALS

49 patients undergoing 3T prostate MRI before radical prostatectomy were included. Exams included DWI with a maximal acquired b-value of 1,000 s/mm2, from which six computed DWI image sets (b-values ranging from 1,500-5,000 s/mm2) were generated. Two radiologists [R1 (attending), R2 (fellow)] independently evaluated the ADC map as well as each DW image set, blinded to the b-value, to assess dominant lesion location. Pathologic findings from radical prostatectomy served as the reference standard.

RESULTS

Sensitivity for tumor: R1-82% (ADC), 80% (b1000), 86% (b1500), 88% (b2000), 86% (b2500), 84% (b3000), 76% (b4000), 65% (b5000); R2-71% (ADC), 63% (b1000), 76% (b1500), 71% (b2000), 70% (b2500), 65% (b3000), 57% (b4000), 37% (b5000). Sensitivity for Gleason score≥7 tumor: R1-83% (ADC), 80% (b1000), 93% (b1500), 93% (b2000), 90% (b2500), 90% (b3000), 80% (b4000), 65% (b5000); R2-75% (ADC), 68% (b1000), 80% (b1500), 78% (b2000), 78% (b2500), 70% (b3000), 60% (b4000), 38% (b5000). PPV for tumor: R1-95% (ADC), 95% (b1000), 93% (b1500), 96% (b2000), 98% (b2500), 93% (b3000), 95% (b4000), 87% (b5000); R2-85% (ADC), 82% (b1000), 93% (b1500), 88% (b2000), 92% (b2500), 94% (b3000), 93% (b4000), 75% (b5000). Dominant lesion visual conspicuity (1-5 scale): R1-3.4±1.5 (ADC), 2.5±1.2 (b1000), 3.3±1.4 (b1500), 3.2±1.3 (b2000), 3.2±1.4 (b2500), 3.1±1.4 (b3000), 2.8±1.4 (b4000), 2.7±1.5 (b5000); R2-3.2±1.6 (ADC), 2.1±1.1 (b1000), 3.2±1.5 (b1500), 3.1±1.6 (b2000), 3.0±1.6 (b2500), 2.5± 1.5 (b3000), 1.8±1.0 (b4000), 1.3±0.6 (b5000). Reader confidence (1-5 scale): R1-3.2±1.5 (ADC), 2.6±1.3 (b1000), 3.1±1.4 (b1500), 3.1±1.4 (b2000), 3.1±1.5 (b2500), 3.1±1.5 (b3000), 3.0±1.6 (b4000), 2.8±1.7 (b5000); R2-3.3±1.7 (ADC), 2.2±1.2 (b1000), 3.2±1.6 (b1500), 3.4±1.7 (b2000), 3.4±1.8 (b2500), 3.1± 1.8 (b3000), 2.6±1.6 (b4000), 1.9±1.3 (b5000).

CONCLUSION

Computed b-values in the range of 1,500-2,500 s/mm2 were optimal for prostate cancer detection, comparing favorably with the ADC map. b-values of 1,000 or 3,000-5,000 exhibited lower performance.

CLINICAL RELEVANCE/APPLICATION

Computed b-values of 1,500-2,500 s/mm2 (but not higher) help optimize prostate DWI, thereby facilitating targeted prostate biopsy and tailored treatments based on imaging guidance.

SSK09-02 Utility of Apparent Diffusion Coefficient (ADC) in Intermediate Grade (Gleason score 3+4=7) Prostate Cancer Diagnosed at Non-targeted TRUS-guided Needle Biopsy

Wednesday, Dec. 2 10:40AM - 10:50AM Location: N228

Participants
Radu Rozenberg, MD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
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Shaheed Hakim, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Trevor A. Flood, MD, FRCPC, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Rebecca Thornhill, PhD, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Christopher Lim, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

PURPOSE

To determine the ability of ADC analysis to predict Gleason score (GS) upgrading of tumor and extra-prostatic extension (EPE) after radical prostatectomy (RP) in 3+4=7 prostate cancer (PCa).

METHOD AND MATERIALS

With REB approval, 54 men with GS 3+4=7 PCa at non-targeted TRUS-guided biopsy underwent 3-Tesla MRI and RP between 2012-2013. Outcomes at RP included: A) upgrading to GS 4+3=7 and B) organ confined disease (OCD). >0.5 mL tumors were contoured by a blinded GU radiologist by correlating ADC to RP histopathology map. Mean ADC, ADC ratio (normalized to peripheral zone), histogram analysis (10th, 25th and 50th centile ADC) and texture analysis features were compared between groups using multi-variate analysis, regression modeling and ROC analysis.

RESULTS

25.9% (14/54) patients were upgraded to GS 4+3=7 and 51.9% (28/54) patients had EPE after RP. There was no difference in age (p=0.38, 0.85), PSA (p=0.96, 0.95) or % of core biopsies with Gleason pattern 4 (p=0.56, 0.89) between groups. Mean ADC (mm2/sec), ADC ratio, 10th, 25th and 50th centile ADC were similar between GS 3+4=7 (0.94 ± 0.24, 0.58 ± 0.15, 0.77 ± 0.31, 0.94 ± 0.28 and 1.15 ± 0.24) and GS 4+3=7 tumors (0.96 ± 0.20, 0.55 ± 0.11, 0.71 ± 0.26, 0.89 ± 0.19 and 1.11 ± 0.16), p>0.05. 10th centile ADC was lower in tumors with EPE (0.69 ± 0.31 versus 0.82 ± 0.28), p=0.02; with no difference comparing all other conventional ADC parameters, p>0.05. Regression models combining texture features improved prediction of GS upgrade: A) Kurtosis+Entropy+Skewness (AUC 0.76 [SE=0.07], p<0.001; sensitivity 71%, specificity 73%) and B) Kurtosis+Heterogeneity+Entropy+Skewness (AUC 0.77 [SE=0.07], p<0.001); sensitivity 71%, specificity 78%).

CONCLUSION

Amongst Gleason score 3+4=7 prostate cancers diagnosed at TRUS-guided biopsy, mean ADC and ADC histogram analysis is not predictive of upgrading after RP, while ADC texture-analysis improves accuracy. 10th centile ADC is predictive of EPE.

CLINICAL RELEVANCE/APPLICATION

Conventional ADC analysis cannot predict upgrading of Gleason score 3+4=7 prostate cancer diagnosed at TRUS-guided biopsy; however, ADC texture-analysis improves accuracy and 10th centile ADC can predict organ confined disease.

SSK09-03 High Resolution 3-Tesla Endorectal Prostate MR Imaging: A Multireader Study of Radiologist Preference and Perceived Interpretive Quality of 2D and 3D T2-weighted FSE MR Images

Wednesday, Dec. 2 10:50AM - 11:00AM Location: N228

Participants
Antonio C. Westphalen, MD, Mill Valley, CA (*Presenter*) Nothing to Disclose
Susan M. Noworolski, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Saunak Sen, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
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Steven S. Raman, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose
Andrew B. Rosenkrantz, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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Ronald J. Zagoria, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

The goal of this study was to compare the perceived quality of 3-Tesla axial T2-weighted high-resolution 2D and high-resolution 3D FSE endorectal MR images of the prostate.

METHOD AND MATERIALS

We studied 85 men (median age=65 years, 46 to 83) with proven or suspected prostate cancer who had endorectal MR imaging with 2D and 3D T2-weighted FSE MR images. Six radiologists from various institutions independently reviewed axial T2 weighted MR images shown individually and paired. Readers identified their preferred images and scored using a 5-point scale their confidence in identifying tumor. They also scored the delineation of the zonal anatomy and capsule, tumor conspicuity, and image quality (artifacts, distortion, and sharpness) using a 3-point scale. We used a meta-analysis routine to calculate pooled estimates based on a random-effects model. A formal analysis of heterogeneity was also done. The presence of heterogeneity is consistent with differences in the readers' scores. We used a mixed effect logistic regression, taking into account the clustering effect, to determine if prior treatment and number of years of reader's experience were predictors of the option for 2D or 3D images.

RESULTS

Each reader had a strong preference for a given T2-weighted MR sequence, favoring one of the two techniques in at least approximately 70% of cases; but the choices were evenly distributed between the two sequence options. The pooled estimate shows that the 3D image is preferred in about 47% of the times (95% CI=20% to 74%). The choice for one or other techniques was not associated with prior treatment or readers' years of experience. There was no significant difference in confidence in tumor identification (p=0.16 to 1.00). There was no difference in delineation of the zonal anatomy (p=0.19), prostatic capsule (p=0.14), and tumor conspicuity (p=0.89). Similarly, no difference was found when assessing motion artifact (p=0.48) and distortion (p=0.41). 2D FSE images were significantly sharper than 3D FSE (p<0.001), but also more likely to exhibit artifacts not related to motion (p=0.002).

CONCLUSION

There are strong individual preferences for the 2D or 3D FSE MR images, but a wide variability among radiologists. There were differences in image quality, but not in the sequences' ability to delineate the glandular anatomy and depict cancer.

CLINICAL RELEVANCE/APPLICATION

2D and 3D FSE techniques appear to be equally adequate fro clinical use.

SSK09-04 Multi-Parametric MRI Performance in Prostate Cancer Detection: Stratified by Gleason Scores and Tumor Size on Whole Mount Histopathology

Wednesday, Dec. 2 11:00AM - 11:10AM Location: N228

Participants
Pooria Khoshnoodi, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Daniel J. Margolis, MD, Los Angeles, CA (*Abstract Co-Author*) Research Grant, Siemens AG
Hector E. Alcala, MPH, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Nelly Tan, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Wei-Chan Lin, MD, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
David Y. Lu, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Jiaoti Huang, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Robert E. Reiter, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
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Steven S. Raman, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the prostate cancer (CaP) detection rate by multi-parametric MR imaging (MP-MRI) confirmed by whole mount histopathology (WMHP) stratified by Gleason Scores (GS) and tumor size.

METHOD AND MATERIALS

A HIPPA-compliant, IRB-approved study of 290 consecutive men who underwent prostate MP-MRI before radical prostatectomy (RP) from October 2010 to January 2015 was performed. Clinical, MP-MRI (T2W, DWI and DCE) and pathologic features (WMHP slides, GS, maximal diameter) were obtained. The index tumor was defined as the pathological lesion with the highest GS or largest tumor when multiple foci had identical GS. A genitourinary (GU) radiologist and a GU pathologist reviewed each case. Each tumor focus on WMHP which matched with concordant target on MP-MRI was considered detected tumor. Chi-squared tests were used to test difference in MRI tumor detection rates by tumor grade (GS=3+3 defined as low grade vs. GS>6 as high grade) and tumor size (<1 cm defined as small vs. ≥ 1cm as large tumor). Logistic regression was used to test a tumor grade by tumor size in MRI detection. Statistical analyses were conducted using Stata 12.1. P-values below .05 were considered significant.

RESULTS

290 patients had 639 unique CaP foci on WMHP. Of 639 total tumors foci on pathology, 310 (48.5%) and of 290 total index lesions, 224 (77.2%) were detected on MP-MRI. MRI detected 86/326 (26.4%) of low grade tumors vs. 223/313 (71.2%) of high grade tumors, and 56/257 (21.8%) of small vs. 253/382 (66.2%) large tumors. MRI detected 44/212 (20.8%) of low grade small tumors vs. 12/45 (26.7%) of high grade small tumors, and 42/114 (36.8%) low grade large tumors vs. 211/268 (78.7%) of high grade large tumors. ($p<.05$)

CONCLUSION

We found that MP-MRI missed 51.6% of all CaP. However, when CaP stratified by size and GS, larger tumors were associated with increased detection rate for both high and low grade tumors. There was also a significant size by grade interaction, such that the difference in detection rates by grade was much larger among tumors 1cm or larger. These findings suggest that the MP-MRI tends to detect larger with higher grade CaP lesions. In our study, MP-MRI detected 78.7% of all high grade large CaP foci.

CLINICAL RELEVANCE/APPLICATION

MP-MRI which combines anatomic with functional and physiologic assessment of prostate cancer has substantially improved diagnostic capabilities of detecting clinically significant prostate tumors.

SSK09-05 Distortion in Diffusion-Weighted Prostate MRI: Readout-Segmented EPI DWI vs. Single-Shot EPI DWI

Wednesday, Dec. 2 11:10AM - 11:20AM Location: N228

Participants
Ivan Platzek, MD, Dresden, Germany (*Presenter*) Nothing to Disclose
Angelika Borkowetz, MD, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Marieta Toma, MD, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Brauer, MD, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Hagen H. Kitzler, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Verena Plodeck, MD, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Manfred Wirth, Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Laniado, MD, Dresden, Germany (*Abstract Co-Author*) Reviewer, Johnson & Johnson

PURPOSE

The aim of this study was to evaluate the utility of segmented-readout echo planar diffusion-weighted imaging (SR EPI DWI) for prostate imaging in comparison to conventional single shot EPI DWI (SS EPI DWI), with an emphasis on distortion artifacts.

METHOD AND MATERIALS

Sixty-eight patients with suspected prostate cancer were included in this prospective study. Patient age varied between 46 and 77 y (65 y on average). All patients underwent multiparametric prostate MRI (mpMRI) at 3T, which included T2-weighted images, dynamic contrast-enhanced (DCE) images, and both SR EPI DWI and SS EPI DWI. Apparent diffusion coefficient maps (ADC) maps were generated for both SR EPI DWI and SS EPI DWI. Overall lesion classification was based on the PI-RADS scoring system proposed by the European society of Urogenital Radiology (ESUR). Distortion on ADC maps was classified on a five point scale. Furthermore, the maximum distortion in the anteroposterior direction was measured in each patient for both SR EPI DWI and SS EPI DWI.

RESULTS

ADC maps based on SR EPI DWI showed no evidence of distortion in 58/68 patients (85%), while ADC maps based on SS EPI DWI showed no distortion in 42/68 patients (61.7%). Distortion scores were higher (indicating stronger distortion) for SS EPI DWI as compared to SR EPI DWI in 19/68 patients (27.9%) and lower in only one patient (1.5%). Visual evaluation showed significantly less distortion for SR EPI DWI in comparison to EPI DWI ($p = 0.0001$). Average maximum distortion (1.5 ± 2.6 mm) was significantly lower

in SR EPI DWI in comparison to SS EPI DWI (4.9 ± 9.7 mm) ($p < 0.0001$). Ninety-six prostate lesions were detected with mpMRI in total. PI-RADS scores did not differ significantly between mpMRI including SR EPI DWI and mpMRI including SS EPI DWI ($p = 0.464$). Mean ADC values based on SS EPI DWI (0.93 ± 0.21) were slightly lower than those based on SR EPI DWI (0.96 ± 0.22)($p = 0.047$).

CONCLUSION

SR EPI DWI of the prostate has significantly less pronounced distortion artifacts compared to SS EPI DWI. As prostate lesion detection and lesion classification based on PI-RADS scores do not change significantly when SR EPI DWI is used instead of SS EPI DWI, SR EPI DWI is a promising alternative to conventional diffusion-weighted sequences.

CLINICAL RELEVANCE/APPLICATION

The use of SR EPI DWI instead of conventional SS EPI DWI in prostate MRI reduces distortion and can help improve correlation between DWI and T2-weighted images.

SSK09-06 Accuracy and Inter-Observer Variability of Prostate Imaging-Report and Data System (PI-RADS) Version 2.0 for Characterization of Lesions Identified on Multiparametric Magnetic Resonance Imaging of the Prostate

Wednesday, Dec. 2 11:20AM - 11:30AM Location: N228

Participants
Andrei S. Purysko, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
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Eric Klein, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To measure the accuracy and inter-observe variability of PI-RADS version 2.0 for the characterization of prostate lesions identified on mpMRI.

METHOD AND MATERIALS

IRB-approved, HIPAA compliant retrospective study including 171 men (mean age: 61.5 yrs.) either being investigated for prostate cancer (n = 128) or enrolled in active surveillance (n =43), who were examined on a 3.0 T magnet without endorectal coil, and were found to have potential targets for biopsy. Two readers with 8 yrs. of experience in abdominal imaging independently reviewed and assigned a PI-RADS V.2 assessment category to the dominant MRI targets. The reference standard was the combined results from the MR/US fusion biopsy and transrectal ultrasound guided 12-core systematic biopsy (SB) performed in all the patients and in the same procedure. Clinically significant (CS) PCa was defined as tumors with Gleason score >= 3 + 4. Receiver operating characteristic (ROC) analysis was performed.

RESULTS

PCa was detected in 49.1% (84/171) and CS PCa was detected in 32.3% (55/171) of the men. Using PI-RADS category > 3 to discriminate any PCa from non-cancerous lesions, the sensitivity (Sen), specificity (Sp) and area under the ROC curve (AUC) were 77.4%, 84.9% and 85.7% for reader 1 and 69.1%, 87.2%, and 77.9% for reader 2. Using PI-RADS category > 3 to discriminate only clinically significant PCa from clinically insignificant prostate cancer and benign lesions, the Sen, Sp, and AUC were 98.2%, 79.1%, and 91.1% for reader 1 and 92.7%, 84.4%, and 90.4% for reader 2. The inter-observer agreement coefficient was 0.68 (95% CI: 0.61- 0.75).

CONCLUSION

PI-RADS V.2 had high sensitivity, specificity and accuracy for the discrimination of clinically significant PCa from other pathology, with good inter-observer agreement.

CLINICAL RELEVANCE/APPLICATION

Lesions with a PI-RADS V.2 assessment category > 3 should be considered for targeted biopsy, while avoiding the biopsy of lesions with a category < 3 reduces the number of negative biopsies and/or detection of clinically insignificant lesions.

SSK09-07 Predicting Organ-confined Prostate Cancer in the Era of Multiparametric MRI: Comparing the Accuracy of the Partin Tables and mpMRI

Wednesday, Dec. 2 11:30AM - 11:40AM Location: N228

Participants
Alison F. Brown, BA, Durham, NC (*Presenter*) Nothing to Disclose
Thomas J. Polascik, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Rachel K. Silverman, MS, Chapel Hill, NC (*Abstract Co-Author*) Nothing to Disclose
Kae Jack Tay, MBBS,MMed, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Rajan T. Gupta, MD, Durham, NC (*Abstract Co-Author*) Consultant, Bayer AG; Speakers Bureau, Bayer AG; Consultant, Invivo Corporation

PURPOSE

To investigate the accuracy of the Partin tables and multiparametric magnetic resonance imaging (mpMRI) in predicting organ-confined (OC) prostate cancer (PCa) after radical prostatectomy (RP), and to determine if radiologic staging information from mpMRI versus digital rectal exam (DRE) to augment the Partin tables increases the predictive accuracy of this widely used nomogram.

METHOD AND MATERIALS

In this retrospective, HIPAA-compliant, IRB-approved study, 157 patients underwent 3T mpMRI with endorectal coil before RP. MpMRI was used to assess clinical stage and an updated version of the Partin tables was used to calculate the probability of each patient to harbor OC disease. Logistic regression models predicting OC disease were created using mpMRI staging alone and with PSA as a covariate. Two sets of probabilities were obtained from the Partin tables, using clinical staging from either DRE or mpMRI. The area under curve (AUC) was used to calculate the predictive accuracy of each of these four predictive methods.

RESULTS

The predictive accuracy of mpMRI alone in predicting OC disease on pathological analysis is greater (AUC=0.86) than the Partin tables (AUC=0.70), and is further improved when combined with PSA values (AUC=0.88). The accuracy of the Partin nomogram in predicting OC disease decreases (AUC=0.59) when clinical stage is based on mpMRI versus DRE.

CONCLUSION

The superior predictive accuracy of mpMRI compared to Partin tables in predicting OC disease on pathological analysis validates results of smaller previously published studies, including one from our group. Partin table probabilities are calculated using clinical stage based on DRE result, a less sensitive test than mpMRI; therefore, this frequently leads to disease understaging. Consequently, although mpMRI has been shown to more accurately predict clinical stage than DRE, using mpMRI stage in the Partin nomogram does not improve its accuracy. In conclusion, mpMRI staging information is valuable as a stand-alone test when available based on its AUC value, but should not be applied to the Partin nomogram in its existing form.

CLINICAL RELEVANCE/APPLICATION

As more accurate clinical staging information is becoming available due to mpMRI, nomograms that incorporate mpMRI stage are needed to better predict OC PCa and assist in surgical planning prior to RP.

SSK09-08 Diagnostic Differentiation of Prostate Cancer from Prostatic Hyperplasia: What Diffusion Kurtosis Imaging Can Help Us?

Wednesday, Dec. 2 11:40AM - 11:50AM Location: N228

Participants
Chen Lihua, Dalian, China (*Presenter*) Nothing to Disclose
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Meiyu Sun, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Zibin Tong, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Ye Li, Dalian, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the feasibility of the typical parameters of DKI in diagnositic differentiation of prostate carcinoma from prostatic hyperplasia.

METHOD AND MATERIALS

One hundred and thirteen patients with the suspicion of prostate disease were recruited in the study. All the patients, with written informed consent obtained, were performed MRI exams on a 3.0T scanner in a protocol containing the routine T1WI, T2WI, contrast-enhanced MRI, DWI and DKI. From the following histopathological examination, it was confirmed that prostate carcinoma was in 30 and prostatic hyperplasia in 29. MR images were reviewed and analyzed by author and one experienced radiologist who has five years experience in prostate diagnosis, using a dedicated software in Functool on GE ADW4.4 workstation. For each focus, the mean value of the parameters of DKI (MK, Ka, Kr, FA, MD, Da, Dr) and DWI(ADC) was measured: in PCa group, the area where shows low signal on T2WI image, high signal on MK image and histopathological positive was the focus, regions of interest (ROIs) drew three times in the tumor, the size of the ROI was chosen to cover the 2/3 of the tumor(fig 1) , then the average value was used in statistics. In BPH group, three identical ROIs (70mm2)were drew in the central zone, the average value was used in statistics. The type of time-signal intensity curve(TIC) was observed by two observers collectively. ICC test was used to examine the consistency of the measurements, Pearson test was used to examine the relevance between MD and ADC value,and student's t-test was executed to compare the obtained parametric values with $p > 0.05$ concerned statistical significant. The ROC curve of all the parameters were drew and analyzed.

RESULTS

The ICC value of the DKI parameters and DWI parameter in the PCa group and BPH group were respectively, 0.963,0.935,0.959,0.905,0.970,0.909,0.967,0.977and 0.804,0.899,0.913,0.901,0.923,0.902,0.911,0.931, exhibiting an amenable consistency. The mean MK, Ka, Kr of PCa were significantly higher ($p < 0.01$) than the BPH, while the mean MD, Da, Dr of cancerous tissue was found to be significantly lower ($p < 0.01$) than the hyperplasia tissue. No statistically significant difference was observed between FA values of two groups ($p > 0.05$). The area under the ROC curve of all parameters were higher than 0.9.

CONCLUSION

DKI demonstrated can supply many meritorious parameters, with most useful in diagnostic differentiation of prostate cancer from prostatic hyperplasia. Combining with the routine prostate MRI, DKI may help in increasing the sensitivity and specificity of cancer detection.

CLINICAL RELEVANCE/APPLICATION

Combining with the routine prostate MRI, DKI may help in increasing the sensitivity and specificity of cancer detection.

SSK09-09 Incidental Bone Lesions on Staging MRI for Prostate Cancer: Prevalence and Clinical Importance

Wednesday, Dec. 2 11:50AM - 12:00PM Location: N228

Participants

Rachel Schor-Bardach, MD, New York, NY (*Presenter*) Nothing to Disclose
Niamh M. Long, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jane D. Cunningham, FFRRCSI, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Anna Kirzner, MD, Brooklyn, NY (*Abstract Co-Author*) Nothing to Disclose
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Hedvig Hricak, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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Hebert Alberto Vargas, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the prevalence of bone lesions identified on prostate MRI and determine the associations between their imaging features, clinical/pathologic characteristics and the presence of prostate cancer (PCa) bone metastases.

METHOD AND MATERIALS

In this IRB approved, retrospective study, the medical records of 3765 patients undergoing staging prostate MRI for newly-diagnosed (PCa) between 2000-2014 were reviewed. Amongst these, the MRI exams of all patients with bone metastases and a random selection of patients without bone metastases (matched with a 3:1 ratio to patients with bone metastases) were reviewed by 2 independent readers (R1 and R2) for presence, size and signal characteristics of bone lesions on T1-weighted sequences along with their subjective level of suspicion (1-5 Likert scale) for the likelihood of bone metastases on MRI. Prostate-specific antigen levels, biopsy Gleason Score, clinical stage and National Comprehensive Cancer Network (NCCN) risk categories were recorded. The reference standard was bone biopsy and/or at least 1-year follow-up after MRI. Associations between MRI and clinical/pathologic findings were tested using Fisher's exact and Wilcoxon Rank Sum tests. Inter-reader agreement and diagnostic accuracy for bone metastases detection were assessed using Cohen's simple Kappa statistic and areas under the receiving operating characteristics curve (AUC).

RESULTS

57 out of 3765 patients (1.5%) had bone metastases. None of the patients with low-risk PCa according to the NCCN criteria had bone metastases. Inter-reader agreement on MRI was fair to substantial (k=0.26-0.70). There was at least 1 bone lesion present on MRI in 72% (95% CI: 0.66-0.78) and 70% (95% CI: 0.64-0.76) of patients according to R1 and R2. The AUC for detecting bone metastases on MRI was 0.97 (95% CI: 0.94-1.00) and 0.90 (95% CI: 0.84-0.95) for R1 and R2. Larger lesion diameter ($p<0.0001$ for both) and absence of intratumoral fat ($p=0.0013$-0.0020) were significantly associated with bone metastases for both readers.

CONCLUSION

Bone lesions in prostate MRI are present in the majority of patients undergoing initial staging for PCa, and infrequently represent metastatic disease.

CLINICAL RELEVANCE/APPLICATION

MRI findings should be interpreted in the context of clinical features which increase the likelihood of metastatic disease.

SSK12

ISP: Musculoskeletal (Spine)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: E353C

MK MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (*Moderator*) Advisory Board, Siemens AG; Consultant, Medtronic, Inc
Jung-Ah Choi, MD, Hwaseong, Korea, Republic Of (*Moderator*) Nothing to Disclose

Sub-Events

SSK12-01 Musculoskeletal Keynote Speaker: Spine MRI-From Technique to Clinical Application

Wednesday, Dec. 2 10:30AM - 10:50AM Location: E353C

Participants
Lawrence N. Tanenbaum, MD, New York, NY (*Presenter*) Speaker, General Electric Compnny; Speaker, Bracco Group; Speaker, Bayer AG; Speaker, Siemens AG; Speaker, Guerbet SA

SSK12-04 Imaging of Cervical Disc Degeneration in 3D Ultrashort Echo Time MR Imaging Comparing with Conventional T2 Weighted Spin Echo Sequences; An in Vivo Preliminary Study

Wednesday, Dec. 2 11:00AM - 11:10AM Location: E353C

Participants
Yeo Ju Kim, Incheon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jang Gyu Cha, MD, Bucheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sangwoo Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Researcher, General Electric Company
Michael Carl, Menlo Park, CA (*Abstract Co-Author*) Researcher, General Electric Company
Mi Young Kim, MD, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Youn Jeong Kim, MD, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ha-Young Lee, MD, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soon Gu Cho, MD, Incheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the image findings of cervical disc degeneration in 3 dimensional ultrashort echo time MR imaging (3D UTE) according to disc degeneration in conventional T2 weighted spin echo sequences (T2 SE).

METHOD AND MATERIALS

A total of 315 discs of 63 patients (36 men and 27 women; mean age 53.62 years, age range - 19-85) were imaged with sagittal T2 SE (repetition time msec/time to echo msec, 2800/90) and sagittal 3D UTE (16.1/0.028, 4.4, echo-subtraction). In T2 SE, disc degenerations were evaluated from C2-3 to C6-7 using a grading system proposed by Pfirrmann et al. In 3D UTE, discs were classified as follows, according to the morphology of the cartilaginous endplate (CEP), and the signal intensity of the nucleus purposes (NP): type I (smooth thin CEP; low signal intensity of the NP), type II (mild irregular CEP; low signal intensity of the NP), type III (irregular and thickened CEP with or without high signal intensities in some portion of the NP), and type IV (an irregular and thickened CEP with high signal intensities in nearly all of the NP). Each type of disc in the UTE was compared with grades of disc degeneration in T2 SE and analyzed by a linear- by-linear association.

RESULTS

In mild degeneration (grade 2, n=127), type I discs (107/127, 84.3%) were most frequently seen but none of the type IV discs were found in 3D UTE. In cases of severe degenerations (grade 4, n= 11), type IV discs (6/11, 54.5%) were most frequently found but none of the type I discs were seen in 3D UTE. There was a statistically significant tendency between the types of disc in UTE and grades of disc degeneration in T2 weighted SE sequences ($P<0.05$).

CONCLUSION

The degenerative cervical discs showed thick irregular CEPs and increased prevalence of high signal intensity at the NP in 3D UTE.

CLINICAL RELEVANCE/APPLICATION

The change of cartilaginous endplates and increased amount of short T2 components in a nucleus pulposus according to degeneration in 3D UTE may help to understand and diagnosedisc degeneration.

SSK12-05 T1rho and T2 Mapping of Lumbar Intervertebral Disc: Correlation with Degeneration and Morphologic Changes

Wednesday, Dec. 2 11:10AM - 11:20AM Location: E353C

Participants
Min A Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Suk-Joo Hong, MD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
In Seong Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Baek Hyun Kim, MD, Ansan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seun Ah Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate correlation between T1rho (T1ρ), T2 values and disc degeneration and morphologic changes in the lumbar intervertebral discs.

METHOD AND MATERIALS

Twenty-two subjects (M:F=8:14; mean age 55.5 years; range 26-84 years) with 109 lumbar intervertebral discs (from L1-2 to L5-S1) were examined at 3.0T MRI. Disc degeneration was evaluated using the 5-level Pfirrmann grading system and the disc morphology was categorized into five groups: normal, bulging, annular tear, protrusion, extrusion. For T1ρ and T2 quantification, regions of interest (ROIs) were drawn on the three mid-sagittal images at nucleus pulposus (NP), posterior annulus fibrosus (AF), and junction of the NP and posterior AF for each disc on T1ρ and T2 maps. Quantitative measurements for herniated discs were made within the protruded or extruded portion. Statistical analysis was performed using Spearman rank correlation and partial correlation.

RESULTS

The Pfirrmann grades showed strong correlations with the T1ρ values at the NP (r=.800, p<.001), T2 values at the NP (r=.-792, p<.001), and T2 values at the junction (r=-784, p<.001). Disc morphology was moderately correlated with T2 values at the junction (r=-.603, p<.001), T2 values at the NP (r=-.578, p<.001), and T1ρ values at the NP (r=.509, p<.001). After correction for effects of patient age and disc level, there was strong to moderate correlation between the Pfirrmann grades and T1 ρ values at the NP (r=.750, p<.001 after correction of age effect and r=.697, p<.001 after correction of disc level effect).

CONCLUSION

T1ρ and T2 mapping, especially T1ρ values at the NP and T2 values at NP and junction, provided quantitative measurements of the progression of the intervertebral disc degeneration with strong correlations. T2 values at the junction proved good relationship in the assessment of the disc morphologic changes.

CLINICAL RELEVANCE/APPLICATION

T1ρ and T2 mapping provide quantitative measurements for disc degeneration and morphologic changes, which can be used as a synergistic modality for evaluation of lumbar degenerative disc disease.

SSK12-06 Spin Echo Based T2-weighted Modified Dixon (mDixon) Images for Detection of Vertebral Metastasis: Can T1-weighted MR Images Be Replaced by Fat Images of T2 mDixon?

Wednesday, Dec. 2 11:20AM - 11:30AM Location: E353C

Participants
Seok Hahn, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Han Lee, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Seung Hyun Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jaemoon Yang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin-Suck Suh, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate diagnostic performance of spin echo based T2-weighted mDixon MR images and to compare with T1-weighted MR images for detection of vertebral metastasis

METHOD AND MATERIALS

From April to September 2014, we found 124 patients who underwent whole spine MRIs with spin echo mDixon for the evaluation of vertebral metastasis. We obtained conventional T1-weighted images, mDixon images including water and fat images of T2 mDixon, and contrast-enhanced water images of T1 mDixon. We found 23 bone metastases of 12 patients by inclusion criteria: 1) patients with a record of a bone metastasis diagnosis as the primary or secondary diagnosis and 2) Positron emission tomography-computed tomography (PET-CT) scan within one month. The lesion at same level on PET-CT scan was utilized as a reference. Two radiologists reviewed fat and water images of T2 mDixon and contrast enhanced water image of T1 mDixon in random order separately. We calculated sensitivities, specificities, accuracies, positive and negative predictive values, inter-observer agreements.

RESULTS

Of 23 metastatic lesions, the reviewer 1 detected 16 on T1-weighted images, 16 on water images, 15 on fat images of T2 mDixon, 20 on contrast enhanced water images of T1 mDixon. And the reviewer 2 detected 19, 18, 18 and 22, respectively. Contrast-enhanced water images of T1 mDixon showed higher sensitivity than other images (76.1% vs. 73.9% vs. 71.7% vs. 91.3%). Specificities, accuracies, positive and negative predictive values of three spin echo based mDixon images were similar values to conventional T1-weighted images (98.9% vs. 98.0% vs. 98.8% vs. 98.1%; 97.2% vs. 96.2% vs. 96.7% vs. 97.7%; 85.4% vs. 75.6% vs. 82.5% vs. 80.8%; 98.0% vs. 97.8% vs. 97.7% vs. 99.3%). The kappa values of inter-observer agreement were moderate degree (0.712, 0.679, 0.679 and 0.790, respectively).

CONCLUSION

The spin echo based T2-weighted mDixon MR images show good diagnostic performances in sensitivity, specificity, accuracy, positive and negative predictive values compared with T1-weighted MR images for detection of vertebral metastasis.

CLINICAL RELEVANCE/APPLICATION

Using spin echo based T2-weighted mDixon technique, we can obtain water and fat images with single scan, which have similar diagnostic performances to conventional T1-weighted images for the detection of vertebral metastases. And fat images of T2 mDixon can be used for detection of vertebral metastasis instead of T1-weighted images.

SSK12-07 Vertebral Involvement in SAPHO Syndrome: A Follow-up Study of 13 Cases Using MR Imaging

Wednesday, Dec. 2 11:30AM - 11:40AM Location: E353C

Participants
Emilie A. Dodre, MD, Lille, France (*Presenter*) Nothing to Disclose
Caroline Parlier, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Gilles Hayem, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Denis Laredo, MD, Paris, France (*Abstract Co-Author*) Research Consultant, Cardinal Health, Inc; Research Consultant, Laurane Medical; Research Consultant, F. Hoffman-La Roche Ltd; Research Grant, SERVIER

PURPOSE

To retrospectively describe the course of magnetic resonance (MR) imaging findings of vertebral involvement in patients with synovitis, acne, pustulosis, hyperostosis and osteitis (SAPHO) syndrome and to seek for clues in the pathophysiology of spondylitis in SAPHO syndrome.

METHOD AND MATERIALS

Between October 1992 and January 2012, 13 patients (10 women, 3 men; median age at first MR imaging: 33 years) with SAPHO syndrome involving the spine underwent 2 MR examinations of the spine after an interval of at least 3 months. Three musculoskeletal radiologists reviewed MR spinal images in consensus. Erosions of vertebral bodies defined lesional foci. Lesional foci separated by one or more normal vertebral corner were analyzed as distinct lesions. Cortical bone erosions, vertebral signal intensity (SI) alterations compared with normal vertebral body SI, soft-tissue involvement, intervertebral disk SI and disk height compared with the other disks and osseous bridges were evaluated.

RESULTS

27 lesional foci were identified in the 13 patients on initial MR images. Extension of the erosions was seen in 20 foci (74%) and 3 new lesional foci appeared. During follow-up, 31 of the 75 (41%) initial erosions spread by degrees within a single vertebra to the adjacent vertebral parts and to the vertebral corner of the adjacent vertebrae. Changes in SI of the vertebral body were seen in 21 of the 27 (78%) initial foci. In 8 (30%) of the 27 initial lesional foci, a soft tissue involvement at the anterior or lateral paraspinal region was noted. Thickness of this involvement progressed compared to initial examinations in 3 of the 27 foci (11%). A decrease in disk space height was observed on follow-up MRI in 10 of the 27 initial foci (37%) and was associated with high SI on T2-weighted images or gadolinium enhancement of the disk space in 3 (11%), further mimicking disk space infection. Bony bridges over the disk space increased in 3 lesional foci (11%) and appeared in 2 (7%) during follow-up.

CONCLUSION

During the course of the SAPHO syndrome, vertebral involvement spread by degrees within a single vertebra to the adjacent cortices as well as to the vertebral corner of the adjacent vertebrae.

CLINICAL RELEVANCE/APPLICATION

The gradual local spread of the vertebral disease process strongly suggests SAPHO syndrome in the appropriate clinical context.

SSK12-08 CT Manifestations of Spinal Lesions in SAPHO Syndrome

Wednesday, Dec. 2 11:40AM - 11:50AM Location: E353C

Awards
Trainee Research Prize - Medical Student

Participants
Wenrui Xu, MD, Beijing, China (*Presenter*) Nothing to Disclose
Chen Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xue Zhao, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Wen Zhang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Wei-hong Zhang, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In this study, we retrospectively evaluated the CT manifestations of spinal lesions in 54 patients with SAPHO (synovitis, acne, pustulosis, hyperostosis and osteitis) syndrome to increase the diagnostic ability of this disease.

METHOD AND MATERIALS

Our study included 54 SAPHO patients (female:male,36:18; mean±SD age, 42.2±10.0 years; age range,16-62 years) with spinal involvement, among whom 50 patients had characteristic cutaneous disorders. The mean±SD values for hs-C-reactive protein and erythrocyte sedimentation rate were 19.7 ±16.8 mg/L and 6.5±10.5 mmHg/h ,respectively (normal range:0-3 mg/L and 0-20 mmHg/h).CT images of the whole spinal column obtained in the subjects using Toshiba Aquilion ONE 640 (thickness: 2mm,window width: 2000HU,window level: 400HU) were analyzed. A total of 1350 vertebrae were evaluated (25 vertebrae for each individual, from the first cervical vertebra to sacrum).

RESULTS

Spinal involvement in SAPHO syndrome is mainly characterized by enthesitis, endplate inflammation and ossification of paravertebral ligaments. On CT images, enthesitis and endplate inflammation manifested as focal cortical erosion of the vertebral corner and endplate, respectively, with reactive osteosclerosis in surrounding cancellous bone or in some cases the entire vertebral body, and progressed to the formation of syndesmophyte, bony bridge and flattening of vertebral body. Enthesitis and endplate inflammation were observed in 17.5%(236/1350) and 5.4%(73/1350) vertebrae, respectively. Ossifications of paravertebral ligaments were observed in 43 out of the 54 patients, 81.4 % (35/43) on the supraspinous ligament, 20.9 % (9/43) on interspinous ligament, 27.9% (12/43) on anterior longtitudinal ligament and 18.6 % (8/43) on posterior longtitudinal ligament.

CONCLUSION

In conclusion, a better understanding of the CT manifestations of spinal lesions in SAPHO patients may support clinical diagnosis in

the absence of characteristic signs.

CLINICAL RELEVANCE/APPLICATION

A deep understanding of the CT manifestations of spinal lesions in SAPHO patients may support clinical diagnosis in the absence of cutaneous disorders and typical anterior chest wall involvement.

SSK12-09 Evaluation of T2-weighted WARP Sequences in Patients with Spinal Prosthesis

Wednesday, Dec. 2 11:50AM - 12:00PM Location: E353C

Participants
Shun Qi, Xi'an, China (*Presenter*) Nothing to Disclose
Ying Liu, MD, PhD, Xian, China (*Abstract Co-Author*) Nothing to Disclose
Panli Zuo, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Hong Yin, MD, PhD, Xi'an, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MRI is an important modality for imaging the spine as it allows assessment of the spinal cord, adjacent soft tissues and osseous structures. In this study, we compared images quality and diagnostic sensitivity between WARP with standard TSE sequences in interbody fixation patients with titanium screws.

METHOD AND MATERIALS

30 patients (11 males and 19 females; age range, 35-72 years) who were clinically examined discomfort after interbody fixation surgery with titanium screws were scanned at a 1.5T MR scanner (MAGNETOM Aera, Siemens). The T2-weighted sagittal and axial images were acquired using a standard TSE sequence and a WARP TSE sequence implemented the SEMAC and VAT techniques as well as increased bandwidth for radiofrequency and readout pulses. SEMAC factor was 6 for all WARP imaging. The cumulative area of signal void was measured on the axial image, which was defined as the area without discernible anatomic information for both low and high-signal-intensity artifacts induced by the prosthesis (Fig. 1A). Length of spinal canal obscuration on the sagittal image was also measured (Fig. 1B).

RESULTS

On axial T2-weighted images, the area of signal void at the level of the prosthesis (mean ± standard deviation) was 10.4 cm2 ± 4.5 for WARP and 26.6 cm2 ± 10.2 for standard TSE images (Fig. 1C). On sagittal T2-weighted images, the length of spinal canal obscuration at the level of the prosthesis was 1.8 cm ± 0.3 for WARP and 5.4 cm ± 1.2 for standard TSE images (Fig. 1D). Visualizations of all periprosthetic anatomic structures were significantly better for WARP compared with standard imaging. Interobserver agreement for visualizations of anatomic structures was good for both WARP (k = 0.73) and standard (k = 0.71) imaging. The number of abnormal findings noted on WARP images (28 findings) was significantly higher than the number of findings detected on standard images (10 findings) with all abnormal imaging findings detected on standard images were also noted on WARP images.

CONCLUSION

MR images with WARP sequences significantly reduced metal-related artifacts and improved delineation of the prosthesis and periprosthetic region therefore increased the diagnostic sensitivity in patients with clinical abnormities.

CLINICAL RELEVANCE/APPLICATION

WARP sequences significantly reduced metal-related artifacts

SSK13

Neuroradiology (Cognitive and Psychiatric Disorders)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: N226

NR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Jody L. Tanabe, MD, Aurora, CO (*Moderator*) Nothing to Disclose
John D. Port, MD, PhD, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

SSK13-01 Brain Microstructural Abnormalities in Medication-free Patients with Major Depressive Disorder: A Systematic Review and Meta-analysis of Diffusion Tensor Imaging

Wednesday, Dec. 2 10:30AM - 10:40AM Location: N226

Participants
Jing Jiang, Chengdu, China (*Presenter*) Nothing to Disclose
Youjin Zhao, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Xinyu Hu, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Ming Y. Du, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Min Wu, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Kai M. Li, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Qiyong Gong, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Numerous neuroimaging studies have reported impaired white matter (WM) integrity in patients with major depressive disorder (MDD). However, due to inclusion of medicated patients, it is difficult to conclude whether the alterations observed in previous meta-analyses of diffusion tensor imaging studies were related to the disease itself. The present study was to provide a quantitative voxel-wise meta-analysis of WM alterations in medication-free MDD patients excluding interference from medication effects.

METHOD AND MATERIALS

A systematic search was conducted for the relevant studies. Anisotropic Effect Size version of Signed Differential Mapping (AES-SDM) was applied to analyse the WM alterations between medication-free MDD patients and healthy controls. Two subgroup analyses were separately conducted in medication wash-out patients and medication-naive patients. DTIquery software was used for fibre tracking.

RESULTS

15 primary studies comprising 434 MDD subjects (251 female; mean age 34 years) matched with 429 healthy controls (233 female; mean age 33 years) were included. Both the pooled meta-analysis and the subgroup meta-analysis in medication wash-out patients showed robustly fractional anisotropy (FA) reductions in the WM of the right cerebellum hemispheric lobule (CHL), the body of the corpus callosum (CC), and the bilateral superior longitudinal fasciculus III (SLF III), while FA reductions in the genu of the CC and the right anterior thalamic projections were only seen in medication-naive patients. Fibre tracking showed that the main tracts involved the right cerebellar tracts (CT), the body of the CC and the bilateral SLF III and arcuate network.

CONCLUSION

By excluding the confounding influences of medication status, the present study revealed the WM abnormalities in brain regions of MDD involved in cognition, memory function and emotional processing. These findings may contribute to a better understanding of the underlying neuropathology of MDD and be conducive to target selection for the non-drug therapy that the current era of psychosurgery utilizes as therapies for depression, such as electroconvulsive therapy, deep brain stimulation, and transcranial magnetic stimulation.

CLINICAL RELEVANCE/APPLICATION

By excluding the confounding influences of medication status, the disease-related brain regions of white matter abnormalities of MDD can be conducive to target selection for the non-drug therapy.

SSK13-02 Multimodal Voxel-Wise Meta-Analysis of White Matter Abnormalities in Autism Spectrum Disorder

Wednesday, Dec. 2 10:40AM - 10:50AM Location: N226

Participants
Xinyu Hu, Chengdu, China (*Presenter*) Nothing to Disclose
Lizhou Chen, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Lei Li, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Ming Y. Du, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Yi Liao, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Ming Zhou, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Qi Liu, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Qiyong Gong, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoqi Huang, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social interaction, communication, and stereotyped or repetitive behaviors. White matter (WM) abnormalities have long been suspected in ASD, but the available evidences have been inconsistent. We conducted the first multimodal meta-analysis of WM volume (WMV) and fractional anisotropy (FA) studies to elucidate the most robust WM abnormalities in ASD.

METHOD AND MATERIALS

PubMed, ISI Web of Science, PsycINFO, Cochrane Library, and EMBASE databases were searched between 1994 and 2014 for all voxel-wise studies comparing WMV or FA between patients with ASD and healthy control subjects (HCS). Manual searches were also conducted and authors were contacted soliciting additional data. Coordinates were extracted from clusters of significant WMV and FA difference between ASD patients and HCS. Anisotropic effect size signed differential mapping (AES-SDM) was used to examine regions of WMV and FA alterations in ASD patients compared to HCS separately. Furthermore, peak WMV and FA data were combined using novel multimodal meta-analytic methods implemented in AES-SDM. Meta regression methods were also used to explore potential effects of clinical profiles.

RESULTS

27 studies (providing 29 datasets: 20 WMV and 9 FA) were included comprising 544 adult and pediatric patients with ASD and 544 matched HCS). Patients with ASD showed widespread WM abnormalities including cerebellum, external capsule, cingulum and prefrontal WM, but findings were particularly robust in the crossing between the genu and anterior body of corpus callosum (CC), which showed both decreased WMV and decreased FA (Fig A-C). Meta-regression showed the age was negatively correlated with WMV in the left cerebellum while the percentage of male patients was negatively correlated with FA in the body of CC (Fig DandE).

CONCLUSION

This study gave a thorough profile for the WM abnormalities in ASD and provided evidence that inter-hemisphere was the most convergent circuitry affected in ASD. Meta-regression results perhaps revealed the structural underpinning of age and gender differences in epidemiological and clinical aspects of ASD.

CLINICAL RELEVANCE/APPLICATION

This study confirmed inter-hemisphere was the most convergent circuitry affected in ASD and suggested that structural underpinning of age and gender differences in epidemiological and clinical aspects of ASD.

SSK13-03 Disorganization of White Matter Microstructure in Attention-Deficit/Hyperactivity Disorder: A Tract-Based Spatial Meta-analysis

Wednesday, Dec. 2 10:50AM - 11:00AM Location: N226

Participants
Lizhou Chen, Chengdu, China (*Presenter*) Nothing to Disclose
Xinyu Hu, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Qi Liu, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Ming Zhou, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Yi Liao, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Qiyong Gong, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoqi Huang, MD, Chengdu, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

White matter (WM) abnormalities have been conceived as important substrates of Attention-deficit/hyperactivity disorder (ADHD), but the available studies involving diffusion tensor imaging (DTI) with tract-based spatial statistics (TBSS) analysis yielded variable findings. We conducted the first tract-based spatial meta-analysis contrasting ADHD patients with healthy control subjects (HCS) to clarify the consistent changes of regional fractional anisotropy (FA) underpinning this disorder.

METHOD AND MATERIALS

Systematic and comprehensive searches of the PubMed, ISI Web of Science, PsycINFO, Medline, Cochrane Library, and EMBASE databases were performed for TBSS studies published between 1994 and 2014 together with 'in press' articles. The reference lists of identified articles and review articles were also manually scrutinized to obtain additional papers. Coordinates were extracted from clusters of significant FA difference between ADHD and HCS. Anisotropic effect size signed differential mapping (AES-SDM) was used to examine regions of FA alterations in ADHD patients relative to HCS. DTIquery software was applied to help locate the fascicles involved in each region. Besides, meta-regression methods were used to explore potential effects of clinical profiles.

RESULTS

A total of 9 TBSS studies (including 11 datasets) were enrolled, comprising 363 ADHD patients and 293 HCS. ADHD patients showed significant FA reductions in the right sagittal stratum and splenium of corpus callosum (CC) compared with HCS (Fig. A and C). Fibers passed through these clusters included the inferior fronto-occipital fasciculus, the inferior longitudinal fasciculus, and the splenium of CC (Fig. D). Sensitivity analysis and subgroups analyses further confirmed these findings. Meta-regression showed that the age was positively correlated with the FA in the splenium of CC (Fig. B).

CONCLUSION

Our findings confirmed the most convergent WM abnormalities in ADHD and suggested that the posterior brain networks of WM tracts may be affected in ADHD, with the potential of disconnection of the gray matter regions they connect. Furthermore, the disruption in splenium of CC may be a key target in the neurodevelopment of ADHD.

CLINICAL RELEVANCE/APPLICATION

Through meta-analysis using signed differential mapping (SDM), our study suggested that the disorganized white matter microstructure of posterior brain network may be a target underpinning ADHD pathophysiology.

SSK13-04 Altered Intranetwork and Internetwork Functional Connectivities in Type 2 Diabetes Mellitus with and

without Cognitive Impairment

Wednesday, Dec. 2 11:00AM - 11:10AM Location: N226

Participants
Shiqi Yang, Wuhan, China (*Presenter*) Nothing to Disclose
Ying Xiong, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose
Yihao Yao, MD, PhD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose
Yan Zhang, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose
Wenzhen Zhu, MD, PhD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose
Yong Liu, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To analyze the alteration of intranetwork and internetwork functional connectivities using resting-state functional MRI (rsfMRI) with type 2 diabetes mellitus (T2DM) progression.

METHOD AND MATERIALS

Nineteen T2DM patients with normal cognition (DMCN), 19 T2DM patients with cognitive impairment (DMCI), 19 heathy controls (HC) were evaluated by 3 T MR scanner. Altered functional connectivities derived from 36 prior well defined brain regions of interest (ROIs) of 5 important resting-state network (RSN) systems[default mode network (DMN), dorsal attention network (DAN), control network (CON), salience network (SAL), sensorimotor network (SMN)] were investigated at 3 levels (integrity, network, connectivity pairs) by one-way ANOVA.

RESULTS

At integrity level, decreased connectivity strength of bilateral posterior cerebellum (pCBLM) were found across DMCN and DMCI ($P < 0.05$), right insula (rIns) only in DMCI. At network level, impaired intranetwork in DMN and CON were found in DMCI while not in DMCN ($P < 0.05$), and no impaired internetwork in the 5 RSNs was found among the 3 groups. At connectivity level, significant differences of fifty connectivity pairs were found among HC, DMCN, DMCI ($P < 0.05$), the top three altered connectivity pairs were left anterior prefrontal cortex versus left superior parietal (laPFC-lSP), right anterior cingulate cortex versus right ventral anterior cingulate cortex (rACC-rvACC), right insula versus right primary visual (rIns-rV1) ($P < 0.005$). Fuctional connectivity strength of specific brain architectures in T2DM at 3 levels were found associated with HbA1c, duration, MMSE and MoCA ($P < 0.05$).

CONCLUSION

These altered profiles of intranetwork and internetwork indicated intergroup differences and cognitive impairment of DMCI, might be the potential biomarkers applied to predict the progression, evaluate the impairment of cognition, understand the pathophysiology further for T2DM.

CLINICAL RELEVANCE/APPLICATION

These findings might be the potential biomarkers applied to predict T2DM progression, evaluate recognition impairment, and understand T2DM pathophysiology further.

SSK13-05 Prequit Right NAcc-VTA Functional Connectivity as a Marker of Smoking Cessation Outcomes

Wednesday, Dec. 2 11:10AM - 11:20AM Location: N226

Participants
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PURPOSE

Chronic smoking hijacks nicotine-dependent individuals' reward circuit, causing structural and functional alteration. However, the relationship between reward circuit and smoking cessation outcomes remains unclear. In the present study, we analyze the association between resting-state functional connectivity (rsFC) in reward circuit and subsequent smoking cessation outcomes(point prevalence abstinence at 4weeks) .

METHOD AND MATERIALS

Functional magnetic resonance images from 53 smokers and 41 healthy controls were acquired using a 3.0T MRI scanner prior to quitting. After 12-week treatment, smokers were divided into relapsers (n=30) and abstainers (n=23). We then analyzed ROI-wise rsFC within reward circuit by setting 11 seeds (including VTA, bilateral NAcc, amygdala, hippocampus, mediodorsal thalamus and rostral anterior cingulate cortex).

RESULTS

The rsFC between right NAcc and VTA, right NAcc and right amygdala were significantly different in the three groups($p=0.014$; $p=0.002$). While only right NAcc-VTA coupling differentiated relapsers from abstainers (higher in relapsers than abstainers, $p=0.026$). In addition, the strength of interhemispheric connectivity between NAcc ($r^2=0.255$,$p=0.004$) and hippocampus ($r^2=0.256$,$p=0.004$) were positively correlated with nicotine dependence severity(FTND) in relapsers.

CONCLUSION

These results suggest that right NAcc-amygdala coupling reflects smoking status, while enhanced right NAcc-VTA coupling, core projection implicated in rewarding, is a promising marker of relapse vulnerability. The findings also show that relapse-vulnerable smokers can be detected before quit attempts, which may optimize clinical intervention and improve smoking cessation outcomes.

CLINICAL RELEVANCE/APPLICATION

Our study brings light to the neural mechanisms underlying smoking cessation. Prequit neuroimage data can help to identify relapse risk, which leads to personalized clinical strategies.

SSK13-06 Describing of Obsessive-compulsive Disorder in Seven Dimensions Using Multivariate Pattern Analysis Based on Gray Matter Anatomy

Wednesday, Dec. 2 11:20AM - 11:30AM Location: N226

Participants
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PURPOSE

Obsessive-compulsive disorder (OCD) is one of the most common disabling psychiatric disorders. Although previous magnetic resonance imaging (MRI) studies have already revealed abnormalities of cortical folding patterns (ie. cortical thickness, surface area) in OCD patients, how these abnormalities can be translated to clinical application is still a challenging task. Multivariate pattern analysis (MVPA) approach is a promising analytical technique which allows the classification of individual observations into distinct groups and bears the advantage of individualized judgement in the future. Thus, in current study, we aimed to apply one of the MVPA approach known as Support Vector Machine (SVM) to distinguish OCD patients from healthy control subjects (HCS) based on multidimensional surface features of gray matter anatomy.

METHOD AND MATERIALS

High-resolution T1-weighted volumetric 3D MR images were acquired for 33 drug-naïve OCD patients and 33 matched HCS using a 3.0 T MRI system. Structural images were preprocessed with the FreeSurfer software to accurately and rapidly generate a set of seven morphometric parameters including volumetric and geometric features at each spatial location on the entire cortical surface (Fig A).Then all these parametric maps were used to discriminate OCD patients from HCS based on leave-one-out cross-validation approach with SVM using Probid software. We also drew a receiver operating characteristic (ROC) curve to help evaluate the performance of each parameter.

RESULTS

Classification accuracies, sensitivity and specificity for SVM classifier of combined left and right morphometric parameters are shown in Fig A. Among all parameters, the cortical thickness provided highest and above chance prediction accuracies for OCD patients (accuracy=75.76%, $P<0.001$) (Fig A and Fig B).

CONCLUSION

The current study illustrated that among all cortical features, cortical thickness showed the highest accuracy in classifying OCD patients from HCS, which indicated its potential diagnostic value in helping detecting OCD.

CLINICAL RELEVANCE/APPLICATION

The present study provides preliminary support for the suggestion that application of SVM to cortical thickness maps could be used to aid the identification of individuals with OCD in clinical practice.

SSK13-07 Phase II Clinical Trial: Efficacy of Methylene Blue in Human Cognitive and fMRI Measures

Wednesday, Dec. 2 11:30AM - 11:40AM Location: N226

Participants
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PURPOSE

Methylene blue (MB) is a FDA grandfathered drug used in clinics for more than 100 years. MB acts in the mitochondria to sustain or enhance ATP energy production. MB has been shown efficacious in animal models of ischemic stroke, traumatic brain injury, and Alzheimer's disease (AD). A phase II clinical trial showed that daily oral MB (RemberTM) slowed the progression of AD compared to placebo. We have also found that low-dose MB increases brain glucose uptake, oxygen consumption, and evoked responses in the rat brain. Our goal was to use functional MRI (fMRI) to assess the efficacy of MB on cognitive and physiologic measures in the human brain.

METHOD AND MATERIALS

Double-blind, placebo-controlled, randomized clinical trial (NCT01836094) of 28 healthy young volunteers using delayed matching to sample (DMTS), psychomotor vigilance task (PVT), and visual-motor tasks (VMT) modeled using e-PRIME 2.0. *Interventions:* USP grade methylene blue (n=15) and placebo (n=13) administered orally at 280 mg once. All subject data were acquired in the same

scanner (Siemens TIM Trio 3.0 Tesla; 32 channel head coil). fMRI and regression analysis were conducted using SPM 8.0 (UCL) and FSL (FMRIB). Correlation analysis was performed using MarsBar and SPSS 22 (IBM), and CBF analysis was conducted using the ASLtbx (UPenn).

RESULTS

Mean age was 29-30 years, 65% of subjects were female, and mean education was 17.5 years for both groups. No difference in cerebrovascular reactivity in both groups using CO_2 challenge. Paired t-test analysis demonstrated that MB increased fMRI BOLD activity in midbrain, cerebellum, medial pallidum, prefrontal, parietal and occipital cortex (cluster-wise pFWE<0.05) during the encoding and maintenance phases of the DMTS memory task. MB subjects had a 7% increase in the number of correct responses during the DMTS task ($p<0.01$). MB subjects also had a significant decrease in mean CBF in the posterior cingulate and inferior parietal cortex during the VMT (cluster-wise pFWE <0.05).

CONCLUSION

MB has a robust effect enhancing visuospatial working memory and its underlying encoding and maintenance neural networks. MB is also associated with greater suppression of the default mode network during the VMT.

CLINICAL RELEVANCE/APPLICATION

As the first fMRI neuroimaging study of MB in healthy humans, our objective was to understand the effect of MB on working memory, vigilance and task-evoked BOLD and cerebral blood flow (CBF).

SSK13-08 Bayesian Analysis of fMRI Data: Application in Autism

Wednesday, Dec. 2 11:40AM - 11:50AM Location: N226

Participants
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Edward H. Herskovits, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Consultant, BioClinica, Inc; Shareholder, RadDx, Inc;

PURPOSE

The goal of this study was to establish an automated and reliable platform for whole-brain analysis of resting state fMR (rsfMR) images using Bayesian data mining. We further investigated the software's feasibility in differentiating the subjects with autism spectrum disorder (ASD) from typically developing controls (TC), based on individual fMRIs.

METHOD AND MATERIALS

An in house developed resting state functional connectivity (rsFC) analysis environment is used to analyze rsfMR images. The analysis environment performs four tasks: image preprocessing, variable selection, Bayesian analysis, and model aggregation. After standard preprocessing and eliminating motion artifacts, the algorithm generates voxel-based rsFC maps for each atlas-based seed region. Investigators can use any structural or functional atlases of their choice. Next, by employing a Bayesian Network data-mining approach the rsFC maps and group membership variable C (e.g., TC vs. ASD) are used as inputs for pattern extraction. The outputs are group of voxels strongly predictive of group membership, presented as potential neuroimaging biomarkers of the clinical condition under analysis. In the last step, the algorithm aggregates all significant connectivity patterns across all seeds and performs the final classification. The algorithm was tested on 116 subjects (ASD=54; mean age 11.29 ± 2.66 years, 6 females) and (TC=62, mean age 12.16 ± 3.02 years, 14 females) from NYU publically available data set.

RESULTS

We used 90 AAL atlas structures as seed regions. 26 connectivity models, from 14 seeds, were found to be highly predictive of ASD with accuracies ranging from 78% to 71%. Six out of those 14 seeds were in frontal lobe. When used all connectivity models, we could classify subjects with 90.5% accuracy. Detected circuits were strongly associated with various indices of clinical severity and accurately reflected the known anatomic distribution of affected regions described in ASD.

CONCLUSION

Compared with conventional methods that focus on group differences, we identified differences in brain connectivity patterns at an individual level and accurately classified subjects in a highly heterogeneous condition such as ASD.

CLINICAL RELEVANCE/APPLICATION

Provides physicians with an automated connectivity analysis environment, and facilitates understanding and subsequently management of highly complex and socially important conditions such as ASD.

SSK13-09 Voxelwise Meta-Analysis of Resting-state Brain Activity Abnormalities in Patients with Major Depressive Disorder

Wednesday, Dec. 2 11:50AM - 12:00PM Location: N226

Participants
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PURPOSE

Resting-state brain activity abnormalities have long been suspected in major depressive disorder (MDD) but the available evidence has been inconsistent. Moreover, to our knowledge, there has been no meta-analysis utilized existent human neuroimaging literature to provide insights into the functional abnormalities in MDD at resting-state. To address this lack we conducted the first

meta-analysis of low-frequency fluctuation (ALFF) and fractional ALFF (fALFF) studies in MDD to help clarify the resting-state functional abnormalities underpinning this condition.

METHOD AND MATERIALS

A systematic search was conducted for ALFF and fALFF studies in MDD. A voxel-wise meta-analysis using the anisotropic effect-size Signed Differential Mapping (AES-SDM) method was conducted on ALFF/fALFF studies. Meta-regression was used to explore the effects of demographics and clinical characteristics.

RESULTS

A total of 8 ALFF and 4 fALFF studies comprising 345 MDD subjects (142/203 male/female; mean age 34 years) matched with 329 healthy controls (149/180 male/female; mean age 33 years) met the inclusion criteria. The pooled meta-analysis of the ALFF and fALFF studies on MDD patients showed significantly increased brain activities in the bilateral anterior cingulate cortex (ACC) extending to medial frontal gyrus and the left insula, and decreased brain activities in the right superior temporal gyrus, the left middle occipital gyrus, the left cerebellum and the right lingual gyrus relative to healthy controls (see Fig.1A). Meta-regression analyses indicated that the illness duration and the symptom severity of MDD patients were positively associated with brain activity in the left anterior cingulated cortex (LACC) and right medial superior frontal gyrus, respectively (RMSFG) (see Fig. 1B).

CONCLUSION

Meta-analysis revealed a pattern of neural abnormalities in MDD, characterized by functional brain abnormalities in brain regions involved in cognition, emotional processing and self-referential processes. These findings may contribute to a better understanding of the underlying pathophysiology as well as better characterization of the functional neural correlates of depressive symptoms.

CLINICAL RELEVANCE/APPLICATION

This study revealed resting-state brain activity abnormalities in major depressive disorder patients and could provide biomarkers for diagnosis and treatment evaluation.

SSK14

Neuroradiology/Head and Neck (Head and Neck Tumors)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: N229

HN NR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Suresh K. Mukherji, MD, Northville, MI (*Moderator*) Nothing to Disclose
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Sub-Events

SSK14-01 Application of Diffusion-weighted Imaging and Dynamic Contrast-enhanced MRI in Differentiating Nasopharyngeal Carcinoma and Nasopharyngeal Lymphoma

Wednesday, Dec. 2 10:30AM - 10:40AM Location: N229

Participants
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Yong Zhang, DO, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate the utility of dynamic contrast-enhanced MRI and diffusion weighted imaging (DWI) in the differentiation of nasopharyngeal carcinoma (NPC) and nasopharyngeal lymphoma (NPL).

METHOD AND MATERIALS

Forty-two patients with pathologically confirmed NPC and 27 patients with NPL were recruited and underwent conventional MRI and dynamic contrast-enhanced MRI. The MR signals, time signal-intensity curves (TIC) types, time to peak (TTP), enhancement peak (EP), maximum contrast enhancement ratio (MCER), mean apparent diffusion coefficient (ADC) value, and relative apparent diffusion coefficient (rADC) value of all the subjects were calculated and analyzed, thereafter, inter-group comparison was performed. The threshold values of ADC and rADC for differentiating NPC from NPL were determined using a receiver operating characteristic curve (ROC) analysis.

RESULTS

For NPC group, 32 cases (76.19%) demonstrated obvious heterogeneous enhancement. The mean TTP, EP, MCER and WR were (48.29±12.20)s, 1475.38±77.76, (136.89±24.41)% and 16.81±8.36, respectively. For NPL group, 24 cases (88.89%) demonstrated obvious homogeneous enhancement. The mean TTP, EP, MCER and WR were (63.21±14.29)s, 1161.82±64.04, (113.47±28.52)% and 7.39±6.21, respectively. The ADC value and rADC value were (842.34±94.66)×10-6 mm2·s-1 and 0.74±0.08 in NPC, whereas (652.15±83.47)×10-6 mm2·s-1 and 0.56±0.08 in NPL. The differences of TTP, EP, MCER, WR, ADC, rADC between NPC and NPL were statistically significant (P<0.05). The TTP of NPC was lower than that of NPL, whereas the opposite for the remaining parameters. The best differentiate threshold value of ADC and rADC were 736.5×10-6mm2·s-1, 634.0×10-6mm2·s-1, respectively. While the areas under the ROC curve (AUC), sensitivity, specificity and Youden index of ADC and rADC were 0.943, 0.909, 0.852, 0.761, and 0.951, 0.955, 0.852, 0.77, respectively. rADC value was slightlly superior to ADC value in differentiating NPC from NPL.

CONCLUSION

DWI and Dynamic contrast-enhanced MRI are effective in differentiating NPC from NPL.

CLINICAL RELEVANCE/APPLICATION

Dynamic contrast-enhanced MRI and DWI can be applied in the differential diagnosis of NPC from NPI.

SSK14-02 Finding the Primary: Detection of Cervical CUP Based on Integrated PET/MRI versus MRI Alone

Wednesday, Dec. 2 10:40AM - 10:50AM Location: N229

Participants
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PURPOSE

To evaluate and compare the diagnostic potential of 18F-FDG PET/MRI to MRI alone for detection of a potential primary cancer in patients suspect for cervical CUP (cancer of unknown primary).

METHOD AND MATERIALS

A total of 21 patients with suspected cervical CUP underwent a simultaneous 18F-FDG PET/MRI examination (Biograph mMR, Siemens). The scan protocol comprised: 1) T1 TSE, 2) T2 TSE, 3) DWI, 4) T1 fs post-contrast VIBE and 5) T1 fs TSE imaging after the application of 0.05 mmol kg/bw Gadoteric acid (Dotarem, Guerbet). The corresponding datasets (PET/MRI and MRI alone) were read separately by two radiologists for detection and identification of potential primary cancer lesions (2 point ordinal scale), lesion conspicuity as well as diagnostic confidence (3 point ordinal scale). All available data (histology, prior examinations, PET/MRI, follow-up examinations) served as standard of reference. Mean values were compared using Wilcoxon rank sum test.

RESULTS

Cervical primary cancer was present in 13 of 21 patients. 18F-FDG PET/MRI enabled correct identification of all 13 (100%), while MRI alone allowed for detection of 9/13 malignancies (69.4%). Lesion conspicuity and diagnostic confidence were rated significantly higher for 18F-FDG PET/MRI compared to MRI alone datasets (e.g. diagnostic confidence: PET/MRI:2.7±0.3; MRI alone 1.8±0.5; $p<0.05$).

CONCLUSION

PET/MRI was shown to be superior towards MRI alone for detection of cervical CUP, offering a significantly higher diagnostic confidence in the discrimination of malignant lesions.

CLINICAL RELEVANCE/APPLICATION

Based on the significantly improved detection of malignant lesions while maintaining equal acquisitions times to MRI alone, integrated PET/MRI can be considered a highly valuable tool for assessment of cervical CUP.

SSK14-03 Post-treatment Change versus Recurrence of Squamous Cell Carcinoma in the Head and Neck: Histogram Analysis of the Area under the Curves Ratio from Dynamic Contrast-enhanced T1-weighted Perfusion MRI

Wednesday, Dec. 2 10:50AM - 11:00AM Location: N229

Participants
Se Jin Cho, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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PURPOSE

To evaluate the predictive value of the histogram parameters of AUCR (initial and final area under the time signal-intensity curves ratio) derived from dynamic contrast-enhanced perfusion MR imaging (DCE MRI) for differentiation of tumor recurrence from post-treatment change of in patients with squamous cell carcinoma in the head and neck (HNSCC).

METHOD AND MATERIALS

Forty-six patients after definitive treatment for HNSCC with contrast-enhancing lesions at the primary sites on follow-up MRI were assessed using conventional and DCE MRI. We calculated and correlated the time signal-intensity curve parameters (initial and final area under the time signal-intensity curves, the maximum signal-intensity from time of arrival to time to peak (Emax), the time at Emax (Tmax), initial slope of signal-intensity increase) and the cumulative histogram parameters of AUCR (AUCR50, AUCR75, AUCR90 and AUCR95) with the final pathologic or clinical diagnosis. The best predictor for differentiation of tumor recurrence from post-treatment change was determined by receiver operating characteristic curve analyses. We assessed the added value of AUCR histogram parameters to inconclusive results of conventional MRI alone after blinded review of conventional MR images by a neuroradiologist.

RESULTS

46 patients were subsequently classified as having tumor recurrence (n=17) or post-treatment change (n=29). Tumor recurrence group showed significantly shorter Tmax and significantly higher AUCR50, AUCR75 and AUCR90 compared to those of post-treatment change group ($P < 0.05$). AUCR90 was the best predictor for tumor recurrence ($Az = 0.77$; 95% CI, 0.64-0.91) with the estimated cut-off of 1.02. When AUCR90 was added on inconclusive results of conventional MRI alone, 17.6 % of recurrent tumors were more detected without significant difference in the diagnostic specificity.

CONCLUSION

Tumor recurrence of HNSCC can be differentiated from post-treatment change by using the histogram parameters of AUCR. The added value of AUCR histogram analysis is 17.6 % of more detection of recurrent tumors without compromise of diagnostic specificity.

CLINICAL RELEVANCE/APPLICATION

Our study signifies that recurrent HNSCC can be differentiated from post-treatment change by using the histogram parameters of AUCR. The added value of AUCR90 on inconclusive results of conventional MRI alone is 17 % more detection of tumor recurrence without compromise of diagnostic specificity

SSK14-04 Gaussian and non-Gaussian Diffusion MRI of the Head and Neck: The Effect of the Choice of B Values

Wednesday, Dec. 2 11:00AM - 11:10AM Location: N229

Participants
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PURPOSE

Diffusion MRI has been widely used for the diagnosis and monitoring of head and neck lesions. Non-Gaussian diffusion parameters (e.g. mean diffusion, ADCo, and kurtosis, K) have the potential to provide important information on tissue microstructure beyond ADC. The aim of this study was to investigate the value of quantitative diffusion assessment in the diagnosis of head and neck lesions.

METHOD AND MATERIALS

This IRB approved prospective study included 46 (27 malignant/19 benign) patients suspected of head and neck tumors between June 2014 and February 2015. Head and neck MRI was performed using a 3-T system equipped with a dedicated 16-channel head and neck coil. A read-out segmented EPI (RS-EPI) sequence combined with GRAPPA parallel acquisition and 2D-navigator-based reacquisition was used with 9 b values of 0, 75, 150, 300, 600, 1000, 1400, 1800, 2200 sec/mm2. Parametric maps of Gaussian and non-Gaussian diffusion parameters (K, ADCo and ADC) were generated by fitting the diffusion MRI signal using variable combinations of b values.

RESULTS

The performance (AUC) of ADC0-1400 (ADC derived from b values of 0 and 1400) (0.802) was higher than ADC0-600 or ADC0-1000 (0.753, 0.748) and ADC150-1400 (0.768). AUC of ADC0-1400 was significantly higher than that of ADC150-1000 (0.727, $P<0.05$). K or ADCo (0.71, 0.685, using all b values) didn't significantly change depending on the choice of b values, and gave the different information than ADC on their parametric maps.

CONCLUSION

The choice of b values could significantly affect the diagnostic performance of ADCs in head and neck lesions. Non-Gaussian diffusion parameters showed stable results regardless of the choice of b values, and their parametric maps have the potential to provide new information on tumor characteristics in addition to ADC.

CLINICAL RELEVANCE/APPLICATION

Non-Gaussian diffusion parameters beyond ADC give the stable results regardless of the choice of b values in head and neck lesions, easier to make comparison between facilities.

SSK14-05 Differentiation of Malignant and Benign Solid Nodules of the Thyroid Gland on Unenhanced Computed Tomography

Wednesday, Dec. 2 11:10AM - 11:20AM Location: N229

Participants
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Hanan Sherif, MD, Doha, Qatar (*Abstract Co-Author*) Nothing to Disclose
Ahmed Sayedin, MBBCh, Doha, Qatar (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The natural iodine content of benign thyroid nodules may be higher than that of malignant nodules. The purpose of this study is to assess the value of unenhanced computed tomography (CT) in differentiation of malignant and benign solid nodules of the thyroid gland based on this hypothesis.

METHOD AND MATERIALS

80 patients with solid thyroid nodules, initially seen on ultrasonography have been examined by an identical protocol of unenhanced and contrast-enhanced CT, including 48 patients with pathologically-proven thyroid carcinoma and 32 patients with pathologically-proven nodular goiter. The attenuation value of the lesions on unenhanced CT has been measured. Statistical analysis has been done by the Student's t- test and the Chi-square test.

RESULTS

The attenuation value of malignant nodules on unenhanced CT has been 34±11 HU, while the attenuation value of benign nodules has been 56±21 HU. The difference has been statistically significant ($p< 0.001$). When the cut-off value for diagnosis of malignancy is ≤50 HU, the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy for the diagnosis of malignancy have been 89.6%, 68.8%, 81.1%, 81.5%, and 81.3% respectively compared to 72.9%, 71.9%, 79.5%, 63.9%, and 72.5% at a cut-off value of ≤40 HU and 93.8%, 53.1%, 75.0%, 85.0%, and 77.5% at a cut-off value of ≤55 HU respectively.

CONCLUSION

Malignant thyroid nodules have a statistically-significant lower attenuation value than benign nodules on unenhanced CT. Attenuation value ≤50 HU has an accuracy of 81.5% for diagnosis of thyroid carcinoma.

CLINICAL RELEVANCE/APPLICATION

Unenhanced CT of the thyroid gland may be useful in differentiation of benign and malignant nodules of the thyroid and needs therefore to be included as part of the protocol of CT of the thyroid gland.

SSK14-06 Prospective Assessment of the Accuracy of Radiologic CT Staging of Extrinsic Tongue Muscle Involvement in Oral Cavity Cancer

Wednesday, Dec. 2 11:20AM - 11:30AM Location: N229

Participants
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Ashley H. Aiken, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Pre-operative imaging plays an important role in staging advanced oral cavity cancer (OCC) treated with surgical resection followed by chemoradiation. Extrinsic tongue muscle invasion (ETMI) was added as a T4a classification in the 3rd edition of AJCC. The purpose of this prospective study was to examine the accuracy of preoperative contrast enhanced CT (CECT) and surgical assessment of ETMI using pathologic evaluation as the gold standard.

METHOD AND MATERIALS

This IRB approved prospective study recruited 34 consecutive patients with primary OCC between August 2014 and February 2015. Inclusion criteria were untreated primary OCC, available pre-operative CECT and surgical resection with pathological gross examination. Two neuroradiologists blindly reviewed the images for ETMI using the following scale: yes (Y), probably yes (PY), no (N), and probably no (PN). Three Head and Neck surgeons assessed for ETMI intra-operatively using the scale: Y, N or indeterminate. A single pathologist reviewed all gross examination notes for ETMI.

RESULTS

Twenty-five of the 34 patients met inclusion criteria. Six patients had pathologically proven ETMI. For statistical analysis, a radiologic score of yes/probably yes was scored as a yes and no/probably no as a no. Sensitivity (SN), specificity (SP), positive predictive value (PPV) and negative predictive value (NPV) for Radiologist 1 and 2 were: 83%, 84%, 62.5%, and 94%, and 100%, 84%, 67%, and 100%, respectively. Two intra-operative cases rated indeterminate by the surgeons were considered a no, leading to an overall intraoperative assessment SN, SP, PPV, and NPV of: 80%, 100%, 100%, 95%.

CONCLUSION

Although this preliminary study suggests that imaging findings on CECT may have a higher SN but lower SP than surgical observation, both radiographic and surgical determination of ETMI had equivocal cases. This highlights the importance of systematic assessment of the gross specimen to facilitate accurate pathologic ETMI to minimize unnecessary upstaging. Ongoing investigation with specific pathologic focus on ETMI would be needed to confirm the reproducibility of pathologic staging and follow up of clinical outcomes to determine the clinical significance.

CLINICAL RELEVANCE/APPLICATION

Radiographic ETMI should be verified with pathological findings and interdisciplinary communication between pathologists, surgeons, and radiologists to minimize unnecessary upstaging.

SSK14-07 Short-Term Effects of Concurrent Radiochemotherapy on Hypopharyngeal and Laryngeal Squamous Cell Carcinoma: Evaluated with Dual-Energy CT Quantitative Parameters

Wednesday, Dec. 2 11:30AM - 11:40AM Location: N229

Participants
Liang Yang, Beijing, China (*Presenter*) Nothing to Disclose
Dehong Luo, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yanfeng Zhao, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Li Lin, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Meng Lin, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the value of dual-energy spectral computed tomography(CT) quantitative parameters in predicting short-term effects of concurrent radiochemotherapy on hypopharyngeal and laryngeal squamous cell carcinoma(SCC), and provide valuable evidence for early judging the response of the tumor to therapy in clinical pratice.

METHOD AND MATERIALS

This study was approved by the ethics committee and all patients provided written informed consent. Spectral parameters of 34 patients with laryngeal and hypopharyngeal SCC who underwent dual-energy spectral CT(GE Discovery CT 750 HD) scan with spectral mode before therapy were analyzed retrospectively, all cases were proven by pathological findings. Specral parameters contained IC-L (iodine concentration of lesion), WC-L (water concentration of lesion) and λHU (slope of spectral HU curve), which were obtained by analyzing pretherapy CT scan datas with GSI Volume Viewer software in AW4.6 workstation. The following scans were taken at the 4th week after concurrent radiochemotherapy ended. By therapeutic effects, all patients were divided into treatment-sensitivity group (28 cases) and reatment-resistant group (6 cases). Parameters between two groups were compared, and the diagnosis experiment was evaluated.

RESULTS

Mean IC-L andλHU in treatment-sensitivity group were 16.80±4.61 mg/cm3, 2.28±0.63 respectively, while the two parameters were 23.84±5.04 mg/cm3, 3.23±0.68 in the other group. IC-L andλHU were significantly different between two groups ($P<0.05$).

However, WC-L was showing no significant difference(P>0.05). Receiver operating characteristic (ROC) analysis of IC-L, and λHU in prediction of treatment-sensitivity showed: AUC (the area under curve) of IC-L was 0.81, larger than the AUC ofλHU(AUC=0.79). With IC-L≤18.43 mg/cm3 as diagnosis threshold in prediction of treatment-sensitivity, the sensitivity, specificity, positive predictive value, negative predictive and Youden's index value were 72.73%, 83.33%, 88.89%, 62.50%, 0.56 respectively .

CONCLUSION

IC-L could be helpful in the prediction short-term effects of concurrent radiochemotherapy on hypopharyngeal and laryngeal squamous cell carcinoma.

CLINICAL RELEVANCE/APPLICATION

Dual-energy spectral CT has a potentian value in clinical treatment options of hypopharyngeal and laryngeal SCC.

SSK14-08 Role of Magnetic Resonance Imaging in Thyroid Nodules ; Evaluation of the Magnetic Resonance Spectroscopy and Diffiusion Weighted in Differentiating Benign from Malignant Thyroid Nodules

Wednesday, Dec. 2 11:40AM - 11:50AM Location: N229

Participants
Pratiksha Yadav, Pune, India (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic benefits of MRI in evaluation of thyroid lesionTo evaluate the role of DWI WITH ADC mappingTo evaluate the characteristic pattern of MR spectroscopy in various benign and malignant pathologies of thyroid

METHOD AND MATERIALS

This is prospective study carried out in 39 patients with already known thyroid nodules diagnosed on ultrasonography.All studies were done on 1.5 T Siemens Magnetom machine.Precontrast T1WI saggital .axial,STIR,T2WI coronal and axial,post contrast fat saturated axial T1WI were taken. DWI with ADC mapping ,single voxel MR spectroscopy were also done. Findings of MRI correlate with the final diagnosis on histopathological examination

RESULTS

Study was done on 39 cases.There were 19 cases of multinodular goiter, 5 cases of adenomas,6 cases of thyroiditis and 9 cases of malignant lesion.The mean ADC value of the thyroid malignant lesion was significantly lower than the mean ADC value of thyroid benign lesionsHigh Choline peak was observed in the malignant lesionsSensitivity of combined DW,ADC mapping and MRS show sensitivity of 98.9 % sensitivity to detect the malignant lesion with specificity of 93.4%

CONCLUSION

Thyroid lesions routine imaging could not differentiate malignant lesion from benign lesion.Diffusion weighted imaging with ADC mapping and Magnetic resonance Spectroscopy are good noninvasive investigation to diagnose malignancy.

CLINICAL RELEVANCE/APPLICATION

MRI evaluation of thyroid lesions combined with DWI & MRS are a good noninvasive test to diagnose the malignant lesion.It is useful to see the extent of the tumor,involvement of the surrounding structures,retrosternal extension and lymph nodal involvement.

SSK14-09 Prediction Study on Energy Spectrum Parameters in Larynx and Hypopharyngeal Squamous Cell Carcinoma with Different Pathological Grades

Wednesday, Dec. 2 11:50AM - 12:00PM Location: N229

Participants
Liang Yang, Beijing, China (*Presenter*) Nothing to Disclose
Dehong Luo, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yanfeng Zhao, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Lin Li, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Meng Lin, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To discuss the effect of energy spectrum parameters in sDECT (single-source dual-energy spectral CT) on evaluating larynx and hypopharyngeal squamous cell carcinoma(SCC) with different pathological grades.

METHOD AND MATERIALS

Retrospective analysis was carried out in 60 patients with confirmed pathological diagnosis of larynx and hypopharyngeal SCC from January to August in 2014. They were all scanned by sDECT (Discovery CT 750 HD) before treatment. After scanning, all data was analyzed with GSI Volume Viewer software of GE AW4.6 workstation. IC-L (iodine concentration of lesion), WC-L (water concentration of lesion), s-SHC (slope of spectral Hu curve), CT value in 70Kev monoergic image, IC-C (iodine concentration of carotid sinus), WC-C (water concentration of carotid sinus), sIC(standardized IC) and sWC (standardized WC). According to cell differentiation, all the patients were divided into low differentiated group and mid-high differentiated group. Parameters between two groups were cpmpared, and the diagnosis experiment was evaluated.

RESULTS

Mean IC-L, s-SHC and sIC in low differentiated group were 15.61 mg/cm3±5.06mg/cm3, 2.07±0.77 and 15.61mg/cm3±5.06mg/cm3 respectively, while the three parameters were 20.29±7.40mg/cm3,2.68±1.04 and 20.29±7.40mg/cm3 in the other group. All three parameters were significantly different between two groups (P<0.05). However, WC-L, CT value and sWC were showing no significant difference(P>0.05). ROC (receiver operating characteristic) analysis of IC-L, s-SHC, and sIC in prediction of low differentiated larynx and hypopharyngeal SCC showed: AUC (the area under curve) of sIC was 0.79, larger than the AUC of IC-L and s-SHC. AUC difference between s-SHC and sIC was significant (P<0.05), while it was not significant between IC-L and sIC (P>0.05). With sIC>5 as diagnosis threshold in prediction of low differentiated SCC, the sensitivity, specificity, positive predictive

value and negative predictive value were 84.21%, 75.61%, 61.5% and 91.2% respectively.

CONCLUSION

sIC could be helpful in the prediction of larynx and hypopharyngeal SCC with different pathological grades.

CLINICAL RELEVANCE/APPLICATION

sDECT maybe a potential method for judgeing the differentiation of pathological grade of Larynx and Hypopharyngeal SCC

SSK18

Vascular/Interventional (Advances in Hepatic Tumor Ablation)

Wednesday, Dec. 2 10:30AM - 12:00PM Location: N227

GI IR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Nael E. Saad, MBBCh, Saint Louis, MO (*Moderator*) Research Consultant, Veran Medical Technologies, Inc; Proctor, Sirtex Medical Ltd
Charles Y. Kim, MD, Durham, NC (*Moderator*) Research Grant, Galil Medical Ltd; Consultant, Kimberly-Clark Corporation; Consultant, Cryolife, Inc

Sub-Events

SSK18-01 Long-Term Therapeutic Outcomes of Radiofrequency Ablation For Subcapsular versus Non-Subcapsular Hepatocellular Carcinoma

Wednesday, Dec. 2 10:30AM - 10:40AM Location: N227

Participants
Tae Wook Kang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyo Keun Lim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Mimi Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

Recent clinical guidelines for management of hepatocellular carcinoma (HCC) have not recommended the radiofrequency (RF) ablation for subcapsular tumor due to a higher risk of incomplete ablation or major complications. However, these guidelines were mainly based on retrospective studies with insufficient sample size and follow-up. We retrospectively compared the long-term therapeutic outcomes of RF ablation for HCC in a subcapsular versus non-subcapsular location using propensity score matching

METHOD AND MATERIALS

508 patients (396 men, 112 women; age range, 30-80 years) with a single HCC (<5 cm) were treated with ultrasonography-guided percutaneous RF ablation as a first-line treatment. We divided the patients into two groups, subcapsular (n = 227) or non-subcapsular group (n = 281). We evaluated the association of subcapsular location and the long-term therapeutic outcomes of RF ablation including local tumor progression (LTP) and overall survival (OS) using the matched data and assessed the major complication rate in overall data.

RESULTS

After matching, there were 163 matched pairs of patients in both groups. In the matched groups, the 3- and 5-years cumulative LTP rates were estimated as 18.8% and 20.9%, respectively, for the subcapsular group, and 13.2% and 16.0% for the non-subcapsular group. The corresponding OS rates were 90.7% and 83.2% in the subcapsular group, and 91.4% and 79.1% in the non-subcapsular group, respectively. The hazard rates for LTP (HR [hazard ratio] = 1.37, P = 0.244) and OS (HR = 0.86, P = 0.604) were not significantly different between two matched groups. In addition, there was no significant difference in both groups in terms of major complications rates (P > 0.05).

CONCLUSION

The difference in long-term therapeutic outcomes of RF ablation for HCC was not significant between the subcapsular and non-subcapsular groups.

CLINICAL RELEVANCE/APPLICATION

The consideration of overall technical difficulty of RF ablation for HCC under various clinical settings is more reasonable than the dichotomous view of recommendation for RF ablation judged by anatomical location including subcapsular HCCs.

SSK18-02 Ablation Margin Size and Not Modality Predicts Local Tumor Progression after Ablation of Colorectal Liver Metastases: A Case-control Study of RF and Microwave Ablation

Wednesday, Dec. 2 10:40AM - 10:50AM Location: N227

Participants
Waleed Shady, MBBCh, New York, NY (*Presenter*) Nothing to Disclose
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Anne M. Covey, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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Nancy Kemeny, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the local tumor progression rates of colorectal liver metastases ablated percutaneously using either microwave (MW) or radiofrequency (RF).

METHOD AND MATERIALS

We preformed an IRB-approved retrospective review of a prospectively created HIPAA-complaint ablation database. We included patients with CLM ablated using RF between November 2009 and December 2012. These were matched to a group of patients with CLM ablated using MW between November 2009 and July 2014. Patients were excluded if the percutaneous ablation was used to treat a local recurrence of a previous ablation. The ablation margin was measured on the 1st portal venous phase CT obtained post-ablation (4-8 weeks), and classified as either ≤5 mm or >5 mm. Patients/tumors were excluded if the ablation margin could not be measured due to either: (a) lack of a CT scan at baseline or at 4-8 weeks post-ablation, or (b) fused ablation defects. Clinical characteristics were compared between both groups. Kaplan-Meier methodology was used to calculate LTP-free survival. Stratified log-rank tests were used to analyze predictors of LTP.

RESULTS

The study enrolled 53 patients with 77 tumors ablated with RF in 64 sessions, and 36 patients with 43 tumors ablated with MW in 39 sessions. No differences existed between both groups in baseline clinical characteristics or mean tumor size (1.9 cm MW versus 1.9 cm RF) (P=0.9). The LTP-free survival rate at 2 years was 67% in the RF group and 71% in the MW group (P=0.9). The percentage of ablation margins >5 mm achieved with RF was 58% (45/77) and 42% with MW (18/43) (P=0.08). An ablation margin ≤5 mm was a predictor of LTP in both the RF group (P<0.001) and the MW group (P=0.005). The median LTP-free survival in tumors with a margin ≤5 mm was longer in the MW group than in the RF group (21 months versus 8 months), approaching statistical significance (P=0.09). The LTP-rate for tumor with an ablation margin >5mm was 4% in the RF group (2/45) and 6% (1/18) in the MW group (P=0.3). Minor complications rate for MW and RF were 26% (10/39) versus 13% (8/64) (P=0.09), and major complications rates were 15% (6/39) versus 13% (8/64) (P=0.7).

CONCLUSION

Local control after ablation of CLM is dependent on an adequate ablation margin and not the modality used.

CLINICAL RELEVANCE/APPLICATION

Sufficient ablation margins remain the most important factor to achieve prolonged LPFS regardless of thermal energy.

SSK18-03 Role of Microwave Ablation (MWA) Therapy of Liver Metastases from Colorectal Carcinoma Post systemic Chemotherapy: Tumor Control and Survival Rates

Wednesday, Dec. 2 10:50AM - 11:00AM Location: N227

Participants
Nour-Eldin A. Nour-Eldin, MD,PhD, Frankfurt Am Main, Germany (*Presenter*) Nothing to Disclose
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Thomas Lehnert, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

to evaluate the safety, efficiency, effectiveness, and overall outcome in patients treated with microwave thermal ablation of colorectal metastases post systemic chemotherapy.

METHOD AND MATERIALS

An institutional review board-approval was obtained with informed consent of all patients. Retrospective analysis of prospective intention to treat study was performed from January 2008 to January 2013, and included 92 patients (mean age 56 years SD: 2.6) with 132 liver metastases measuring 0.7-5.0cm, who were treated with microwave ablation (MWA). Local tumor control, complications, and long-term survival were analyzed.

RESULTS

The mean follow-up period was 32.5 months. Complete ablation was achieved in 117 of 132 (88.6%) nodules. Seventeen of the 117 (14.5%) successfully treated nodules developed local recurrence. Univariate analysis showed that tumor size of < 3 cm is a significant risk factor (P = 0.04). Multivariate analysis showed that number of cycles of chemotherapy (FOLFOX) was a significant prognostic factor for overall recurrence (P=0.03), whereas disease-free interval was the significant prognostic factor for distant recurrence (P=0.03). Major complications occurred in 1.1% of patients. No procedure-related mortalities were observed. The 1, 2, 3, and 5-year overall survival rates after the initial ablation were 82, 61.2, 51.2, and 38.3%, respectively. The main cause of death was systemic tumor progression in 65.3% of the patients.

CONCLUSION

MWA is a safe and effective treatment therapeutic option for patients with liver metastases from Colorectal Carcinoma post systemic chemotherapy.

CLINICAL RELEVANCE/APPLICATION

MWA could be safely used as a part of the therapeutic armamentarium in the management of patients with hepatic colorectal metastasis post systemic chemotherapy.

SSK18-04 Local Response Assessment after Percutaneous CT-guided IRE of Hepatic Malignancies: How Useful is Diffusion-weighted MRI (DWI)?

Wednesday, Dec. 2 11:00AM - 11:10AM Location: N227

Participants
Alexandra Barabasch, MD, Aachen, Germany (*Presenter*) Nothing to Disclose
Philipp Heil, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Martina Distelmaier, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nils A. Kraemer, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Assessment of response to hepatic IRE using standard MR-sequences is difficult due to complex signal intensity (SI) changes of the ablation zones that occur during follow-up. DWI offers a high sensitivity for detection of liver metastases. Therefore, aim of this study was to evaluate if DWI is useful to help distinguish normal post-therapeutic SI changes after IRE from local recurrence.

METHOD AND MATERIALS

27 Patient (mean age 62y) with 37 malignant liver tumors (4 HCC, 33 metastases) underwent CT-guided percutaneous IRE. Pre- and post-interventional hepatic MRI (T2w TSE, dynamic CE T1w GE, T1w GE in late phase) with DWI (b=800) was performed before treatment, within 2 hours after IRE, at 24 hours after IRE, and at 1, 2, 4, 6, 8, 12 weeks after IRE, and every 3 months thereafter. MR-images were systematically analyzed by two readers in consent. The ablation volume was carefully manually rendered on each b=800 DW image of the ablation zone to create a volume of interest. Minimal ADC-values (ADCmin) were measured in the target lesion before treatment and in the ablation zone volume after treatment.

RESULTS

Within the first two days after IRE, ADCmin-values decreased significantly compared to pre-treatment ADCmin in 26 of 37 patients. Thereafter, ADCmin values increased continuously in all of these patients and, within 1-3 months after IRE, were back to normal, i.e. reached the level of the ADCmin values of normal liver parenchyma. In 8/37 patients, this normalization of ADCmin-values was not observed, but instead, exhibited a further decrease of ADCmin at follow up (6 weeks - 12 months) that were then lower than the baseline ADCmin of the tumor before IRE treatment. At the time when the ADC-min decrease was found, remaining hepatic MRI pulse sequences, including visual analysis of DWI, were not suspicious of local recurrence. Only at later follow-up MRI, presence of local tumor recurrence was confirmed in 7 out of these 8 cases.

CONCLUSION

These initial results suggest that quantitation of ADCmin is useful to identify local recurrencies after hepatic IRE, because changes of ADCmin (specifically, a new decrease of ADCmin after post-treatment ADC normalization) precede visually perceptible SI changes.

CLINICAL RELEVANCE/APPLICATION

DWI, with ADC-min quantitation, may allow early diagnosis of local tumor recurrence after IRE.

SSK18-05 MR Imaging Findings after Hepatic Irreversible Electroporation (IRE) - How to Depict Local Recurrence

Wednesday, Dec. 2 11:10AM - 11:20AM Location: N227

Participants
Alexandra Barabasch, MD, Aachen, Germany (*Presenter*) Nothing to Disclose
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Philipp Heil, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Philipp Bruners, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We systematically followed patients after percutaneous IRE for primary or secondary liver malignancies according to a standardized follow-up MRI protocol. Our aim was to describe the normal changes of MR signal pattern over time that can be expected after IRE; this knowledge is important in order to allow the sensitive detection of signal intensity (SI) changes that are not within normal limits, i.e. likely represent local recurrence.

METHOD AND MATERIALS

27 patients (13 male, mean age 62y) with 37 malignant liver tumors (33 secondary, 4 HCC) underwent percutaneous CT-guided IRE. Patients underwent pre- and post-interventional hepatic MRI with Gd-EOB-DTPA according to a standardized protocol (including T2 TSE sequences, dynamic contast-enhanced T1w GE sequence, T1w GE in late phase) before treatment, within 2 hours after IRE, at 24 hours after IRE, and then at 1, 2, 4, 6, 8, 12 weeks after IRE, and every 3 months thereafter. MR images were systematically evaluated by two readers in consent.

RESULTS

Even after successful IRE, in 23/37 (62%) cases, the ablated tumor was still visible, with unchanged SI and internal architecture as before IRE, for 1-8 weeks after IRE in 8/23 cases, for 3-9 months in 12/23 cases, and for more than 12 months in 3/23 cases. The ablation zone itself appeared as an intermediately hyperintense area on T2w images until 1 week after IRE in all cases. Thereafter, the ablation zone inverted its SI and appeared on T2w images intermediately hypointense in the center, with a hyperintense rim, the latter exhibited strong contrast enhancement in 34/37 cases. This appearance persisted for 1-4 weeks in 17/34 cases, for 6-8 weeks in 10/34 and for 3-6 months in 7/34 cases.The ablation zones showed a steady decrease in size and disappeared completely in 21/37 cases (within 3 months in 16 cases). Local recurrences were observed in 7/37 (19%) cases and were visible as intermediately hyperintense masses on the edge of the intermediately low SI ablation zone on T2w images.

CONCLUSION

IRE induces complex signal intensity changes that vary over time. In the majority of cases, the treated target lesions were visible within the ablation zone over a longer period of time. This makes diagnoses of local recurrence difficult.

CLINICAL RELEVANCE/APPLICATION

Knowledge of the typical MR-imaging appearance of the IRE ablation zone and its changes over time is important to avoid diagnostic errors in the follow up of patients after IRE.

SSK18-06 Procedural Sedation and Analgesia versus General Anesthesia for Respiratory-gated MR-HIFU Ablation in the Liver

Wednesday, Dec. 2 11:20AM - 11:30AM Location: N227

Participants
Johanna M. van Breugel, MSc, Utrecht, Netherlands (*Presenter*) Nothing to Disclose
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Maurice V. Bosch, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Mario G Ries, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Investigate the feasibility of respiratory-gated MRHIFU ablation in the liver under PSA with spontaneous breathing in an animal experiment Validate the introduced respiratory depression by PSA in sedated human patients

METHOD AND MATERIALS

Five pigs were placed on a Philips Sonalleve MR-HIFU system (1.5T, Philips Healthcare). PSA was induced using propofol (4.5-6mg/kg/h) and remifentanil (4.8-5.8µg/kg/h). Volumetric sonications were performed under PSA (4x4x10mm3, 450W acoustic power, 15-25s). MRI and acoustic energy delivery were respiratory gated with a pencil beam navigator. Then, GA was induced using midazolam (1mg/kg/h), nimbex (0.09mg/kg/h), and sufentanil (11.3µg/kg/h). Mechanical ventilation was set to 13/min and the ablation protocol was repeated. For both protocols the nonperfused volumes (NPVs) were measured and the duty cycles (DC) of the therapeutic sonications were compared. PSA was induced in two patients prior to HIFU treatment using propofol (1.4 and 1.6 mg/kg/h) and remifentanil (2.5 and 0.3 µg/kg/h). Vital functions were monitored.

RESULTS

Under GA a median DC of 64.0% (IQR 62-67, n=42) was achieved and of 79.5% (IQR 73-85, n=42) under PSA. The mean NPV per sonication was 0.09ml during GA and 0.16ml during PSA. Breathing frequency (BF) under PSA varied between 9-15 breaths/min. Vital functions remained stable. During both patient treatments under PSA the BF could be depressed to values as low as 5/min while the ETCO2 level stayed <6.5%, and blood pressure and heart rate values remained normal.

CONCLUSION

The animal experiments confirmed the feasibility of volumetric HIFU ablations using respiratory gating under PSA. The results were comparable or superior to those achieved under GA. The subsequent PSA procedures on human patients evidenced the similarity in respiratory depression of the PSA protocol while vital functions and patient safety were not impaired. Future work anticipates translation of these findings in a clinical liver ablation study.

CLINICAL RELEVANCE/APPLICATION

Magnetic Resonance-guided High Intensity Focused Ultrasound (MR-HIFU) ablation in the liver is complicated by the continuous target movement due to respiration. Respiratory gating represents a simple and robust solution, which usually requires general anesthesia (GA) to obtain a long resting phase. From a patient's perspective however, procedural sedation and analgesia (PSA) has advantages over GA: a lower risk of complications and shorter recovery.

SSK18-08 Preclinical Evaluation of an MR - Compatible Microwave Ablation System and Comparison with a Standard Microwave Ablation System in an ex Vivo Bovine Liver Model

Wednesday, Dec. 2 11:40AM - 11:50AM Location: N227

Participants
Rudiger Hoffmann, Tubingen, Germany (*Presenter*) Nothing to Disclose
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Hans-Jorg Rempp, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate a newly developed MR-compatible microwave ablation system with focus on ablation performance and compare it with a corresponding standard microwave ablation system in an ex-vivo setting.

METHOD AND MATERIALS

Overall, 52 ablation procedures were performed in an ex vivo bovine liver phantom, with various non-perfusion cooled microwave ablation devices and varying ablation durations, using the following settings: [A] 16G standard antenna, 2cm active tip, 2.4m cable; [B] MR-compatible 16G-antenna, 2cm active tip, 2.4m cable; [C] MR-compatible 16G-antenna, 2cm active tip, extended 6m cable; [D] MR-compatible 16G-antenna, 4cm active tip, extended 6m cable. Ablation durations were 3min, 5min and 10min for settings [A]-[C], performing an additional 15min ablation for setting [D]. Settings [A]-[C] were compared regarding the size of the ablation, i.e., short axis diameter (SA), Volume (V), as well as the generator energy output (E), with analysis of variance and Tukey post

hoc test. Ablation performance of the MR-compatible settings [C] and [D] were compared regarding SA, V, E and sphericity index (SA/LA) with unpaired t-test.

RESULTS

No statistically significant differences were found between [A], [B] and [C] regarding SA and V (10min; [A]: SA=25.8±2.4mm, V=17.8±4.4cm³. [B]: SA=25.3±1.9mm, V=16.6 ± 3.0 cm³. [C]: SA=25.0±2.0mm, V=17.8 ± 2.7 cm³); however, the highest generator energy output was measured for setting [C] ([A]: 9.9±0.5kJ, [B]: 10.1±0.5kJ, [C]: 13.1±0.3kJ, p<0.001). SA, V and E were significantly larger with setting [D] than [C] with 10min ablations ([D]: SA=34.0±2.9mm, V=39.4±7.5 cm³, E=16.7±0.8kJ) without significant difference in sphericity index ([C]: SA/LA=0.46±0.02, [D]: SA/LA=0.52±0.04, p=0.08). Largest ablation zone was achieved with setting [D] after 15 min ablation time (SA=41±1.4mm, V=60.9±5.2cm³, SA/LA=0.59±0.01).

CONCLUSION

The MR-compatible microwave antenna and a standard, comparable, non-MR-compatible microwave ablation device create similar ablation zones. Use of an extension cable for generator positioning outside the MR scanner room is possible without loss of ablation performance.

CLINICAL RELEVANCE/APPLICATION

The tested MR-compatible system can be used without loss of ablation performance compared to the standard system.

SSK18-09 Percutaneous of Microwave Ablation of Hepatic Dome: Assessment of Efficacy and Safety

Wednesday, Dec. 2 11:50AM - 12:00PM Location: N227

Participants
Nazanin H. Asvadi, MD, Boston, MA (*Presenter*) Nothing to Disclose
Arash Anvari, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Raul N. Uppot, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ashraf Thabet, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ronald S. Arellano, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the efficacy and safety of computed tomography (CT) guided microwave ablation of tumors in hepatic dome.

METHOD AND MATERIALS

An Interventional Radiology database was used to retrospectively identify patients who underwent CT-guided percutaneous microwave ablation for liver tumors located in the hepatic dome between June 2011 and December 2014. Creation of artificial ascites was attempted as an adjunctive maneuver to displace the liver away from the right hemidiaphragm to minimize the potential risks of phrenic nerve injury, pneumothorax or peritoneal burn.Treatment response was assessed by either contrast material enhanced CT or magnetic resonance imaging (MRI) at 1, 3, 6, 9, 12 months and every 3 months therafter. Primary clinical success was defined as absence residual tumor on one month post-ablation CT or magnetic resonance imaging. Secondary clinical success defined as no residual lesion after repeat microwave ablation.

RESULTS

Between June 2011 and December 2014, 46 patients (M: F = 31:15, mean age = 64.4 years, (range = 25-89 years) underwent CT-guided percutaneous microwave ablation for 48 tumors in the hepatic dome. Creation of artificial ascites with 0.9% normal saline solution (0.9% NS) as an adjunctive maneuver to displace the dome from the right hemidiaphragm was performed in 34/48 (70%) of ablations with mean volume of 1237.5 ml of fluid (range=300-3000 ml). Primary success was achieved in 41/48 (85%). Four tumors required retreatment to achieve complete necrosis for a secondary success rate of 94%. There were no major complications. Two patients experienced small, asymptomatic pneumothoraces that were aspirated at the time of the procedure and did not result in thoracostomy or unexpected hospitalization.

CONCLUSION

Computed tomography guided microwave ablation of hepatic dome lesions is associated with high success rate and low complication rate. Creation of artificial ascites may have a protective effect on minimizing the risk of thermal injury to the diaphragm and/or risk of significant pneumothorax.

CLINICAL RELEVANCE/APPLICATION

Computed tomography guided microwave ablation of hepatic dome lesions is associated with high success and low complication rates.

BRS-WEA

Breast Wednesday Poster Discussions

Wednesday, Dec. 2 12:15PM - 12:45PM Location: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Jiyon Lee, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

BR253-SD-WEA1 Contrast-enhanced Ultrasound Imaging in Ablation Therapy for Primary Breast Carcinoma

Station #1

Participants
Toshikazu Ito, MD, PhD, Izumisano City, Japan (*Presenter*) Nothing to Disclose

PURPOSE

This study was performed to evaluate the usefulness of contrast-enhanced ultrasound in assessing the therapeutic response of percutaneous radiofrequency (RF) ablation therapy in patients with breast carcinoma. To evaluate therapeutic efficacy of percutaneous ultrasound guided ablation therapy for primary breast cancer using contrast-enhanced ultrasound.

METHOD AND MATERIALS

Between January 2012 and December 2014, 33 patients with biopsy-confirmed breast carcinoma 2.0cm or less in diameter underwent contrast-enhanced ultrasound using the microbubble contrast agent Perflubutane before and after percutaneous RF ablation therapy. We examined 33 patients with 33 breast cancer lesions by contrast-enhanced ultrasound and MRI before and after RF ablation therapy. Ultrasound guided RF abltion therapy was performed using a 17-gauge internally cooled electrode (Cool-TipTM, Valleylab, Boulder, CO, USA) under general anesthesia. Therapeutic success was defined as a lack of contrast enhancement by contrast-enhanced ultrasound, MRI and non-viable cancer tissue by ultrasound guided vacuum-assisted biopsy (VAB).

RESULTS

Before treatment, all examined 33 breast carcinoma nodules were detected to be hypervascular on contrast-enhanced ultrasound and MRI. Contrast-enhanced ultrasound four weeks after RF ablation therapy showed ablation zones and adequate tumor necrosis in all 33 cancer lesions treated. Contrast-enhanced ultrasound made it possible to see that tumor vessels of treated lesions had disappeared after RF ablation therapy. Contrast enhanced ultrasound and MRI showed a ablation zone and non-viable cancer tissue were seen by VAB in 33 ablation zones.

CONCLUSION

Contrast-enhanced ultrasound using Perflubutane may provide an alternative approach that has high diagnostic agreement with MRI in assessing the therapeutic effect of RF ablation therapy in primary breast carcinomas.

CLINICAL RELEVANCE/APPLICATION

Contrast-enhanced ultrasound using Perflubutane may provide an alternative approach that has high diagnostic agreement with MRI in assessing the therapeutic effect of RF ablation therapy in primary breast carcinomas.

BR254-SD-WEA2 Fast Bilateral Breast Coverage with High Spectral and Spatial Resolution (HiSS) MRI at 3T

Station #2

Participants
Milica Medved, PhD, Chicago, IL (*Presenter*) Nothing to Disclose
William Weiss, BS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Abe, MD, Chicago, IL (*Abstract Co-Author*) Consultant, Seno Medical Instruments, Inc
Gillian M. Newstead, MD, Chicago, IL (*Abstract Co-Author*) Medical Advisory Board, Bayer AG; Consultant, Three Palm Software LLC; Consultant, VuCOMP, Inc; Medical Advisor, Quantitative Insights, Inc
Olufunmilayo I. Olopade, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Maryellen L. Giger, PhD, Chicago, IL (*Abstract Co-Author*) Stockholder, Hologic, Inc; Shareholder, Quantitative Insights, Inc; Royalties, Hologic, Inc; Royalties, General Electric Company; Royalties, MEDIAN Technologies; Royalties, Riverain Technologies, LLC; Royalties, Mitsubishi Corporation; Royalties, Toshiba Corporation; Researcher, Koninklijke Philips NV; Researcher, U-Systems, Inc
Gregory S. Karczmar, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

High spectral and spatial resolution (HiSS) MRI is a small-voxel implementation of echo-planar spectroscopic imaging (EPSI), with fat and water the resonances of interest. It provides excellent diagnostic images of breast cancer and normal breast even without contrast enhancement by separating the water and fat signal in the spectral domain and visualizing lesion morphology without contrast agent-induced artifacts. Here we further improve imaging speed and in-plane resolution, at higher field strength (3T) and quantify fat suppression.

METHOD AND MATERIALS

Thirty six subjects (18 healthy volunteers, 8 patients with suspicious findings, and 10 cancer patients) were scanned using a 16-channel dedicated breast coil, on a Philips Achieva 3T-TX magnet. High-resolution EPSI was implemented (384 mm FOV, 0.8x0.8x3

mm³ voxels in 50-60 slices, TR/TE 2350/23 ms, 23 echoes, 23.9 Hz spectral resolution, scan time 6.5-7.5 min, SENSE factor 3 (L/R)) via a software patch and complex SENSE-accelerated images of individual echoes were reconstructed on the scanner console. HiSS MRI was acquired prior to contrast administration. During off-line data processing, the fat peak in each voxel was fit to a Lorentzian and the fit and baseline subtracted from the full water and fat proton spectrum. The remaining pure water spectrum was analyzed to obtain images proportional to water resonance peak height and integral.

RESULTS

Average parenchymal signal to suppressed fat signal ratio was 3.9±0.6 in fat-suppressed T1-weighted images and 7.6±2.1 in water peak height images, yielding 94% improvement in parenchymal conspicuity ($p < 0.001$). 10 out of 12 malignant lesions found in 10 patients were visualized on HiSS images.

CONCLUSION

Fast, high resolution HiSS images were acquired at 3T in 6.5-7.5 minutes. The T2*-weighted HiSS sequence could potentially replace the existing T2-weighted pre-contrast sequence, and could provide high-resolution fat-suppressed pre-contrast morphologic imaging of lesions, eliminating artifacts resulting from contrast agent administration. HiSS MRI allows detection and characterization of small quantities of water-bearing tissue, and could be used to improve calculation of breast density in risk-assessment studies.

CLINICAL RELEVANCE/APPLICATION

Fast HiSS MRI could replace T2-weighted sequences, while providing excellent unenhanced diagnostic images of breast lesions and potentially better quantitative measurement of breast density.

BR255-SD-WEA3 Diagnostic Accuracy of Digital Breast Tomosynthesis - Thick versus Thin Slices

Station #3

Participants
Alexander Stork, Dusseldorf, Germany (*Presenter*) Consultant, General Electric Company;
Dietmar Seitz, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Eckhard Wegjan, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp G. Begemann, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Joern K. Kemper, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare clinical performance of digital breast tomosynthesis (DBT) reviewed in thick slices versus the combination of thick and thin slices.

METHOD AND MATERIALS

276 consenting women with indication of work-up were enrolled in a HIPAA-compliant prospective trial and imaged with DBT (MLO view) on the suspected breast(s). 49 patients had malignancies and 227 benign lesions, all proven through histopathology or 1-year follow-up. DBT volumes were reconstructed from 9 exposures equally distributed around a 25° angle. DBT image sets included 0.5mm-spaced (thin) slices and 1cm-thick slices. Thick slices were obtained by combination of 20 adjacent thin slices. Five independent breast radiologists (experience 10-15 years), blinded on truth, assessed the cases using BI-RADS® categories (1-5). DBT images were scored in two sequential steps: thick slices (DBTS) first, then combined with thin slices (DBTSS). Areas under the ROC curves (AUCs) were evaluated and t-test used to check differences. Mean file sizes were calculated.

RESULTS

AUCs across readers were 0.817 and 0.816 for DBTSS and DBTS, respectively. Mean AUC difference and related 95% confidence interval (CI) for DBTSS versus DBTS were 0.001 [-0.009, 0.012]. The difference was not statistically significant ($p=0.738$). Mean patient file size was 116Mb and 1,265Mb for DBTS and DBTSS, respectively.

CONCLUSION

There was no statistical difference in ROC AUC across readers between DBT displayed as thick slices or as the combination of thick and thin slices, but there was a 10 times reduction of image file size with thick slices only.

CLINICAL RELEVANCE/APPLICATION

DBT interpretation may be limited to thick slices only with a large potential for patient file size reduction.

BR256-SD-WEA4 Training Effect on Screening Breast Ultrasound for Women at Average Risk of Breast Cancer: Improvement in the Positive Test Rate and Biopsy Rate over 3 Years

Station #4

Participants
Sooyeon Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Min Jung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hee Jung Moon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Hyun Yoon, MD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun-Kyung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We investigated whether training reduced the positive test rate without loss of the cancer detection rate on screening US for women at average risk of breast cancer.

METHOD AND MATERIALS

3171 women at average risk of breast cancer who underwent screening US adjuvant to mammographically dense breast from March 2010 to February 2013 - 918, 1173, and 1020 women at the first, second, and third year - were included. Since 2010, we trained

to classify galactocele-like lesions and circumscribed oval-shaped solid nodules of a short diameter of 5mm or smaller as Breast Imaging Reporting and Data System (BI-RADS) category 2. Reference standard information was a combination of biopsy and surgical results within 1 year after screening US, and a follow-up US performed at least 12 months after screening US. BI-RADS category 3, 4, and 5 on screening US were considered as screening test positive. Interval cancers were defined as those diagnosed because of clinical abnormalities occurring in an interval less than 1 year after the last screening US. PPVs, total and invasive cancer yield per 1000 exams, and biopsy rates were calculated. Mantel-Haenszel Chi-square test was used to evaluate the trends in BI-RADS categories, PPVs and biopsy rates. Chi-square or Fisher's exact test was used to evaluate the differences in total and invasive cancer yields.

RESULTS

This training significantly reduced the percentage of BI-RADS 3 from 28.3% to 12.6%, BI-RADS 4 from 5.6% to 2.1%, BI-RADS 3-5 from 33.9% to 14.7%, and the biopsy rate from 8.4% to 2.8% over 3 years (All, p<0.001). PPVs did not significantly increase. Total and invasive cancer yield was 2.8 and 2.2 cancers per 1000 exams, respectively. Interval cancers were not detected. No US-detected cancer had lymph node metastasis. Of these, 77.8% (7 of 9) were invasive, and the median size was 8mm.

CONCLUSION

Training to downgrade galactocele-like lesions and circumscribed oval-shaped solid nodules of a short diameter of 5mm or smaller without any suspicious US features into BI-RADS category 2 lesions on screening US was effective in reducing the positive test rate and biopsy rate, without significant loss of the cancer detection rate.

CLINICAL RELEVANCE/APPLICATION

The training reduced the percentage of BI-RADS category 3 and 4 lesions and the biopsy rate, without significant loss of the cancer detection rate.

BR258-SD-WEA6 Impact of the New Density Reporting Laws: Radiologist Perceptions and Actual Behavior

Station #6

Participants
David Gur, PhD, Pittsburgh, PA (*Presenter*) Nothing to Disclose
Jules H. Sumkin, DO, Pittsburgh, PA (*Abstract Co-Author*) Scientific Advisory Board, Hologic, Inc
Amy Klym, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Jill L. King, MS, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Andriy I. Bandos, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess radiologists' perceptions of how the Breast Density Notification Act (BDNA) of Pennsylvania would affect their breast density reporting and their actual reporting patterns after implementation.

METHOD AND MATERIALS

IRB approval was obtained. We surveyed 21 radiologists about their belief as to how the new law affected their breast density reporting patterns and analyzed actual data for 16 respondents at three different times: 12 and 3 months pre- and between 1 and 5 months post the law taking effect. Three hundred consecutive reports were assessed for each radiologist at each period. Distributions of reported density BI-RADS ('1'-'4') were compared using a type III test in the context of an ordinal mixed model accounting for between-reader variability and adjusting for age (proc glimmix, SAS v9.3) using a two-sided 0.05 significance level.

RESULTS

Seventeen radiologists responded to the survey. One retired shortly thereafter. Of the 16 practicing respondents, 56% (9/16) did not favor the law, 13% (2/16) were in favor, and 31% (5/16) were neutral. The fraction of radiologists who perceived that after implementation they rated more, equally, or less frequently breasts as BI-RADS 2 versus BI-RADS 3 was, 50% (8/16), 44% (7/16) and 6% (1/16), respectively. Actual BIRADS 2 rates were 0.43 (2074/4800), 0.48 (2522/4800) and 0.53 (2522/ 4800), for 12 months prior, 3 months prior, and one to 5 months post, respectively. Comparing actual 3 months pre to post implementation, 69% (11/16) performed differently than their survey answers with an average overall shift of 5% of cases from BIRAD 3 to BIRAD 2 (p<0.001), with three radiologists changing their individualized reporting by 10% or more (p<0.001). Comparing 12 months pre- to post implementation, 44% (7/16) performed differently than their survey answers and 14 of 16 radiologists increased the frequency of reported BI-RADS 2 scores after the BDNA implementation with seven having statistically significant (p<0.001) increases.

CONCLUSION

Radiologists' reporting patterns changed after the density reporting law and for some radiologists in an unexpected way, at least for a short duration.

CLINICAL RELEVANCE/APPLICATION

Radiologists' reporting patterns changed after the new density reporting law, at least for a short duration, and for some in a different manner than their own reported expectation.

BR259-SD-WEA7 Variation in the Sensitivity of Shear Wave Elastography (SWE) for the Detection of Invasive Breast Cancer According to Histological Type: Findings from 1120 Breast Cancers

Station #7

Participants
Andrew Evans, MRCP, FRCR, Dundee, United Kingdom (*Presenter*) Research Grant, SuperSonic Imagine Speakers Bureau, SuperSonic imagine
Colin Purdie, MBChB,PhD, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Lee Jordan, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Sarah J. Vinnicombe, MRCP, FRCR, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Kim Thomson, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Patsy Whelehan, MSc, Dundee, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Previous studies of SWE of invasive breast cancers have included less than 300 tumours so the numbers of special histological type tumours included have been low. The aim of this study is to ascertain the sensitivity of SWE of breast cancer according to histological subtype in a large dataset.

METHOD AND MATERIALS

The mean elasticity values of 1120 invasive breast cancers were compared according to histological subtype. The patients were recorded on a prospectively collected database of all US visible lesions in our breast unit over 5 years. It includes both screen detected and symptomatic lesions. The frequency of abnormal stiffness (mean kPa of >50) and the average mean stiffness of special tumour types with 8 or more cases were compared with ductal carcinomas of no specific type (DNST).

RESULTS

Seven hundred and ninety one of 846 (93.5%) DNST tumours were stiff at SWE (average mean stiffness 132 kPa). Tubular cancers were significantly less likely to be stiff compared to DNST tumours (32 of 43 (74.4 %) p=0.0002 (average mean stiffness 103kPa).Lobular cancers (146 of 155 (94.2%), p=0.71, average mean stiffness 132 kPa), mucinous cancers ((26 of 26(100%), p=0.06, average mean stiffness 153 kPa), papillary cancers (25 of 26 (96%), p=0.57, average mean stiffness 134 kPa) and metaplastic cancer (8 of 8 (100%), p=0.3, average mean stiffness 140 kPa) had frequencies of stiffness similar to that seen in DNST tumours.

CONCLUSION

Tubular cancers are significantly less likely to be stiff at SWE compared to other tumour types. Other tumour types notably lobular cancer, papillary and mucinous cancers have similar frequencies of stiffness as DNST tumours.

CLINICAL RELEVANCE/APPLICATION

SWE findings in small spiculate lesions which may reprent tubular cancer should interpeted with courtion

BR154-ED-WEA8 Common Artifacts and Positioning Mistakes to be Avoided in Digital Mammography

Station #8

Participants
Maria Soledad Nocetti, MD, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Lucia I. Beccar Varela, MD, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose
Bernardo O. Blejman, MD, Buenos Aires, Argentina (*Abstract Co-Author*) Nothing to Disclose
Karina Pesce, Vicente Lopez, Argentina (*Presenter*) Nothing to Disclose
Gabriela Ladeiro, Vicente Lopez, Argentina (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

Recognize and analyze most common artifacts that condition an optimal mammographic diagnosis/ Learn to fix them to ensure high quality standads.

TABLE OF CONTENTS/OUTLINE

Evaluation of digital mammography artifacts is essential for optimizing image quality.Radiologists and technologists should be familiar with them, to avoid creating pseudolesions or masking true abnormalities.Artifacts may be related to: the mammography unit (field inhomogeneity, detector artifacts, underexposure, grid lines, grid misplacement, vibration artifact, loss of edge), the technologist (improper use of the equipment or positioning mistakes) or the patient (motion, superimposed objects or substances, as body parts, clothing, hair, medical devices, foreign bodies or cosmetics on the skin).The aim of mammography is to obtain an optimum image along with maximum breast tissue visualization.The purpose of this work is that the reader is able to identify and understand the causes of digital mammographic artifacts so, when posible, take actions to eliminate them to ensure high quality standards.

MSRT45

ASRT@RSNA 2015: Interventional Cardiovascular MRI (iCMR): Clinical and Pre-Clinical Applications

Wednesday, Dec. 2 2:20PM - 3:20PM Location: N230

VA IR MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Jonathan Mazal, MS, RRA, Bethesda, MD (*Presenter*) Nothing to Disclose
Toby Rogers, BA, MRCP, Bethesda, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define interventional cardiovascular magnetic resonance (iCMR). 2) Compare advantages and disadvantages of MRI versus other imaging modalities to guide cardiovascular interventions. 3) Describe personnel and infrastructure requirements to start an iCMR program. 4) Identify current clinical applications of iCMR. 5) Review pre-clinical applications of iCMR to inform future clinical directions.

SSM03

ISP: Cardiac (Congenital Heart Disease/Cardiac Stents)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: S502AB

CA CT MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Cynthia K. Rigsby, MD, Chicago, IL (*Moderator*) Nothing to Disclose
U. Joseph Schoepf, MD, Charleston, SC (*Moderator*) Research Grant, Bracco Group; Research Grant, Bayer AG; Research Grant, General Electric Company; Research Grant, Siemens AG; Research support, Bayer AG; ; ;

Sub-Events

SSM03-01 Iterative Reconstructions for Imaging of Coronary-Artery Stents with Computed Tomography: First In-vitro Experience

Wednesday, Dec. 2 3:00PM - 3:10PM Location: S502AB

Participants
Tilman Hickethier, MD, Cologne, Germany (*Presenter*) Nothing to Disclose
Jan Robert Kroger, MD, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
Jochen von Spiczak, Muenster, Germany (*Abstract Co-Author*) Nothing to Disclose
Bettina Baessler, MD, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
Dirk K. Mueller, PhD, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Walter Giepmans, Best, Netherlands (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Guido Michels, Cologne, Germany (*Abstract Co-Author*) Nothing to Disclose
David C. Maintz, MD, Koln, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexander C. Bunck, Koln, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In-stent restenosis is one of the most important limitations of coronary angioplasty (PCI). Accurate assessment of coronary stents after PCI using non-invasive CT imaging remains challenging despite new stent materials and improvements in CT technology. New model-based iterative reconstruction (IR) filters have been shown to significantly improve the assessment of native coronary vessels. In our study we systemically evaluated the influence of IR on visualization of coronary stent lumen.

METHOD AND MATERIALS

Ten coronary stents of various materials placed in plastic tubes filled with contrast agent (345 HU) were scanned with a 256-slice CT (iCT, Philips). Images were reconstructed (0.67mm slice thickness, 0.35mm increment) with standard filtered back projection, hybrid IR (iDose L4) and two different model-based IR settings (Cardiac Routine (CR) & Cardiac Sharp (CS)) at 3 strength levels (IMR, Philips). Each stent and reconstruction was assessed using established parameters: image noise (standard deviation (SD) in a standardized ROI), in-stent attenuation (mean attenuation difference between stented and non-stented lumen of the contrast agent-filled tube) and image sharpness (calculated maximum slope of signal intensity profiles across the stents).

RESULTS

Image noise was significantly lower in IMR data, being lowest at higher iteration levels (FBP 25.4/iDose 18.8/IMRCR1 9.6/IMRCR2 6.1/IMRCR3 3.4/IMRCS1 12.9/IMRCS2 8.6/IMRCS3 4.7 HU; $p < .01$).Differences in attenuation across the stents were significantly smaller in IMR data when applying the CR setting which showed the best depiction of the in-stent attenuation (FBP 372.8/iDose 353.9/IMRCR1 90.1/IMRCR2 110.8/IMRCR3 112.6 HU; $p < .01$). IMR CS however suppressed stent-blooming artifacts excessively with in parts severely reduced densities in stented tube lumina which might be explained by limitations of spatial resolution.Maximum image sharpness was significantly higher in IMR data (FBP 387.2/iDose 386.8/IMRCR1 656.2/IMRCR2 661.8/IMRCR3 647.0/IMRCS1 845.3/IMRCS2 862.8/IMRCS3 879.7 HU/pixel; $p < .01$).

CONCLUSION

Well-established objective CT image-quality assessment parameters of coronary stents are significantly improved by using model-based IR when the adequate setting is applied.

CLINICAL RELEVANCE/APPLICATION

Non-invasive evaluation of coronary stents is an important and challenging task. Model-based IR has the potential of significantly improving coronary-stent assessment.

SSM03-02 Assessment of Iterative Metal Artifact Reduction (iMAR) in Cardiac CT for Patients with Pacemakers and Implantable Defibrillators

Wednesday, Dec. 2 3:10PM - 3:20PM Location: S502AB

Participants
Juan Montoya, Rochester, MN (*Presenter*) Nothing to Disclose
Shuai Leng, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Ahmed Halaweish, PhD, Rochester, MN (*Abstract Co-Author*) Employee, Siemens AG
Cynthia H. McCollough, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, Siemens AG
Eric E. Williamson, MD, Rochester, MN (*Abstract Co-Author*) Research Grant, General Electric Company

PURPOSE

Metal artifacts from pacemaker leads and implantable cardioverter defibrillators (ICD) can significantly obscure relevant anatomy in

cardiac CT. This study aimed to apply iterative metal artifact reduction (iMAR) to Cardiac CT for improved visualization of lead tips and surrounding anatomy in patients with pacemakers and ICDs.

METHOD AND MATERIALS

CT raw data were retrospectively collected for patients that underwent clinically indicated gated CT of the heart using a dual-source CT scanner (Somatom Definition and Definition Flash, Siemens Healthcare) and had a pacemaker or ICD. Images were reconstructed using routine weighted-filtered back projection (WFBP) and a research prototype of cardiac iMAR using an offline reconstruction workstation. A cardiac radiologist evaluated WFBP and iMAR images side-by-side, blinded to the reconstruction method. Another investigator determined post hoc which image was WFBP and iMAR so that the following grading scale was applied to the iMAR images: 1= obviously worse, degrades diagnosis confidence, 2=slightly worse, does not affect diagnosis confidence, 3=equivalent, 4=slightly better, does not affect diagnosis confidence, 5=obviously better, improves diagnosis confidence. For objective metal artifact evaluation, the length of severe artifacts from each lead were measured in multiple axial images. Wilcoxon signed rank test was used to compare the radiologist evaluation as well as the difference in the length of metal artifacts.

RESULTS

16 patients (13 pacemakers, 3 ICDs) had a total of 31 leads. Mean reader grade was 4.5 for iMAR (P-value<0.001) indicating significant improvement of image quality and diagnostic confidence. The average reduction in the length of severe metal artifacts caused by the leads was 4.5 mm using iMAR compared to WFBP (p-value < 0.0001). Better metal artifact reduction was achieved in right ventricle leads, which we suspect is due to increased motion in the right atrium. Two iMAR cases created artifacts in anatomical regions different than lead tips.

CONCLUSION

The use of iMAR for cardiac CT in patients with pacemakers or ICDs can improve the visualization of anatomical structures close to the leads, resulting in improved diagnostic confidence.

CLINICAL RELEVANCE/APPLICATION

The use of iMAR in cardiac CT could improve the visualization of critical anatomy by significantly reducing artifacts from metal devices, leading to improved diagnostic confidence.

SSM03-03 Cardiac Keynote Speaker: Congenital Heart Disease

Wednesday, Dec. 2 3:20PM - 3:40PM Location: S502AB

Participants
Albert De Roos, MD, Leiden, Netherlands (*Presenter*) Nothing to Disclose

SSM03-05 Pulmonary Insufficiency Assessment by Cardiac Magnetic Resonance: Regurgitation Fraction or Absolute Value of Reverse Volume?

Wednesday, Dec. 2 3:40PM - 3:50PM Location: S502AB

Participants
Francesco Secchi, MD, Milano, Italy (*Presenter*) Nothing to Disclose
Marcello Petrini, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Paola Maria Cannao, MD, San Donato Milanese, Italy (*Abstract Co-Author*) Nothing to Disclose
Elda Chiara Resta, Milano, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimo Chessa, San Donato Milanese, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco Sardanelli, MD, San Donato Milanese, Italy (*Abstract Co-Author*) Speakers Bureau, Bracco Group Research Grant, Bracco Group Speakers Bureau, Bayer AG Research Grant, Bayer AG Research Grant, IMS International Medical Scientific
Mario Carminati, MD, San Donato Milanese, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the use pulmonary regurgitation fraction (PRF) or absolute value of pulmonary reverse volume (PRV) in the evaluation of pulmonary insufficiency with cardiac magnetic resonance (CMR).

METHOD AND MATERIALS

We retrospectively studied 44 patients (mean age 23±11 mean value±standard deviation, 17 females and 27 males) with pulmonary/conduit insufficiency due to various congenital heart diseases who underwent CMR (1.5 T) before and after surgical valve implantation (14 patients) or percutaneous Melody valve implantation (30 patients). We performed short axis ECG triggered cine true-FISP (fast imaging with steady state precession) and phase contrast sequences. A reader with four-year of experience in CMR segmented endocardial contours of right ventricle (RV) to obtain end diastolic volume index (EDVi), stroke volume index (SVi) and analyzed the flow. We obtained both PRF (%, retrograde flow divided by anterograde) and PRV (ml/m2) and we correlated them with RVEDVI, SVi and differences (Δ) of RVEDVI before and after procedures. Spearman test was used.

RESULTS

Overall PRF (%), PRV (ml/m2), RVEDVi (ml/m2) and SVi (ml) were 23±25, 0.29±0.22, 99±43 and 45±16 respectively. RVEDVI was significantly correlated with PRF (r=0.480; P=.001) and PRV (r=0.549; P<.001). RVSVi was significantly correlated with PRF (r=0.605; P<.001) and PRV (r=0.701; P<.001). ΔRVEDVi was significantly correlated with PRF (r=0.427; P=.004) and PRV (r=0.489; P=.001).

CONCLUSION

PRV is stronger correlated with RVEDVi, RVSVi and ΔRVEDVi than PRF.

CLINICAL RELEVANCE/APPLICATION

Pulmonary reverse volume is a stronger indicator of RV dysfunction than regurgitant fraction.

SSM03-06 Assessment and Intervention Planning in Aortic Coarctation Based on Anatomic and 4D PC MRI

Wednesday, Dec. 2 3:50PM - 4:00PM Location: S502AB

Participants
Anja Hennemuth, PhD, Bremen, Germany (*Presenter*) Nothing to Disclose
Hanieh Mirzaee, Bremen, Germany (*Abstract Co-Author*) Nothing to Disclose
Mathias Neugebauer, Bremen, Germany (*Abstract Co-Author*) Nothing to Disclose
Johann Drexl, Bremen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Schumann, Bremen, Germany (*Abstract Co-Author*) Nothing to Disclose
Marcus Kelm, MD, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Aortic coarctation is a narrowing of the aorta in the region of the transition between the aortic arch and the descending aorta where the fetal ductus arteriosus had joined. The AHA Guidelines recommended therapy for patients with a systolic coarctation pressure gradient of more than 20 mmHg.We have implemented a solution for the non-invasive assessment of aortic diameters and pressure gradients based on an MRI protocol combining a whole heart or angiographic MRI with a 4D PC MRI.

METHOD AND MATERIALS

The EXTENTO software prototype works with a 3D whole heart covering the aortic arch or MR angiography of the aorta for the extraction of the anatomical information and geometrical measurements. This is fused with a 4D PCMRI sequence for the assessment of the corresponding hemodynamics. The workflow consists of an interactive segmentation followed by the exploration of diameters as well as the centerline pressure difference curve for an interactively selected vessel region. Furthermore, pressure maps are visualized in 3D.The provided application has been applied to 5 datasets of patients scheduled for stenting therapy of aortic coarctation (age 11-44). All data were acquired with a Philips Achieva 1.5T scanner. Whole heart volumes were acquired with a resolution of 1.42x1.42x2mm³, 4D PC MRI had a velocity encocing between 3 and 4 m/s, a spatial resolution of 1.41x1.41x2.3mm³, and a temporal resolution of 40ms.

RESULTS

Data processing was possible in all cases and took 10 to 15 minutes. Systolic pressure gradients along the selected centerline sections were between 15 and 22mmHg and clearly visible in the calculated parameter maps.

CONCLUSION

The presented results suggest that the proposed MR imaging protocol and image processing solution could be suitable for the non-invasive assessment of stenoses in clinical practice.

CLINICAL RELEVANCE/APPLICATION

Aortic coarctation occurs in about 7% of all congenital heart defects. The high afterload induced by the stenosis can lead to ventricular dysfunction and thus a major therapy goal is to remove the pressure gradient. Pressure catheters are the standard diagnostic tool for the assessment of intravascular pressures. The suggested imaging and analysis aims at enabling the non-invasive measurement of relevant anatomic and hemodynamic information.

SSM08

Gastrointestinal (Loco-regional Therapy Liver Imaging)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: E353A

GI CT IR MR OI US

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Debra A. Gervais, MD, Chestnut Hill, MA (*Moderator*) Nothing to Disclose
Steven S. Raman, MD, Santa Monica, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSM08-01 Irreversible Electroporation in Patients with Hepatocellular Carcinoma: Immediate Versus Delayed Findings on MR Imaging

Wednesday, Dec. 2 3:00PM - 3:10PM Location: E353A

Participants
Guy E. Johnson, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Matthew J. Kogut, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
James O. Park, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Raymond S. Yeung, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Siddharth A. Padia, MD, Seattle, WA (*Presenter*) Nothing to Disclose

PURPOSE

Irreversible electroporation (IRE) is a non-thermal technique used to ablate soft tissue tumors. Our study assessed MR imaging appearance after IRE for the treatment of hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

In this institutional review board-approved retrospective study with waiver of informed consent, twenty patients with HCC were treated with IRE over a 2.5 year period. Median patient age was 62, and 75% of patients had Child-Pugh A cirrhosis. Median tumor diameter was 2.0 cm (range 1.0-3.3 cm). Contrast-enhanced multiphase MR was performed on post-procedure day 1, 30, and every 90 days thereafter. Ablation zone sizes and signal intensities were compared between each time point for both T1- and T2-weighted images. Trends in MR signal intensity and tumor dimensions over time were quantified using generalized linear models.

RESULTS

MR appearance of a treated tumor includes a zone of peripheral enhancement with centripetal filling on delayed post-contrast images. Compared to post-procedure day one, there is a decrease in enhancing ablation zone size of 28.9% (mean) every 90 days. There is a trend towards decreasing signal intensity of the peripheral ablation zone over time on both T2 ($p=0.01$) and contrast-enhanced T1 weighted images ($p<0.08$). Conversely, the tumor itself typically demonstrates increased signal intensity over the same sequences.

CONCLUSION

IRE of HCC results in a large region of enhancement on immediate post-procedure MR, which involutes on follow-up imaging. This is associated with decreasing signal intensity of the peripheral ablation zone over time. This phenomenon may represent resolution of the reversible penumbra.

CLINICAL RELEVANCE/APPLICATION

1. Understanding of the standard MR imaging appearance after IRE can help guide future therapy and assess prognosis with respect to tumor response.2. The large area of enhancement seen after IRE may represent regions of reversible electroporation, which may be used to optimize treatment protocols or target localized drug delivery in future studies.

SSM08-02 Local Hepatic Tumor Control in Patients with HCC Undergoing Transarterial Lipiodol Embolisation Followed by Microwave Ablation

Wednesday, Dec. 2 3:10PM - 3:20PM Location: E353A

Participants
Roland M. Seidel, MD, Homburg, Germany (*Presenter*) Nothing to Disclose
Alexander Massmann, MD, Homburg/Saar, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Fries, MD, Homburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Guenther K. Schneider, MD, PhD, Homburg, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Research Grant, Bracco Group;
Arno Buecker, MD, Homburg, Germany (*Abstract Co-Author*) Consultant, Medtronic, Inc Speaker, Medtronic, Inc Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG

PURPOSE

To investigate local tumor control in patients with HCC undergoing lipiodol embolization and subsequent microwave ablation.

METHOD AND MATERIALS

25 patients with 35 HCC (mean size 23mm, SD 9mm) underwent superselective transarterial embolization with lipiodol. Subsequently

percutaneous CT guided microwave ablation of the tumors was performed using a 2,45 GHz generator (power output 80 to 120W) with cooled tip probes (Acculis , Angiodynamics, USA). All patients were investigated before therapy by unenhanced and dynamic contrast enhanced MR or CT; follow up was performed within 1, 3, 6 and more months after treatment. Treatment was rated as successful in case of a complete rim of necrosis surrounding the lesion and no further tumor growth. Patient data were evaluated retrospectively on a PACS workstation by two readers in consensus.

RESULTS

In 24 of 25 (96%) patients a complete ablation was diagnosed on the early follow up imaging. The patient rated with incomplete ablation presented tumor progression on follow up imaging. 1 patient initially rated as complete ablation presented lesion progression and underwent chemoembolization with no residual tumor up to 510 d after microwave ablation. Overall complete ablation rate per patient was 92% (23 of 25 patients) and 94% per lesion (33 of 35 lesions).

CONCLUSION

Microwave ablation in combination with lipiodol embolization for patients with HCC is a valuable therapeutic procedure for smaller hepatic tumors. Especially the targeting and embolizing potential of the retained lipiodol is likely to contribute to a more reliable tumor access and ablation effect .

CLINICAL RELEVANCE/APPLICATION

The treatment of smaller local HCC tumors becomes more and more an issue in the bridging to transplant situation and therefore minimal invasive percutaneous ablation techniques become attractive, since local tumor control is in the range of surgical treatments. This study demonstrates a reliable minimal invasive targeting and embolization technique in combination with microwave ablation for the enhancement of local tumor control.

SSM08-03 Analysis of a Series of Microwave Ablated Native HCCs: Which Parameters do Affect Outcome after Treatment?

Wednesday, Dec. 2 3:20PM - 3:30PM Location: E353A

Participants
Valentina Battaglia JR, MD, Pisa, Italy (*Presenter*) Nothing to Disclose
Salvatore Mazzeo, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Carla Cappelli, MD,PhD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Rosa Cervelli, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Piercarlo Rossi, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Bartolozzi, MD, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the efficacy at 1 month after treatment of ultrasound-guided percutaneous microwave ablation (MWA) of series of native HCCs.

METHOD AND MATERIALS

From January 2013 to February 2015, 221 patients with a single HCC lesion were candidate for ultrasound-guided percutaneous MWA. Of them, 113 were excluded because of patients' habitus or limited US visibility of the lesion (42 and 71 patients respectively). Finally, our study included 108 patients who were treated with MWA for a single hepatic lesion. All lesions were classified on the basis of dimensions, location and venous vessel contiguity. A cooled shaft antenna of 16 or 14 Gauge was percutaneously inserted into the tumor under ultrasound guidance. Microwave emitting power and time of treatment were tailored to tumor size (ranging from 35 to 50W). Lesions were classified on the basis of dimensions (1.5cm to 2cm: 31/108; 2.1 to 3cm: 54/108; 3.1 to 4cm: 23/108), of location: centrohepatic, subcapsular, close to gallbladder, para-hilar and para-caval. Moreover, lesions were divided into subdiaphragmatic (23: yes; 86: no) and on the basis of proximity (<5mm) to vascular structures (59: yes; 49: no).In all cases, a CT evaluation performed 1 month after procedure was done. Tumor response after treatment was evaluated by means of mRECIST.Statistical analysis was performed by means of Chi-square test and bivariate correlation.

RESULTS

All neoplasm were ablated in a single session and no major complication occurred.At CT evaluation, 84 lesions showed a Complete Response, 23 Partial response and 1 lesion Stable Disease.Statistical analysis showed no significant relationship between complete response and tumor size, time of ablation or power applied. At bivariate analysis, tumor location and subdiaphragmatic position did correlate ($p<0.0001$) with lesions'response to treatment, independently from dimensions and technical parameters of power emission.

CONCLUSION

In our series, tumor size did not appear to impact complete ablation rates, whereas lesion localization represents the most important factor influencing tumor response.

CLINICAL RELEVANCE/APPLICATION

Lesions'characteristics might lead to formulate a grading on the basis of whom to predict tumor response after treatment.

SSM08-04 Local Treatment for Colorectal Cancer Liver Metastases, Comparison of Radiofrequency Ablation and Surgical Metastasectomy

Wednesday, Dec. 2 3:30PM - 3:40PM Location: E353A

Participants
Naik Vietti Violi, Lausanne, Switzerland (*Presenter*) Nothing to Disclose
Alban L. Denys, MD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Pierre E. Bize, MD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Rafael Duran, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Demartines, MD, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Nermin Halkic, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose

Jean-Francois Knebel, Lausanne, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare local recurrence rate of radiofrequency ablation (RFA) and surgical metastasectomy for colorectal cancer liver metastases from a surgical and radiological database of consecutive patients and to define the best candidates for each treatment.

METHOD AND MATERIALS

We analyzed, lesion by lesion, 121 metastases treated by metastastectomy (in 43 patients, median follow up 798 days) and 110 metastases treated by RFA (in 60 patients, median follow up 590 days). We compared rate of local recurrence (LR) and hepatic recurrence (HR) between the two groups. Predictive factors for recurrence (patients and primary tumor characteristics and metastasis data - size, depth in the liver (distance between metastasis and hepatic capsule), distance to vascular structures (all veins located within 10 mm to the metastasis were registered), pathological margins in case of surgery (R0/R1 status)), were analyzed by Chi square and logistic regression in uni and multivariate analysis.

RESULTS

We found no difference between the two groups for patients and primary tumor characteristics. Survival curves were similar between the two groups. Mean metastasis size was larger in metastectomy group than RFA group (18mm, range 2-90mm, standard error=0.11 and 15mm, range 3-55mm, standard error=0.06; p=0.03). Rate of LR and HR between the two groups were nearly statistically different in favor of RFA: LR was 19% for metastasectomy group and 10% for RFA group (p=0.06, delay: 245 and 289days, p=0.56), HR were 78.5% for metastasectomy and 66% for RFA (p=0.054, delay: 226 and 235days, p=0.81). R1 status and metastasis deepness were predictive factors for recurrence in the metastasectomy group (p=0.03 and p=0.02, respectively). Metastases deepness and proximity to vascular structure increased risk for R1 (p=0.04 and p<0.001, respectively). We found no predictive factor for recurrence in RFA group.

CONCLUSION

Pending proper selection (small lesions visible under imaging guidance), RFA tends to have a lower recurrence rate than metastasectomy. Lesions localized in depth in the liver parenchyma, close to large veins are at risk of local recurrence after metastasectomy.

CLINICAL RELEVANCE/APPLICATION

Metastasectomy and radiofrequency ablation are currently used for treatment of colorectal cancer liver metastasis aiming for total tumor ablation and sparing liver parenchyma. There is no study comparing results and risk of local recurrence between metastasectomy and RFA.

SSM08-05 Diagnostic Performance of DECT in the Assessment of Treated Zone Following Percutaneous Ablation in Renal Cell Cancer: Image Quality and Radiation Dose Considerations

Wednesday, Dec. 2 3:40PM - 3:50PM Location: E353A

Participants
Diana Murcia, MD, Boston, MA (*Presenter*) Nothing to Disclose
Andrea Prochowski Iamurri, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Manuel Patino, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ronald S. Arellano, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Dushyant V. Sahani, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Consultant, Allena Pharmaceuticals, Inc
Avinash R. Kambadakone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the diagnostic performance of DECT in the evaluation of treated zone following percutaneous ablation of renal cell cancer (RCC) with assessment of value of iodine images (MD-I), image quality and radiation dose considerations.

METHOD AND MATERIALS

In this retrospective study, 26 patients (17 M, 9 F, mean age 69 years) with RCC treated with percutaneous ablation were included. The patients underwent contrast enhanced nephrographic phase dual energy CT scan with a single-source dual energy CT (750HD GE Healthcare, Milwaukee WI) as part of post ablation surveillance. In this cohort, 13 patients had single energy unenhanced scans. All the patients in this cohort had renal mass protocol single energy CT (SECT) at different time-points. Post processed subtraction, material density iodine (MD-I) and virtual unenhanced images were generated. Two blinded radiologists reviewed the SECT and DECT images in two separate sessions for ablation zone margin, presence of residual/recurrent tumor, image quality and presence of artifacts with a 5 point confidence score. The CTDI and DLP were recorded and compared between DECT series and SECT series.

RESULTS

A total of 28 RCC underwent percutaneous ablation. DECT with MD-I iodine images demonstrated higher specificity for detection of abnormal enhancement in the ablation zone suggesting residual tumor/recurrence compared to SECT (30% vs 91%). The image quality score for DECT (with MD-I) was higher compared to standard SECT images (5 vs 4.1 of SECT with p<0.05) with higher number of artifacts recorded in the subtraction images generated from standard non-contrast and contrast enhanced CT images (25% of cases). A single phase DECT had significant radiation dose reduction in comparison to dual phase SECT scans (736.11±231.6 mGy-cm vs 1596.5±450.2 mGy-cm; p<0.001) and the radiation dose considerations of nephrographic phase DECT and SECT were comparable (736.11±231.6 mGy-cm vs 609.5±169.1 mGy-cm; p=0.179)

CONCLUSION

DECT with iodine specific images improves diagnostic performance in the evaluation of ablation zone in RCC as compared to standard SECT images with significant reduction of radiation dose due to exclusion of non-contrast phase.

CLINICAL RELEVANCE/APPLICATION

Post ablation surveillance of treated zone in patients with RCC can present diagnostic challenges with the need for non-contrast

scans and subtraction images which increase the cumulative radiation dose and are affected by artifacts.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Dushyant V. Sahani, MD - 2012 Honored Educator
Dushyant V. Sahani, MD - 2015 Honored Educator

SSM08-06 CT and MR Imaging Features to Predict Residual or Recurrent Hepatocellular Carcinoma after Trans-arterial or Percutaneous Treatment

Wednesday, Dec. 2 3:50PM - 4:00PM Location: E353A

Participants
Eric C. Ehman, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Sarah Umetsu, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Nicholas Fidelman, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Linda Ferrell, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Michael A. Ohliger, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;
Judy Yee, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, EchoPixel, Inc
Thomas A. Hope, MD, San Francisco, CA (*Abstract Co-Author*) Advisory Committee, Guerbet SA; Research Grant, General Electric Company

PURPOSE

To determine which CT and MR features are most predictive of viable hepatocellular carcinoma (HCC) following percutaneous or transarterial therapy.

METHOD AND MATERIALS

Pathology reports for liver explants from 12/2012-7/2014 with CT or MR imaging performed within 90 days of transplant (45±28 days) were reviewed. Patients with a history of hepatocellular carcinoma and preoperative treatment including transarterial chemoembolization (TACE) or percutaneous ablation (radiofrequency, microwave, cryo, ethanol) were included. Each lesion was reviewed on the most recent pre-transplant imaging study and size, location and enhancement features recorded. Pathology slides were reviewed and the size of viable tumor nodule recorded (if present).

RESULTS

91 patients with 135 treated lesions were included. 88(65%) lesions were imaged with CT and 47(35%) with MR, including 89(66%) post-TACE, 24(18%) post-ablation, and 22(16%) post both TACE and ablation. At explant, 69(51%) of lesions showed viable tumor. 11/42(26%) of viable lesions at CT and 15/27(56%) at MR demonstrated nodular arterial enhancement ($p=0.02$). Washout was seen in 13/42(31%) of viable HCCs at CT and in 6/27(22%) at MR ($p>0.05$). Capsule appearance was seen in 2/42(5%) of viable lesions at CT and in 1/27(4%) at MR ($p>0.05$). Using each criteria to diagnose a study positive for recurrence, sensitivity and specificity were 38% and 92% for nodular enhancement, 28% and 94% for washout and 4% and 100% for capsule. Using any of the three criteria, overall sensitivity and specificity were 45% and 91%. Detection rate for nodular recurrence was 33% for lesions <1cm, 55% for lesions 1-2cm and 71% for lesions >2cm. Lesion detection by size was similar at CT and MR.

CONCLUSION

No single imaging finding was sensitive for viable HCC following treatment. Nodular arterial enhancement was the most frequently seen, and seen significantly more at MR than at CT. Washout was less frequently seen and seen equally at MR and CT. Capsule was rarely seen but when present always predicted recurrence. There is limited detection of lesions <1cm both at MR and CT and only marginal detection between 1-2cm.

CLINICAL RELEVANCE/APPLICATION

Post-treatment imaging is difficult to interpret and imaging features predictive of recurrent or residual disease are not well understood. Accurate diagnosis of viable tumor at post-treatment imaging is important to guide future therapy such as repeat TACE or ablation.

SSM09

Gastrointestinal (Esophagus Imaging)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: E353B

GI CT MI MR NM OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
David J. Lomas, MD, Cambridge, United Kingdom (*Moderator*) Nothing to Disclose
Lisa M. Ho, MD, Durham, NC (*Moderator*) Nothing to Disclose

Sub-Events

SSM09-01 Changes in Esophageal Dimensions during Continuous Swallowing in Healthy Adults as Detected by Magnetic Resonance Imaging

Wednesday, Dec. 2 3:00PM - 3:10PM Location: E353B

Participants
Sabarish Narayanasamy, MBBS,MD, Aligarh, India (*Presenter*) Nothing to Disclose
Mehtab Ahmad, MBBS, Aligarh, India (*Abstract Co-Author*) Nothing to Disclose
Mudit Arora, DMRD, Aligarh Ho, India (*Abstract Co-Author*) Nothing to Disclose
Faisal Janal, MBBS, Aligarh, India (*Abstract Co-Author*) Nothing to Disclose
Breethaa J. Selvamani, Aligarh, India (*Abstract Co-Author*) Nothing to Disclose
Anusha Sundararajan, Loma Linda, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study was designed to quantify the degree of fluctuation in esophageal dimensions during continuous swallowing on Magnetic Resonance (MR) Imaging.

METHOD AND MATERIALS

30 healthy volunteers (25 males and 5 females, age range: 15-45 years) were chosen for the study. MR examination was done using a 1.5 tesla magnet. Initially, the esophagus was imaged in the resting state (Resting MR). Then, the volunteer was asked drink water continuously and another set of MR images were obtained (Swallowing MR). The thoracic esophagus was divided into three segments (upper, middle and lower) based on anatomical landmarks. Diameter and the wall thickness of the esophagus were measured in each segment and the cross sectional area (CSA) was calculated.

RESULTS

The esophageal CSA increased by twofold on swallowing MR scans as compared to the resting scans [Median(interquartile range) increase in CSA in upper segment - 117.3%(61-162.2), in middle segment - 87.7%(54.3-162.9) and in the lower segment - 122.1% (78.9 - 188.1)]. The anteroposterior and transverse diameters of the thoracic esophagus increased by about 60% as compared to the resting MR scans. The mean wall thickness of the thoracic esophagus was reduced by about 25% on swallowing MR as compared to resting scan.

CONCLUSION

Our study helps to define normal changes in esophageal dimensions during continuous swallowing. The lower third of the thoracic esophagus appears to be the most distensible segment.

CLINICAL RELEVANCE/APPLICATION

Swallowing MRI has been proposed as an experimental investigative modality for motility disorders of the esophagus and knowledge of the fluctuation in esophageal dimensions during swallowing might be of clinical utility.

SSM09-02 Differentiate Esophageal Cancer Stages with Spectral CT Imaging

Wednesday, Dec. 2 3:10PM - 3:20PM Location: E353B

Participants
Yang Chuangbo, MMed, Xianyang City, China (*Presenter*) Nothing to Disclose
Yongjun Jia, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Xirong Zhang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Chenglong Ren, Shanxi, China (*Abstract Co-Author*) Nothing to Disclose
Haifeng Duan, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Taiping He, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoxia Chen, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the value of spectral CT imaging to differentiate esophageal cancer stages.

METHOD AND MATERIALS

67 patients with esophageal cancer diagnosed by esophagoscopy underwent plain and double-phase enhanced CT scan with spectral CT mode. Patients were divided into well-to-moderately differentiated and poorly differentiated squamous carcinoma groups. The iodine-based material decomposition (MD) images were generated and analyzed with GSI Viewer software to measure the iodine concentration (IC) in tumors. Normalized iodine concentration (NIC) was obtained by dividing tumor IC to that of aorta. Data from the two cancer groups were analyzed statistically by independent-samples t test and were correlated with pathological

findings.

RESULTS

There were 32 well-to-moderately differentiated(Picture 1) and 35 poorly differentiated(Picture 2) squamous carcinoma verified by pathology. IC values of the well-to-moderately differentiated squamous carcinoma in both the arterial phase (AP) (2.66±1.07mg/ml) and venous phase (VP) (2.12±0.94mg/ml) were lower than that of the poorly differentiated squamous carcinoma (2.85±1.25mg/ml and 2.57±1.06mg/ml, respectively). The NIC value of the well-to-moderately differentiated squamous carcinoma was also lower than that of the poorly differentiated squamous carcinoma: 0.12±0.05 vs. 0.13±0.06 in AP and 0.42±0.13 vs. 0.61±0.18 in VP, respectively. Statistical differences of IC and NIC were found between the two groups in VP (both $p<0.05$) but not in AP ($p>0.05$).

CONCLUSION

There are correlation between the iodine concentration and normalized iodine concentration of esophageal cancers and their histological differentiation stages. IC and NIC parameters obtained in spectral CT for the esophageal cancer in the venous phase can be used as new indexes to differentiate esophageal cancer stages.

CLINICAL RELEVANCE/APPLICATION

Parameters such as normalized iodine concentration in esophageal cancer determined in spectral CT may be used to differentiate esophageal cancer stages.

SSM09-03 Diffusion-Weighted MRI in the Staging of Esophageal Cancer: Ready for Clinical Use? Prospective Comparison with EUS and MDCT

Wednesday, Dec. 2 3:20PM - 3:30PM Location: E353B

Participants
Francesco Giganti, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Paolo G. Arcidiacono, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Nicoletti, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Elena Orsenigo, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This pilot study was intended to prospectively compare the diagnostic performance of Diffusion-Weighted Magnetic Resonance Imaging (DW-MRI), Multidetector Computed Tomography (MDCT) and Endoscopic Ultrasonography (EUS) in the preoperative loco-regional staging of esophageal cancer.

METHOD AND MATERIALS

This study was institutional review board-approved. Eighteen patients with biopsy proved esophageal or gastro-esophageal (Siewert I) tumor (9 directly treated with surgery and 9 addressed to chemo/radiotherapy before) underwent 1.5 T DW-MRI, 64-channels MDCT and EUS before and after neoadjuvant treatment. All images were analyzed and staged blindly by dedicated operators according to the 7th TNM edition and two radiologists calculated indipendently the Apparent Diffusion Coefficient (ADC) from the initial scan. The results were then compared with histopathological findings. Statistical analysis included Spearman and intraclass correlation coefficients, Mann-Whitney U test and receiver operator characteristic curve analysis. After the population had been divided according to local invasion (T1-2 vs T3-4) and nodal involvement (N0 vs N+), sensitivity, specificity, accuracy, positive and negative predictive value were calculated and compared for each technique. Quantitative measurements from DWI were also analyzed.

RESULTS

For T staging, EUS showed the best sensitivity (100%) while MR showed the highest specificity (92%) and accuracy (83%). For N staging, MR and EUS showed the highest sensitivity (100%) but none of the three techniques showed adequate results for specificity. Overall, MR showed the highest accuracy (66%) for N stage. Mean pathological ADC was different between surgery-only and chemo/radiotherapy groups (1.90 vs 1.30 x 10-3 mm2/s, respectively; $p= 0.005$), with an optimal cut off for local invasion of 1.33 x 10-3 mm2/s ($p=0.05$).

CONCLUSION

DW-MRI could improve the current preoperative staging workup for esophageal cancer, showing characteristic advantages for both staging and initial treatment decision-making.

CLINICAL RELEVANCE/APPLICATION

DW-MRI can be useful in the preoperative workup for esophageal cancer and could help to select appropriate treatments after initial staging.

SSM09-04 The Use of 3T Multiparametric MRI in the Staging of Esophageal Cancer (EC)

Wednesday, Dec. 2 3:30PM - 3:40PM Location: E353B

Participants
Daniela A. Cenzi, MD, Verona, Italy (*Presenter*) Nothing to Disclose
Lisa Zantedeschi, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Lucia Camera, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Giacomo Schenal, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Massimiliano Motton, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefania Montemezzi, MD, Verona, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate diagnostic feasability of MP-MRI for the preoperative staging of EC and to assess its efficacy in discrimination between

responders and non-responders in those who underwent neoadjuvant treatment (NT).

METHOD AND MATERIALS

Between 2011 and January 2015, 36 patients with biopsy-proven EC underwent 3T MRI with the same approach: T2 weighted images, DWI and DCE sequences, with cardiac and respiratory gating. According to local invasion (T1-2 vs T3-4) and nodal involvement (N- vs N+), we identified 11 patients with organ confined lesion who underwent surgery: MR-staging results were compared with histopathological findings directly. 25 patients were addressed to NT and restaging MRI after treatment was compared to histological findings after surgery. Sensitivity (SE), specificity (SP), positive (PPV) and negative (NPV) predictive value and accuracy were calculated for the both groups. For NT group, changes in ACD and changes in DCE time intensity curve at MRI before and after treatment were calculated. 2 readers indipendently determined: pre-NT and post-NT ADC, percentage changes in ADC (ΔADC), DCE time intensity curves and interobserver variability.

RESULTS

Surgery group: for T staging, SE was 98 %, SP 78 %, accuracy 90%; for N staging SE was 67 %, SP 60 %, accuracy 64%. NT group after NT: for T staging SE was 80 %, SP 85 %, PPV 67%, NPV 92%, accuracy 89% and 76%, 78%, 50%, 91% and 91% respectively for N staging.Responders showed lower pre-NT ADC (1.30 vs 1.80Å~10-3mm2/s; P=0.002) and higher post-NT ADC (2.50 vs 1.64Å~10-3mm2/s; P=0.001) than non-responders and ADC increased in responders (ΔADC, 90.28 versus 11 %, respectively). A slight difference was observed in DCE curves but without a significant difference (p>0.05).Interobserver reproducibility was good both for surgery (k 0.68) and post-NT (k 0.86).

CONCLUSION

MR can correctly stage organ-confined lesions according to the high specificity (for the T stage) and to rightly assess pathological nodal involvement (for the N stage) thanks to the good SE. The ADC can be used to assess esophageal tumour response to NT treatment as a reliable expression of tumour regression.

CLINICAL RELEVANCE/APPLICATION

Preoperative staging in esophageal cancer is critical in order to prompt a surgical (T1-T2 stages without nodal involvement) or neo-adjuvant therapy (T3-T4 stages with nodal involvement).

SSM09-05 Textural Analysis of Baseline 18F-FDG PET for Predicting Treatment Response and Prognosis in Patients with Locally Advanced Esophageal Cancer

Wednesday, Dec. 2 3:40PM - 3:50PM Location: E353B

Participants
Xiaorong Sun, Jinan, China (*Presenter*) Nothing to Disclose
Lu Sun, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Ligang Xing, Jinan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Textural features on baseline 18F-FDG PET have shown the potential role in predicting treatment response in mixed stage esophageal cancer. This study is aim to investigate the value of this new technique for locally advanced esophageal squamous cell cancer (ESCC) receiving chemoradiotherapy.

METHOD AND MATERIALS

Under a waiver from IRB, 48 patients with newly diagnosed locally advanced ESCC who treated with concurrent chemoradiotherapy were retrospectively reviewed. Thirty-nine patients with early stage ESCC were included as control. All patients underwent pretreatment whole-body 18F-FDG PET/CT. Fifty-four texture indices describing global, local, and regional features were measured in addition to 5 conventional indices as standardized uptake values (SUVs, including maximum, peak, and mean SUV), metabolic volume (MV), and total lesion glycolysis (TLG). Patients were classified as responders (R, complete or partial response) and non-responders (NR, stable or progressive disease) according to RECIST1.1. Progression-free survival (PFS) and overall survival (OS) were recorded. The prognostic significance of parameters was examined using receiver-operating-characteristic curves, Kaplan-Meier analysis, and Cox regression analysis.

RESULTS

Both intratumor heterogeneity and mean/peak intensity of FDG uptake were significantly higher in locally advanced ESCC than those in early stage. Thirty-four texture indices, MV, and TLG showed the ability to differentiate R from NR. Nine texture indices showed higher sensitivity (76.7%~86.7%) and specificity (77.8%~94.4%) than MV (76.7% and 83.3%) and TLG (73.3% and 83.3%). Ten texture indices and MV were hazard factors of PFS and OS. Large-zone emphasis, one of the regional texture indices, was the only independent predictor of survival, with hazard ratio of 4.22 (95%CI:1.83~9.72) for PFS and 3.90 (1.74~8.79) for OS. None of the SUVs could predict treatment response and survival.

CONCLUSION

FDG PET texture indices provide better predictive information than conventional parameters for locally advanced ESCC.

CLINICAL RELEVANCE/APPLICATION

The clinical application of FDG PET texture analysis could be an important step in personalized treatment of esophageal cancer.

SSM09-06 CT Signs Can Predict Treatment Response and Long-Term Survival: A Study in Locally Advanced Esophageal Cancer with Preoperative Chemotherapy

Wednesday, Dec. 2 3:50PM - 4:00PM Location: E353B

Participants
Xiao-Yan Zhang, Beijing, China (*Presenter*) Nothing to Disclose
Xiaoting Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhilong Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Ying-Shi Sun, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Accurate prediction of treatment response and prognosis before surgery will allow prompt therapy adjustment. This study proposed to evaluate the efficacy of CT signs on treatment response and survival for advanced esophageal squamous cell carcinoma patients with preoperative chemotherapy.

METHOD AND MATERIALS

This study retrospectively enrolled 135 consecutive patients with preoperative chemotherapy from September 2005 to December 2011. Logistic regression model was conducted to evaluate the association between pathological response and CT signs. Overall survival(OS) and disease-free survival (DFS) were estimated using Kaplan-Meier method and Cox proportional hazards model was constructed to determine associations between CT signs after neoadjuvant chemotherapy and survival outcomes.

RESULTS

The logistic regression showed the total LN number(> 6) at baseline and the CT value change rate (≤ 17%) were significant for poor response; OR were 5.07 (95% CI, 1.86 to 13.81, P = 0.002) and 2.35 (95% CI, 1.05 to 5.23, P = 0.037), respectively. In Cox analyses, preoperative tumor thickness (> 10 mm), total LN number (>6), and short diameter of the largest LN (> 10 mm) were significant for OS, HR were 2.33(95% CI, 1.36 to 4, P = 0.002), 1.88(95% CI, 1.12 to 3.17, P = 0.017) and 1.87(95% CI, 1.07 to 3.28, P = 0.028), respectively; whereas only the short diameter of the largest LN was significant for DFS, HR was 2.36(95% CI, 1.23 to 4.54, P = 0.01).

CONCLUSION

CT signs can predict therapeutic efficacy and survival outcomes and provide an opportunity to offer additional treatment options before surgery.

CLINICAL RELEVANCE/APPLICATION

This study provided the first evidence that CT signs can predict survival outcomes and therapeutic efficacy of patients with esophageal cancer who received preoperative chemotherapy. Therefore, it is of great clinical significance to perform CT examinations before and after neo-adjuvant therapies in esophageal cancer patients. The CT images interpreted before surgery could provide important information about survival and response, which would improve individualized treatment programs.

SSM10

ISP: Gastrointestinal (Pancreas Cystic Lesions)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: E353C

GI CT MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Douglas S. Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose
Desiree E. Morgan, MD, Birmingham, AL (*Moderator*) Research support, General Electric Company

Sub-Events

SSM10-01 Gastrointestinal Keynote Speaker: Update on the Management of Small Pancreatic Cysts

Wednesday, Dec. 2 3:00PM - 3:10PM Location: E353C

Participants
Douglas S. Katz, MD, Mineola, NY (*Presenter*) Nothing to Disclose

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Douglas S. Katz, MD - 2013 Honored Educator
Douglas S. Katz, MD - 2015 Honored Educator

SSM10-03 Diffusion-Weighted MR Imaging in Distinguishing between Mucin-producing and Serous Pancreatic Cysts

Wednesday, Dec. 2 3:20PM - 3:30PM Location: E353C

Participants
Chiara Pozzessere, MD, Siena, Italy (*Presenter*) Nothing to Disclose
Sandra L. Castanos Gutierrez, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Celia P. Corona-Villalobos, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Chunmiao Xu, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ihab R. Kamel, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Pancreatic cysts detection has increased due to the widespread use of advanced cross-sectional imaging. Pancreatic cysts represent a wide spectrum of lesions varying from those with extremely low malignant potential, to those associated with cancer. Mucin-producing cysts have a malignant potential, whereas serous cysts are generally benign. An overlap between imaging features can be misleading, and in the indeterminate cases additional evaluations such as follow up, FNA and/or surgery are required. The aim of this study was to evaluate the feasibility and the reproducibility of diffusion-weighted imaging (DWI) in characterizing pancreatic cysts when standard imaging is not diagnostic.

METHOD AND MATERIALS

Forty-four pancreatic cysts (43 patients; 27 females; 16 males; mean age 47 years) underwent histological or cyst fluid analysis after MRI including DWI were retrospectively analyzed. Three blinded readers independently evaluated signal intensity (SI) and ADC. Intra-observer and inter-observer agreement were calculated. Fisher's exact test and Welch's t test were used to compare SI and ADC values respectively, to pathological results. Diagnostic accuracy of thresholds ADC was assessed by ROC analysis. A p value of less than 0.05 was considered statistically significant.

RESULTS

The mean ADC value of the mucin-producing cysts was 3.26 x10-3 mm2/sec, 3.27 x10-3 mm2/sec and 3.35 x10-3 mm2/sec for the three readers, respectively. The mean ADC value of the serous cysts was 2.86 x10-3 mm2/sec, 2.85 x10-3 mm2/sec and 2.85 x10-3 mm2/sec for the three readers, respectively. Difference in ADC values between the two cyst groups was 12.4%, 12.9% and 14.8% for the three readers, respectively ($p<0.001$). Intra-observer and inter-observer agreement were excellent. ROC analysis showed an area under the curve of 0.82 (CI, 0.69-0.94), 0.81 (CI, 0.67-0.94) and 0.85 (CI, 0.69-0.95) for the three readers, respectively. A threshold ADC of 3x10-3 mm2/sec resulted in correct identification of cysts in 77-81% of cases, with sensitivity and specificity ranging between 84-88% and 66-72%, respectively.

CONCLUSION

DWI may be a helpful tool in distinguishing between mucin-producing and serous pancreatic cysts.

CLINICAL RELEVANCE/APPLICATION

ADC values may be used to differentiate between mucin-producing and serous cysts of the pancreas and could potentially reduce unnecessary invasive approaches to diagnosis or the need for follow up studies.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying

educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ihab R. Kamel, MD, PhD - 2015 Honored Educator

SSM10-04 Transabdominal Ultrasound of the Pancreas for Surveillance of Known Pancreatic Cystic Lesions

Wednesday, Dec. 2 3:30PM - 3:40PM Location: E353C

Participants
Maryellen R. Sun, MD, Boston, MA (*Presenter*) Research Grant, Glaxo SmithKline plc
Corinne D. Strickland, MD, MS, Boston, MA (*Abstract Co-Author*) Shareholder, Thayer Medical Corporation
Bahar Tamjeedi, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Alexander Brook, PhD, Boston, MA (*Abstract Co-Author*) Spouse, Research Grant, Guerbet SA
Olga R. Brook, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Robert A. Kane, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Koenraad J. Mortele, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Bettina Siewert, MD, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the utility of transabdominal ultrasound in follow up evaluation of known pancreatic cystic lesions (PCL) using same-day MRI examinations as gold standard.

METHOD AND MATERIALS

In an IRB-approved, HIPAA-compliant study, patients with known PCL scheduled for MRI follow up underwent prospective transabdominal ultrasound of the pancreas on the same date as the MRI examination. PCL were measured in transverse (TR), anteroposterior (AP), and craniocaudad (CC) dimensions and the longest dimension obtainable in any plane. US was performed in blinded fashion to same date MR results. Detection rate of US was correlated with patient factors including weight, AP abdominal diameter, thickness of subcutaneous abdominal fat, location of cyst within pancreas, and size of cyst, using chi-squared and Wilcoxon rank sum tests. Size measurements of pancreatic cysts at US were compared with MR measurements. MR measurements were taken as gold standard for cyst size.

RESULTS

252 PCL were evaluated in 57 patients (39 females, 18 males, mean age 67 yrs (range, 39-86 yrs)). Mean maximum cyst diameter was 8.5 mm (range, 2-92 mm). PCL were identified at ultrasound in 100% (5/5) of cysts ≥3 cm; 92% (12/13) of cysts ≥2 and <3 cm; 78% (43/55) of cysts ≥1 and <2 cm; 35% (27/78) of cysts ≥5mm and <1 cm; and 16% (16/101) of cysts <5 mm. Measured max diameter at US differed from max diameter at MRI by a mean 0.7 mm (range, - 6 to +16 mm); cysts were under measured by US in 46% and over measured in 31% of maximum diameter measurements, respectively. US identified 47% (14/30) of cysts located in uncinate process, 53% (27/51) in head; 83% (10/12) in neck, 52% (35/67) in body, and 18% (17/93) in tail. There were statistically significant correlations between PCL visualization at US and maximum cyst size ($p<0.001$), patient weight ($p=0.012$), and AP abdominal diameter ($p=0.0059$); no significant correlation ($p=0.43$) between thickness of subcutaneous abdominal fat and cyst visualization at ultrasound was identified.

CONCLUSION

The vast majority of PCL can be visualized at follow up with transabdominal ultrasound. Frequency of detection varies strongly with lesion size, location, patient weight and abdominal diameter.

CLINICAL RELEVANCE/APPLICATION

Many pancreatic cystic lesions known to exist from prior imaging can be visualized and accurately measured at follow up with transabdominal ultrasound. Body habitus and cyst size and location correlate with success of ultrasound.

SSM10-05 Fate of Small Pancreatic Cysts (<3cm) after Long-term Follow-up: Analysis of Significant Radiologic Characteristics and Proposal of Follow-up Strategy

Wednesday, Dec. 2 3:40PM - 3:50PM Location: E353C

Participants
Heera Yoen, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Dong Ho Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Su Joa Ahn, Seoul , Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jeong Hee Yoon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe the natural history of small, incidental pancreatic cysts after long-term follow-up, with an emphasis on identifying indicators of indolent lesions.

METHOD AND MATERIALS

We retrospectively selected 95 patients with 150 cysts from our hospital database. Selection criteria included patients with pancreatic cysts<3cm in CT from 2003-2004, followed with CT or MR for greater than 5 years (mean 117.1±19.6 months), or received pancreatic surgery during the follow-up period. Two radiologists reviewed the initial CT and recorded size, location, shape, ductal communication, p-duct dilatation, calcification and presumptive radiologic diagnosis of each cyst. We then recorded the size change after the conclusion of follow-up period. For patients who underwent an operation, we compared the cysts' radiologic features with those of the patients who did not undergo an operation. Furthermore, for surgical patients, we compared the preliminary radiologic diagnosis with the pathologic results.

RESULTS

Among 95 patients with 150 cysts, 12 patients with 16 cysts underwent operations. Out of 134 cysts in 83 non-surgical patients, 49(36.6%) cysts didn't change in size, while 57(42.5%) increased, and 27(20.9%) decreased or vanished. Among increased 57 cysts, only 5 were larger than 3cm at the end of the follow-up period. The initial size of the cyst was significantly larger in the surgical group compared to the nonsurgical group(17.2±7.3mm vs 11.3±5.5 mm, p<0.000). Reasons for surgery included malignancy(4/95, 4.21%), borderline IPMN(6/95, 6.31%) with 5 moderate and 1 low grade, and SCN with increasing size(2/95, 2.11%). Pleomorphic and clubbed shape were significant features for borderline and malignant cysts. No cysts<15 mm and without p-duct change showed a significant change in size in 3 years.

CONCLUSION

The incidence of malignancy was 4.21% in our group. However, the majority of small cysts remained less than 3cm after long-term follow-up. The initial size of cysts as well as the shape are important features for predicting the progress and potential for malignant transformation. Patients with initial cysts<15mm, without P-duct change, and non-pleomorphic or clubbed shape may be assessed at long term intervals without significant risk of malignancy.

CLINICAL RELEVANCE/APPLICATION

It is a feasible strategy to extend follow-up interval for cysts<15mm, without P-duct change, non-pleomorphic or clubbed shape, which could lead to reduce medical expenditure.

SSM10-06 The Diagnostic Performance of Transabdominal Ultrasonography for Incidental Pancreatic Cysts: Focus on the Effect of Prior Images, Size, and Location

Wednesday, Dec. 2 3:50PM - 4:00PM Location: E353C

Participants
Ju Hyun Jeon, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jung Hoon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ijin Joo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess diagnostic performance of transabdominal ultrasonography (TAUS) for incidental pancreatic cysts with a focus on the effect of prior images, size, and location.

METHOD AND MATERIALS

1064 pancreatic cysts which were radiologically confirmed by contrast enhanced CT (n=795), MRI (n=21), CT and MRI (n=202), or endoscopic ultrasonography (EUS, n=46), were included in 938 patients who underwent TAUS. TAUS finding was analyzed based on the formal reports. One radiologist also retrospectively reviewed TAUS, CT, MR, and EUS images to determine the size, location, and detection rate of the pancreatic cyst before and after CT, MRI, or EUS. For statistical analysis, independent samples T-test and Chi-square test were applied.

RESULTS

Among 1064 pancreatic cysts, 107 cysts underwent TAUS before CT, MR, or EUS and 477 cysts underwent TAUS after prior study. 480 cysts underwent TAUS both before and after CT, MRI, or EUS. Overall 940 pancreatic cysts (88.3%) were delineated on TAUS.The detection rate of pancreatic cyst on TAUS before CT, MRI, or EUS was 49.2% (289/587), and the detection rate of pancreatic cyst on TAUS after CT, MRI, or EUS was 86.7% (830/957). In a group of patients who underwent TAUS both before and after CT, MRI, or EUS, the detection rate of pancreatic cyst on TAUS was increased after CT, MRI, or EUS (before; 40.0%, after; 85.2%, p=0.0001).The size of detected cysts (mean±SD, 15.5±9.2 mm) was larger than undetected cysts (mean±SD, 11.8±7.5 mm, p<0.0001) with significant difference. Undetected cysts on US were almost smaller than 2cm. The detection rate of TAUS before CT, MRI, and EUS in neck, body, head, tail, and uncinated process was 60.7%, 55.7%, 54.6%, 37.9%, and 27.5%. The detection rate of TAUS after CT, MRI, and EUS in neck, head, body, uncinated process, and tail was 95.6%, 91.4%, 91%, 87.6%, and 67.8%.

CONCLUSION

Transabdominal US is useful for detection of pancreatic cyst. The detection rate of TAUS was improved after CT, MRI, and EUS regardless the location.

CLINICAL RELEVANCE/APPLICATION

Transabdominal US is useful image modality for incidental pancreatic cysts; especially follow up after CT, MRI, and EUS.

SSM12

ISP: Health Service, Policy and Research (Medical/Practice Management)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: S102D

MR HP SQ

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
James V. Rawson, MD, Augusta, GA (*Moderator*) Nothing to Disclose
Paul P. Cronin, MD, MS, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SSM12-01 Health Service, Policy and Research Keynote Speaker: Medical/Practice Management

Wednesday, Dec. 2 3:00PM - 3:10PM Location: S102D

Participants
James V. Rawson, MD, Augusta, GA (*Presenter*) Nothing to Disclose

SSM12-02 Using Modality Log Files to Guide MR Protocol Optimization and Improve Departmental Efficiency

Wednesday, Dec. 2 3:10PM - 3:20PM Location: S102D

Participants
Martin L. Gunn, MBChB, Seattle, WA (*Presenter*) Research support, Koninklijke Philips NV; Spouse, Consultant, Wolters Kluwer NV; Medical Advisor, TransformativeMed, Inc;
Bruce E. Lehnert, MD, Seattle, WA (*Abstract Co-Author*) Research support, Koninklijke Philips NV
Jeffrey H. Maki, MD, PhD, Seattle, WA (*Abstract Co-Author*) Research support, Bracco Group; Speakers Bureau, Lantheus Medical Imaging, Inc;
Christopher Hall, PhD, Briarcliff Manor, NY (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Thomas Amthor, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Julien Senegas, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Norman J. Beauchamp JR, MD, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV

PURPOSE

Imaging equipment log files contain detailed data about workflow and equipment utilization that is unavailable on RIS and PACS sources. The purpose of this study was to investigate the use of log files to identify areas of waste based on scanner time, variability and number of sequances, and measure the impact of a departmental MR efficiency process.

METHOD AND MATERIALS

Log files (MRLFs) were extracted from 4 MR scanners from 07/2013 to 02/2015 and were parsed to extract several parameters (e.g. protocol, sequences, exam duration, idle time, table movement). Using RIS data and MRLFs, we identified protocols with the greatest volume, duration and variation. Using MRLFs, we monitored system utilization of liver mass (MRLiv) and abdo/pelvis survey (MRAP) protocols pre and post protocol optimization. Optimization included assigning MRLiv patients with cirrhosis undergoing HCC screening to a new abbreviated protocol (MRLivCirr), and sequence reduction and optimization (MRAP). Statistical comparisons included a 2 tailed T-test and F-test.

RESULTS

Mean monthly MRLiv patient volume (+/- s.d.) was 55 ± 16 before and 20 ± 1 after optimization. The remaining 38 +/- 18 patients/month were for HCC screening and were assigned to the new MRLivCirr protocol. Mean monthly MRAP exams before was 20.6 ± 7.3 and after was 17.6 ± 2.3. Exam duration (table time ± s.d.) for MRLiv patients was 30.9 ± 9.3 min before and 31.4 ± 11.7 min after ($p=0.7$). However, for patients in the new MRLivCirr protocol group, mean time reduced by 7.2 min/exam to 23.7 ± 7.9 min($p<0.001$). Duration for patients undergoing MRAP reduced from 52.9 ±16.6 min to 43.1± 15.6 min, saving 9.8 min/exam ($p<0.001$). At an estimated rate of $650/hr, potential yearly savings could reach $36k for cirrhosis screening, and $22k for MRAP patients. The predictability of the exam length was improved with the s.d. of the MRLivCirr group (7.9 min) lower than the MRLiv group (11.7 min); F-Test, $p<0.02$.

CONCLUSION

MRLFs can be used to identify opportunities for equipment utilization improvement and measure the impact with accuracy. During our process we were able measure exact time savings and decreased variability per patient.

CLINICAL RELEVANCE/APPLICATION

Log files provide a way to measure modality utilization during image acquisition that are unavailable from RIS and PACS sources. They can be used to evaluate operational improvements in the department, potentially saving cost, and improving patient satisfaction.

SSM12-03 Comparison between Tumor Evaluation Using Free-text and RECIST 1.1 Criteria in Everyday Work

Wednesday, Dec. 2 3:20PM - 3:30PM Location: S102D

Participants
Juliane Schelhorn, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Julia Hoischen, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Haemi P. Schemuth, Essen, Germany (*Presenter*) Nothing to Disclose
Elena Stenzel, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

Felix Nensa, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Kai Nassenstein, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Different criteria have been established to improve and standardize tumor response evaluation. Currently, these criteria are used in clinical trials, but are rarely employed in daily work. This retrospective study compared tumor response evaluation by free-text and RECIST 1.1 criteria in everyday tumor patients.

RESULTS

Main included tumor entities were lung (17%), colorectal (16%), and breast cancer (14%). Median time intervals between CT follow-ups were 9-12 weeks. At first follow-up, 51% of patients were rated with different response categories comparing free-text and RECIST 1.1. This was significant ($p<0.001$) with an obvious underrepresentation of SD and an overrepresentation of PR and PD in free-text evaluation. At second follow-up, 46% had categorical differences, which was significant ($p<0.003$). At the later follow-ups, categorical differences were obvious, but not significant (3. follow-up: 42% differences, $p=0.570$; 4. follow-up: 35%, $p=0.824$; 5. follow-up: 47%, $p=0.209$). The severity of categorical differences increased with increasing follow-up time (up to a difference of three response categories) due to different reference points used for image analysis.

CONCLUSION

Severe differences in tumor response evaluation were detected comparing evaluation by free-text and RECIST 1.1. Given this, tumor response criteria should be implemented in the daily routine.

CLINICAL RELEVANCE/APPLICATION

To improve routine tumor patient monitoring tumor response criteria should be used in everyday work.

SSM12-04 Implementing a Collaborative Approach to Imaging Utilization Managementat a Provider-Owned Managed Services Organization

Wednesday, Dec. 2 3:30PM - 3:40PM Location: S102D

Participants
Daniel Durand, MD, Baltimore, MD (*Presenter*) Stockholder, Evolent Health, LLC; Advisor, National Decision Support Company; Advisor, Radiology Response; Founder, am-I-ok.com
Criag Reich, MD, Oakland, CA (*Abstract Co-Author*) Nothing to Disclose
Jeffrey D. Robinson, MD, MBA, Seattle, WA (*Abstract Co-Author*) Consultant, HealthHelp, LLC; President, Clear Review, Inc;
David B. Larson, MD, MBA, Los Altos, CA (*Abstract Co-Author*) Intellectual property license agreement, Bayer AG; Potential royalties, Bayer AG
Richard Sankary, MD, Oakland, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

While effective at controlling utilization, radiology benefit managers (RBMs) are disliked because they require ordering physicians to demonstrate medical necessity to an imaging gatekeeper who is not part of the community in which care occurs. Provider-owned health plans often utilize RBMs because their non-radiologist Medical Directors (MDs) are not imaging specialists. The purpose of our study was to demonstrate that radiologists can train local MDs to be effective stewards of imaging using collaborative techniques and produce results on par with RBMs but with fewer denials.

METHOD AND MATERIALS

A provider-owned Managed Services Organization (MSO) underwent an imaging utilization management (UM) process redesign. Prior to 2015, only PET/CTs and MRI exams ordered by primary care physicians were reviewed. After 1/1/15, all requests for CT, MRI, PET/CT, nuclear caradiology, and echocardiography were reviewed using Milliman Care Guidelines. The UM MD staff attended a day-long workshop led by two radiologists expert in collaborative imaging stewardship. The peer-to-peer process was rescripted to emphasize the risks of imaging (e.g. radiation) and suggesting alternative management plans (e.g. alternative imaging modalities) when appropriate. To assess the efficacy of the intervention, the MSO pre-authorization database was queried for the intervention period (Q1 2015) and a seasonally-matched baseline period (Q1 2014). The data elements extracted are shown in Figure 1. Impact rate was defined as the percentage of cases modified, withdrawn, or denied.

RESULTS

There was a significant increase in impact rate (0.4% vs. 4.6%, $p=0.005$) during the intervention period versus the control period. The number of requests modified or withdrawn by the ordering physician increased significantly (0.4% vs. 3.8%, $p=0.01$), while the number of requests denied by MDs was not significantly different (0.0% vs. 0.6%, $p=0.51$). Overall, the number of studies authorized per 1,000 patients declined significantly after the intervention (96.8 vs. 89.0, $p=0.006$).

CONCLUSION

Local MDs trained by radiologists can be effective stewards of imaging by using collaborative techniques that significantly reduce unnecessary imaging utilization without significantly increasing the use of denials.

CLINICAL RELEVANCE/APPLICATION

Radiologists can create significant value for health systems by training local MDs to be effective stewards of imaging UM using collaborative techniques.

Honored Educators

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David B. Larson, MD, MBA - 2014 Honored Educator

SSM12-05 Has Use of Prostate Biopsy and Transrectal Ultrasound Declined as Concerns Mount about Overdiagnosis of Prostate Cancer?

Wednesday, Dec. 2 3:40PM - 3:50PM Location: S102D

Participants
David C. Levin, MD, Philadelphia, PA (*Presenter*) Consultant, HealthHelp, LLC; Board of Directors, Outpatient Imaging Affiliates, LLC
Laurence Parker, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Ethan J. Halpern, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Vijay M. Rao, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In recent years there has been considerable debate about the issue of overdiagnosing prostate cancer (PCa). Since it is often an indolent disease and the potential harms from diagnosis and treatment are considerable, some have advocated a more conservative approach to conducting screening and diagnostic procedures. For example, the U.S. Preventive Services Task Force has issued a grade D recommendation against PSA-based screening. Our purpose was to study trends in the use of prostate biopsy (PB) and transrectal ultrasound (TRUS) over a recent 13-year period.

METHOD AND MATERIALS

The nationwide Medicare Part B Physician/Supplier Procedure Summary Master Files for 2001 through 2013 were used. They cover all Medicare fee-for-service beneficiaries (17.2 million males in 2013). CPT codes for PB and TRUS were selected and trends in procedure volume were evaluated. Utilization rates per 1000 males were calculated. Medicare specialty codes were used to identify the specialty of the physicians performing the procedures.

RESULTS

PB volume peaked in 2002, when a total of 292,045 were performed in Medicare patients. A generally downward trend then followed in subsequent years, reaching 165,382 in 2013 (-43%). The rate of PBs per 1000 male Medicare beneficiaries was 17.4 in 2002, decreasing to 9.6 in 2013. In that last year, urologists performed 87% of the biopsies, while radiologists performed 0.6%. Most of the rest were done in independent diagnostic testing facilities, in which the provider specialty could not be determined. TRUS volume peaked in 2006 at 318,518, then declined in subsequent years to 214,980 in 2013 (-33%). In that last year, urologists performed 90% of TRUSs, while radiologists performed 4%. The remaining 6% were performed by physicians in various other specialties.

CONCLUSION

The use of both PB and TRUS has declined substantially in recent years. This appears to reflect a more conservative approach to screening for PCa, which in turn has resulted from the extensive debate about the risks, costs, and benefits of identifying and treating the disease.

CLINICAL RELEVANCE/APPLICATION

Physicians are now performing fewer procedures relating to prostate cancer diagnosis.

SSM12-06 Calmative Training of MR Imaging Support Staff Improving Study Completion Rates and Patient Show-Up Rates

Wednesday, Dec. 2 3:50PM - 4:00PM Location: S102D

Participants
Alexander M. Norbash, MD, Boston, MA (*Presenter*) Co-founder, Boston Imaging Core Laboratories, LLC;
William T. Yuh, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
E. Kent Yucel, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Elvira V. Lang, MD, Brookline, MA (*Abstract Co-Author*) Founder and President, Hypnalgesics, LLC;
Stephen Pauker, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Amna A. Ajam, MBBS, Little Rock, AR (*Abstract Co-Author*) Nothing to Disclose
Gheorghe Doros, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Nina A. Mayr, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The throughput efficiency of high cost imaging services such as Magnetic Resonance Imaging (MRI) has major impact to the financial status of the imaging service, particularly given decreasing overall diminishing healthcare margins. We evaluated whether a simple and inexpensive calmative training to the imaging staff team as a cost-effective way to improve the throughput and impact the financial bottom line.

METHOD AND MATERIALS

A total of 97,712 patient visits from 3 tertiary academic medical centers participated, including 49,733 visits during one-year period prior to the calmative training and 47,979 one-year after training. The center's MRI teams received calmative skill training with advanced communication and calmative techniques through onsite proctoring, and additional education using case-based simulations with scenarios requiring calmative interventions and utilizing electronic educational tools. The study's incompletion rate and patient no-show rate during-year intervals before and after training were compared using two-sided chi-square tests for proportions at a 0.05 significance level.

RESULTS

Despite variations in the patient population at the different sites with differing baseline no-show rates (ranged 5-19.4%) and study incompletion rates (ranged 0.8-6.9%) prior to training, the combined patients data showed significant ($p<0.0001$) improvement of patient throughput with calmative training. Based upon the one-year data intervals compared before and after training, no-show rates decreased from 11.2% to 8.7% and incompletion rates decreased from 2.3 to 1.4% for all show-up patients. Additonally, increasingly lengthy and complex studies such as cardiac, whole body, or combined imaging studies were performed without an increase in no-show or incompletion rates following calmative training.

CONCLUSION

The results suggest that calmative training of the imaging support staff can significantly improve the no-show and incompletion rates of the MRI service, thereby improving the throughput and utilization of high-value and expensive imaging modalities such as MRI which happens to have offputting physical features including noise and a constrained bore.

CLINICAL RELEVANCE/APPLICATION

Calmative training of supportive staff can significantly improve the no-show and incompletion rates of the MRI service, improving throughput and resource use without added capital budget investment.

SSM14

Molecular Imaging (Inflammation/Immunology)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: S504CD

MI MR NM

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Michael S. Gee, MD, PhD, Jamaica Plain, MA (*Moderator*) Nothing to Disclose
Tomio Inoue, MD, PhD, Yokohama, Japan (*Moderator*) Nothing to Disclose

Sub-Events

SSM14-01 Assessment of Renal Allograft Pathology by Arterial Spin Labelling and Diffusion Weighted Imaging

Wednesday, Dec. 2 3:00PM - 3:10PM Location: S504CD

Awards
RSNA Country Presents Travel Award

Participants
Katja Hueper, Hannover, Germany (*Presenter*) Nothing to Disclose
Marcel Gutberlet, Dipl Phys, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Dagmar Hartung, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Song Rong, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank K. Wacker, MD, Hannover, Germany (*Abstract Co-Author*) Research Grant, Siemens AG Research Grant, Pro Medicus Limited
Faikah Gueler, MD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Jan Hinrich Braesen, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Bennet J. Hensen, Hanover, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Meier, PhD, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Rongjun Chen, Hannover, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Mengel, Edmonton, AB (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Renal allograft dysfunction early after kidney transplantation (ktx) is frequent, and may be caused by ischemia reperfusion injury or acute rejection. The purpose was to investigate renal allograft pathology in a mouse model of allogenic and isogenic ktx by perfusion imaging with arterial spin labelling (ASL) and diffusion weighted imaging (DWI) in correlation to histology.

METHOD AND MATERIALS

Allograft rejection was induced by allogenic ktx of C57Bl/6 (B6)-kidneys to Balb/c-mice in n=14 animals, isogenic ktx (B6-kindeys to B6-mice) was performed in n=18 mice. Cold and warm ischemia times were 60 and 30 min, respectively, in both groups. Healthy B6-mice served as controls. MRI was performed 1 and 6 days after ktx using a 7T-scanner. Flow alternating inversion recovery (FAIR) ASL and DWI sequences (7 b-values) were acquired, and maps of renal perfusion and apparent diffusion coefficient (ADC) were calculated. Renal histology was assessed for rejection and the severity of tubular injury and cell infiltration.

RESULTS

Following allogenic ktx animals developed a T-cell-mediated rejection, whereas isogenic mice had mild tubular injury but no rejection. Renal perfusion at d1 was reduced after allogenic (262±43 ml/(min*100g)) and isogenic ktx (335±41 ml/(min*100g)) compared to normal B6-mice (483±23 ml/(min*100g), $p<0.001$). After allogenic ktx, renal perfusion further decreased until d6 and was lower than in the isogenic group (80±13 vs 260±33 ml/(min*100ml), $p<0.001$). In contrast, ADC was unchanged after isogenic ktx compared to normal B6-mice. In the allogenic group with acute rejection ADC was reduced compared to the isogenic group at d1 (1.24±0.11 vs 1.61±0.03*10^{-3}mm²/s, $p<0.001$) and d6 (1.09±0.04 vs 1.55±0.07*10^{-3}mm²/s, $p<0.001$). Higher tubular injury and inflammation scores and higher percentage of infiltrating T-cells significantly correlated with ADC reduction at d1and6 and perfusion impairment at d6.

CONCLUSION

Renal allograft rejection is associated with progressive perfusion impairment and ADC reduction representing inflammation and cell infiltration. Isogenic ktx with prolonged cold ischemia time leads to moderate perfusion impairment without ADC reduction. MRI parameters correlate with histology.

CLINICAL RELEVANCE/APPLICATION

Functional MRI with ASL and DWI allows differentiation of renal graft pathology after transplantation. Parameters correlate with histology and may improve non-invasive diagnosis in ktx patients.

SSM14-02 The Value of Whole Body Fully Integrated 18F-FDG-PET/MR in Idiopathic Retroperitoneal Fibrosis

Wednesday, Dec. 2 3:10PM - 3:20PM Location: S504CD

Awards
Molecular Imaging Travel Award

Participants
Ingo Einspieler, Munich, Germany (*Presenter*) Nothing to Disclose
Klaus Thurmel, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Sabine Wolfram, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Henninger, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Matthias J. Eiber, MD, Muenchen, Germany (*Abstract Co-Author*) Speakers Bureau, Johnson & Johnson
Markus Schwaiger, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Markus Essler, MD, Muenchen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Idiopathic retroperitoneal fibrosis (IRF) is a rare inflammatory condition potentially leading to severe complications such as renal failure. Besides, there is evidence of associated large vessel vasculitis (LVV), potentially causing life-threatening consequences such as vessel stenosis and aneurysms. Therefore, early and precise assessment of both disease extent and activity is essential to guide therapy decision. Due to the lack of reliable parameters to objectively assess the degree of inflammation, imaging by whole body 18F-FDG PET/MR might help as a new approach.

METHOD AND MATERIALS

14 whole body 18F-FDG-PET/MR examinations were performed in 12 patients with IRF. T1 and T2 sequences were used for anatomical localization of FDG uptake and identification of morphological changes associated with IRF. Contrast enhanced-MRA was performed to judge changes of the vessel lumen. IRF tissue volume was calculated on MRI in cm3. FDG-uptake was assessed visually (using a 4-point scale) and quantitatively (maximal standardized uptake value [SUV max], target to background ratio [TBR]). Correlations between PET/MR findings (SUV max, TBR, visual score, IRF volume) and DAS (disease activity score), combining typical clinical symptoms for IRF, CRP/ESR/IL-6 levels and results of previous examinations by ultrasound, CT and MRI, were analyzed. Intended therapeutic management was documented before and after availability of PET/MR findings.

RESULTS

DAS classified 7 cases as having active disease and 7 as inactive. In contrast, PET/MR revealed active IRF in 10/14 cases and changed disease status according to DAS in 5 cases (36%), more specifically in 4 cases from inactive to active disease and active to inactive disease in 1 case. There was no association between DAS and the various PET/MR findings ($p > 0.05$). PET/MR showed vessel changes suggestive for active LVV in 3 cases. In addition, PET/MR imaging results had impact on therapeutic management in 6/14 cases (43%), in particular by starting or avoiding immunosuppressive therapy.

CONCLUSION

Whole body 18F-FDG-PET/MR may be considered as a useful approach for aiding in the management of patients with IRF.

CLINICAL RELEVANCE/APPLICATION

In IRF there is still a lack of reliable parameters to objectively assess the degree of inflammation and to guide therapy decisions. Imaging by whole body 18F-FDG PET/MR might help as a new approach.

SSM14-03 Glycosaminoglycan Chemical Exchange Saturation Transfer of Lumbar Intervertebral Discs in Patients with Spondyloarthritis

Wednesday, Dec. 2 3:20PM - 3:30PM Location: S504CD

Awards
Molecular Imaging Travel Award

Participants
Christoph Schleich, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Anja Lutz, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Joel Aissa, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Sewerin, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Ruben Sengewein, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Benedikt Ostendorf, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Benjamin Schmitt, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Falk R. Miese, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess glycosaminoglycan (GAG) content of lumbar intervertebral discs (IVD) in patients with spondyloarthritis (SpA) using glycosaminoglycan chemical exchange saturation transfer (gagCEST).

METHOD AND MATERIALS

Ninety lumbar intervertebral discs of nine patients with SpA and nine age-matched healthy controls (eight patients with ankylosing spondylitis; one patient with spondylitis related to inflammatory bowel disease; mean age: 44.1 ± 14.0 years; range: 27 - 72 years) were examined at a 3T MRI scanner in this prospective study. The MRI protocol included standard morphological, sagittal T2 weighted (T2w) images to assess Pfirrmann score of the five lumbar IVDs (L1 to S1) and biochemical imaging with gagCEST to calculate a region-of-interest analysis of nucleus pulposus (NP) and annulus fibrosus (AF). Prior to statistical testing of gagCEST effects (MTRasym values in %) in patients and controls, IVDs were classified according to the Pfirrmann score.

RESULTS

Significantly lower gagCEST values of NP and AF were found in SpA patients compared with healthy volunteers (NP: 1.41 % ± 0.41 %, $p = 0.001$; 95%-confidence interval, CI [0.600% - 2.226 %]; AF: 1.19 % ± 0.32 %, $p < 0.001$; CI [0.560 % - 1.822 %]) by comparing the differences of the means. Pooled non-degenerative IVDs (Pfirrmann 1 and 2) had significantly lower gagCEST effects in patients suffering from SpA compared with healthy controls in NP ($p < 0.001$; CI [1.176 % - 2.337 %]) and AF ($p < 0.001$; CI [0.858 % - 1.779 %]). No significant difference of MTRasym values was found in degenerative IVDs between patients and controls in NP ($p = 0.204$; CI [-0.504 % - 2.170 %]).

CONCLUSION

GagCEST analysis of morphologically non-degenerative IVDs (Pfirrmann score 1 and 2) in T2w images demonstrated significantly

lower GAG values in patients with spondyloarthritis in NP and AF possibly representing a depletion of GAG in spondyloarthritis in the absence of morphologic degeneration.

CLINICAL RELEVANCE/APPLICATION

GagCEST may be a powerful tool to access IVD composition in spondyloarthritis and to investigate therapy effects on GAG content in advanced studies.

SSM14-04 Preliminary Experience with 3T Time of Flight Simultaneous Cardiac PET/MRI in the Evaluation of Cardiac Sarcoidosis

Wednesday, Dec. 2 3:30PM - 3:40PM Location: S504CD

Awards
Trainee Research Prize - Fellow

Participants
Kate Hanneman, MD, Toronto, ON (*Presenter*) Nothing to Disclose
Andrei Iagaru, MD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Grant, Bayer AG
Henry Guo, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Amir Barkhodari, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Mehran Jamali, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Dawn Holley, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose
Robert J. Herfkens, MD, Stanford, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study is to investigate the utility of simultaneous time of flight (TOF) cardiac PET/MRI in the evaluation of cardiac sarcoidosis.

METHOD AND MATERIALS

Six consecutive patients (50% male, 53.3±12.3 years) were prospectively recruited over a 3-month period for parallel assessment of suspected cardiac sarcoidosis by standard clinical evaluation and simultaneous PET/MRI. Five healthy volunteers were initially scanned for protocol optimization. Patients first underwent standard cardiac PET/CT (Discovery 600 or 690, GE Healthcare) after administration of 9.7±0.4 mCi of 18F FDG. This was followed by a cardiac PET/MRI using a simultaneous scanner with TOF and 3T (Signa, GE Healthcare). Participants were prepared with 8-hour dietary instructions in order to suppress physiologic myocardial glucose uptake. Cardiac MRI sequences included breath-hold, ECG-triggered cine SSFP, T2-weighted, T1-mapping (pre- and post-contrast), and delayed myocardial enhanced (DME). Three experienced readers performed image analysis using an independent workstation with dedicated post-processing software.

RESULTS

PET/CT was acquired with a delay of 95.8±26.6 min, while PET/MRI had a delay of 195.5±35.6 min from 18F FDG injection. Total scan time for PET/MRI was significantly longer than for PET/CT (75.8±17.7 vs. 36.6±6.3 min, p=0.016). PET from PET/CT was positive for cardiac sarcoidosis in 50% of patients, while PET from PET/MRI was positive for cardiac sarcoidosis in 100% of patients. LV measurements by MRI were: EDV (159.3±33.5mL), ESV (87.6±50.0mL), LVEF (47.3±19.7%), pre-contrast T1 (1455.9±25.6ms), post-contrast T1 (307.0±63.6ms) and extra-cellular volume (ECV) (38.5%). DME and T2 hyper-intensity were identified in 67% and 33% of patients, respectively. There was a significant difference in effective radiation dose (ED) between PET/CT and PET/MRI (p=0.007). ED from the CT component of the PET/CT exam alone was 4.6±1.4mSv.

CONCLUSION

Simultaneous cardiac PET/MRI is feasible achieving diagnostic image quality with the added benefit of radiation dose reduction in comparison to PET/CT.

CLINICAL RELEVANCE/APPLICATION

Simultaneous cardiac PET/MRI is feasible, and provides additional information over PET/CT, potentially reducing the number of exams for patients.

SSM14-05 Role of FDG PET/CT for the Detection of Renal Infections in Cases of Pyrexia of Unknown Origin

Wednesday, Dec. 2 3:40PM - 3:50PM Location: S504CD

Participants
Sikandar M. Shaikh, DMRD, Hyderabad, India (*Presenter*) Nothing to Disclose
Hrushikesh Aurangabadkar, Hyderabad, India (*Abstract Co-Author*) Nothing to Disclose
Madhur K. Srivastava SR, MBBS, Chennai, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Patients with pyrexia of unknown origin were evaluated by FDG PET/CT for the detection of renal infections

METHOD AND MATERIALS

26 patients underwent FDG PET/CT for the detection of infection foci involving the kidneys. Positive FDG PET/CT findings and pathological correlation served as the main outcome measures.

RESULTS

Of the 26 study patients, 18 (70.2%) had positive FDG PET/CT findings and a total of 24 major infection foci were identified. Five patients (24.6%) had at least two infection foci on FDG PET/CT scans. Two (53.8%) of the 3 patients with primary renal infections had concurrent multiple foci. seven patients (26.9%) had their treatments modified by FDG PET/CT results. Multivariate logistic regression analysis demonstrated that leucocyte count at diagnosis along with correlation with positive FDG PET/CT results. seven patients (26.0%) landed in hemodialysis during their hospital stay, and 6 of them had positive FDG PET/CT findings (P = 0.014). Positive FDG PET/CT results were an independent predictor of mortality (hazard ratio [HR]=3.896, 95% CI=1.039-14.613, P =

0.044).

CONCLUSION

Our results suggest that FDG PET/CT is clinically useful for detecting occult infection foci in renal infections. In this population, positive FDG PET/CT findings may lead to a significant change in clinical management and independently predict mortality.

CLINICAL RELEVANCE/APPLICATION

PET-CT IS HIGHLY SENSITIVE IN EVALUATING THE RENAL INFECTION IN CONTEXT OF PYREXIA OF UNKNOWN ORIGIN.

SSM14-06 Image Monitoring of Impaired Phagocytic Activity of Kupffer Cells and Liver Oxygen Saturation in a Mouse Cholangitis Model Using Sonazoid-Enhanced US and Photoacoustic Image

Wednesday, Dec. 2 3:50PM - 4:00PM Location: S504CD

Participants
Jung Hoon Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Seo-Youn Choi, MD, Bucheon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyo Won Eun, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seunghyun Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate serial change of impaired phagocytic activity of Kupffer cells and liver Oxygen Saturation (sO2) in a mouse cholangitis model using sonazoid enhanced US (SEUS) and photoacoustic image (PI)

METHOD AND MATERIALS

Mouse cholangitis models were created by ligation of common bile duct (n=20, G1), left intrahepatic bile duct (n=19, G2-left and G2-right) and compared with control (n=14, G3). SEUS and PI were performed at 1, 2, and 4 weeks. PA images were collected at 750 and 850 nm and parametric maps of sO2 were generated. Serial change of echogenicity on the Kupffer phase and liver sO2were measured in each groups. Serial changes in each group were analyzed using one way ANOVA with Bonferroni's method. Kupffer cell fraction using CD68 immunohistochemistry stain was also compared with SEUS.

RESULTS

Serial change of sonazoid enhacement enhancement showed decreased in G1 (15.1 + 8.6 x 10-5) and G2-left (9.3+7.9 x 10-5) than G2-right (248.8+253.3 x 10-5) and control (153.7+34.7 x 10-5). However, Kupffer cell fraction showed increased in G1 (36.1+7.1%) and G2-left (26.8+5.1%) than G2-right (16.6+5.6%) and control (12.3+3.3%), suggesting impaired phagocytic activity of Kupffer cells. Liver sO2 showed decreased in G1 (24.0+8.0%) and G2-left (22.7+8.4%) than G2-right (39.1+12.0%) and control (41.7+8.1%).

CONCLUSION

SEUS and PI are useful for monitoring of serial change of impaired phagocytic activity of Kupffer cells and liver sO2 in a mouse cholangitis model.

CLINICAL RELEVANCE/APPLICATION

SEUS and PI are feasible to assess the serial change of phagocytic activity of Kupffer cells and liver sO2 in a mouse cholangitis model.

SSM15

ISP: Musculoskeletal (MRI Around Metal: Technique and Clinical Application)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: E450A

MK MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Hollis G. Potter, MD, New York, NY (*Moderator*) Research support, General Electric Company
Siegfried Trattnig, MD, Vienna, Austria (*Moderator*) Nothing to Disclose

Sub-Events

SSM15-01 Musculoskeletal Keynote Speaker: MR Imaging Around Metal-Technique and Clinical Implementation

Wednesday, Dec. 2 3:00PM - 3:20PM Location: E450A

Participants
Hollis G. Potter, MD, New York, NY (*Presenter*) Research support, General Electric Company

SSM15-03 Particle Induced Synovitis on MRI and Correlation with Polyethylene Surface Damage at Retrieval Analysis

Wednesday, Dec. 2 3:20PM - 3:30PM Location: E450A

Awards
Trainee Research Prize - Fellow

Participants
Angela E. Li, MBBS, MMed, New York, NY (*Presenter*) Nothing to Disclose
Christine C. Johnson, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Darryl B. Sneag, MD, Chestnut Hill, MA (*Abstract Co-Author*) Nothing to Disclose
Chelsea N. Koch, BS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Kara Fields, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Timothy M. Wright, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Theodore T. Miller, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Douglas E. Padgett, MD, New York, NY (*Abstract Co-Author*) Consultant, Stryker Corporation;
Hollis G. Potter, MD, New York, NY (*Abstract Co-Author*) Research support, General Electric Company

PURPOSE

To determine if a correlation exists between degree of polyethylene surface damage in total knee arthroplasty (TKA) tibial components and the severity of synovitis, osteolysis, and capsular thickness on MRI.

METHOD AND MATERIALS

With IRB approval, 62 patients who had an MRI within 1 year prior to revision arthroplasty were consecutively selected from our hospital registry of retrieved TKA implants. The MR images were retrospectively graded for particle induced synovitis based on the percentage of bulky hypertrophied synovium filling the joint. Capsular thickness and volume of osteolytic lesions were calculated. The articular surfaces of the retrieved tibial inserts were visually inspected, blinded to the MR appearances, and subjectively assigned damage scores by two independent observers using an established grading system. Inserts were graded for: deformation, embedded debris, scratching, burnishing, delamination, pitting, and abrasion. The MRI scores and measurements were compared to the articular surface damage scores using the Spearman correlation coefficient.

RESULTS

A positive correlation was found between the MRI grade of particle induced synovitis and the damage score (r_s=0.423, $p<0.01$, or r_s=0.450, $p<0.01$ when the synovitis grade was corrected for the degree of capsular distention). The volume of osteolytic lesions correlated with the damage score (r_s=0.335, $p<0.01$). Capsular thickness did not correlate with damage scores (r_s=-0.097, $p=0.5$). The synovitis grade strongly correlated with the volume of osteolytic lesions (r_s=0.579, $p<0.01$). The length of implantation of the TKA correlated with both the synovitis grade and damage score (r_s=0.396, $p<0.01$ and r_s=0.487, $p<0.01$, respectively). The mean length of implantation was 6.7 years (range 1-30, SD 6.1 years).

CONCLUSION

Polyethylene surface damage in TKA correlates with the severity of particle-induced synovitis and volume of osteolytic lesions on MRI.

CLINICAL RELEVANCE/APPLICATION

The association between MRI findings and retrieval analysis of polyethylene damage suggests a link between wear debris and subsequent synovial reactions around failed TKAs.

SSM15-04 Metal Artifact Reduction (MAR) on a Sliding Gantry CT-scanner: Evaluation of a MAR Algorithm Based on Two Compartment Physical Modelling in Patients with Hip Implants

Wednesday, Dec. 2 3:30PM - 3:40PM Location: E450A

Participants

Johannes Boos, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Lino Sawicki, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Rotem S. Lanzman, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christoph Schleich, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Patric Kroepil, MD, Duesseldorf, Germany (*Presenter*) Nothing to Disclose

PURPOSE

The aim of this study was to evaluate the impact of a novel metal artifact reduction (MAR) algorithm on image quality compared to standard filtered back projection (FBP) on a CT scanner with sliding gantry in patients with metallic hip implants.

METHOD AND MATERIALS

Twenty two patients with 25 metallic hip implants were included in this retrospective study. All patients underwent abdominopelvic computed tomography on a 64 row scanner with sliding gantry (Definition AS+ sliding gantry, Siemens, Germany). Axial images were reconstructed using FBP and five increasing MAR levels (M30-34). Objective artifact reduction was assessed by ROI measurements in localization of the strongest artifact (SIart) and in osseous structures without artifacts (SInorm). Differences between both measurements served as a measure for objective artifact strength (OAS: SIart-SInorm). Two blinded, independent reader evaluated subjective IQ regarding metallic hardware, delineation of bone, adjacent muscle and pelvic organs on a five point scale (1: non diagnostic - 5: excellent IQ, no artifacts). In addition, new artifacts due to MAR were recorded.

RESULTS

OAS values were 153.2±48.3 HU for M34; 261.0±241.6 HU for M33; 328.7±228.8 HU for M32; 393.2±225.9 HU for M31; 446.8±224.2 HU for M30 and 528.9±227.7 HU for FBP. OAS values were significantly lower for M32-34 compared to FBP ($p<0.05$).Subjective image quality was 2.0±0.2 for FBP, 2.3±4.8 for M30, 2.6±0.5 for M31, 3.0±0.6 for M32, 3.5±0.6 for M33 and 3.8±0.4 for M34 ($p<0.05$ for M31-M34 vs. FBP, respectively). Increasing strength of the MAR level resulted in new artifacts in up to 16%.

CONCLUSION

The MAR algorithm leads to a significant reduction in artifacts from metallic hip implants. The highest MAR-level allows for the maximal artifact reduction but may also induce new artifacts.

CLINICAL RELEVANCE/APPLICATION

High levels of a MAR algorithm lead to a significant improvement of image quality in patients with hip implants.

SSM15-05 Contrast Enhanced MRI Adjacent to Metal Interfaces

Wednesday, Dec. 2 3:40PM - 3:50PM Location: E450A

Participants
Rajeev Mannem, MD, Milwaukee , WI (*Presenter*) Nothing to Disclose
Suryanarayanan Kaushik, PhD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Scott J. Erickson, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Mark D. Hohenwalter, MD, Milwaukee, WI (*Abstract Co-Author*) Nothing to Disclose
Kevin M. Koch, PhD, Waukesha, WI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Metal-induced susceptibility artifacts in MRI can be greatly reduced using Three-Dimensional Multi-Spectral Imaging methods (3D-MSI). A variety of previous studies have demonstrated preliminary clinical utility of 3D-MSI (i.e. "MAVRIC SL" and "SEMAC/Advanced WARP") in assessing complications near metal implants. Here, we present preliminary analysis of 3D-MSI utility in contrast-enhanced (CE) MRI at a field strength of 1.5T. Susceptibility-artifacts near metal implants introduce unique challenges to CE MRI . In particular, the hyperintense 'pileup' artifacts that are present in conventional fast/turbo spin-echo sequences often confound assessment of CE near metal implants. Use of T1w 3D-MSI for CE MRI reduces the footprint of these hyperintensity artifacts.

METHOD AND MATERIALS

MAVRIC SL 3D-MSI was implemented using modified pulse-sequencing software that allowed for shorter TR periods than the commercially available sequence. 3D-MSI images were acquired pre-and post contrast in at least one scan plane for each case. In addition conventional 2D-FSE images were acquired for each case for qualitative comparison of artifact reduction. Imaging data was acquired on a variety of implants including total hip-replacements, spinal fusion hardware, fixation screws, and support rods. All subjects were consented into a research study approved by the local ethics committee.

RESULTS

CE T1-weighted 3D-MSI at 1.5T enables uptake assessment in the immediate vicinity of metallic instrumentation. For assessments of painful total hip replacements CE aided in tissue differentiation in cases of adverse local tissue reaction. Contrast-enhanced 3D-MSI enabled improved assessments of early tumor recurrence. Assessment of failed back surgery syndrome also showed potential benefit from CE 3D-MSI, where contrast uptake in the immediate vicinity of pedicle screws was consistently observed. In addition, assessment epidural fibrosis and infection in the immediate vicinity of spinal hardware was enabled using contrast-enhanced 3D-MSI.

CONCLUSION

New 3D-MSI metal artifact reduction techniques can be used effectively to assess contrast uptake in the immediate vicinity of metallic hardware.

CLINICAL RELEVANCE/APPLICATION

These methods allow the freedom to assess common pathological conditions as if the hardware were absent and encourages future studies characterizing disease processes due to the hardware itself.

SSM15-06 Usefullness of Slice Encoding Metal Artifact Correction (SEMAC) for Reducing Metal Artifacts after Total Knee Arthroplasty

Wednesday, Dec. 2 3:50PM - 4:00PM Location: E450A

Participants
Miriam Reichert, MD, Mannheim, Germany (*Presenter*) Nothing to Disclose
Michael Kostrzewa, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan O. Schoenberg, MD, PhD, Mannheim , Germany (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Ulrike I. Attenberger, MD, Mannheim, Germany (*Abstract Co-Author*) Research Consultant, Bayer AG

PURPOSE

To compare metal artifact reduction after total knee arthroplasty in MRI at 1.5 T using novel MRI sequence strategies.

METHOD AND MATERIALS

Two sequences were compared for the imaging of metal implants after total knee arthroplasty on a 1.5 T MR system: a slice encoding sequence for metal artifact correction (SEMAC) and a standard TSE sequence. 15 patients with titanium implants were evaluated. Degree of artifact reduction was assessed quantitatively and qualitatively by both, artifact measurements and a blinded read. The images were ranked by the following parameters: artifact size, distortion, and the ability to differentiate bone marrow, cortex and soft tissue. The images were also evaluated in respect of the visibility of crucial and collateral ligaments and the patellar tendon. The Insall-Salvati-Index was measured as well. The SEMAC technique was compared directly to the TSE standard sequence.

RESULTS

In comparison to standard sequences artifact size was 59% less utilizing SEMAC. In terms of bone marrow, bone cortex and soft tissue visualization SEMAC was ranked superior to the corresponding standard sequence. Distortion was less with SEMAC. For the evaluation of blur, the standard images were ranked superior to the corresponding SEMAC sequence. In terms of overall image quality, SEMAC was ranked superior to the standard sequence. For all terms of clinical relevance SEMAC was ranked superior to the corresponding standard sequence.

CONCLUSION

SEMAC effectively reduces artifacts caused by metallic implants after total knee arthroplasty relative to standard imaging.

CLINICAL RELEVANCE/APPLICATION

SEMAC sequences allow for better visualisation of crucial anatomic structures after total knee arthroplasty thus improving evaluation of postoperative result and detection of postoperative complications.

SSM18

Neuroradiology (Resting State Functional Brain Imaging)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: N226

NR MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Haris I. Sair, MD, Baltimore, MD (*Moderator*) Research support, Carestream Health, Inc
Joshua S. Shimony, MD, PhD, Saint Louis, MO (*Moderator*) Nothing to Disclose

Sub-Events

SSM18-01 Altered Brain Neural Activity in Sellar-Tumor Patients: A Resting-State fMRI Study

Wednesday, Dec. 2 3:00PM - 3:10PM Location: N226

Participants
Zhongyan Wang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Tianyi Qian, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Binbin Sui, MD, Beijing, China (*Presenter*) Nothing to Disclose
Peiyi Gao, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of the current study was to explore how brain neural activity changes with visual deprivation in patients with sellar tumors by measuring the pattern of low-frequency fluctuation (0.1~0.01 Hz) of the BOLD signal.

METHOD AND MATERIALS

21 patients with sellar tumors and 21 sex-matched healthy volunteers participated in this study. The resting-state fMRI data were processed usingthe SPM8 MATLAB toolbox and DPARSF. The spontaneous brain neural activity was measured by calculating the amplitude of low-frequency fluctuations (ALFF), regional homogeneity (ReHo) and functional connectivity (FC) of BOLD (blood-oxygenation-level-dependent) signals. A two-sample t-test was performed to investigate the difference between the groups, thereafter computing the correlation coefficient between the patterns obtained from rs-fMRI of some regions and the tumor size, as expressed by its left-right radius.

RESULTS

The results of the group analysis showed that, compared to normal control subjects, patients with sellar tumors exhibited significantly decreased ALFF in the bilateral cuneus, left lingual gyrus and the right supplementary motor area (SMA). ALFF in bilateral lentiform nucleus has significantly increased (Fig.1). The sellar tumors showed decreased ReHo value in the bilateral cuneus, but increased ReHo value in the precuneus, the left insular, and left lentiform nucleus. The ReHo values in precuneus and insula are significantly correlated with the tumor radius in left-right direction (Fig.2)

CONCLUSION

The results of this study suggest that the function of the area response for high-level cognition function in visual network is less stable than primary visual cortex in the patient with sellar tumors. The decreased brain activity in the precuneus and other brain areas might reflect a maladjustment behavior caused by visual deprivation. The increased brain activity in the lenticular nucleus and insula might be related to a compensatory phenomenon. The results provide useful information for us to better understand how brain functional network change under the influence of visual deprivation.

CLINICAL RELEVANCE/APPLICATION

The value of the functional patterns in these areas could potentially be used for evaluating the recovery prognosis of visual function in the patients with sellar tumor.

SSM18-02 Changes of Brain Motor Functional Connectivity of Ischemic Stroke Patients in the Resting State after rTMS Treatments

Wednesday, Dec. 2 3:10PM - 3:20PM Location: N226

Participants
Jing Li, Beijing, China (*Presenter*) Nothing to Disclose
Xuewei Zhang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhentao Zuo, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jie Lu, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yuzhou Guan, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Wei-hong Zhang, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Yong Fan, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The study aimed to 1) investigate the resting-state functional connectivity (rsFC) changes of the ipsilesional primary motor cortex (M1) with the brain after acute stroke; 2) investigate the difference of rsFC of the ipsilesional M1 in stroke patients before and after high frequency repetitive Transcranial Magnetic Stimulation(rTMS) treatments.

METHOD AND MATERIALS

Nineteen patients with unilateral ischemic stroke and fourteen age- and gender-matched healthy volunteers were recruited. Five of

the patients achieved the rTMS treatment. Pearson correlation analysis between the time course of M1 and that of every voxel within the whole brain was performed for maps of correlation coefficients, which were Fisher's z-transformed and called as z-functional connectivity (z-FC) maps. Two sample t-tests were conducted to compare the z-FC maps between the patients and volunteers, and paired t-tests carried out between pre- and post-treatment groups. The Ethics Committee of hospital approved the study. All participants obtained written consent.

RESULTS

1) Compared with volunteers, the patients demonstrated decreased rsFC with the ipsilesional M1 and contralesional cerebellum, ipsilesional precentral gyrus, supplementary motor area(SMA) and precuneus. 2) The pre-treatment group showed higher rsFC of ipsilesional M1 with ipsilesional inferior temporal gyrus, while decreased ones with contralesional M1 and SMA. However, the post-treatment group showed higher rsFC of ipsilesional M1 with ipsilesional middle temporal gyrus, contralesional inferior temporal gyrus, middle frontal gyrus and precuneus, while decreased ones with the ipsilesional premotor cortex, M1, contralesional paracenteral lobe and M1. Higher rsFC was found in the ipsilesional M1 and contralesional frontal medial gyrus in the post-treatment groups. 3) The National Institutes of Health Stroke Scale (NIHSS) of the post-treatment group decreased ($p<0.05$) compared to pre-treatment group, while the Fugl-Meyer Assessment (FMA) and Barthel Index (BI) increased ($p<0.05$).

CONCLUSION

The areas mentioned above may play an crucial role in acute stroke and the rTMS may facilitate motor recovery in stroke patients.

CLINICAL RELEVANCE/APPLICATION

High frequency repetitive transcranial magnetic stimulation elicits cortical excitation. We localized it on the ipsilesional primary motor cortex to facilitate the motor recovery in stroke patients.

SSM18-04 The Similar Aberrant Spontaneous Brain Activity Related to Cognitive Impairment in Subcortical Stroke Patients: Using Two different Resting-state fMRI Analysis Methods

Wednesday, Dec. 2 3:30PM - 3:40PM Location: N226

Participants
Cheng-Yu Peng, Nanjing, China (*Presenter*) Nothing to Disclose
Ying Cui, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Yun Jiao, PhD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Shenghong Ju, MD, PhD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Gao-Jun Teng, MD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study combined using two resting-state functional magnetic resonance imaging (rs-fMRI) analysis methods to investigate regional homogeneity (ReHo) and the amplitude of low frequency fluctuation (ALFF) changes in subcortical stroke patients and whether these changes were correlated with impaired cognitive performance.

METHOD AND MATERIALS

Subcortical stroke patients (n=30) and age-, sex-, and education-matched healthy controls subjects (n=30) underwent multi-modality MRI examinations to calculate the ReHo and ALFF within the scope of the whole brain not limited in the DMN. In the process of data processing, the stroke patients were divided into two groups (the left- and right-sided lesion groups) by flipping the brain imaging, then, the two group results were compared with the controls respectively. Scores from neuropsychological tests were also obtained and compared between the two groups. The potential relationships between ALFF and ReHo values and cognitive performance were evaluated via partial correlation analysis.

RESULTS

The patients exhibited significant deficiencies in some cognitive domains (all $P < 0.05$). Compared with healthy controls, patients with stroke had significantly increased ALFF and ReHo values in the left inferior parietal lobule (IPL) consistently (Fig. 1). Moreover, the partial correlation results indicated that the ALFF values of the left IPL were positively correlated with the Digit Span Forwards Test scores ($r = 0.427$; $P = 0.026$) in the subcortical stroke patients.

CONCLUSION

The abnormalities of spontaneous brain activity reflected by ALFF and ReHo measurements in post-stroke patients may provide insights into the neurobiological consequences such as cognitive impairment no matter which side the lesions located in.

CLINICAL RELEVANCE/APPLICATION

ALFF and ReHo could be the important imaging biomarkers for the observation ofneurobiological consequences in post-stroke patients no matter which side the lesions located in.

SSM18-05 Leveraging Microstructural White Matter Changes to Guide Investigation of Resting-state Functional Network Connectivity

Wednesday, Dec. 2 3:40PM - 3:50PM Location: N226

Participants
Susan Sotardi, MD, MS, Bronx, NY (*Presenter*) Nothing to Disclose
Roman Fleysher, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Namhee Kim, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Michael Stockman, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Craig A. Branch, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Jeremy Smith, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
David Gutman, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Michael L. Lipton, MD, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Prior research has examined the relationship of diffusion measures of structural white matter integrity to cognitive outcomes. Additionally, resting-state functional connectivity (rs-FC) is correlated with behavioral outcomes. These parallel approaches have revealed important observations regarding the role of connectivity in brain disorders. However, the methodology is inherently limited by the essentially separate nature of structural and functional arms. We propose a method that uses abnormal structural integrity to guide investigation of rs-FC, in a cohort of patients with mild traumatic brain injury (mTBI).

METHOD AND MATERIALS

23 mTBI patients who presented to the emergency department within 48 hours of injury and 43 normal controls were recruited with IRB approval and gave informed consent. DTI and resting fMRI were performed at 3T. All individual FA maps were matched to the brain volume of a healthy volunteer for group analysis. A voxelwise t-test comparing mTBI and control subjects was used to identify regions of abnormally low FA. Regions of low FA were used as seeds for tractography with the entire cortex serving as the termination point. Gray matter regions thus reached then served as seed ROI for voxelwise analysis of rs-FC.

RESULTS

Multiple regions which showed low FA in mTBI subjects were identified. Using a region in the external capsule, tractography was used to delineate fiber tracts, (Figure1). The intersection of the fiber tract and frontal gray matter, which included the frontal eye field region, served as the seed for rs-FC analysis. Voxel-wise comparison of the correlation maps from the mTBI and control groups identified gray matter clusters where connectivity in mTBI subjects was stronger than in controls (Figure2).

CONCLUSION

Our results demonstrate a new approach to rs-FC analysis where diffusion tractography based on abnormal structural connectivity findings, is used to delineate cortical regions of interest for assessment of functional connectivity. The proposed method avoids the use of a priori seed ROI in rs-FC analysis to more directly interrogate the functional consequences of white matter injury.

CLINICAL RELEVANCE/APPLICATION

Our results demonstrate a new approach to resting state fMRI analysis where diffusion tractography, based on abnormal structural connectivity findings, is used to delineate cortical regions of interest for assessment of functional connectivity.

SSM18-06 Mutual Connectivity Analysis with Graph Theoretic Measures for Identifying Regions with Altered Functional Connectivity in HIV Infection

Wednesday, Dec. 2 3:50PM - 4:00PM Location: N226

Participants
Anas Z. Abidin, MS, Rochester, NY (*Presenter*) Nothing to Disclose
Adora M. D' Souza, BEng, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Mahesh B. Nagarajan, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Xixi Wang, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Axel Wismueller, MD, PhD, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To quantify resting state fMRI (rsfMRI) functional connectivity profiles obtained from analyzing graph theoretic measures based on a novel Mutual Connectivity Analysis (MCA) framework, and to demonstrate the applicability of this approach for differentiating between HIV+ and HIV- subjects.

METHOD AND MATERIALS

A cohort of 25 age-matched subjects (13 HIV+, 12 HIV-, 21-68 yrs, 15M, 10F) underwent rsfMRI scanning (3T, TR=1650ms, 25 slices, 240 acquisitions). After standard preprocessing and registration, the datasets were parcellated into 116 regions using the Automated Anatomic Labeling (AAL) atlas. The average time series of each of these regions was computed and used with the MCA framework, resulting in a pairwise affinity matrix describing the nonlinear mutual predictability for each region pair. We used generalized radial basis function neural networks as nonlinear time-series predictors. The resulting network graph can be characterized using graph theoretic measures for global properties, such as assortativity, transitivity, global efficiency, or for local/regional properties, such as modularity, clustering coefficient, local efficiency. Whole-brain and region-specific measures were computed to test for differences between HIV+ and HIV- subject cohorts. Statistical analyses were performed using a non-parametric Kolmogorov-Smirnov test.

RESULTS

Modularity and clustering-coefficient values of nodes corresponding to regions of the parietal lobe and the right and left posterior cingulate gyrus showed significant differences ($p<0.01$) between HIV+ and HIV- subject cohorts. In contrast, no significant differences between cohorts were seen when using statistics characterizing the global properties of the whole-brain network.

CONCLUSION

Graph theoretic analysis of brain network properties using the MCA framework is a novel method that can identify changes in rsfMRI functional connectivity patterns in patients with HIV infection. Significant regional differences between HIV+ and HIV- subjects were demonstrated for several network measures. The corresponding brain regions are in agreement with the findings of other studies investigating the effects of HIV infection on the brain.

CLINICAL RELEVANCE/APPLICATION

The regional differences in functional connectivity profiles from rsfMRI captured by our approach can be used to develop clinical imaging biomarkers in patients with HIV-related cognitive impairment.

SSM19

Neuroradiology (Cerebral Ischemia and Hemorrhage)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: N229

NR MR ER

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Ronald L. Wolf, MD, PhD, Philadelphia, PA (*Moderator*) Nothing to Disclose
Jalal B. Andre, MD, Seattle, WA (*Moderator*) Research Grant, Koninklijke Philips NV; Consultant, Hobbitview, Inc; Research Grant, Toshiba Corporation;

Sub-Events

SSM19-01 Comparison of Iodinated Contrast Staining and Hyperacute Hemorrhage on MRI : Phantom Study

Wednesday, Dec. 2 3:00PM - 3:10PM Location: N229

Participants
Sung-Hye You, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Kyu Ri Son, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byung-Joon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Nam Joon Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Mina Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the effect of diluted iodinated contrast agents with normal saline or blood on the magnetic resonance (MR) imaging, especially on T1 weighted image(T1WI), T2 weighted image (T2WI) and gradient echo image(GRE) for distinguishing contrast staining from hyperacute hemorrhage which could occur after intraarterial thrombolysis in the patient with acute stroke.

METHOD AND MATERIALS

On a 3.0T MRI, T1WI, T2WI and GRE images were scanned using the phantom with diluted five different kinds of non-ionic iodinated contrast agents with different concentration (0, 0.1, 0.4, 0.6, 1.2, 2, 2.4 M I mole/L). The contrast agents are diluted with normal saline or venous blood (which was sampled within 6 hours). We compared SI of the phantom visually, and quantitatively calculated T1- and T2-relaxation times.

RESULTS

Iodinated contrast agents showed T1 and T2 shortening effect. With increase in concentration of contrast agents, the effect of T1 and T2 shortening became more prominent. T2 shortening effect of the iodinated contrast agents was much weaker than that of the product of venous blood. Whereas diluted iodinated contrast agents with normal saline showed intermediate SI on GRE image, blood with/without iodinated contrast agents showed dark SI on GRE image.FIG Comparison of SI among the physiolotic saline, undiluted iodinated contrast agent, diluted iodinated contrast agent with saline, contrast agent diluted with blood and undiluted blood itself on T2WI, T1WI and GRE image. Contrast agent mixed with blood or blood itself could be distinguished from diluted iodinated contrast agents at T2WI and GRE image.

CONCLUSION

By obtaining T2WI and GRE images, clinicians may be able to discriminate iodinated contrast staining from hyperacute hemorrhage in stroke patients receiving transarterial thrombolysis.

CLINICAL RELEVANCE/APPLICATION

By obtaining T2WI and GRE images, clinicians may be able to discriminate iodinated contrast staining from hyperacute hemorrhage in acute stroke patients after intrasarterial thrombolysis.

SSM19-02 Digital Subtraction Angiogram for Perimesencephalic Subarachnoid Hemorrhage: Is Once Enough? A Retrospective Study, Systematic Review and Meta-analysis

Wednesday, Dec. 2 3:10PM - 3:20PM Location: N229

Participants
Christopher A. Potter, MD, Boston, MA (*Presenter*) Nothing to Disclose
Kathleen R. Fink, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Amanda L. Ginn, BA, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
David R. Haynor, MD, PhD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Non-aneurysmal subarachnoid hemorrhage (NASAH) accounts for 15% of subarachnoid hemorrhage (SAH) cases. A subset of NASAH patients with perimesencephalic hemorrhage distribution (PM-NASAH) has a relatively benign clinical course. Identifying these patients on initial imaging can prevent exposure to the risks of multiple conventional angiograms. Previous studies demonstrating adequacy of a single initial digital subtraction angiogram (DSA) have been suggestive, but underpowered.

METHOD AND MATERIALS

Our institutional retrospective study included consecutive patients from 01/2000-12/2013 with noncontrast head CT within 48 hours positive for SAH, negative initial DSA and followup DSA within 10 days. 252 subjects were identified. Head CT images were reviewed and strictly classified per criteria of van Gijn. 131 subjects with PM-NASAH were identified. DSA reports and images were

reviewed. The medical record was reviewed, including condition at last follow up.Systematic review and meta-analysis using MEDLINE and electronic databases from database inception through 11/01/2014 identified studies documenting workup of patients with NASAH. Inclusion criteria were (a) consecutive patients, (b) head CT within 72h, (c) categorization of PM-NASAH as per Gijn et al, (d) initial negative DSA, (e) follow up DSA within 10 days. Exclusion criteria included cohort of less than 25 subjects. Data from 6 included studies were pooled. Methodology was assessed using the MOOSE guidelines for observational meta-analyses.

RESULTS

131 subjects from our institutional study were pooled with 298 subjects from 6 included studies. No aneurysm was seen on follow up DSA at our institution. 3 aneurysms were reported in the included studies. 2 of the 3 were reported in studies with cases that preceded current DSA technique. Diagnostic yield of subsequent DSA following initial negative DSA was 0.7% (95% CI, 0-1.4%), similar or less than the rate of DSA complication, reported from 0.3% to 2.6%.

CONCLUSION

In patients with SAH that strictly adheres to the PM-NASAH pattern, a single DSA essentially excludes a causative aneurysm. Subsequent DSA examinations are very unlikely to benefit and expose patients to unnecessary risk.

CLINICAL RELEVANCE/APPLICATION

Complications from SAH and hemorrhage recurrence in patients with PM-NASAH are rare. Reducing additive risk of multiple DSA examinations is essential in the preventing complications in a benign disease course.

SSM19-03 Dynamics of Cerebral Perfusion Deficits after Subarachnoid Hemorrhage - Predictive Value of an Early Incidence

Wednesday, Dec. 2 3:20PM - 3:30PM Location: N229

Participants
Christian Rubbert, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Rebecca May, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Bernd Turowski, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Delayed cerebral ischemia (DCI) is the major contributor to reduced functional outcome after subarachnoid hemorrhage (SAH). Although the pathogenesis of DCI is not fully understood, limitations in microcirculation appear to be one of the main drivers. CT perfusion (CTP) imaging can indirectly measure microcirculation and is increasingly used in treatment decisions.Early changes in perfusion might be able to predict the risk for critical changes in perfusion after SAH and allow for further risk stratification. To this end, the value of early CTP imaging is retrospectively analyzed.

METHOD AND MATERIALS

Between 1/2006 and 6/2010 351 patients with an aneurysmal SAH underwent CTP imaging. According to local guidelines, CTP imaging is acquired within 1 day after aneurysm treatment (range 0-2d after SAH), 6-8d and 9-11d after SAH or when there is clinical suspicion for deterioration in brain perfusion. Inclusion criteria were 1) at least one early CTP exam <72h after SAH and 2) at least 3 CTP exams in total. 813 CTP exams of 166 patients (4.9±1.8 exams/patient, aged 53.2±12.4, 65.1% female) were analyzed.Purpose-built software was used to automatically generate perfusion parameter maps, define a 1 cm wide circular ROI along the cortex and compute a running average over 10° every 2° for each parameter. The mean transit time (MTT) was evaluated. Critical changes in perfusion were defined as a mean MTT >=4.1s in a hemisphere according to prior work. Receiver-Operator-Characteristic analysis was performed to identify the MTT cutoff with the highest sensitivity and specificity in early CTP imaging to predict critical changes in perfusion in follow-up CTP imaging.

RESULTS

The optimal MTT cutoff was 3.58s (AUC 0.65). 88 of 166 patients (53%) had an early MTT >=3.58s. Critical changes in follow-up CTP imaging were observed in 67 of 166 patients (40.4%) and could be predicted with a sensitivity of 67.2% and specificity of 56.6%.

CONCLUSION

Critical changes in brain perfusion in follow-up CTP imaging can, to some degree, be predicted by early CTP imaging <72h after SAH. Further research is needed to improve the prediction model and include data on functional outcome. Given the potential disabilities due to DCI, a cutoff with a higher sensitivity and lower specificity may be of greater clinical value.

CLINICAL RELEVANCE/APPLICATION

Early CTP imaging might be used in the decision to escalate neuromonitoring.

SSM19-04 Diagnostic Yield of Cervical Spine MRI in the Setting of Angiogram-Negative Spontaneous Intracranial Subarachnoid Hemorrhage

Wednesday, Dec. 2 3:30PM - 3:40PM Location: N229

Participants
Gelareh Sadigh, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Chad A. Holder, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Jason W. Allen, MD, PhD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the diagnostic yield of cervical spine (c-spine) magnetic resonance imaging (MRI) in identifying a structural cause for angiogram-negative spontaneous subarachnoid hemorrhage (SAH).

METHOD AND MATERIALS

Consecutive patients 18 years or older presenting with acute spontaneous (non-traumatic) intracranial SAH between February 2009

and October 2014 at two University Hospitals whose catheter angiography results did not reveal an etiology for the SAH, and who underwent c-spine MRI as part of the angiogram-negative SAH protocol, were eligible. Patients with acute intracerebral, subdural or epidural hematoma, parenchymal contusion, recent history of trauma, or previously known cervical vascular malformation were excluded. All patients underwent noncontrast head CT, CT angiography of the head and neck, and MRI of the brain and c-spine as part of the angiogram-negative SAH protocol. Radiology reports from c-spine MRI scans, interpreted by board-certified (CAQ) neuroradiologists, were retrospectively reviewed, with IRB approval.

RESULTS

232 patients met inclusion criteria (mean age 54 years; 50% male; 53% white; 26% African-American). 77% of patients presented to the hospital within 24 hours of experiencing symptoms. SAH was diagnosed by head CT in 97% of cases and by lumbar puncture in 3%. Of 135 patients with reported Hunt and Hess classification of SAH in the electronic medical record, 70% were scored 1, 4% scored 2, 18% scored 3, 7% scored 4, and 1% scored 5. Catheter angiography was performed within the first 4 days after admission in all cases (median of 12 hours). C-spine MRI was performed within the first 19 days after admission in all cases (median of 24 hours). In all 232 patients (100%), c-spine MRI was negative for an etiology to explain the SAH.

CONCLUSION

In our large retrospective series, c-spine MRI following angiogram-negative spontaneous SAH, specifically following a negative head and neck CTA, had no diagnostic yield and is not routinely needed.

CLINICAL RELEVANCE/APPLICATION

C-spine MRI following angiogram-negative SAH has very low to no diagnostic yield. Our data indicate that routine MRI for cervical sources of intracranial SAH after a negative angiogram is not warranted.

SSM19-05 Blood Brain Barrier Permeability Imaging Correlates with Cerebrospinal Fluid Matrix Metalloproteinase-2 (MMP-2) Levels in Aneurysmal Subarachnoid Hemorrhage

Wednesday, Dec. 2 3:40PM - 3:50PM Location: N229

Participants
Jana Ivanidze, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose
Omar N. Kallas, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ashley E. Giambrone, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Michael Lerario, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Alan Z. Segal, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ajay Gupta, MD, New York, NY (*Abstract Co-Author*) Research Consultant, Biomedical Systems; Research support, General Electric Company
Moonsoo Jin, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Pina C. Sanelli, MD, Manhasset, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT Perfusion (CTP) allows assessment of quantitative blood brain barrier permeability (BBBP) parameters, including PS (flow across the vessel wall to the extravascular extracellular space (EES)), Ktrans (plasma flow per unit tissue volume), and VE (EES volume). However, sensitivity has to date not been established in the clinical setting. Matrix metalloproteinase 2 (MMP-2) is a known molecular upregulator of BBBP. The purpose of our study was to correlate quantitative BBBP parameters on CTP with MMP-2 cerebrospinal fluid (CSF) protein levels in aneurysmal subarachnoid hemorrhage (SAH) patients to assess the ability of CTP to detect BBB dysfunction in the clinical setting.

METHOD AND MATERIALS

In this prospective IRB-approved study, 10 SAH patients underwent extended whole brain CTP with an axial shuttle mode protocol on day 0-3 after aneurysmal rupture. CTP data were post-processed into quantitative PS, Ktrans and VE maps using Olea Sphere software (Olea Medical, La Ciotat, France). Global mean values were calculated from standardized cortically based ROIs. CSF was collected via ventriculostomy catheter (placed for intracranial pressure management) within 24 hours of CTP. MMP-2 protein levels were measured in CSF supernatant using multiplex microbead immunoassay technology (Luminex Corp, Austin, TX). Spearman correlation analysis was performed to determine correlation between MMP-2 levels with each BBBP parameter.

RESULTS

Median patient age was 55 years, and the median modified Fisher score was 4. 80% of patients had hydrocephalus and 70% had global cerebral edema at presentation. There was a statistically significant positive correlation between MMP-2 CSF levels and PS ($r = 0.6565$; $p = 0.0448$), Ktrans ($r = 0.8024$; $p = 0.0075$), and VE ($r = 0.7477$; $p = 0.0164$), respectively.

CONCLUSION

Elevation of PS, Ktrans and VE indicates increased flow across the BBB into the EES, or increased BBBP. MMP-2 is an established indicator of BBBP. We demonstrate that elevated BBBP, as evaluated by CTP, correlates with elevated CSF levels of MMP-2 in patients with SAH, further establishing CTP as a promising tool to assess BBB dysfunction in the clinical setting.

CLINICAL RELEVANCE/APPLICATION

This preliminary study supports the clinical application of quantitative BBBP imaging with CTP. In SAH, where elevated BBBP has been shown to correlate with poor clinical outcomes, this application may become an important prognostic indicator in future studies.

SSM19-06 Preliminary Evaluation of Arterial Spin Labeling as a Method to Predict Clinically Significant Vasospasm Following Aneurysmal Subarachnoid Hemorrhage

Wednesday, Dec. 2 3:50PM - 4:00PM Location: N229

Participants
Jalal B. Andre, MD, Seattle, WA (*Presenter*) Research Grant, Koninklijke Philips NV; Consultant, Hobbitview, Inc; Research Grant, Toshiba Corporation;

Michael Levitt, MD, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Danial K. Hallam, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Greg Zaharchuk, MD, PhD, Stanford, CA (*Abstract Co-Author*) Research Grant, General Electric Company;
Daniel S. Hippe, MS, Seattle, WA (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company
Basavaraj Ghodke, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Laligam Sekhar, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Danny J. Wang, PhD, Los Angeles, CA (*Abstract Co-Author*) Research Grant, Siemens AG Research Grant, Biogen Idec Inc Shareholder, Translational MRI, LLC
Max Wintermark, MD, Lausanne, Switzerland (*Abstract Co-Author*) Advisory Board, General Electric Company;
Louis Kim, MD, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose
Yoshimi Anzai, MD, Salt Lake Cty, UT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate a multidelay, pseudocontinuous arterial spin labeling (MDpCASL)-based screening tool for the diagnosis of vasospasm (VSP) in patients with aneurysmal subarachnoid hemorrhage (aSAH).

METHOD AND MATERIALS

Patients with clinically suspected VSP after aSAH (based on clinical and/or Transcranial Doppler exam) underwent a 10-minute MDpCASL MRI en route to digital subtraction angiography (DSA) for endovascular VSP intervention. The multi-parametric MDpCASL sequence was performed with background suppression and 3-dimensional gradient- and spin-echo readout, at 4 postabel delays (=1.5/2/2.5/3s), and processed using an in-house post-processing pipeline to generate quantitative CBF maps. DSA images were independently reviewed by two blinded, expert neurointerventional readers at a PACS station for the presence, location and extent of VSP, and asked to provide treatment recommendations. Readers were then shown corresponding ASL images and asked how this information influenced treatment recommendations. ASL images were evaluated by a third, blinded expert reader with extensive ASL experience. DSA and ASL findings were aggregated into 5 major vascular territories per patient (anterior left and right, middle left and right and posterior) for comparison. Associations between DSA and ASL were analyzed using logistic regression based on generalized estimating equations to account for repeated measurements per patient.

RESULTS

Ten patients were studied. ASL perfusion deficits were significantly associated with spasm on DSA ($p=0.002$). ASL detected clinically significant perfusion deficits in nearly 31% of evaluated vascular territories, in which no significant (≥50%) DSA spasm was identified. 25% of territories with significant spasm had minimal perfusion deficits by ASL. Expert neurointerventionalists also agreed that having ASL images available prior to performing DSA would have changed treatment recommendations in 60% of cases. Blinded two-reader neurointerventional assessment of ASL images suggested that evaluation of ASL-derived CBF would have prevented 3 of 10 patients from undergoing an unnecessary DSA.

CONCLUSION

Perfusion information from MDpCASL prior to DSA may reduce unnecessary DSA in select patients and modify therapy in others, possibly improving patient triage and management.

CLINICAL RELEVANCE/APPLICATION

Obtaining MDpCASL prior to DSA may alter treatment in patients suspected of VSP following aSAH.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Yoshimi Anzai, MD - 2014 Honored Educator

SSM21

Physics (MRI III-Applications)

Wednesday, Dec. 2 3:00PM - 4:00PM Location: S404AB

MR PH

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: .50

Participants
Gregory S. Karczmar, PhD, Chicago, IL (*Moderator*) Nothing to Disclose
Chen Lin, PhD, Indianapolis, IN (*Moderator*) Nothing to Disclose

Sub-Events

SSM21-01 Skeletal Muscle Mitochondrial Capacity and Pi-to-ATP Exchange Rate Relate to Alkaline Pi Pool and PDE Concentration Measured at Rest by ^{31}P-MRS at 7T

Wednesday, Dec. 2 3:00PM - 3:10PM Location: S404AB

Participants
Ladislav Valkovic, PhD, Vienna, Austria (*Presenter*) Nothing to Disclose
Marjeta Tusek Jelenc, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Barbara Ukropcova, Bratislava, Slovakia (*Abstract Co-Author*) Nothing to Disclose
Wolfgang Bogner, MSc, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Marek Chmelik, MS, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Ivan Frollo, Bratislava, Slovakia (*Abstract Co-Author*) Nothing to Disclose
Jozef Ukropec, Bratislava, Slovakia (*Abstract Co-Author*) Nothing to Disclose
Siegfried Trattnig, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Martin Krssak, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Dynamic phosphorus MR spectroscopy (31P-MRS) and saturation transfer (ST) are established methods for measurement of muscle mitochondrial capacity and ATP turnover-kinetics, associated with metabolic and cardiovascular disorders. However, as a complex experimental setup or advanced sequences are required, the use of static 31P-MR spectra, i.e., concentration of phosphodiesters ([PDE]) and moreover the alkaline Pi (Pi2), to obtain similar information, has been promoted recently. Therefore our aim was to assess the interrelations between parameters derived from static and dynamic 31P-MRS measurements at 7T.

METHOD AND MATERIALS

In total, data from thirty-seven subjects (25m/12f, a=32.9±7.3y) were analysed and divided into groups based on their physiological characteristics: obese sedentary subjects prior (ObSe) and after 3 months of training (ObAc), and lean subjects active on regular basis (LeAc). 31P-MRS was performed on a 7T MR system (Siemens Healthcare, Erlangen, Germany) equipped with a 1H/31P surface coil. The examination protocol was divided into three experiments: (i) acquisition of static spectra, for quantification of [PDE] and the Pi2/Pi1 ratio; (ii) ST experiment, for quantification of Pi-to-ATP reaction rate constant (kATP) and ATP flux (FATP); and (iii) dynamic examination, for quantification of mitochondrial capacity (Qmax). The physiological and 31P-MRS parameters were compared between the groups by a one-way ANOVA and a Tukey post-hoc test and their potential relations by a linear regression.

RESULTS

Group ObSe had significantly lower values of Qmax in comparison to the active groups. In addition, group LeAc had significantly lower PDE concentration and higher Pi2/Pi1 ratio when compared to the other groups. Apart from previously reported correlations between Qmax and FATP and between FATP and the [PDE], further significant correlations were found, i.e., Qmax correlated to Pi2/Pi1 and [PDE]; and Pi2/Pi1 correlated to kATP and [PDE].

CONCLUSION

Our investigation, performed on sedentary and active obese subjects as well as on lean active individuals, shows that resting measurements of Pi2/Pi1 ratio and [PDE] correlate with measures derived from dynamic and ST 31P-MRS measurements in skeletal muscle.

CLINICAL RELEVANCE/APPLICATION

Measurement of basal Pi2/Pi1 ratio and [PDE] at 7T might provide a surrogate marker of myocellular metabolism, alterations of which are connected to metabolic and cardiovascular disorders.

SSM21-02 In Vitro Assessment of Flow Patterns around Sub-prosthetic Pannus Tissue using PC-MRI

Wednesday, Dec. 2 3:10PM - 3:20PM Location: S404AB

Participants
Jihoon Kweon, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Dong Hyun Yang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hojin Ha, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Guk-Bae Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Young-Hak Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Sub-prosthetic pannus overgrowth after aortic valve replacement (AVR) has been reported that may cause an aortic stenosis and a

high peak pressure gradient across the mechanical heart valve (MHV). However, clinical implications of the sub-prosthetic pannus have not been fully understood. The present study aims to investigate the hemodynamic effect of the pannus by applying phase contrast MRI to aorta phantoms with different pannus formations.

METHOD AND MATERIALS

A flow phantom was constructed by implementing a supra-annular mechanical valve (St. Jude 25 mm medical masters HP series) into an aorta model fabricated by 3D printer. Five different types of pannus models were alternately installed at the inlet of aorta model and the axial position of the pannus was the same as the hinge tip of the MHV. The effective orifice area (EOA) reduced by pannus models was 8.2% ~ 47.66%, and the thickness of the modeled pannus was 3mm. Image acquisition was performed on 3T scanner (MAGNETOM Skyra, Siemens) using a gradient echo sequence. The velocity encoding range was set as 120cm/s and imaging matrix was 256 × 156 on a field of view of 160mm × 97.5mm. Repetition and echo times were 23ms and 3.16ms, respectively. Flow information on MR images was analyzed using customized-Matlab software.

RESULTS

The minimal pannus showed a negligible flow interference, maintaining almost planar symmetric flow pattern (maximum velocity 66.3cm/s). However, with larger single pannus, the peak velocity increases due to the reduced EOA (up to 11.2%) and the position of peak velocity was moved to between the leaflets. In the distal side of MHV, the flow was skewed toward the wall on the pannus side. For the paired pannus, peak flow was observed in the middle of flow area (26.8% increase) and the low velocity regions due to the leaflets were disappeared. For the largest pannus, the estimated pressure gradient using the averaged velocity of the far distal side (23cm/s) increased by 70.3% of the smallest one.

CONCLUSION

The EOA reduction due to the pannus formation caused a higher peak velocity in the distal side of MHV and thereby increased the pressure difference estimated from the peak velocity.

CLINICAL RELEVANCE/APPLICATION

Sub-prosthetic pannus after AVR may cause a high pressure gradient across the MHV.

SSM21-03 Magnetic Resonance Elastography and Ultrasound Shear Wave Speed Imaging for Assessment of Renal Allograft Function

Wednesday, Dec. 2 3:20PM - 3:30PM Location: S404AB

Participants
Stephan Marticorena Garcia, MD, Berlin, Germany (*Presenter*) Nothing to Disclose
Jing Guo, MD, PhD, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Bernd K. Hamm III, MD, Berlin, Germany (*Abstract Co-Author*) Research Consultant, Toshiba Corporation; Stockholder, Siemens AG; Stockholder, General Electric Company; Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, General Electric Company; Research Grant, Elbit Imaging Ltd; Research Grant, Bayer AG; Research Grant, Guerbet SA; Research Grant, Bracco Group; Research Grant, B. Braun Melsungen AG; Research Grant, KRAUTH medical KG; Research Grant, Boston Scientific Corporation; Equipment support, Elbit Imaging Ltd; Investigator, CMC Contrast AB
Ingolf Sack, PhD, Berlin, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Fischer, MD, Berlin, Germany (*Abstract Co-Author*) Speaker, Toshiba Corporation; Advisory Board, Toshiba Corporation

PURPOSE

Kidney transplant rejection is associated with viscoelastic tissue changes. The purpose of this study is to non-invasively assess the renal elasticity in kidney transplant recipients with magnetic resonance elastography (MRE) and ultrasound shear wave speed imaging (SSI).

METHOD AND MATERIALS

10 kidney transplant recipients (age range 27-51 years, 2 females) were included (mean transplant duration 63±97 months). Among them, 3 patients have dysfunctional kidney (GFR <15 ml/min) with biopsy proven fibrosis. Recipients with normal renal function were identified by constant blood creatinine/GFR values, normal B-mode appearance and resistive index (RI), obtained during 6 months period before MRE/SSI. MRE (1.5 T scanner, Siemens) was performed with 7 slices (2.5 mm cubic voxel resolution) at 4 mechanical frequencies from 40 to 70 Hz. MRE data were processed giving |G*| (magnitude of the complex modulus) which relates to the shear stiffness of the kidney. In SSI (Aplio500, Toshiba), an ultrasonic burst was captured by a 14 MHz linear broadband transducer, and propagation speed reflecting tissue stiffness was compared to MRE results.

RESULTS

In combined cortex and medulla region, the group mean values of shear stiffness (MRE 6.12±0.95 kPa) and wave speed (SSI: 3.1±0.43 m/s) correlate very well with each other (r=0.76, p=0.01). In the same region, significant decrease of both stiffness and wave speed were observed in patients with dysfunctional kidney (MRE, functional: 6.09±0.39 kPa vs. dysfunctional: 4.00±0.79 kPa, p=0.012; SSI, functional: 3.44±0.33 m/s vs. dysfunctional: 2.86±0.33 m/s, p=0.019).

CONCLUSION

MRE and SSI are both sensitive in detecting renal allograft fibrosis.

CLINICAL RELEVANCE/APPLICATION

Mechanical properties obtained from both techniques could be used as biomarker for non-invasive assessment of renal allograft rejection.

SSM21-04 Time Effficient Estimation of Abdominal Fat Distribution in MRI

Wednesday, Dec. 2 3:30PM - 3:40PM Location: S404AB

Participants
Nicolas Linder, Leipzig, Germany (*Presenter*) Nothing to Disclose

Alexander Schaudinn, MD, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Nikita Garnov, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas K. Kahn, MD, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose
Harald F. Busse, PhD, Leipzig, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the prediction of abdimonpelvic visceral and subcutaneous adipose tissue (VAT, SAT) volume based on a single MRI slice.

METHOD AND MATERIALS

162 patients (Caucasians, mean BMI 35.6 kg/m², 43 males) were scanned at 1.5T (2 point Dixon, 50 slices of 10 mm thickness and 0.5 mm gap) and semiautomatic quantification of VAT and SAT volumes (V-VAT V-SAT) was performed. Fat areas at the level of 11 anatomical landmarks [levels of lumbar discs L1-L2 to L5-S1, umbilicus (UM) +/- 0,5,10 cm, femoral head] were used for estimation of VAT and SAT volumes (VE-VAT, VE-SAT). Statistical measures of agreement were the coefficient of determination R^2 of a linear regression through the origin as well as the standard deviations σ of the differences between measured and predicted volume.

RESULTS

Mean V-VAT and V-SAT were 3.6 and 15.4 L in females and 5.8 and 12.1 L in males. The optimum level of SAT volume prediction was at L5-S1 independent of sex and BMI (females: R^2=0.82 and σ=1.4 L; males: R^2=0.92 and σ=1.1L). Differences could be seen for VAT with the optimum level at L2-L3 for males (R^2= 0.84 and σ=0.9 L) and less obese women (BMI < 35kg/m²; R^2= 0.83 and σ=0.6 L) whereas more obese females (BMI > 35 kg/m²) showed an optimum at L5-S1 (R^2= 0.69 and σ=0.8 L). Looking at a single slice position to quantify both SAT and VAT best results were detected at L4-L5 for females and L5-S1 for males.

CONCLUSION

Whole abdominopelvic SAT and VAT volumes can be reliably predicted from a single slice at the level of a BMI and sex-dependent anatomic landmark.

CLINICAL RELEVANCE/APPLICATION

This studys might be beneficial for standardization of VAT and SAT estimation in studies interested in obesity related risk factors.

SSM21-05 Non-Contrast 4D MR Myocardium Blood Flow

Wednesday, Dec. 2 3:40PM - 3:50PM Location: S404AB

Participants
Mitsue Miyazaki, PhD, Vernon Hills, IL (*Presenter*) Employee, Toshiba Corporation
Xiangzhi Zhou, PhD, Oak Brook, IL (*Abstract Co-Author*) Employee, Toshiba Corporation
Tsutomu Hoshino, Vernon Hills, IL (*Abstract Co-Author*) Employee, Toshiba Corporation
Kenichi Yokoyama, MD, Mitaka-Shi, Japan (*Abstract Co-Author*) Nothing to Disclose
Rieko Ishimura, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshiaki Nitatori, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To develop a non-contrast 4-dimensional time-spatial labeling inversion pulse (4D Time-SLIP) technique (3D acquisition and time) for investigation of myocardial blood flow on healthy volunteers without administration of contrast materials.

METHOD AND MATERIALS

The non-contrast 4D Time-SLIP technique was applied on eight healthy volunteers to image myocardium blood flow at 1.5T. The Time-SLIP sequence has a tag-on block with a non-selective inversion recovery (non-sel-IR) pulse and a spatially selective inversion recovery (sel-IR) and a tag-off block with only the non-sel-IR pulse. The tagging plane was placed at the proximal ascending aorta and imaging slab was placed at mid-ventricle. The complex subtraction between tag-on and tag-off is performed to depict only the tagged blood flowing into the myocardium with cancellation of background signal. For each inversion time (TI), tag-on and tag-off acquisitions with a 3D bSSFP readout was alternately acquired within a breath-hold. To achieve variable TI, the tagging pulses were triggered with variable delay time while the readout was placed at a fixed mid-diastolic phase in the second RR interval. As a result, each 3D tag-on and tag-off acquisition can be performed within 2 RR intervals, which can be repeated with multiple TIs. To visualize the blood flow, the time resolved 3D short axis myocardial images were registered and the myocardium was segmented for the visualization of myocardial signal changes caused by the tagged blood along the TI. The non-contrast perfusion curves were also generated to identify the perfusion peaks.

RESULTS

Both time-resolved 3D short axis images and perfusion curves were successfully obtained, where blood flow shows basal to apical directions. At the mid-ventricle, the blood flow reached peak about 200-400 ms after tagging the aortic root blood, and then blood signal returned to baseline. This observation of quick return to baseline is controversial to the results obtained from other non-contrast methods where the signal does not return to baseline.

CONCLUSION

The technique permits obtaining non-contrast 4D myocardium blood flow images and perfusion curves with high temporal resolution without administration of contrast materials.

CLINICAL RELEVANCE/APPLICATION

The 4D Time-SLIP technique permits obtaining non-contrast 4D myocardium blood flow images and perfusion curves with high temporal resolution without administration of contrast materials.

SSM21-06 Ultra-Fast Low Dose Dynamic Contrast Enhanced MRI for Prostate Cancer Diagnosis - A Preliminary Study

Wednesday, Dec. 2 3:50PM - 4:00PM Location: S404AB

Participants
Shiyang Wang, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Xiaobing Fan, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Federico Pineda, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Milica Medved, PhD, Chicago, IL (*Presenter*) Nothing to Disclose
Ambereen Yousuf, MBBS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Aytekin Oto, MD, Chicago, IL (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; ; ;
Gregory S. Karczmar, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study is to investigate the effectiveness of ultra-high temporal resolution (Ufast) dynamic contrast enhanced MRI (DCE), with a low dose of contrast media, for prostate cancer (PCa) diagnosis.

METHOD AND MATERIALS

Eleven men (age 40-69 years) who were scheduled for prostatectomy after MRI were enrolled. Ufast DCE MRI was performed on a Philips Achieva 3T scanner, with temporal resolution of 1.5 sec, slice thickness 3.5mm, 24 slices, in plane resolution 1.5x2.8 mm^2, before and for 15 sec after a low dose (LD) of contrast agent was (.015 mM/Kg; 15% of conventional dose). Following ultrafast imaging, a routine clinical DCE scan was performed pre- and post I.V. injection of 0.085 mM/kg of contrast media. A 'time of arrival' (TOA) map was calculated from the Ufast images, based on the time at which significant (25%) enhancement was detected in each pixel. The TOA ratio (rTOA) was defined as the percentage of voxels in each ROI significantly enhanced during the first 60 seconds. TOA and rTOA were compared in cancer (n=11), normal (n=10) and BPH (n=11) ROIs. Kruskal-Wallis Analysis of Variance (ANOVA) test and Welch two sample t-test were performed to compare results.

RESULTS

Enhancement in normal prostate was delayed by an average of 5.1±1.6 sec compared with cancer, and enhancement of BPH was delayed by an average of 7.5 sec relative to cancer, where delays were calculated for each patient, then averaged over all patients. Average TOAs were 45.6±4.4 sec, 48.3±3.9 sec and 49.2±4.1 sec in cancer, normal and BPH ROIs, respectively (where time of arrival was averaged over all pixels from all patients). TOAs for cancer and BPH were significantly different (p=0.04). rTOAs were 0.77, 0.85±0.3 and 0.94±0.1 in patient groups with GS=6,7and 9, respectively.

CONCLUSION

Ufast imaging, with measurement of TOA and rTOA has the potential to differentiate PCa from BPHs, and may also be sensitive to cancer grade. In this study a very low dose was used in the Ufast protocol so that total dose (sum of the low dose and high dose used for conventional DCE scan) was acceptable. Enhancement due to the low dose was easily detectable, and may have advantages, including reduced non-linear enhancement effects. In future studies, a range of contrast agent doses will be tested.

CLINICAL RELEVANCE/APPLICATION

Ufast DCE-MRI has potential to increase diagnostic accuracy. Very low doses of contrast media are effective.

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Aytekin Oto, MD - 2013 Honored Educator

MSRT46

ASRT@RSNA 2015: Prostate Cancer and MR Imaging: What Do We Want to See and How to Get It

Wednesday, Dec. 2 3:40PM - 4:40PM Location: N230

GU MR OI

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
James Stirling, DCR, DMS, Middlesex, United Kingdom, (james.stirling@kcl.ac.uk) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn the anatomy and comon pathology of the prostate gland. 2) To learn the factors and how to optimise prostate sequences eg. T1, T2 and STIR whole pelvis sequences, small field of view T2 axial, sagital and coronal sequences, diffusion weighted imaging, contrast enhanced T1 and T2* dynamic sequences. 3) To learn how different sequences are used with primary, secondary and metastatic prostate cancer. 4) To give a taste of hybid PET/MR 18F Choline imaging.

ABSTRACT

Over the last couple of years MRI of prostate cancer has moved from just T1 and T2 imaging to multi-parametric, multi-modality imaging. To produce high quality imaging, sequence parameter factors have to be optimized, balancing clinical requirements with patient comfort, total on-table time, scanner capabilities and limitations. The lecture will include prostatic anatomy and how different sequences can characterize benign and malignant disease. The talk will show the sequences that are needed and how to optimize them. This will include T2 small field of views, diffusion weighted imaging, T1 and T2* dynamic contrast enhanced sequences and intrinsic susceptibility weighted imaging. As prostate cancer develops and is treated the imaging protocols change. The protocols include surveillance and staging and then progress to recurrence and metastatic whole body imaging. MRI is now being complemented with PET in hybrid machines combining the strengths of both modalities. This lecture will show how MR imaging of malignant prostate disease changes as the disease progresses.

SPSC41

Controversy Session: US, CT, or MR Imaging in Possible Appendicitis in Children: Three Pegs and Often Only One Hole

Wednesday, Dec. 2 4:30PM - 6:00PM Location: E451A

GI CT MR US ER PD

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Nancy R. Fefferman, MD, New York, NY, (nancy.fefferman@nyumc.org) (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

Sub-Events

SPSC41A US

Participants
Nancy R. Fefferman, MD, New York, NY, (nancy.fefferman@nyumc.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the advantages, disadvantages and limitations of US as an effective imaging modality in the diagnosis of appendicitis in children. 2) Review the current literature addressing the diagnostic performance of US for pediatric appendicitis. 3) Discuss the role of US in the imaging evaluation of suspected appendicitis in children.

ABSTRACT

SPSC41B CT

Participants
Michael J. Callahan, MD, Boston, MA, (michael.callahan@childrens.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Highlight the advantages, disadvantages and versatility of computed tomography for the diagnosis of suspected acute appendicitis in children. 2) Describe published sensitivity and specificity values for computed tomography in the setting of suspected acute appendicitis in the pediatric population. 3) Explain the challenges and potential barriers for standardization of pediatric appendicitis clinical practice guidelines at academic and non-academic centers.

SPSC41C MR

Participants
R. Paul Guillerman, MD, Houston, TX, (rpguille@texaschildrens.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Develop an MRI protocol for suspected pediatric appendicitis. 2) Estimate the diagnostic efficacy of MRI for suspected pediatric appendicitis. 3) Appraise how radiation-induced cancer risks and diagnostic performance characteristics influence the optimal selection of US, CT and MRI for suspected pediatric appendicitis.

SPSC44

Controversy Session: Prostate Imaging: Just What MR Technique is Best?

Wednesday, Dec. 2 4:30PM - 6:00PM Location: E450A

GU MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Rajan T. Gupta, MD, Durham, NC (*Moderator*) Consultant, Bayer AG; Speakers Bureau, Bayer AG; Consultant, Invivo Corporation

LEARNING OBJECTIVES

1) The goal of this session is to explore the different techniques that comprise high quality multiparametric MRI of the prostate. More specifically, we will deal with some of the key protocol questions that one must tackle in order to set up mpMRI in their own practice. Examples of the topics to be discussed include 1.5T vs. 3T imaging; endorectal coil vs. phased array body coil use; the optimal diffusion weighted metrics to be used to assess lesion aggressiveness, etc.; the changing role of dynamic contrast enhanced MRI in prostate imaging, especially in light of the recent release of PI-RADS version 2; and finally, the optimal techniques to evaluate for disease recurrence after therapy. The format of the session will be both didactic and interactive with audience participation.

Sub-Events

SPSC44A Introduction to Session and Overview of Multiparametric Prostate MRI

Participants
Rajan T. Gupta, MD, Durham, NC (*Presenter*) Consultant, Bayer AG; Speakers Bureau, Bayer AG; Consultant, Invivo Corporation

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSC44B 1.5T vs 3T Imaging: Pros and Cons

Participants
Rajan T. Gupta, MD, Durham, NC (*Presenter*) Consultant, Bayer AG; Speakers Bureau, Bayer AG; Consultant, Invivo Corporation
Francois Cornud, MD, Paris, France (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSC44C Diffusion Weighted Imaging

Participants
Andrew B. Rosenkrantz, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSC44D Dynamic Contrast Enhanced Imaging

Participants
Sadhna Verma, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Honored Educators

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Sadhna Verma, MD - 2013 Honored Educator

SPSC44E Imaging of Recurrence in Prostate Cancer

Participants
Adam Froemming, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC601

Contemporary Imaging of Lung Cancer

Thursday, Dec. 3 8:30AM - 10:00AM Location: N227

CH CT MI MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jeremy J. Erasmus, MD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

RC601A Non-small Cell Lung Cancer Staging: Concepts and Controversies

Participants
Ioannis Vlahos, MRCP, FRCR, London, United Kingdom (*Presenter*) Research Consultant, Siemens AG Research Consultant, General Electric Company

LEARNING OBJECTIVES

1) Summarize the origins, basis and rationale of the current TNM classification of lung cancer. 2) Discuss the strengths and limitations of the current system and how to practically address these 3) Highlight areas where current radiology, oncological, surgical and pathological best practice and evolving knowledge in these area are progressing beyond the current staging system.

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Ioannis Vlahos, MRCP, FRCR - 2015 Honored Educator

RC601B Contemporary Concepts in Small Cell Lung Cancer

Participants
Fergus V. Gleeson, MBBS, Oxford, United Kingdom (*Presenter*) Consultant, Alliance Medical Limited; Consultant, Blue Earth Diagnostics Limited; Consultant, Polarean, Inc;

LEARNING OBJECTIVES

1) To learn the clinical manifestations, staging and prognostic factors of small cell lung cancer. 2) To become familiar with the role of PET-CT in the investigation and management of small cell lung cancer. 3) To review unusual presentations of small cell lung cancer and their investigation and treatment.

ABSTRACT

Small cell lung cancer, SCLC, accounts for approximately 15% of all lung cancers, with its overall incidence decreasing, although it is increasing in women, with the male to female incidence ratio now 1:1. Small cell lung cancer has a more rapid doubling time than non-small cell lung cancer, with most patients presenting with hematogenous metastases, and only approximately one-third presenting with limited-stage disease confined to the chest.Small cell lung cancer uncommonly presents with a solitary pulmonary nodule, and the disease does not appear to have benefited from Lung Cancer Screening. There are multiple neurologic and endocrine paraneoplastic syndromes associated with small cell lung cancer, with marked improvement on treatment of the underlying tumour.Historically SCLC was staged according to the Veteran's Administration Lung Group's 2 stage classification of 1) extensive-stage disease or 2) limited-stage disease, and this classification used to guide therapy. More recently it has been recommended that SCLC is staged according to the International Association of the Study of Lung Cancer (IASLC) and the AJCC Cancer Staging Manual 7th edition, using the same staging system for NSCLC and SCLC.Whilst contrast enhanced CT scan of the chest and abdomen remain routine as the initial method for staging SCLC, FDG PET-CT now plays a more important role in staging and management. SCLC is a highly metabolic disease, and PET-CT both upstages and downstages disease, potentially altering management

RC601C PET Imaging of Lung Cancer: Beyond Standard Metabolic Assessment

Participants
Eric M. Rohren, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review advanced image processing and metabolic parameters in FDG-PET/CT. 2) Discuss non-FDG radiotracers and their potential applications in non-small cell lung cancer. 3) Illustrate the application and clinical use of advanced metabolic imaging biomarkers derived from FDG-PET/CT using case examples.

ABSTRACT

Assessment of non-small cell lung cancer with PET is typically performed using F-18 fluorodeoxyglucose (FDG). The uptake and retention of FDG by the tumor is taken to be a measure of metabolism, which in turn can provide useful information on staging, grading, and prognosis. Advances in the field of PET/CT imaging may provide additional information for the evaluation and care of patients with lung cancer. Advanced semi-quantitative analyses including total lesion glycolysis (TLG) and metabolic tumor volume

(MTV) have been employed to capture additional information from FDG-PET/CT studies, which in some cases is additive to standard metabolic parameters such as SUVmax. New tracers are under development, with some nearing approval in the U.S. and elsewhere. These include tracers targeting proliferation, receptor expression, and protein catabolism, investigating molecular events and processes beyond glucose metabolism.

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Eric M. Rohren, MD, PhD - 2015 Honored Educator

RC601D MRI: Advances in Nodule Characterization and Lung Cancer Staging

Participants
Kyung S. Lee, MD, PhD, Seoul, Korea, Republic Of, (kyungs.lee@samsung.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review most popular MRI techniques that are used in thoracic MR imaging. 2) To demonstrate how effective MR imaging is in nodule characterization and lung cancer staging, particularly focused on diffusion-weighted imaging (DWI) and diffusion-weighted whole-body imaging with background body signal suppression (DWIBS).

ABSTRACT

Diffusion-weighted MR imaging helps characterize lung nodule, and enables staging and prognosis prediction in lung cancer. Diffusion-weighted whole-body imaging with background body signal suppression (DWIBS) is known to be specific in nodal staging and effective in whole body MR imaging. Both whole body MRI and PET-CT may be used in extra-thoracic lung cancer staging, but each modality has its own and different merits in lung cancer staging. Whole body MRI-PET may be the future oncologic imaging modality.

URL

RC601E CT Perfusion Imaging in Lung Cancer

Participants
Friedrich D. Knollmann, MD, PhD, Sacramento, CA, (fknollmann@ucdavis.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To identify suitable indications for the use of CT perfusion imaging in lung cancer. 2) To apply CT perfusion imaging to lung tumors. 3) To recognize important features of a valid CT perfusion imaging protocol. 4) To interpret the results of a CT perfusion study in lung tumors.

ABSTRACT

CT perfusion (CTP) imaging has become a tenable proposition with the advent of multislice CT. Preliminary data have indicated a potential role in the assessment of treatment response in lung cancer, but the method is not widely used. In this course, the rationale for using CT perfusion imaging as a quantitative imaging biomarker in lung cancer is discussed. A review of CT protocols includes factors that have impeded a wider adoption of the method in the clinical sphere, such as the reproducibility of measurements, and validation efforts. Solutions to these problems, such as improved anatomic coverage with wider detectors and table motion, reduced radiation exposure with iterative reconstruction, advanced postprocessing with dual blood supply algorithms, motion registration and correction, and volumetric perfusion analysis are addressed. With these methods, tumor classification, assessment of tumor response, and prognostic testing are promising applications of CTP imaging.

RC601F Thoracic Oncologic Imaging: Treatment Effects and Complications

Participants
Brett W. Carter, MD, Houston, TX (*Presenter*) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc; ;

LEARNING OBJECTIVES

1) Understand the role of imaging in the evaluation of patients who have been treated for thoracic malignancies. 2) Recognize the manifestations of radiation therapy in the chest and be able to differentiate expected changes from residual or recurrent disease. 3) Identify intrathoracic complications from radiation therapy, chemotherapy, and surgery.

ABSTRACT

Imaging plays an important role in the evaluation of patients who have been treated with radiation therapy, chemotherapy, and/or surgery for intrathoracic malignancies such as lung cancer, esophageal cancer, malignant pleural mesothelioma, and thymoma. Following thoracic radiation therapy, radiation pneumonitis (1-6 months following therapy) and radiation fibrosis (6-12 months following therapy) are typically identified in the lungs. However, complications such as esophagitis, esophageal ulceration, and radiation-induced cardiovascular disease may develop. Patients treated with chemotherapy may develop pulmonary and cardiovascular complications such as drug toxicity, organizing pneumonia, thromboembolic disease, vasculitis, and cardiomyopathy. Knowledge of the spectrum of expected treatment-related changes, potential treatment complications and the appearance of tumor recurrence is critical in order to properly monitor patients, identify iatrogenic complications, and avoid misinterpretation.

Honored Educators

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educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Brett W. Carter, MD - 2015 Honored Educator

RC612

Peripheral Artery Disease (PAD)

Thursday, Dec. 3 8:30AM - 10:00AM Location: N229

VA CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Stephen T. Kee, MD, Stanford, CA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the basic pathology of peripheral artery disease. 2) Describe the risk factors associated with the development of peripheral artery disease. 3) Outline the benefits of providing a comprehensive clinical service in the management of PVD. 4) Discuss how to build a PVD practice. 5) Describe the basic techniques employed in the treatment of PVD.

ABSTRACT

Sub-Events

RC612A Clinical Overview of PAD

Participants
Stephen T. Kee, MD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC612B Lower Extremity CTA

Participants
Richard L. Hallett II, MD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe techniques for patient selection, acquisition, reconstruction, and interpretation of lower extremity CTA. 2) Describe evidence-based results for lower extremity CTA, and expected impact on patient care. 3) Describe a coherent plan that integrates lower extremity CTA into cost-effective clinical care.

ABSTRACT

Peripheral arterial disease (PAD) is a common cause of morbidity and mortality in developed countries. Traditionally, imaging for risk stratification and therapeutic planning involved catheter angiography. In recent years, cross-sectional imaging by CTA and MRA has proven a robust technique for non-invasive PAD assessment. Given ubiquity of CT scanning technology, CTA is widely available. High resolution datasets can be acquired rapidly, which facilitates assessment of clinically labile or trauma patients. To be optimally effective, CTA techniques require particular attention to contrast medium and scan protocol. With appropriate protocol design, data acquisition requires limited operator dependence. The acquired 3D dataset is rich with information, but requires careful scrutiny by the interpreting physician. Volumetric review of these datasets produces the most accurate results. Extensive small vessel calcification remains a potential barrier to full assessment of pedal vessels by CTA. Recent published data validates the clinical effectiveness of CTA for diagnosis of PAD and for the direction of treatment planning. Ongoing research aims to exploit the newest generation of CT scanners to acquire additional information, including dual energy data, time-resolved information, and radiation dose savings.

URL

Active Handout:Richard Lee Hallett

http://abstract.rsna.org/uploads/2015/13012018/Active RC612B.pdf

RC612C Lower Extremity MRA

Participants
Harald Kramer, MD, Munich, Germany (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the appropriate technique for peripheral MRA depending on the available hardware and the clinical question and condition of the patient. 2) Differentiate between different contrast agents and their specific characteristics. 3) Chose between different contrast agent application schemes depending on the technique used and the clinical question. 4) Compare the pros and cons of contrast-enhanced and non contrast-enhanced techniques for peripheral MRA.

ABSTRACT

The prevalence of symptomatic peripheral artery disease (PAD) ranges around 3% in patients aged 40 and 6% at an age of 60 years. Additionally, the prevalence of asymptomatic PAD lies between 3% and 10% in the general population increasing to 15% to 20% in persons older than 70 years of age. However, these data still might underestimate the total prevalence of PAD since

screening studies showed that between 10% and 50% of all patients with intermittent claudication (IC) never consult a doctor about their symptoms.These data prove the need for an accurate and reliable method for assessment of the peripheral vasculature. Digital subtraction angiography (DSA) still serves as the reference standard for all vascular imaging techniques. However, because of the absence of ionizing radiation, the use of non-nephrotoxic contrast agents or even non contrast-enhanced sequences and the large toolbox of available techniques for high-resolution static and dynamic imaging Magnetic Resonance Angiography (MRA) constitute an excellent non-invasive alternative. Different acquisition schemes and contrast agent application protocols as well as different types of data sampling for static, dynamic, contrast- and non contrast-enhanced imaging enable to tailor each exam to a specific question and patient respectively.

RC612D Endovascular Treatment of PAD

Participants
Stephen T. Kee, MD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC615

BI-RADS (An Interactive Session)

Thursday, Dec. 3 8:30AM - 10:00AM Location: E450A

BR DM MR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC615A BI-RADS: Mammography

Participants
Edward A. Sickles, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand and use the new approach to classifying breast density. 2) Properly use current BI-RADS assessment categories. 3) Report discordances between assessment category and management recommendation.

RC615B Ultrasound

Participants
Ellen B. Mendelson, MD, Chicago, IL (*Presenter*) Medical Advisory Board, Delphinus Medical Technologies, Inc; Research support, Siemens AG; Consultant, Siemens AG; Speaker, Siemens AG; Medical Advisory Board, Quantason, LLC; Consultant, Quantason, LLC;

LEARNING OBJECTIVES

At the conclusion of this session on BI-RADS for US, learners will be able to 1. Understand inseparability of image quality and interpretability. 2. Assess breast masses using a trio of feature categories: shape, margin, orientation. 3. Apply the principle of multiple benign masses to address low PPV's of breast US. 4. Recognize architectural distortion and other Associated Features.

ABSTRACT

RC615C MRI

Participants
Elizabeth A. Morris, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the new MRI BI-RADS® descriptors including background parenchymal enhancement (BPE). 2) Properly apply the Final Assessment categories, particularly BI-RADS® 0 for MRI. 3) Apply the audit recommendations to your breast MRI practice.

RC617

MR Neurography and New Methods to Image Pain

Thursday, Dec. 3 8:30AM - 10:00AM Location: S505AB

NR MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Sandip Biswal, MD, Stanford, CA (*Moderator*) Co-founder, SiteOne Therapeutics Inc; Research Grant, General Electric Company; Stockholder, Atreus Pharmaceuticals Corporation

Sub-Events

RC617A MR Neurography of the Brachial Plexus and Upper Extremities

Participants
Amelie M. Lutz, MD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the role of/indications for MR neurography in the multidisciplinary diagnostic work-up of brachial plexus and upper extremity nerve pathologies. 2) To understand the technical requirements and challenges of MR neurography in the brachial plexus and upper extremities. 3) To get familiar with the anatomy and normal MR imaging appearance of the brachial plexus and upper extremity nerves. 4) To recognize commonly encountered pathologies and their differential diagnoses in brachial plexus and upper extremity nerves.

ABSTRACT

Continuous improvements in magnetic resonance scanner, coil, and pulse sequence technology have resulted in the ability to perform routine, high-quality imaging of the brachial plexus and upper extremity nerves. MR neurography has evolved into a very helpful diagnostic tool in the work-up of peripheral nerve and plexus pathologies. It is commonly used for the detection and preoperative staging of neural mass lesions, in evaluating inflammatory and traumatic brachial plexus changes, confirming and/or complementing electrophysiologic exams. This talk will focus on the technical requirements for imaging the brachial plexus and upper extremities, discuss the anatomy, and demonstrate relevant examples of normal and abnormal findings.

RC617B MR Neurography of the Lumbar Plexus and Lower Extremities

Participants
Avneesh Chhabra, MD, Dallas, TX, (avneesh.chhabra@utsouthwestern.edu) (*Presenter*) Research Consultant, Siemens AG; Consultant, ICON plc

LEARNING OBJECTIVES

1) Employ new techniques for LS plexus and lower extremity evaluation. 2) Understand the differences between normal and abnormal imaging appearances of LS plexus and lower extremity peripheral nerves. 3) Discuss the differential diagnosis of various LS plexus and lower limb nerve pathologies based on available clinical history and imaging findings. 4) Learn how to incorporate the MRN modality in the diagnostic algorithm of plexopathies and related peripheral neuropathies in a multi-disciplinary fashion.

ABSTRACT

Lumbosacral plexus has a complex anatomy with a number of nerve convergences and divergencesresulting in formation of multiple essential peripheral nerves that provide motor and sensory function tothe pelvis and lower extremities. Due to the deep location and complexity, MR neurography (MRN) plays amajor role in evaluation of its normalcy and pathologic states.This talk will discuss current state of the art techniques available for LS plexus evaluation and show normal and abnormal imaging appearances of various common and uncommon pathologic states involving LS plexus and its branch nerves.The talk will specifically address new 3D techniques that suppress vessel signal effectively while preserving effective nerve visualization. Role of MRN in chronic pelvic pain, nerve injuries and its incremental value over conventional lumbar spine imaging will be discussed. Current role of functional DTI in qualitative and quantitative assessment of nerve pathology and tumors will be highlighted.

RC617C DTI of the Peripheral Nervous System

Participants
Gustav Andreisek, MD, Zurich, Switzerland (*Presenter*) Grant, Holcim Ltd; Grant, Siemens AG; Speaker, Mepha Pharma AG; Speaker, Guerbet SA; Travel support, Guerbet SA; Consultant, Otsuka Holdings Co, Ltd; Travel support, Otsuka Holdings Co, Ltd; Institutional Research Grant, Bayer AG; Institutional Research Grant, Guerbet AG; Institutional research collaboration, Siemens AG; Institutional research collaboration, Koninklijke Philips NV; Speaker, General Electric Company; Speaker, Koninklijke Philips NV; Speaker, Siemens AG; ;

LEARNING OBJECTIVES

1) Identify the basic microanatomy of peripheral nerves, main pathologic conditions, and physiologic principles of diffusion-weighted tensor imaging (DTI). 2) Apply diffusion-weighted tensor imaging (DTI) to imaging protocols for peripheral neuropathies, used for both, research and clinical practice. 3) Analyze diffusion-weighted tensor imaging (DTI) images both quantitatively and qualitatively. 4) Understand the current applications but also limitations of diffusion-weighted tensor imaging (DTI) of peripheral nerves.

ABSTRACT

Diffusion tensor imaging (DTI) is an MR imaging technique which uses the random motion (diffusion) of water molecules within biologic tissues. Due to the tissues ` distinct structural properties, the diffusion is hindered in some directions but at the same typically not hindered in other directions.DTI is a well known imaging technique in the brain and central nervous system, but its application to the periperal nerveous system was limited in the past due to multiple technical reasons. However, numerous recent studies show now that the technique cannot only be applied sucessfully to image peripheral nerves, but they also showed that the technique is very sensitive and specific for the detection of peripheral nerve injuries and other neuropathies. DTI may also serve as a biomarker for the demyelination of axons and the extend of nerve fiber loss.The refresher course will cover the basic principles of DTI, the challanges and limitations for imaging protocols, as well as the evaluation of DTI images (both quantitatively and qualitatively). MR tractography of peripheral nerves will also be covered.

RC617D PET and MR Methods to Image Pain

Participants
Sandip Biswal, MD, Stanford, CA (*Presenter*) Co-founder, SiteOne Therapeutics Inc; Research Grant, General Electric Company; Stockholder, Atreus Pharmaceuticals Corporation

LEARNING OBJECTIVES

1) Understand the challenges of current conventional imaging approaches in diagnosing peripheral pain generators. 2) Understand the basis for identifying specific molecular and cellular biomarkers of pain and how these biomarkers can be exploited with molecular and cellular imaging techniques. 3) Demonstrate both clinical and pre-clinical PET/MR or advanced MRI approaches in identifying pain generators.

ABSTRACT

Chronic pain is now the prevalent disease in the world. The chronic pain sufferer is currently faced with a lack of objective tools to identify the source of their pain. The goal of this session is to describe new clinical molecular imaging and emerging molecular/cellular imaging methods to more accurately localize chronic pain generators/drivers so that we may objectively identify and more intelligently act upon the cause in a pain sufferer. Successful imaging of pain is relying heavily upon a multidisciplinary effort that include expertise from of a number of scientists and clinicians in the fields of synthetic chemistry, radiochemistry, magnetic resonance physics/engineering, molecular pain neurobiology, clinical pain, radiology and others. A number of clinical and emerging pre-clinical approaches in positron emission tomography (PET) and magnetic resonance imaging (MRI) will be described. These imaging methods will demonstrate how the site of increased nociceptive activity is highlighted in the peripheral nervous system and spinal cord.

RC621

Medical Physics 2.0: Magnetic Resonance Imaging

Thursday, Dec. 3 8:30AM - 10:00AM Location: E451A

MR PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Ehsan Samei, PhD, Durham, NC (*Director*) Nothing to Disclose
Douglas E. Pfeiffer, MS, Boulder, CO (*Director*) Nothing to Disclose

Sub-Events

RC621A Magnetic Resonance Imaging Perspective

Participants
Douglas E. Pfeiffer, MS, Boulder, CO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the history and development of magnetic resonance imaging equipment. 2) Understand the impact of equipment development on testing protocols. 3) Understand the requirements for medical physics support in image quality and safety.

ABSTRACT

Magnetic resonance imaging equipment has developed significantly since its inception. Field strength increases and technology development increase the complexity of the equipment and the need for medical physics and MRI scientist support. This talk will briefly introduce the developments that have taken place and discuss the impact that this development has had on testing and support.

RC621B Magnetic Resonance Imaging 1.0

Participants
Ronald Price, PhD, Nashville, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the image quality metrics that are currently used as part of an MRI system performance report. 2) Discuss how the medical physicist can assist in the development and evaluation of imaging sequences used as part of clinical protocols. 3) To review items that should be included as part of an MRI safety survey. 4) Discuss the steps necessary for establishing and maintaining a routine quality assurance program. 5) Review aspects of AAPM Report No. 100 regarding acceptance testing of new MRI systems. 6) Review modality and system specific requirements for MRI accreditation.

ABSTRACT

MRI 1.0: Magnetic Resonance Imaging Ronald R. Price The purpose of this presentation is to review the current role of the medical physicist in clinical Magnetic Resonance Imaging (MRI). The discussion will first discuss MRI acceptance testing with reference to the recommendations of AAPM Report No. 100 and will specifically include items that should be part of both the initial and annual MRI safety survey. This discussion will be followed by a review or the image quality metrics that are currently used as part of an MRI system performance report as well as how the medical physicist may go about assisting in the development and evaluation of imaging sequences used as part of clinical protocols. The presentation will also discuss the steps necessary for establishing and maintaining a routine quality assurance program with emphasis on the necessity of establishing a strong working relationship with the MRI quality assurance technologist. There will also be a review of the system specific requirements for MRI accreditation.

RC621C Magnetic Resonance Imaging 2.0

Participants
David R. Pickens III, PhD, Nashville, TN (*Presenter*) Stockholder, Johnson & Johnson

LEARNING OBJECTIVES

1) Indentify requirements for improving quality assurance and compliance tools for advanced and hybrid MRI systems. 2) Indentify the need for new quality assurance metrics and testing procedures for advanced systems. 3) Identify new hardware systems and new procedures needed to evaluate these systems. 4) Understand safety concerns for personnel and patients from advanced systems. 5) Recognize the importance of the medical physicist in the clinical testing, safety evaluations, and use of these systems.

ABSTRACT

This talk will look into the future of clinical MR imaging and what the clinical medical physicist will need to be doing as the technology of MR imaging evolves. Many of the measurement techniques used today will need to be expanded to address the advent of higher field imaging systems and dedicated imagers for specialty applications. Included will be the need to address quality assurance and testing metrics for multi-channel MR imagers and hybrid devices such as MR/PET systems. New pulse sequences and acquisition methods, increasing use of MR spectroscopy, quantitative imaging, and real-time guidance procedures will place the burden on the medical physicist to define and use new tools to properly evaluate these systems, but the clinical applications must be understood so that these tools are used correctly. Finally, new rules, evolving clinical requirements, new safety concerns, and changing regulations will mean that the medical physicist must actively work to keep her/his sites compliant and must work closely with physicians to ensure best performance of these systems while ensuring the best patient care.

RC623

MR Safety I

Thursday, Dec. 3 8:30AM - 10:00AM Location: S105AB

NR MR PH SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Joel P. Felmlee, PhD, Rochester, MN (*Director*) Nothing to Disclose

Sub-Events

RC623A MRI Safety - Rules, Regulations, and Concepts

Participants
Karl Vigen, PhD, Madison, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand safety issues in MRI, particularly those caused by the main magnetic field, magnetic field gradients, and transmit RF. 2) Understand guidance from the ACR, and governmental regulations designed to address these issues. 3) Describe the importance of an MR Safety program including comprehensive patient screening in the clinical setting. 4) Briefly address safety issues regarding MRI contrast agents.

RC623B MRI Safety of Deep Brain and Other Simulators

Participants
Yunhong Shu, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe various types of neurostimulators and their clinical applications. 2) Understand the underlying MR physics associated with the risks of scanning patients with neurostimulators. 3) Learn the precaution steps to ensure the safety of the patient with neurostimulators during MR scanning.

ABSTRACT

The demands and applications for neurostimulators continue to increase as the technology advances. MRI is an important diagnostic tool for postoperative evaluation and potential future workup. The presence of the neurostimulator poses potential safety risks in the MR scanning environment. By observing certain precautions, MRI can be performed with an extremely low risks. It is important to follow the manufactures' MRI guidelines to ensure the safety of the patients and continuous functioning of the device.

RC629

Prostate MRI Using PI-RADS (Prostate Imaging Reporting and Data System) (An Interactive Session)

Thursday, Dec. 3 8:30AM - 10:00AM Location: E450B

GU MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

LEARNING OBJECTIVES

1) Describe the clinical indications for prostate MRI and MRI-targeted interventions. 2) Assess technical considerations for performance of multi-parametric prostate MRI, including pulse sequences, coils, contrast administration, magnetic field strength. 3) Integrate information from T2, DCE, and DWI to analyze and report prostate MRI exams using new ACR-PIRADS methodology. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC629A Introduction to PI-RADS

Participants
Jeffrey C. Weinreb, MD, New Haven, CT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC629B Technical Considerations

Participants
Clare M. Tempany-Afdhal, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC629C How to Use PI-RADS

Participants
Jelle O. Barentsz, MD, PhD, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Active Handout:Jelle O. Barentsz

http://abstract.rsna.org/uploads/2015/14000510/Active RC629C.pdf

RC629D Interactive Clinical Case Review

Participants

LEARNING OBJECTIVES

View learning objectives under main course title.

RC651

Pediatric Series: Optimizing Acquisition and Achieving Efficiency in Pediatric Imaging

Thursday, Dec. 3 8:30AM - 12:00PM Location: S102D

MR PD SQ

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 3.50

FDA Discussions may include off-label uses.

Participants
Donald P. Frush, MD, Durham, NC (*Moderator*) Nothing to Disclose
Aliya Qayyum, MBBS, Houston, TX (*Moderator*) Nothing to Disclose
Rajesh Krishnamurthy, MD, Houston, TX (*Moderator*) Research support, Koninklijke Philips NV; Research support, Toshiba Corporation
A. James Barkovich, MD, San Francisco, CA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

ABSTRACT

This session will focus on the importance of minimizing general endotracheal anesthesia in children and discuss recent papers that highlights risks in children. It will discuss techniques for minimizing the use of sedation and intubation in pediatric imaging, including use of abbreviated protocols for common indications, feed and wrap techniques, and state of the art MR sequences for free-breathing 2-D and 3-D acquisition of morphology , function and flow in children.

Sub-Events

RC651-01 Minimizing Sedation in Pediatric Neuroimaging

Thursday, Dec. 3 8:30AM - 8:50AM Location: S102D

Participants
A. James Barkovich, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

There are several keys to minimizing sedation in Pediatric Neuroimaging. Most important are targeting the study to obtaining the specific answer requested by the referring clinician, and obtaining the data as efficiently as possible by using sequences that will answer the question in the shortest time. The second is that the strategy changes depending upon the age of the patient: neonates most often can be scanned without sedation; a relatively short scan can be performed on infants by the 'feed and swaddle' method, and older children (6 years and above) can very frequently be studied without sedation if training and/or movies (to give them focus) are used. For neonates requiring a relatively short scan (is injury present or not), a useful technique is to feed the baby immediately before the procedure and then wrap them in a vacuum bean bag or wrap (swaddle) them in a blanket. Reducing noise by use of ear muffs, insulating the inner bore of the magnet, parallel imaging or ultra-short TE sequences can help, as can retrospective motion correction. Infants can also be scanned using feed and swaddle; it helps to do the scan during their nap time, if possible, and to take them to a quiet room with a parent so that they are asleep when placed in the MRI scanner. Use quiet sequences early in the study, saving the noiser ones for the end. Again, use of parallel imaging or ultra-short TE sequences helps to reduce noise. It is very difficult to image children between ages of 1 and 6 years without sedation. The goal is to scan efficiently. for older children, a training session before the scan to reduce anxiety is useful. Use of a system that allows the child to watch a movie of their own choice is very helpful as well.

RC651-02 Comparison of Non-sedated Brain MRI and CT for the Detection of Acute Traumatic Injury in Children Less than 5 Years Old

Thursday, Dec. 3 8:50AM - 9:00AM Location: S102D

Participants
Joseph Y. Young, MD, Boston, MA (*Presenter*) Nothing to Disclose
Ann-Christine Duhaime, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Paul A. Caruso, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ari Cohen, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jean Klig, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sandra Rincon, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The 2014 ACR Appropriateness Criteria consider CT the first line study for acute intracranial injury in children because of its wide availability, detection of acute hemorrhage, and lack of sedation. A tailored MRI study with rapidly acquired sequences can obviate the need for sedation and radiation. We compared the sensitivity of rapid non-sedated brain MRI and CT for the detection of traumatic head injury in young children.

METHOD AND MATERIALS

We reviewed a consecutive series of children less than 5 years old who presented to our ED during a 5 year period with head trauma and received a non-sedated brain MRI and CT within 24 hours of injury. Most MRI studies were limited to triplane T2 and susceptibility sequences. A few studies had additional sequences, including FLAIR and DWI, if clinically indicated and if the patient could tolerate a longer exam. Two neuroradiologists concurrently reviewed the MRI and CT studies on separate days and assessed

for the following five findings: fracture, epidural hematoma (EDH)/subdural hematoma (SDH), subarachnoid hemorrhage (SAH), intraventricular hemorrhage (IVH), and parenchymal injury.

RESULTS

27 patients met inclusion criteria with a mean age of 21 months. A total of 49 abnormalities was noted in 25 patients, with 21 patients having intracranial findings. There was 79% agreement between the two modalities assessing for the presence of fracture, EDH/SDH, SAH, IVH, and parenchymal injury for each patient. CT missed 13 findings which included 6 EDH/SDH, 5 SAH, and 2 parenchymal injuries. MRI missed 13 findings which included 10 non-displaced fractures (of 17 fractures), 2 small EDH/SDH, and 1 SAH. The CT was negative for 4 patients in whom the MRI demonstrated intracranial findings (4 EDH/SDH, 2 SAH, 2 parenchymal). MRI was negative in 1 patient for whom CT had intracranial findings (1 small EDH/SDH).

CONCLUSION

Non-sedated MRI is at least as sensitive as CT for the detection of intracranial injury in young children presenting with acute head trauma, though missed 10 of 17 fractures. Non-sedated MRI may be a useful alternative to CT in select populations. Low-dose CT may be obtained when fracture detection is clinically indicated.

CLINICAL RELEVANCE/APPLICATION

Non-sedated MRI may be a useful alternative to CT for young children presenting with acute head trauma, thereby avoiding associated radiation risks.

RC651-03 Quantifying the Radiation Dose Savings of Implementing an Ultra-Fast Brain MRI Protocol for Children with Hydrocephalus

Thursday, Dec. 3 9:00AM - 9:10AM Location: S102D

Participants
Daniel Durand, MD, Baltimore, MD (*Presenter*) Stockholder, Evolent Health, LLC; Advisor, National Decision Support Company; Advisor, Radiology Response; Founder, am-I-ok.com
Mahadevappa Mahesh, MS, PhD, Baltimore, MD (*Abstract Co-Author*) Author with royalties, Wolters Kluwer nv
Thierry Huisman, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
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Allison Greene, BS, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Siyuan Cao, BS, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Aylin Tekes, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Children with shunted hydrocephalus frequently require neuroimaging to evaluate shunt function. For a number of practical reasons including length of study, need for sedation, and scanner availability, CT is favored over MRI at most centers. Children are also more susceptible than adults to radiation-induced cancer, with empirical evidence showing that the pediatric brain is particularly prone to cancers associated with CT. Previous reports have shown that ultrafast MRI can be used in place of head CT for evaluating hydrocephalus without any loss of sensitivity or specificity. The purpose of our study was to quantify the net radiation dose savings associated with transitioning from head CT to ultrafast brain MRI in this population.

METHOD AND MATERIALS

An ultra-fast brain MRI protocol without sedation/anesthesia with an average scan time under 5 min was implemented for children with shunted hydrocephalus. A RIS query was designed to extract all neuroimaging orders for obstructive hydrocephalus for two time periods: a 3 month baseline period and a 6 month post-intervention period. The number of CTs performed per month was determined for each period and used to determine the number of cases avoided per month. Size-specific dose estimates for 30 patients in the baseline group were determined using measurements of anteroposterior and mediolateral head diameter as well as CTDIvol and scan length data stored on the PACS. The average dose per case and the CT avoidance rate were used to yield estimates of the annual radiation dose savings to the population in units of size-specific dose estimate (mGy) and age-adjusted effective dose (mSv).

RESULTS

The pre- and post-intervention imaging rates were 20.7 and 8.5, yielding a CT avoidance rate of 12.2 per month. The mean size-specific dose estimate (Figure 1) per CT was 30.40 mGy and the mean age-adjusted effective dose was 1.76 mSv. The annual population radiation dose savings was 4,450 mGy and 258 mSv.

CONCLUSION

Implementing a standard protocol to encourage the use of ultrafast brain MRI in place of head CT significantly reduced the annual radiation dose to pediatric patients imaged for hydrocephalus.

CLINICAL RELEVANCE/APPLICATION

Our results show the benefit of using ultrafast brain MRI in place of head CT for suspected hydrocphalus. The method used here to quantify population radiation dose savings can be used more generally to highlight the value that radiologists and medical physicists bring to care pathway redesign.

RC651-04 Silent MRI Reduces Children's Risk by Decreasing Need for Additional Sedation

Thursday, Dec. 3 9:10AM - 9:20AM Location: S102D

Participants
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Hisashi Tanaka, MD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
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Eri Yoshioka, MD, Matsubara, Japan (*Presenter*) Nothing to Disclose
Shin Nabatame, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
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Matthew W. Lukies, MBBS, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Sedated children often wake up during magnetic resonance imaging (MRI) and additional sedatives are needed; the acoustic noise during the MR scanning might be the main cause of this. We hypothesized that silent MRI would decrease the frequency of arousal and additional administration of sedatives during examinations when compared with conventional MRI.

METHOD AND MATERIALS

Twenty-eight children (M:F=18:10, age 13 months-8 years, mean 4.3 years, median 5 years) who underwent silent brain MRI from January to August in 2014 were retrospectively compared to 26 children (M:F=10:16, age 4 months-8 years, mean 4.0 years, median 3 years) who underwent conventional brain MRI from May to December in 2013 with the same 3T MR unit. The pediatrician administered intravenous sedatives including thiopental to all patients. Data from the medical chart of each patient was reviewed as follows: administered sedatives, doses, and need for additional intravenous injections during examinations. Unpaired t-test was used in the statistical analysis of the initial dose of thiopental. The need for additional sedation was assessed by Fisher's exact test.

RESULTS

The mean initial dose of thiopental was 3.1 mg/kg for conventional MRI group and 3.3 mg/kg for silent MRI group. There was no significant difference between the two groups (p=0.55). Ten out of twenty-six patients (38%) woke up during conventional MRI and additional sedatives were needed. On the other hand, three out of twenty-eight patients (11%) woke up during silent MRI and required additional sedatives. There was a significant difference between the two groups (p=0.02).

CONCLUSION

Silent MRI decreased the frequency of arousal and additional intravenous sedation during examinations. This can reduce patient risk and may possibly reduce the amount of time required for examinations.

CLINICAL RELEVANCE/APPLICATION

Silent MRI can reduce children's risk by decreasing the need for additional sedation and may possibly reduce the amount of time required for examinations; silent MRI is recommended in routine brain evaluation for children.

RC651-05 High-pitch CT of the Chest in Newborns and Infants: Is Sedation or Breath-hold Still Necessary?

Thursday, Dec. 3 9:20AM - 9:30AM Location: S102D

Participants
Ilias Tsiflikas, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Michael Esser, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Sergios Gatidis, MD, Tubingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ines Ketelsen, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Sabrina Fleischer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Juergen F. Schaefer, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate feasibility and image quality of high-pitch computed tomography of the chest without sedation or breath-hold in newborns and infants under the age of 12 months.

METHOD AND MATERIALS

IRB waived informed consent and approved this retrospective, HIPAA-compliant study. 88 patients (48 boys, age 153 ± 103 days) received 123 high-pitch CT examinations (HPCT) of the chest between October 2010 and December 2014. All examinations were scanned in free breathing. 84 HPCT were without sedation or general anesthesia, whereas 39 examinations were performed in general anesthesia because of patients' clinical condition. 84/123 HPCT were contrast-enhanced. Tube voltage and current were determined according to our institutional weight-adopted standard scanning protocol (70-100 kV; 6 - 80 mAs). Image quality was evaluated by two experienced pediatric radiologists with respect to typical artifacts arising from movement, breathing or pulsation of the heart or pulmonary vessels (0 - no; 1 -moderate; 2 - severe artifacts). Effective dose (E eff) was estimated according to the European Guidelines on Quality Criteria for Multislice Computed Tomography.

RESULTS

All examinations were performed without the notice of moving artifacts. In awake patients there was a higher frequency of moderate breathing artifacts (19/84 vs. 1/39, p<0.01) and pulsation artifacts (19/84 vs. 8/39, p=0.79), but in no examination severe artifacts could be detected.The overall dose was very low (0.52 ± 0.30 mSv). As expected the estimated E eff was higher in contrast-enhanced examinations than in non-enhanced scans (0.58 ± 0.33 vs. 0.40 ± 0.18 mSv). Further E eff was higher in examinations in general anesthesia (0.61 ± 0.42 vs. 0.48 ± 0.22 mSv), what might be explained due to a higher rate of contrast-enhanced scans (79% vs. 63%) in this patient group.

CONCLUSION

High-pitch scanning allows the examination of the chest in newborns and infants without sedation or breath-hold in sufficient image quality and with low effective doses.

CLINICAL RELEVANCE/APPLICATION

Newborns and infants undergoing chest CT can be examined without sedation or breath-hold without significant loss in image quality.

RC651-06 The Optimal Scanning Protocol of Prospective ECG-triggering DSCT Thoracic Angiography in Children with Tetralogy of Fallot

Thursday, Dec. 3 9:30AM - 9:40AM Location: S102D

Participants
Yanhua Duan, MD, Jinan, China (*Presenter*) Nothing to Disclose
Ximing Wang, Jinan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the effect of 4 different scanning protocols (bolus-tracking technique, test-bolus technique, fixed delay time technique and "manual" bolus-tracking technique) on image quality and effective dose of prospective ECG-triggering DSCT thoracic angiography in children with TOF.

METHOD AND MATERIALS

Eighty consecutive children (48 boys; mean age of 3.5 years; mean heart rate: 97 bpm) with known or suspected TOF were enrolled between December 2008 and September 2014 in our institute. All children underwent prospective ECG-triggering DSCT thoracic angiography.All patients were assigned to 4 groups randomly according to the different enhanced scanning protocols: bolus-tracking technique (n=20, group A), test-bolus technique (n=20, group B), fixed delay time (25s) technique (n=20, group C) and "manual" bolus-tracking technique (place the region of interest in the background at the level of four-chamber, a monitoring scanning started at 18s after injection, the acquisition was manually triggered at the moment that the contrast medium artifact in the right atrium began to disappear) (n=20, group D).Subjective image quality was independently assessed by two radiologists. The total effective dose (including premonitoring, monitoring scanning and angiographic scanning) were calculated.

RESULTS

All prospective ECG-triggering DSCT angiographic scans were successful. The image quality scores of groups A, B, C and D were 3.20±1.06, 3.10±1.12, 3.40±1.30, 4.15±0.81, respectively, there were significant differences among the four groups (p=0.012). The total effective dose of groups A, B and C were (0.40±0.06)mSv, (0.56±0.14)mSv, (0.38±0.06)mSv, (0.39±0.09)mSv, respectively, there were significant differences among 4 groups (p=0.023).

CONCLUSION

The scanning protocol has a significant impact on the image quality with a significantly different radiation dose. Considered the image quality and radiation dose together, the optimal scanning protocol for patient with TOF was the "manual" bolus-tracking technique.

CLINICAL RELEVANCE/APPLICATION

"Manual" bolus-tracking technique is an excellent scanning protocol for TOF patients.

RC651-07 Minimizing Sedation and Radiation in Pediatric Cardiovascular Imaging

Thursday, Dec. 3 9:40AM - 10:00AM Location: S102D

Participants
Rajesh Krishnamurthy, MD, Houston, TX (*Presenter*) Research support, Koninklijke Philips NV; Research support, Toshiba Corporation

LEARNING OBJECTIVES

View learning objectives under main course title.

RC651-08 Minimizing Sedation in Pediatric Abdominal and Musculoskeletal MRI

Thursday, Dec. 3 10:20AM - 10:40AM Location: S102D

Participants
Shreyas S. Vasanawala, MD, PhD, Palo Alto, CA (*Presenter*) Research collaboration, General Electric Company; Consultant, Arterys; Research Grant, Bayer AG;

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Sedation for pediatric MRI has multiple disadvantages. It confers risk of adverse events for what is an otherwise non-invasive procedure. Additionally, sedation contributes to cost, makes exam scheduling complex, and leads to inefficient imaging utilization. This presentation will present some approaches to reduce the incidence, duration, and depth of sedation for pediatric abdominal and musculoskeletal indications.An overview of child developmental approaches that reduce the incidence of sedation will be given. Then an approach for compact protocols to minimize duration of sedation will be presented. This will be followed by discussion of methods of managing respiratory motion artifacts without periods of suspended respiration, thus reducing depth of anesthesia.

RC651-09 High-pitch Low-dose Whole Body CT for the Assessment of Ventriculo-peritoneal Shunts in Pediatric Patients: An Experimental ex-Vivo Study in a Rabbit Model

Thursday, Dec. 3 10:40AM - 10:50AM Location: S102D

Participants
Ahmed E. Othman, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose
Saif Afat, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Rastislav Pjontek, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Marc A. Brockmann, MD, Luebeck, Germany (*Abstract Co-Author*) Nothing to Disclose
Omid Nikoubashman, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Martin Wiesmann, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the sensitivity of whole-body Low-Dose CT (LD-CT) in pediatric patients, regarding the detection of ventriculo-peritoneal shunt (VP-shunt) complications in comparison to radiographic shunt series (SS), with special regards to radiation exposure, using an ex vivo rabbit model.

METHOD AND MATERIALS

In a first step, an optimized low dose CT imaging protocol, with low tube voltages (70 kVp and 80 kVp) was assessed on a 16 cm phantom regarding signal-to-noise ratio (SNR) and radiation dose (with and without iterative reconstruction). After defining the CT protocol with the lowest possible radiation dose, 12 VP-shunts were implanted in 6 rabbit cadavers (weight, 4 - 6 kg). 24 mechanical complications (extracranial and extraperitoneal malpositioning, breakages, disconnections) were induced in 6 VP-shunts. LD-CT scans with the lowest possible radiation doses (80 kVp; 4 mAs) as well as conventional SS were acquired. Blinded readings on image quality and diagnostic accuracy regarding shunt complications as well as radiation dose estimations were performed.

RESULTS

For the detection of shunt complications, LD-CT yielded a sensitivity of 1.0 for both readers. SS yielded a sensitivity of 0.79 for reader A and 0.71 for reader B with moderate agreement (kappa=0.56) (Figure). No false positive findings were registered. Mean effective radiation doses for LD-CT were as low as 0.069 ± 0.003 mSv and therefore comparable to reported doses for SS (0.047 mSv - 0.086 mSv).

CONCLUSION

LD-CT allows accurate detection of VP-shunt complications in pediatric patients with higher sensitivity than SS and comparably low radiation exposure. Thus, LD-CT provides a potentially superior alternative to radiographic shunt series for imaging VP-shunts.

CLINICAL RELEVANCE/APPLICATION

The improvement of accurate diagnostic tools such as LD-CT might potentially reduce time-to-diagnosis and patient turnaround time and might therefore improve the poor outcome and quality of life for children with shunted hydrocephalus.

RC651-10 Application of T1-weighted BLADE Sequences to Abdominal MR Imaging of Young Children: Comparison with Turbo Spin Echo Sequence

Thursday, Dec. 3 10:50AM - 11:00AM Location: S102D

Participants
Kyusung -. Choi, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Jung-Eun Cheon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ji-Eun Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Suk Cho, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yu Jin Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Sun Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
In-One Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the usefulness of T1-weighted BLADE sequences for axial T1-weighted abdominal imaging in small children who cannot hold their breath.

METHOD AND MATERIALS

Two different BLADE sequences with (IR-BLADE) and without inversion pulse (BLADE) were compared to TSE with six number of signal acquired (NSA) in fifteen consecutive pediatric patients (mean age of 4.4 years, range 0.5-8 years) who were incapable of holding their breath. The overall image quality, motion artifact, radial artifact, sharpness of hepatic vessels, renal corticomedullary differentiation and lesion conspicuity were retrospectively assessed by two radiologists in a qualitative manner, using four or five-point scaled scoring systems. Signal variations of each sequence were measured in the liver, muscle and air for quantitative comparison. The acquisition times of three sequences were compared.

RESULTS

IR-BLADE and BLADE showed improved overall image quality and reduced motion artifact compared with TSE ($p<0.01$). IR-BLADE showed better edge sharpness of hepatic vessels and corticomedullary differentiation, compared with both BLADE and TSE ($p<0.001$). Radial artifacts were only observed on IR-BLADE and BLADE. In seven patients with lesions, IR-BLADE showed improved lesion conspicuity, compared with both BLADE and TSE ($p=0.023$). Both IR-BLADE and BLADE showed decreased signal variation in the liver, muscle and increased signal variation in the air, compared with the TSE. The mean acquisition times for IR-BLADE, BLADE and TSE were 3min 47s, 3min 32s, and 3min 26s respectively.

CONCLUSION

Application of BLADE technique with inversion pulse for the T1-weighted MR imaging of the pediatric abdomen resulted in improved image quality, tissue contrast and lesion conspicuity with a diminished respiratory motion artifact and a comparable acquisition time, compared with the conventional TSE sequence.

CLINICAL RELEVANCE/APPLICATION

IR-BLADE could be a promising alternative to conventional TSE sequence for T1-weighted abdominal imaging of small children.

RC651-11 Performing Screening Lumbar Spine MRIs in Infants without Sedation - The L-Spine Feed and Sleep

Thursday, Dec. 3 11:00AM - 11:10AM Location: S102D

Participants
Nicholas V. Stence, MD, Aurora, CO (*Presenter*) Nothing to Disclose
Patrick T. McCormick, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
David M. Mirsky, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Laura Z. Fenton, MD, Greenwood Village, CO (*Abstract Co-Author*) Nothing to Disclose
John D. Strain, MD, Greenwood Village, CO (*Abstract Co-Author*) Nothing to Disclose
John A. Maloney, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Brent O'Neill, MD, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The feed and sleep technique is used in infants to avoid general anesthesia during MRI. The method typically involves fasting an infant prior to exam, feeding and swaddling immediately before scanning until asleep. This technique is commonly used in children's hospitals for neonatal brain MRI, and has been described in the literature in brain and cardiac MRIs. We describe the application of this technique in our institution to outpatient screening lumbar spine MRIs ordered for sacral dimples in children less than 6 months of age.

METHOD AND MATERIALS

This project was undertaken as an internal quality improvement project and therefore did not require IRB approval. The departmental Montage database (Montage Healthcare Solutions) was queried for the number of outpatient, non-contrast lumbar spine MRI exams performed in infants less than 6 months of age over the last 5 years. The number of exams performed as non-sedated feed and sleeps was extracted.The feed and sleep method is performed as follows: Infants are scheduled for exams between 7 p.m. and 9 p.m. Parents are instructed to keep the child awake and fasted for 3-4 hours prior to arrival in the department. On arrival, the MRI technologist aids the parents with swaddling and feeding the infant. Once the child is asleep, they are placed in the scanner and provided ear protection with both a headset and a Philips foam acoustic shield.

RESULTS

From January 2009 through January 2014, 111 of 342 (32%) of outpatient screening lumbar spine MRIs were successfully performed using the feed and sleep method, compared to 52 of 98 (53%) exams performed March 2014 through March 2015. The average age of successful feed and sleep exams in the last year was 3.3 months. Over the last year, approximately 10% of the exams attempted as feed and sleeps required rescheduling with general anesthesia after the attempt was unsuccessful.

CONCLUSION

Our institution was able to avoid the use of general anesthesia in 52 of 98 infants who required a screening lumbar spine MRI for sacral dimples. The successful use of this method has increased over the past 5 years. This is likely due to increased MRI technologist confidence and skill with the technique, as well as an increasing awareness of this technique among referring clinicians.

CLINICAL RELEVANCE/APPLICATION

Wider application of this technique could lead to a reduction in general anesthesia for this type of exam, leading to decreases in cost and risk to the patient.

RC651-12 A Retrospective Analysis of the Safety and Cost Implications of Pediatric Contrast Enhanced Ultrasound in a Single Centre

Thursday, Dec. 3 11:10AM - 11:20AM Location: S102D

Participants
Gibran Yusuf, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose
Maria E. Sellars, MD, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Annamaria Deganello, MD, London, United Kingdom (*Abstract Co-Author*) Speaker, Bracco Group
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Paul S. Sidhu, MRCP, FRCR, London, United Kingdom (*Abstract Co-Author*) Speaker, Bracco Group; Speaker, General Electric Company

PURPOSE

There are concerns over increasing use of ionising radiation in children. Contrast enhanced ultrasound (CEUS) offers a cheaper radiation free alternative licensed in adults, widely used in Europe for liver assessment but used "off-label" in non-liver indications. Pediatric CEUS is "off label", and safety has not been assessed. We retrospectively analyse the prevalence of adverse incidents in a cohort of paediatric CEUS and investigate the financial implication of subsequent reduced CT and MR imaging.

METHOD AND MATERIALS

Pediatric (≤18 yrs) CEUS examinations (January 2008 and March 2015) were analysed. Parental informed consent was obtained and any reaction considered related to the contrast examination was documented in the radiology report, with electronic patient records examined for reactions ≤24hrs. Using tariffs calculated from National Institute of Clinical Excellence (UK) analysis; CEUS cost ($168) was compared to the cost for CT ($172) and MR ($280) imaging, the normal diagnostic imaging pathway. The possible reduction in cost when CEUS would have precluded further imaging was calculated.

RESULTS

240 paediatric CEUS were performed (144 male, 96 female, age range 1-18 years). The majority of studies were performed for characterising liver lesions (123/240; 51%) and trauma (86/240; 36%), with renal and vascular assessment the remaining. There were no immediate adverse reactions. Two patients (2/240; 0.8%) experienced delayed adverse reactions of transient hypertension (n=1) and transient tachycardia (n=1) deemed not due to the underlying disorder; neither were symptomatic.

CONCLUSION

CEUS in children is "off label"; however, our experience shows paediatric CEUS is both safe and can offer a cost-effective imaging

modality.

CLINICAL RELEVANCE/APPLICATION

CEUS in paediatrics offers a safe, cost effective alternative to MR and CT imaging in a variety of settings without the risk of ionising radiation, iodinated contrast or risks of sedation which may otherwise be needed.

RC651-13 Sonographic Evaluation of MAGEC Growing Scoliosis Rods in Pediatric Patients

Thursday, Dec. 3 11:20AM - 11:30AM Location: S102D

Participants
Sara M. O'Hara, MD, Cincinnati, OH (*Presenter*) Author, Reed Elsevier; Stockholder, Reed Elsevier; Speakers Bureau, Toshiba Corporation; Medical Advisory Board, Toshiba Corporation
Peter F. Sturm, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
Sarah E. Gilday, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Adjustable, magnetically controlled "growing" scoliosis rods (MAGEC rods) are increasingly used in pediatric patients, and require periodic adjustments and confirmation of lengthening following this non-invasive procedure. Previously, adjustable rods required open surgical procedures for lengthening. The purpose of our study was to determine if these MAGEC rods could be adequately visualized and measured with ultrasound, thereby minimizing radiation exposure from serial spine X-rays.

METHOD AND MATERIALS

All patients with recently implanted MAGEC rods were examined with ultrasound before and after their first transcutaneous magnetic rod lengthening procedures. Measurements obtained sonographically were compared with baseline scoliosis X-rays and the length programmed into the magnetic motor used to extend the rod. Measurements will also be compared with scoliosis X-rays obtained once or twice each year.

RESULTS

12 patients have been studied to this point (3 month period) - 6 female, and 6 male, between 6 and 10 years of age. All of the MAGEC rod components including extension motors and expandable rod segments were well visualized sonographically before and after lengthening procedure. All of the patients showed good correlation between post-op scoliosis measurements and first, pre-lengthening ultrasound measurements. 4 of the 13 patients rods showed less lengthening than expected based on the length programmed into the magnetic motor driver. All patients will be re-imaged in the next few months to quantify measurement reliability and compare with expected extension parameters.

CONCLUSION

MAGEC rods can be reliably imaged with ultrasound before and after transcutaneous lengthening procedures, thereby reducing radiation exposure. In addition, the ultrasound may offer additional confidence that the rods have in fact extended the length programmed into the magnetic motor.

CLINICAL RELEVANCE/APPLICATION

Ultrasound should be the preferred method for serial imaging of MAGEC adjustable scoliosis rods in pediatric patients to minimize exposure to ionizing radiation.

RC651-14 Low Dose Pediatric Chest CT: Radiation Dose Comparison of a 70 kVp CT Protocol and a 100 kVp Protocol Using a Tin Filter for Spectral Beam Shaping

Thursday, Dec. 3 11:30AM - 11:40AM Location: S102D

Participants
Meike Weidner, Mannheim, Germany (*Presenter*) Nothing to Disclose
Thomas Henzler, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Holger Haubenreisser, Mannheim, Germany (*Abstract Co-Author*) Speaker, Siemens AG; Speaker, Bayer AG
Mathias Meyer, Mannheim, Germany (*Abstract Co-Author*) Speaker, Siemens AG; Speaker, Bracco Group
Sonja Sudarski, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan O. Schoenberg, MD, PhD, Mannheim , Germany (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Wolfgang Neff, MD, PhD, Alzey, Germany (*Abstract Co-Author*) Nothing to Disclose
Claudia Hagelstein, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

With the introduction of 3rd generation dual-source CT two competetive techniques for further radiation dose reduction became clinically available. On the one hand the CT peak tube voltage can be decreased down to 70 kVp whereas on the other hand 100 kVp imaging can be combined with a dedicated 0.6 mm tin (Sn) filter behind the x-ray tube in order to filter-out low energy photons. We aimed to compare radiation dose in pediatric chest CT scans between 70kV and 100kVp-Sn acquisitions.

METHOD AND MATERIALS

All chest CT examinations were performed on a 3rd generation 2 x 192 slice dual source system (Somatom Force, Siemens Healthcare, Germany) using a pitch factor of 3.2 and automatic tube current modulation without any sedation. In total, 46 examinations were included in this study (mean age 5.8±5.9 years, 70kV n=26; 100Sn n=20). Radiation dose was compared by the CT dose index (CTDIvol), effective dose (ED) after ICRP guideline 103 and organ doses. The latter were calculated with commercially available software (Radimetrics, Bayer, Germany). Signal to noise ratio (SNR) was calculated for lung tissue.

RESULTS

CTDIvol was significantly lower in the 100 kVp-Sn examinations (0.26±0.13 mGy) when compared to 70kVp (0.81±0.73 mGy; $p<0.0001$). Accordingly, mean effective dose was significantly reduced when using 100 kVp-Sn (0.30±0.09 mSv) compared to 70kVp acquisitions (0.84±0.54 mSv; $p<0.0001$; Fig. 1). Organ doses were also significantly lower with the 100 kVp-Sn protocol

compared to the 70kVp protocol, e.g. breast dose with 100 kVp-Sn was 0.49 mSv vs. 1.57 mSv with 70kV, resulting in a factor of 3.2 ($p<0.0001$). SNR in lung tissue was comparable between both examination protocols ($p=0.1$).

CONCLUSION

Both, tube voltage reduction to 70kV and Sn-filter based spectral shaping at 100kVp allow to acquire pediatric chest CT scans at sub-mSv dose levels. In direct comparison 100Sn even performs at lower dose levels. Consequently, chest CT scans without contrast agent should be performed with this technique.

CLINICAL RELEVANCE/APPLICATION

Pediatric chest CT scans can be performed with sub-mSv dose levels when using either 70kVp tube voltage or spectral beam shaping with an additional tin filter at 100kVp (100 kVp-Sn). All pediatric chest CT scans without contrast agent should be acquired with 100 kVp-Sn.

RC651-15 Comparative Assessment of New Generation CT Scanners for Pediatric Applications

Thursday, Dec. 3 11:40AM - 12:00PM Location: S102D

Participants
Whal Lee, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Reviewing the mechanical development of CT machines. 2) Comparative Assessment of New Generation CT Scanners. 3) Knowing new applications and new pitfalls in scanning in children.

ABSTRACT

Computed tomography scanner was introduced at 1974. The scan was sequential at that time, in which the gantry made a complete rotation to acquire an image of a slice.This conventional step-and-shoot technique needed a long scan time because of the interscan delays between the slices. In the late 1980's and early 1990's, spiral scanners were introduced. The gantry continuously rotates, while the table is continuously moving. This spiral scanning allowed fast and continuous acquisition of a complete set of volume image data. In 1998, multi-detector technology was announced with first 4 channels MDCT. Since then, the number of rows of detectors has ever increased, 8, 16, 64, 128 and reaching 320 in 2008. The fast rotation speed of gantry is essential for imaging of an organ. The gantry rotation times have been fast up to 270 msec. There is a machine of two X-ray tube and two detector systems in a gantry which allow only one forth rotation enough to make a slice of image and high pitch fast scanning. The wide detector CT and high pitch scanning is fascinating imaging method for child to overcome motion artifact and reducing radiation dose. However, we have to know the pitfalls in these new scan mode. The overscan range is larger than that of past and wide beam angle of wide detector scanner gave us geometrical unused radiation and that cannot be neglected. In this lecture we will review the mechanical development of CT machines and new applications and new pitfalls in scanning in children.

Active Handout:Whal Lee

http://abstract.rsna.org/uploads/2015/14044487/RC651-15 new CT ped app handout.pdf

SSQ01

Breast Imaging (MR Diagnostics)

Thursday, Dec. 3 10:30AM - 12:00PM Location: E450A

BR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Linda Moy, MD, New York, NY (*Moderator*) Nothing to Disclose
Janice S. Sung, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSQ01-01 Correlation between MR Imaging and Level of Tumor Infiltrating Lymphocyte (TIL) in Triple Negative Breast Cancer (TNBC)

Thursday, Dec. 3 10:30AM - 10:40AM Location: E450A

Participants
Su Hee Baek, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hak Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
You Jin Ku, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joo Hee Cha, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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Woo Jung Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Triple negative breast cancer (TNBC) is a heterogeneous disease with varying prognosis. Recently, the importance of tumor-infiltrating lymphocyte (TILs) has been determined. That is, increased TIL positively correlated with the pathologic complete response rate and increased patient survival. The purpose of this study is to investigate associations between TIL and magnetic resonance (MR) imaging in TNBC.

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board, and informed consent was waived. From February 2006 to December 2014, 112 consecutive women (mean age; 47 years, range ; 25-73 years) with TNBC who had undergone MR imaging were selected.All lesions were evaluated according to Breast Imaging Reporting and Data System (BI-RADS) lexicon by two radiologists. Apparent diffusion coefficient (ADC) values, lymph node involvement and multifocality were also assessed.According to the level of TIL, we divided into two groups: low TIL ; <50% and high TIL ; 50-100%. Associations between TIL and imaging features were evaluated.Statistical analysis was performed by using independence test.

RESULTS

One hundred twelve malignant lesions (range, 9-73mm; mean, 27.8mm) were evaluated, of which 62 (55.4 %) were in low TIL and 50 (44.6%) were in high TIL.Tumors with high TIL shows more round shape (n = 23, 46%), circumscribed margin (n = 38, 76%), homogenous enhancement (n = 16, 32%) and absence of multifocality (n = 44, 88%) (p <0.005).Low TIL group shows more irregular shape (n = 43, 69.3%), not circumscribed margin (n = 49, 79.0%), heterogeneous enhancement (n = 47, 75.8%) and multifocality (n = 44, 70.9%) (p <0.005).All lesions show typical washout kinetic findings of malignancy without significance. ADC value was higher in high TIL group without reaching significance.

CONCLUSION

MR imaging features of round shape, circumscribed margin, homogenous enhancement and lack of multifocality are typical pattern of TNBC with high TIL.

CLINICAL RELEVANCE/APPLICATION

TNBC with high TIL shows characteristic features and it may provide added diagnostic benefit in identifying TNBC with relatively good prognosis.

SSQ01-02 Contralateral Parenchymal Enhancement in DCE-MRI of Patients with Unilateral Node-negative ER+/HER2-breastcancer: Potential Value for Chemotherapy Selection

Thursday, Dec. 3 10:40AM - 10:50AM Location: E450A

Participants
Bas H. van der Velden, MSc, Utrecht, Netherlands (*Presenter*) Nothing to Disclose
Claudette E. Loo, MD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Ruud Pijnappel, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Kenneth G. Gilhuijs, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Low parenchymal enhancement in the contralateral breast at dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) has been associated with inferior invasive disease-free survival (IDFS) of patients with estrogen-receptor positive and human-epidermal-growth-factor-receptor-2 negative (ER+/HER2-) breast cancer. The aim of this retrospective study is to explore whether contralateral parenchymal enhancement has complementary value to existing guidelines to identify patients who may benefit from

chemotherapy.

METHOD AND MATERIALS

Between 2000 and 2008, 531 consecutive patients eligible for breast-conserving therapy based on conventional imaging and physical examination received a preoperative DCE-MRI in study context. Two-hundred-and-sixty-five patients had ER+/HER2- breast cancer and negative lymph nodes, of whom 66 received hormonal therapy. Forty-two of these patients did not receive chemotherapy.In this group, high-risk and low-risk patients for IDFS were identified based on parenchymal enhancement in the contralateral breast, using a previously reported method. In short, parenchyma was automatically segmented in 3D, enhancement was calculated as the mean of the top-10% of the relative signal increase over time, which was associated with IDFS. The MRI-based risk groups were compared with the Dutch guidelines for systemic therapy based on Adjuvant! Online. Kaplan-Meier estimators and log-rank tests were used.

RESULTS

The average age at diagnosis in the subgroup treated with hormonal therapy without chemotherapy was 58 years (range: 35-79). The median follow-up was 86 months (range: 37-146). An event occurred in 4/42 (10%) patients. Twenty-one patients (50%) were in the high-risk MRI group. All events occurred in this group (P=.034). Thirty-three patients (88%) were indicated for chemotherapy based on the Dutch guidelines, which was not found to be specific for IDFS (P=.320). Eighteen patients (43%) were in the high-risk MRI group and were indicated by the guidelines, containing all events (P=.009).

CONCLUSION

Parenchymal enhancement in the contralateral breast may have potential as a prognostic biomarker to complement clinical indication for chemotherapy in patients who receive hormonal therapy.

CLINICAL RELEVANCE/APPLICATION

Contralateral parenchymal enhancement may have prognostic potential to complement clinical indication for chemotherapy in node negative ER+/HER2- breast cancer patients receiving hormonal therapy.

SSQ01-03 Characterization of Breast Lesion Kinetics with Accelerated DCE-MRI Using Conventional Sampling Methods

Thursday, Dec. 3 10:50AM - 11:00AM Location: E450A

Awards
Trainee Research Prize - Resident

Participants
Federico Pineda, BS, Chicago, IL (*Presenter*) Nothing to Disclose
Keiko Tsuchiya, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Abe, MD, Chicago, IL (*Abstract Co-Author*) Consultant, Seno Medical Instruments, Inc
Milica Medved, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Shiyang Wang, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Xiaobing Fan, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
David V. Schacht, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Aytekin Oto, MD, Chicago, IL (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV; ; ;
Gillian M. Newstead, MD, Chicago, IL (*Abstract Co-Author*) Medical Advisory Board, Bayer AG; Consultant, Three Palm Software LLC; Consultant, VuCOMP, Inc; Medical Advisor, Quantitative Insights, Inc
Gregory S. Karczmar, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To characterize the kinetics of breast lesions in DCE-MRI with high temporal resolution during the first minute post contrast injection using conventional sampling methods.

METHOD AND MATERIALS

23 women with known enhancing lesions (17 malignant and 18 benign lesions) underwent a combined high temporal/standard protocol DCE-MRI. Patients were imaged on a Philips Achieva 3T-TX with a bilateral breast coil and a protocol consisting of 8 fat-suppressed fast acquisitions after injection of contrast media (0.1mM/kg MultiHance) followed by 5 fat-suppressed 'standard' acquisitions. Temporal resolution for the fast scans was 6.2-9.9s, with spatial resolution of 1.5x1.5x3mm^3; standard protocol temporal resolution was 58-79s and 0.8x0.8x1.6mm^3 spatial resolution. Percent signal enhancement data were fit to a 2-parameter (uptake only) empirical mathematical model (EMM). Time-of-arrival (TOA) was defined as the time at which a lesion enhanced by 20%, relative to the time when arterial enhancement in the breast first reached 20%. Time to 90% of maximum enhancement (T90) and initial area under the contrast curve (iAUC) were calculated from the EMM parameters. Lesion conspicuity was defined as the ratio of lesion signal increase to background parenchymal enhancement (BPE).

RESULTS

Significant differences ($p<0.005$) between benign and malignant lesions were measured for: uptake rate, initial slope, iAUC, TOA, and T90. The average TOA of malignant lesions was 7.2 ± 3.7s, and 25 ± 18.7s for benign lesions. T90 was 50 ± 34s and 191 ± 127s for malignant and benign lesions respectively. Average initial uptake rate was 34 ± 64%/s for malignancies and 2 ± 3%/s for benign lesions. Lesion conspicuity was highest in 4th fast time-point when its average was 11:1, compared to 4.4:1 by the final fast acquisition.

CONCLUSION

Malignant lesions, on average, had significantly faster signal enhancement than benign lesions, and significantly shorter TOA. Fast sampling may show larger differences between benign and malignant lesions compared to conventional DCE-MRI, and allows measurement of kinetics relative to arterial TOA. Lesion conspicuity was highest at early times after injection, before the sampling of the center of k-space in standard protocols.

CLINICAL RELEVANCE/APPLICATION

Fast sampling allows accurate measurement of early lesion kinetic parameters, which may be diagnostically useful. Higher lesion

conspicuity in early fast images may be beneficial in cases with marked BPE.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Aytekin Oto, MD - 2013 Honored Educator

SSQ01-04 Novel Informatics Modeling Using Clinical and Radiological Imaging Metrics for Characterization of Breast Tumors with the OncotypeDX Gene Array

Thursday, Dec. 3 11:00AM - 11:10AM Location: E450A

Participants
Michael A. Jacobs, PhD, Baltimore, MD (*Presenter*) Research Grant, Siemens AG
Katarzyna J. Macura, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Umbricht, MD,PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Vishwa Parekh, MS, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Riham H. El Khouli, MD, PhD, Silver Spring, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio C. Wolff, MD, Baltimore, MD (*Abstract Co-Author*) Research Grant, F. Hoffmann-La Roche Ltd

PURPOSE

Emerging data on breast cancer suggest that different breast cancer subtypes (phenotypes) may respond differently to available adjuvant therapies. Optimal use of established and novel imaging methods, such as multiparametric magnetic resonance imaging(MRI) can simultaneously identify key functional parameters and provide unique imaging phenotypes of breast cancer. We have developed a new informatics tool that integrates clinical variables, derived from imaging and clinical workup, to compare with the 21-gene array assay, OncotypeDX, which stratifies patients into three risk groups: low, medium, and high risk.

METHOD AND MATERIALS

We tested our informatics modeling in a group of 86 patients who were ER+ and candidates for the OncotypeDX gene array test and underwent breast MRI imaging at 3T. The clinical and imaging parameters included, breast density, morphology, lesion volume, mass enhancement, Ki-67, Pharmacokinetic(PK)-DCE MRI, ADC mapping, and others. There were 36 patients with OncotypeDX gene array scores of low risk(0-17), 40 patients with intermediate risk(18-31), and 10 patients with high risk(>31). Our non-linear dimensionally reduction(NLDR) informatics algorithm computes the similarity matrix using a hybrid k-means algorithm. We then employed multidimensional scaling to embed the similarity matrix into a two-dimensional representation via random forest decision trees to model the clinical parameters to the risk groups. T-tests were used to determine statistical significance.

RESULTS

There was no age difference(51-56y/o) between groups. The PK-DCE parameters, Ktrans for the high and intermediate risk groups were higher (0.45 and 0.50 (1/min)) compared to the low-risk group (0.35(1/min)) with similar results for the extra vascular fraction(EVF). The ADC values for high and intermediate risk groups were significantly lower than those for the low-risk group(1.09 vs 1.38x10-3mm2/s). However, the ADC values in glandular tissue were similar across all groups(2.14-2.17x10-3mm2/s). These results are visualized in our novel informatics heat map.

CONCLUSION

The most important surrogate imaging and histological parameters determined from the informatics model were the ADC values, the PK-DCE parameters, lesion size, Ki-67, and breast lesion volume.

CLINICAL RELEVANCE/APPLICATION

Informatics modeling of clinical and radiological variables can provide the foundation to relate these variables to the OncotypeDX gene array score.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Katarzyna J. Macura, MD, PhD - 2012 Honored Educator
Katarzyna J. Macura, MD, PhD - 2014 Honored Educator
Riham H. El Khouli, MD, PhD - 2012 Honored Educator

SSQ01-05 The Impact of Pre-operative Breast MRI on Surgical Waiting Time

Thursday, Dec. 3 11:10AM - 11:20AM Location: E450A

Participants
Michelle Zhang, MD, Montreal, QC (*Presenter*) Nothing to Disclose
Simon Sun, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Ann E. Aldis, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Sarkis Meterissian, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Benoit D. Mesurolle, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this project is to assess the impact of pre-operative breast MRI on surgical waiting time (defined as from the time of biopsy to the time of surgery), and to identify possible factors contributing to the delay in management, specifically in a publicly

funded healthcare system.

METHOD AND MATERIALS

This is a retrospective cohort study that includes 1265 patients. Patients evaluated for pre-operative planning for newly diagnosed breast cancer from 2007 to 2013 at a tertiary center were divided into 2 groups: those who had a pre-operative MRI and those who did not (control group). Linear regression using matched populations was then used to compare the surgical waiting time between the 2 patient groups. Potential influences on surgical waiting time and subgroup analysis of the pre-operative MRI patient group were obtained using median regression analysis and Kruskal-Wallis test respectively.

RESULTS

There was a statistically significant increase ($p < 0.001$) in the surgical waiting time for the MRI group, after matching for confounding characteristics such as age, pathology and surgeon. The mean surgical waiting time for patients having had a pre-operative breast MRI was 57.9 days (95% CI: 55.6-60.1) compared to the control group which was 47.0 days (95% CI: 45.1-48.9). Increased surgical waiting time was associated with more favorable pathology (i.e. DCIS), later year of diagnosis (e.g. 2013 vs. 2007) and older patient age. Second-look ultrasound and subsequent biopsies were also associated with a statistically significant increase in surgical waiting time ($p=0.001$). Within the different subgroups of patients who underwent pre-operative MRI, surgical waiting time was mostly affected by the waiting time from MRI to the time of surgery, rather than from time of cancer diagnosis to MRI ($p<0.0005$).

CONCLUSION

Pre-operative breast MRI increased surgical waiting time on average from 47.0 to 57.9 days. The waiting time length also correlated with histology, year of diagnosis, patient's age and second-look US/biopsy. A main contributor to the waiting time was the delay between completion of the MRI to surgery, rather than from the delay between initial diagnosis to MRI.

CLINICAL RELEVANCE/APPLICATION

Pre-operative breast MRI in a publicly funded system may increase surgical waiting time; this increase is in large part due to the wait time from MRI to surgery, rather than the MRI waitlist time.

SSQ01-06 Integrated Axillary Lymph Node (ALN) Screening during Pre-operative Breast MRI

Thursday, Dec. 3 11:20AM - 11:30AM Location: E450A

Participants
Sabine M. Detering, Aachen, Germany (*Presenter*) Nothing to Disclose
Simone Schrading, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Timm Dirrichs, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

According to the ACOSOG Z001 trial, axillary lymph node dissection (ALND) does not improve survival in women with positive sentinel lymph nodes (SLN). Therefore, an increasing number of women with positive SLNB do not proceed to ALND. However, this could lead to (axillary) relapse in patients with undetected advanced ALN disease. Purpose of this study was to analyze whether a short additional pulse sequence, integrated into our routine pre-operative breast MRI protocol, is sufficient to detect such ALN disease.

METHOD AND MATERIALS

218 women with biopsy-proven invasive breast cancer underwent preoperative MRI at 1.5 T. The standardized protocol included a pre-contrast coronal T1w-TSE-sequence acquired with the system's built-in body coil and prescribed to cover the axilla, TR/TE 550/15ms, FOV: 370 mm, scan time: 3 min. Two radiologists rated the likelihood of ALN metastasis on a 4 point scale ranging from 1 = definitely absent to 4 = definitely positive. Results of axillary surgery served as standard of reference.

RESULTS

Histology revealed that 80/218 (37%) patients were node-positive, 138/218 (63%) were node-negative. Of the 80 node-positive, 52 (65.0%) were staged pN1 (up to 1-3 ALN with micromets or 1 macrometastasis > 2 mm), whereas 28 (35.0%) had significant nodal disease, defined as all pN stages > pN1. Of the 28 patients with significant nodal disease, MRI classified 25 (89.3%) correctly as node positive. Stratified by nodal stages, MRI had a sensitivity of 7% (1/15) for pN1mic, 54% (22/41) for pN1a-c, 86% (12/14) for pN2 and of 100% (10/10) for pN3. MRI correctly excluded presence of ALN metastases in 127/138 patients (specificity: 92.0%).

CONCLUSION

A fast, 3-minute, additional T1-w MRI of the axilla as part of routine pre-operative breast MRI seems useful for complimentary staging of the axilla in addition to SLNB: MRI has predictably a poor sensitivity for ALN micrometastases - i.e. information on disease that is needed for accurate stage categorization, but not requiring specific treatment, and information that will be provided by SLNB. SLNB alone will, in turn, be unable to detect clinically significant ALN disease outside the sentinel node - a task that appears to be accomplished by MRI.

CLINICAL RELEVANCE/APPLICATION

A fast MRI of the axilla, as part of routine pre-operative breast MRI, seems suitable to complement SLNB in order screen the axilla for clinically important axillary node disease.

SSQ01-07 Kinetic Analysis of the Ultra Early Phase on Breast MRI: Comparison between Benign and Malignant Lesions using Ultrafast Dynamic Contrast Enhanced MRI

Thursday, Dec. 3 11:30AM - 11:40AM Location: E450A

Participants
Hiroyuki Abe, MD, Chicago, IL (*Presenter*) Consultant, Seno Medical Instruments, Inc
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Keiko Tsuchiya, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
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David V. Schacht, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Federico Pineda, BS, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Gregory S. Karczmar, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the kinetic data of benign and malignant breast lesions in ultra early phase after contrast injection, using a whole breast ultrafast scanning technique.

METHOD AND MATERIALS

15 patients (10 benign and 10 malignant breast lesions) were scanned with an acquisition protocol of Ultrafast MRI, consisting of 5 pre and 8 post-contrast bilateral, fat-suppressed T1 weighted images of whole breasts, with temporal resolution of 7 second followed by four regular whole breast acquisitions with temporal resolution of 75 second with Philips Achieva 3T-TX with a dedicated 16 channel bilateral breast coil. Spatial resolution of the ultrafast scan was 1.5 x 1.5 x 3 mm3; for the standard protocol spatial resolution was 0.8 x 0.8 x 1.6 mm3. Kinetic curves of each lesion during the ultrafast phase (0 - 56 sec) were assessed with a commercially available CAD system (Dynacad) in terms of initial enhancement ratio (IER), peak enhancement ratio (PER) and curve shape (persistent, plateau, or wash-out). IER was obtained at the second phase after the lesion was visualized. To make the kinetic curve, the time-point for the early phase was set at the second phase after the lesion was visualized, and the late phase was set at the last phase of ultrafast scan.

RESULTS

Statistically significant differences between benign and malignant lesions were obtained. IER of benign lesions ranged from 32% to 117% (mean 68%), and that of malignant lesions ranged from 107% to 241% (mean 149%) (p<.001). PER ranged from 48% to 163% (mean 107%), and that of malignant lesions ranged from 147% to 268% (mean 184%) (p<.001). As for curve shape, all benign lesions showed persistent type kinetics except for one lesion that had plateau type kinetics. For malignant lesions, 6 had persistent type kinetics and 3 had plateau type kinetics.

CONCLUSION

Kinetic analysis of the ultra early phase is useful for differentiation between benign and malignant lesions.

CLINICAL RELEVANCE/APPLICATION

Ultrafast MRI, which is less influenced by background parenchymal enhancement, could be more clinically useful with the inclusion of kinetic assessment.

SSQ01-08 Prediction of Indolent Hormone Receptor-Positive Breast Cancer Using Perfusion Parameters and Apparent Diffusion Coefficient

Thursday, Dec. 3 11:40AM - 11:50AM Location: E450A

Participants
SoHee Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hee Jung Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hak Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ki Chang Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joo Hee Cha, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Young Chae, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Jung Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether perfusion parameters and apparent diffusion coefficient (ADC) were useful for the prediction of indolent tumor with very favorable prognostic factors.

METHOD AND MATERIALS

This prospective study was approved by institutional review board and the informed consent was obtained. We enrolled 87 patients with 91 tumors patients (mean, 49.6 years; range, 29-74 years) who underwent definitive surgery. We defined estrogen receptor-positive tumors with low histologic grade, low Ki67 (<14%), and negative lymph node metastasis as an indolent tumor. We compared these indolent tumors (n=33; 36%) with the others (n=58; 64%) using perfusion and diffusion parameters. Statistical analysis was performed using Fisher's exact test, Chi-square test, and t test. Receiver operating characteristic (ROC) curve and logistic regression analysis was performed to evaluate the diagnostic performance of perfusion and diffusion parameters for the prediction of indolent tumors.

RESULTS

On univariate analysis, wash-in and iAUCqualitative values were significantly different according to the histologic grade, estrogen receptor, HER-2, Ki67 and lymphovascular invasion (P<.05 for all variables). ADCdiff was significantly different according to the histologic grade, HER-2, and Ki67 (P=.010, .007, and .013). On multivariate analysis, Ktrans, iAUCqualitative, and ADCdiff were the significant variables for the prediction of indolent tumors, and the AUC was 0.78, which was higher than those of individual parameter. Mean ADC was positively correlated with wash-out (r=0.350, P=.001), and negatively correlated with Kep (r= -0.207, P=.048). ADCdiff was positively correlated with wash-in (r = 0.263) and iAUCqualitative (r = 0.245) (P=.012 and .019), respectively.

CONCLUSION

The prediction model using Ktrans, iAUCqualitative, and ADCdiff on DCE-MRI and DWI could be helpful for the identification of indolent tumors and may be used as an imaging biomarker to guide treatment plan.

CLINICAL RELEVANCE/APPLICATION

Prediction of indolent tumors with very favorable prognostic features using preoperative breast MRI could help oncologists or

surgeons to decide the treatment plan such as neoadjuvant endocrine therapy or immediate surgery omitting chemotherapy.

SSQ01-09 Early-stage Invasive Breast Cancer: Association of Tumor Apparent Diffusion Coefficient Values with Axillary Lymph Node Metastasis

Thursday, Dec. 3 11:50AM - 12:00PM Location: E450A

Participants
Jin You Kim, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Shinyoung Park, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Il Moon, MD, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ji Won Lee, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Suk Kim, MD, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate any association between tumor apparent diffusion coefficient (ADC) values and axillary node metastasis in early-stage breast cancer.

METHOD AND MATERIALS

The institutional review board approved this retrospective study, and waived the need for informed consent. Between May 2013 and November 2014, the records of 270 patients (mean age, 51.3 years; range, 23-85 years) with stages T1 and T2 breast cancer (mean tumor size, 2.2 cm; range, 0.5-5.0 cm) who underwent preoperative breast magnetic resonance imaging, including diffusion-weighted (DW) imaging with b values of 0 and 1,000 s/mm2 were reviewed. The ADC values of the breast tumors were measured and compared with clinicopathological variables. Receiver operating characteristic (ROC) curve and multivariate regression analyses were used to test the predictive power of the tumor ADC values with regard to axillary node metastasis.

RESULTS

Of the 270 patients, 58 (21.5%) experienced axillary lymph node metastasis. The mean tumor ADC values were significantly lower in patients with axillary node metastasis versus those without metastasis (0.880×10-3 vs. 0.999×10-3 mm2/s; $P < 0.001$). A ROC curve demonstrated a tumor ADC value of 0.991×10-3 mm2/s to be the optimal cut-off for predicting axillary node metastasis. Multivariate regression analysis revealed that lower tumor ADC value (≤ 0.991×10-3 mm2/s; adjusted odds ratio (OR) = 5.861, $P < 0.001$) was an independent variable associated with axillary node metastasis, along with large tumor size (> 2 cm; adjusted OR = 3.156, $P = 0.002$) and presence of lymphovascular invasion (adjusted OR = 4.125, $P < 0.001$). When tumor ADC value was added to known risk factors (i.e., tumor size and lymphovascular invasion) a significant improvement in the accuracy of risk prediction for axillary node metastasis was shown (c-statistic = 0.758 vs. 0.816, $P = 0.026$).

CONCLUSION

Tumor ADC values obtained at DW imaging may be an independent predictive factor for axillary lymph node metastasis in patients with early-stage breast cancer.

CLINICAL RELEVANCE/APPLICATION

In early-stage breast cancer, tumor ADC values may be a predictor of axillary node metastasis, which may assist selection of therapeutic strategies regarding management of axillary nodes.

SSQ02

Cardiac (PET CT, PET MRI and SPECT)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S502AB

CA CT MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Rainer K. Rienmueller, MD, Graz, Austria (*Moderator*) Nothing to Disclose
Seth J. Kligerman, MD, Denver, CO (*Moderator*) Nothing to Disclose
W. Brian Hyslop, MD, PhD, Chapel Hill, NC (*Moderator*) Nothing to Disclose

Sub-Events

SSQ02-01 Optimal Scan Timing for Transluminal Attenuation-gradient Coronary CT Angiography Using a Contrast-material Flow Phantom

Thursday, Dec. 3 10:30AM - 10:40AM Location: S502AB

Participants
Yoshinori Funama, PhD, Kumamoto, Japan (*Presenter*) Nothing to Disclose
Toshiaki Shimonobo, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Shirasaka, BS, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Daisuke Utsunomiya, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Seitaro Oda, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group

PURPOSE

The transluminal attenuation gradient (TAG), the gradient of intraluminal radiological attenuation, is a novel index that improves the classification of coronary artery stenosis in coronary CT angiography (CCTA). However, the quantitative TAG value affected by the scan timing after the injection of contrast material because it is calculated from the difference between the pre- and post-stenosis CT numbers. Using a flow phantom and a 320-MDCT volume scanner we investigated the quantitative TAG value at different scan timing points after contrast material injection for coronary CT angiography.

METHOD AND MATERIALS

Using a contrast-material flow phantom we performed one-volume scans on a 320-MDCT volume scanner (Aquilion ONE ViSION, Toshiba). We employed two types of connecting tubes mimicking 0% and 70% stenosis. The heart rate (HR) was set at 60 bpm, cardiac output at 2.0 and 4.0 l/min; the injection volume of contrast material was 40 ml delivered in the course of 10 sec. Flushing was with 20 ml of physiological saline. The tube voltage and rotation time were 120 kVp and 275 msec. Acquisition of the 80-mm coverage area (160 x 0.5 mm) along the z-axis was started 5.0 sec post-injection and repeated at 0.5 sec intervals for 40 sec with no table movement. We measured the CT numbers on the same slice level and calculated the time density curve (TDC) for 40 sec at 0.5-sec intervals. The TAG value was also calculated from the difference in the CT number obtained at 0% and 70% stenosis at each time point.

RESULTS

At 70% stenosis and a cardiac output of 2.0 l/min, the time to peak enhancement (PE) from the arrival time was 15.5 sec. In contrast, the time from the arrival time for the lowest TAG value was 6.5 sec at -6.6 Hounsfield units (HU)/cm, i.e. 9.0 sec earlier from the time to PE. At the same time point of 6.5 sec from the arrival time, The TAG value at 0% stenosis was -1.4 HU/cm. At 70% stenosis and a cardiac output of 4.0 l/min, the time for the lowest TAG was 6.0 sec earlier and the TAG value was -4.0 HU/cm; it was -1.7 HU/cm at 0% stenosis.

CONCLUSION

The TAG value depends on the scan timing after contrast material injection and optimal scan timing dose not correspond to the time to peak enhancement.

CLINICAL RELEVANCE/APPLICATION

The time to PE differs by 6.0-9.0 sec when the TAG value is obtained with optimal scan timing on a 320-MDCT volume scanner.

SSQ02-02 Feasibility Study of Low Tube Voltage (80kVp) Coronary CT Angiography with Knowledge Based Iterative Reconstruction on Patients with BMI 20-25

Thursday, Dec. 3 10:40AM - 10:50AM Location: S502AB

Participants
Fan Zhang, PhD, Sanya, China (*Presenter*) Nothing to Disclose
Li Yang, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the feasibility of low tube voltage (80kVp) coronary CT angiography with knowledge based iterative reconstruction (IMR, Philips Healthcare) on BMI20-25 patients by comparing to images acquired with clinical routine protocols.

METHOD AND MATERIALS

Coronary CT angiography scans were acquired using a 256-slice MSCT (Brilliance iCT, Philips Healthcare) on 94 patients with body

mass index (BMI, 20-25 kg/m2) who were randomly assigned into 2 groups. The scan protocol for group 1 was 100kVp, 600mAs with 70ml contrast medium at an injection rate of 4.5 to 5.5ml/s, and images were reconstructed by a hybrid iterative reconstruction technique (iDose4, Philips Healthcare), while the protocol for group 2 was 80kVp, 600mAs with 35ml contrast medium at an injection rate of 3.5 to 4.5ml/s, and images were reconstructed with IMR. The mean image noise and CNR of different groups were measured on CT images and compared using the paired-t test. In addition, image quality evaluation was performed by two radiologists who were blinded to scan protocol, using a five-point scale (1 [poor] to 5 [excellent]).The results of the two groups were compared between two groups with the Mann-Whitney U-test.

RESULTS

Compared to group 1, group 2 reduced the iodine delivery rate by 52.4% from 2.1±0.5 gI/s to 1.0±0.5 gI/s and the effective radiation dose by 56.4% from 5.5±1.4 mSv to 2.4±1.2mSv. The mean CT attenuation, CNRs and image quality of all segments on group2 were significantly improved compared to those on group2 (all, $p<0.01$).

CONCLUSION

By using of knowledge based iterative reconstruction technique, an ultra-low tube voltage combining with low contrast medium protocol for cCTA can reduce both radiation dose and contrast medium dose with even better image quality.

CLINICAL RELEVANCE/APPLICATION

The use of 80kV-IMR with low injection dose protocols offers even lower image noise and better image quality especially of distal segments despite a 56.4% radiation dose reduction and a 52.4% contrast medium dose reduction when compared to 100kV-HIR with standard injection dose protocols on non-obese patients.

SSQ02-03 Myocardial Triglyceride and Left Ventricular Systolic Function: A Cross-Sectional CMR Study in Post-Acute Hospitalization Heart Failure Patients

Thursday, Dec. 3 10:50AM - 11:00AM Location: S502AB

Participants
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Jiun-Jie Wang, Taoyuan City, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Koon-Kwan Ng, Guishan, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Shu-Hang Ng, MD, Taoyuan, Taiwan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Myocardial triglyceride (TG) is related to increased risk of heart disease. However, its relation with cardiac function in recovery status of acute heart failure (HF) has not been investigated. We aim to study the association between myocardial TG content measured on magnetic resonance spectroscopy (1H-MRS) and left ventricular (LV) function revealed on cardiac MR (CMR) in post-acute hospitalization HF patients.

METHOD AND MATERIALS

We enrolled 50 HF patients discharged from acute hospitalization 6-12 month ago and recruited 21 age- and gender-matched normal controls. Myocardial TG content as well as the left ventricular (LV) function and LV mass was measured by using a 3.0 T MR system. Myocardial TG resonances, comprising fatty acid (FA) and unsaturated fatty acid (UFA), were analyzed and normalized with water (W) signal by using the LC-Model algorithm. According to their LV ejection fraction (LVEF) at the time of CMR examination, our patients was dichotomized into the low LVEF group (LVEF < 50%) and the normal LVEF group (LVEF >= 50%).

RESULTS

There were 48 patients and 21 controls with successful 1H-MRS available for analysis. Among our 48 patients, 25 had their low LVEF (mean, 31.2%) while the other 23 had normal LVEF (mean, 60.2%). Myocardial UFA/W, but no TG/W or FA/W, showed significant differences among the low LVEF group, the normal LVEF group and the control group (7.9% vs 2.1% vs 1.4%, $p = 0.02$).Myocardial UFA/TG was strong correlated with LV mass ($r = 0.39$, $p < 0.001$) and margninally correlated with LV end-diastolic volume (LVEDV) ($r = 0.24$, $p = 0.039$), while myocardial FA/TG was negatively correlated with LV mass ($r = -0.39$, $p < 0.001$) and LVEDV ($r = -0.24$, $p = 0.039$).

CONCLUSION

Increased myocardial UFA was observed in post-acute hospitalization HF patients as compared with controls, with a significantly higher level of UFA in the low LVEF group than in the normal LVEF group. Myocardial UFA was strong correlated with LVEDV, LV mass and, to a lesser degree, cardiac output. We believe that metabolic imaging for measurement of myocardial UFA content by 1H-MRS may be useful for noninvasively evaluation for HF patients post-acute hospitalization.

SSQ02-04 13N-ammonia PET/MR Myocardial Stress Perfusion Imaging Early Experience

Thursday, Dec. 3 11:00AM - 11:10AM Location: S502AB

Participants
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Agus Priatna, PhD, Ballwin, MO (*Abstract Co-Author*) Research Consultant, Siemens AG Employee, Siemens AG
Robert J. Gropler, MD, Saint Louis, MO (*Abstract Co-Author*) Advisory Board, Bracco Group Advisory Board, GlaxoSmithKline plc Advisory Board, Pfizer Inc Advisory Board, Bayer AG Research Grant, GlaxoSmithKline plc Research Grant, Pfizer Inc Research Grant, Clinical Data, Inc Research Grant, Lantheus Medical Imaging, Inc
Pamela K. Woodard, MD, Saint Louis, MO (*Abstract Co-Author*) Research Consultant, Bristol-Myers Squibb Company; Research Grant, Astellas Group; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Bayer AG; Research agreement, Siemens AG; Research Grant, Actelion Ltd; Research Grant, Guerbet SA; ; ;

PURPOSE

Simultaneous acquisition Positron Emission Tomography/Magnetic Resonance (PET/MR) is a new technology with potential use in cardiac perfusion imaging. Pharmacologic stress perfusion imaging with 13N-ammonia-PET and MR have previously been validated separately for detection of coronary artery disease (CAD). In this pilot study, we optimize a protocol for comprehensive cardiac PET/MR stress perfusion imaging, and evaluate its diagnostic accuracy for CAD when compared to GSPECT-MPI.

METHOD AND MATERIALS

15 patients with reversible myocardial perfusion defect on GSPECT-MPI for whom standard of care coronary angiography was planned were recruited. Patients received 400mcg Regadenoson, followed 30 seconds later by simultaneous 13N-Ammonia-PET (10.2 +/- 0.46 mCi) and gadolinium-based (0.075 mmol/Kg) contrast MR perfusion imaging. The procedure was repeated at rest. PET attenuation correction μ-map was a dual echo VIBE Dixon sequence. PET images were reconstructed with 3D-OSEM (Ordered Subset Estimation Maximization) with 3 iterations, 21 subsets and post-Gaussian filter of 4 mm. The presence and absence of ischemia and infarction were assessed by two independent readers. Areas of decreased perfusion on MRI were correlated to PET myocardial blood flows (MBF) as measured by 2-compartment modeling analysis.

RESULTS

PET/MR demonstrated excellent concordance with coronary angiographic findings. In this small data set, when compared to GSPECT-MPI, combined PET/MR demonstrated superior diagnostic accuracy (69% vs 54%). The inter-reader concordance was 77%. Using PET/MR as a diagnostic tool for CAD, in this small cohort, there is a 100% sensitivity, 100% negative predictive value, and a 64% positive predictive value.

CONCLUSION

Early experience with 13N-PET/MR perfusion imaging showed excellent diagnostic accuracy, sensitivity and specificity for CAD detection.

CLINICAL RELEVANCE/APPLICATION

Perfusion PET/MR offers a comprehensive myocardial ischemic evaluation. Potential benefits including shorter exam time than SPECT, lower radiation dose, absolute myocardial blood flow quantification, and internal validation between PET and MR findings.

SSQ02-05 Doppler-Ultrasound in Comparison to Electrocardiogram and Pulse Oximetry for Gating Cardiac MRI at 3T

Thursday, Dec. 3 11:10AM - 11:20AM Location: S502AB

Participants
Fabian Kording, Hamburg, Germany (*Presenter*) Nothing to Disclose
Jin Yamamura, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gunnar K. Lund, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Friedrich Uberle, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Caroline Jung, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Bjoern Schoennagel, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Electrocardiogram (ECG) triggering for cardiac magnetic resonance (CMR) may be influenced by magnetic interferences with increasing magnetic field strength. Doppler Ultrasound (DUS) is not objected to magneto-hydro-dynamic effects (MHD) and does not interact with the electromagnetic field of the MRI. The purpose of this study was to evaluate the performance of Doppler ultrasound (DUS) as a trigger technique for CMR in comparison to ECG and pulse oximetry (POX) at 3 Tesla.

METHOD AND MATERIALS

Balanced Turbo Field Echo 2D short axis cine CMR and 2D phase-contrast angiography of the ascending aorta was performed in 11 healthy volunteers using ECG, DUS and POX for CMR. The E-wave in early diastole was selected for DUS trigger time points to obtain a marker for quiescent heart phases which were subsequently compared to quiescent heart phases determined manually based on ECG triggered cine images by two observer. Trigger signals were recorded simultaneously in reference to standard ECG trigger signals and compared in terms of trigger quality. Image quality was assessed by endocardial border sharpness (EB) and functional assessment in terms of LV volumetry and aortic blood flow velocimetry.

RESULTS

The mean sensitivity of trigger recognition for all sequences was similar between DUS (99±1%), ECG (99±1%) and POX (99±1%). DUS trigger points correlated strong with manually determined cardiac quiescence (R=0.9, Obs. 1; R=0.9, Obs. 2). Mean EB averaged over the entire cardiac cycle was similar for ECG, DUS and POX with no significant differences (pECG/DUS = 0.6; pECG/POX = 0.5; pDUS/POX = 0.8). Early diastolic EB was significantly reduced for DUS compared to ECG (pECG/DUS = 0.007) and POX (pDUS/POX=0.03), but not for ECG versus POX (pECG/POX=0.3). Mean EDV (pECG/DUS=0.8, pECG/POX=0.7), ESV (pECG/DUS=0.9, pECG/POX=0.6) and mean aortic velocity (pECG/DUS=0.6, pECG/POX=0.6) were not significantly different.

CONCLUSION

This study demonstrated the feasibility of DUS for gating human CMR at 3T. With the benefit of not being influenced by

This study demonstrated the feasibility of DUS for gating human CMR at 3T. With the benefit of not being influenced by electromagnetic interferences DUS may offer an alternative trigger technique at high magnetic field environments.

CLINICAL RELEVANCE/APPLICATION

Doppler ultrasound measures physiological motion of the heart rather than electrical activation and, hence, may enable a more accurate gating, especially for higher field strength.

SSQ02-06 Hybrid Cardiac 18F-FDG PET/MRI in Patients with Suspected Myocarditis

Thursday, Dec. 3 11:20AM - 11:30AM Location: S502AB

Awards
RSNA Country Presents Travel Award

Participants
Felix Nensa, MD, Essen, Germany (*Presenter*) Nothing to Disclose
Ercan Tezgah, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Thorsten D. Poeppel, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Juliane Schelhorn, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Kai Nassenstein, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas W. Schlosser, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic performance of hybrid 18F-FDG PET/MRI in comparison to late gadolinium-enhancement (LGE) and T2-weighted imaging in patients with suspected myocarditis.

METHOD AND MATERIALS

A total of 60 consecutive patients (24 female, age: 35±13 y) with suspected myocarditis were prospectively assessed using integrated cardiac 18F-FDG PET/MRI (mMR Biograph, Siemens Healthcare). The MR imaging protocol consisted of functional cine images, T2-weighted triple inversion recovery images and LGE images 10 minutes after injection of gadobutrol. PET data acquisition was performed simultaneously to MR imaging. Physiological glucose uptake in the myocardium was suppressed with a high-fat, low-carbohydrate diet and i.v. administration of unfractionated heparin. Consent diagnosis by three experienced cardiologists, who were blinded to PET/MR data, was used as standard of reference.

RESULTS

PET/MRI examination was successful in 50 of 60 enrolled patients: 2 patients were excluded due to incomplete PET/MRI examinations because of claustrophobia, 8 patients were excluded due to failed inhibition of physiological myocardial glucose uptake. No significant difference in left ventricular ejection fraction was found between patients with clinical evident myocarditis and those clinically diagnosed as not having myocarditis (59.2±7.2% vs. 60.3±12.8%, p=0.298, n=50). Sensitivity and specificity of LGE for the detection of clinically evident myocarditis were 71% and 88% (80% accuracy). Sensitivity and specificity of T2-weighted imaging for the detection of clinically evident myocarditis were 58% and 88% (74% accuracy). Sensitivity and specificity of PET for the detection of clinically evident myocarditis were 75% and 88% (82% accuracy). Odd ratios for the detection of myocarditis were 5.5 for LGE, 5.0 for T2-weighted imaging and 7.0 for PET. Of all combinations, the best diagnostic performance was obtained when at least one of three parameters (LGE, T2, PET) was positive in the same patient yielding 92% sensitivity, 81% specificity, and 86% diagnostic accuracy.

CONCLUSION

Hybrid 18F-FDG PET/MRI can improve the non-invasive diagnosis in patients with suspected myocarditis.

CLINICAL RELEVANCE/APPLICATION

FDG PET/MRI might guide the therapeutic strategy in patients with suspected myocarditis by providing a more accurate diagnosis and - with FDG uptake - a surrogate parameter for the activity of inflammation.

SSQ02-07 Correlating Corrected Coronary Opacification Gradients to PET Myocardial Perfusion: CT Angiography in Functional Assessment of Coronary Lesions

Thursday, Dec. 3 11:30AM - 11:40AM Location: S502AB

Participants
Leonid Chepelev, MD,PhD, Ottawa, ON (*Presenter*) Nothing to Disclose
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Benjamin Chow, MD, Ottawa, ON (*Abstract Co-Author*) Research Grant, General Electric Company Support, TeraRecon, Inc
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation;

PURPOSE

To explore the potential use of corrected coronary opacification (CCO) gradients in predicting functional severity of coronary artery disease as assessed by PET myocardial perfusion imaging.

METHOD AND MATERIALS

We retrospectively evaluated 42 consecutive patients who underwent CCTA and 82Rb PET MPI within 180 days of each other. CCO was defined as mean coronary intraluminal attenuation normalized to mean aortic attenuation within the same axial slice. Coronary artery geometries and corresponding CCO measurements were automatically derived based on expert vessel centerline annotations with a 1.5mm diameter cutoff and fused with PET perfusion polar maps using software developed by our group in Java and MATLAB. CCO gradients, corrected and uncorrected by coronary artery diameter, were measured in the distal, proximal, and entire coronary

arteries, excluding non-diagnostic, calcified, stenotic, and stented regions. The CCO gradients were correlated to PET myocardial perfusion in the immediate vessel vicinity and projected perfusion territory of a given vessel.

RESULTS

The maximal Pearson correlation coefficients were observed when considering distal 40% vessel segments and immediately adjacent (±30 degrees on polar map) perfusion territories while omitting calcific and stenotic vessel regions. For the correlation between CCO and PET myocardial perfusion in the immediate vicinity, this yielded absolute Pearson correlation coefficients of 0.71±0.18, 0.70±0.25, and 0.80±0.23 for LAD, LCX, and RCA respectively. Correction of CCO by vessel diameter at the distal 40% vessel segments yielded coefficients that were not significantly different: 0.70±0.20, 0.70±0.24, and 0.80±0.22, respectively.

CONCLUSION

The correlation between CCO gradients and PET MPI data supports their use in functional lesion assessment.

CLINICAL RELEVANCE/APPLICATION

Corrected coronary opacification gradients may supplement functional assessment of coronary artery lesions and potentially predict the functional status of the myocardium using existing CCTA data.

SSQ02-08 Quantitative Assessment of Diffuse Myocardial Fibrosis in Patients with Diabetic Cardiomyopathy by T1-Mapping: Correlates with Diabetic History

Thursday, Dec. 3 11:40AM - 11:50AM Location: S502AB

Participants
Xiao-Chun Zhang, Chongqing, China (*Presenter*) Nothing to Disclose
Shang Yongning, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose
Jun Zhao, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose
Tianjing Zhang, Beijing, China (*Abstract Co-Author*) Employee, Siemens AG
Jian Wang, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to use cardiac magnetic resonance (CMR) T1-mapping technique to evaluate diffuse myocardial fibrosis and to explore its relationship with diabetic history.

METHOD AND MATERIALS

Thirty three patients with diabetic cardiomyopathy (DCM) (16 men, 17 women, mean age 46±8 years) and 48 healthy controls were performed in Siemens Trio 3.0T, the WIP sequence. T1 Mapping was used for measurement of T1 values, ECV values were calculated from pre and post T1 values. The results' correlation with patients' diabetic history were analyzed as well.

RESULTS

Pre-contrast myocardial T1 time and myocardial extracellular volume (ECV) in patients with DCM was significantly higher than the measurement in control cases, and post-contrast myocardial T1 time in DCM patients was significantly lower than that in control cases ($p<0.001$, respectively). In DCM patients, diabetic history was correlated with pre-contrast T1, ECV and post--contrast T1 ($r=0.92$, 0.95 and -0.93, respectively. $p<0.001$).

CONCLUSION

Diffuse myocardial fibrosis in patients with DCM can be assessed by CMR T1-mapping. The study results demonstrate that increased diabetic history is likely to be a major contributor to the severity of diffuse myocardial fibrosis.

CLINICAL RELEVANCE/APPLICATION

As a new imaging modality, CMR T1-mapping can provide four dimensional data to quantitatively assess the severity of diffuse myocardial fibrosis in DCM patients, which is useful for the clinical decision.

SSQ02-09 Rate of Incidental Findings at Myocardial Perfusion Scintigraphy

Thursday, Dec. 3 11:50AM - 12:00PM Location: S502AB

Participants
Andrea O. Vergara Finger, MD, Burlington, VT (*Presenter*) Nothing to Disclose
Sean Reynolds, MD, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose
Janusz K. Kikut, MD, Burlington, VT (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The SNMMI/ASNC/SCCT consensus guidelines on cardiac SPECT/CT and PET/CT advocate for reporting of incidental findings (IF) on noted on PET/CT and SPECT/CT and SPECT cardiac imaging. However, the definition of a reportable incidental finding is left to the discretion of the interpreting physician. The incidence of IF is reported at 34% in the literature; however, the incidence of clinically important findings is significantly lower, reported as around 5%. However, image quality is often quite different between SPECT/CT and PET/CT with image quality substantially better for the latter. We retrospectively evaluated the rate of IF defined as an unknown or potentially unknown new diagnosis and compared the rate in SPECT/CT as compared to PET/CT to see if the improved image quality available at PET/CT affected the IF rate.

METHOD AND MATERIALS

A total of 10,520 Sestamibi SPECT/CT and Rb-82 PET/CT cardiac studies performed at our institution in from 2011-2014 were retrospectively evaluated by querying the dedicated IF field of a NM structured reporting database (Vericis, Merge Healthcare, Chicago, IL). All IF were evaluated by ABR certified readers. Only significant findings as determined by the interpreting radiologist were placed into the field. IF were categorized into those seen on the emission scan and those seen on CT.

RESULTS

IF were discovered on 370 (3.5%) of studies. Of these, 9 (0.08%) were noted on the emission scan, while 362 (3.4%) were noted on the CT. The rate on Sestamibi SPECT/CT was 166/9446 (1.7%) while the rate on Rb-82 PET was 204/1074 (19.0%).

CONCLUSION

IF considered significant by the interpreting radiologist are more prevalent in our practice than previously reported especially when CT quality approaches diagnostic quality as with PET/CT. On hybrid imaging, they are more common on the CT portion of the study than on the emission scan. This underscores the recommendation for reporting these findings and argues for having physicians familiar with conventional CT imaging interpret the CT portion of hybrid imaging studies.

CLINICAL RELEVANCE/APPLICATION

The majority of IF at hybrid cardiac imaging appear on CT, arguing for having interpreters experienced in conventional CT review the CT portion of the study.

SSQ03

Cardiac (General Topics II)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S504CD

CA CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Andre J. Duerinckx, MD, PhD, Washington, DC (*Moderator*) Nothing to Disclose
James C. Carr, MD, Chicago, IL (*Moderator*) Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA

Sub-Events

SSQ03-02 The Impact of Iterative Reconstruction on Detectability and Quantification of Calcifications in CT Coronary Calcium Scoring: Individual Lesion-by-lesion Comparison

Thursday, Dec. 3 10:40AM - 10:50AM Location: S504CD

Participants
Jelmer M. Wolterink, MSc, Utrecht, Netherlands (*Abstract Co-Author*) Research Grant, Pie Medical Imaging BV
Tim Leiner, MD, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, Bracco Group
Martin J. Willemink, MD, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Max A. Viergever, Utrecht, Netherlands (*Abstract Co-Author*) Research Grant, Pie Medical Imaging BV;
Ivana Isgum, PhD, Utrecht, Netherlands (*Presenter*) Research Grant, Pie Medical Imaging BV; Research Grant, 3mensio Medical Imaging BV;

PURPOSE

The amount of coronary artery calcium (CAC) as quantified in cardiac CT is a strong and independent predictor of cardiovascular events. Cardiac CT can be reconstructed using iterative reconstruction (IR), which reduces objective image noise compared with filtered back projection (FBP). We have investigated the impact of IR on the detectability and quantification of CAC lesions.

METHOD AND MATERIALS

The study included 101 consecutive patients who underwent non-contrast-enhanced ECG-triggered cardiac CT for CAC scoring (256-detector row CT, 120 kVp, 55 mAs). Five series with 3 mm slice thickness were reconstructed for each CT: one with FBP and four with increasing IR levels (iDose4 L1, L3, L5, L7). CAC lesions (>= 130 HU) in the FBP series were identified by an expert and matching lesions in the IR series were identified at corresponding locations. Calcium volume (in mm^3) and calcium mass (in mg) of matching lesions in different series were compared. The Friedman test (significance level $P < 0.05$) was used to analyze overall differences among series. The Wilcoxon signed-rank test with Bonferroni correction (significance level $P < 0.007$) was used to analyze pairwise differences between series.

RESULTS

The FBP series contained 416 CAC lesions with median (interquartile range) volume 16.0 (5.6-41.1) mm^3 and mass 3.3 (0.9-10.6) mg. Out of these, 14 (3%), 25 (6%), 35 (8%) and 42 (10%) lesions with volume/mass below 2.4 mm^3/0.4 mg, 4.7 mm^3/0.8 mg, 4.7 mm^3/0.8 mg, and 6.3 mm^3/0.9 mg were identified in the FBP series but not in the L1, L3, L5 and L7 series, respectively. For lesions identified in all series, calcium volume and mass differed significantly among series ($P < 0.05$). A significant reduction in calcium volume and mass was present between the FBP series and each IR series ($P < 0.007$), as well as between series with increasing IR levels ($P < 0.007$).

CONCLUSION

IR causes significant reductions in volume and mass of CAC lesions. Small low-density lesions are increasingly likely to be missed in CAC scoring when higher IR levels are used.

CLINICAL RELEVANCE/APPLICATION

CAC scoring in IR CT may underestimate cardiovascular risk, especially in patients with small low-density CAC lesions.

SSQ03-03 In vivo Coronary Artery Plaque Assessment with Computed Tomography Angiography – Is There an Impact of Iterative Reconstruction on Plaque Volume and Attenuation Metrics?

Thursday, Dec. 3 10:50AM - 11:00AM Location: S504CD

Participants
Zhongyi Chen, Montreal, QC (*Presenter*) Nothing to Disclose
Irina Boldeanu, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Simon Nepveu, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Madeleine Durand, MD,MSc, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
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Carl Chartrand-Lefebvre, MD, Montreal, QC (*Abstract Co-Author*) Equipment support, Koninklijke Philips NV; Equipment support, Bayer AG;
Claude Kauffmann, PhD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Gilles P. Soulez, MD, Montreal, QC (*Abstract Co-Author*) Speaker, Bracco Group Speaker, Siemens AG Research Grant, Siemens AG Research Grant, Bracco Group Research Grant, Cook Group Incorporated Research Grant, Object Research Systems Inc

Cecile Tremblay, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Coronary computed tomography (CT) angiography allows to evaluate coronary plaque characteristics, such as low attenuation (lipid-filled) component, and can impact on plaque vulnerability assessment and patient prognostication. The objective of the study is to determine the effect of iterative reconstruction (IR) on coronary plaque volume and composition assessment.

METHOD AND MATERIALS

Approval was obtained from Institutional Review Board and written consent from all subjects. Asymptomatic patients without known coronary artery disease were prospectively enroled for low-dose 256-slice CT. Images were reconstructed with both filtered back projection (FBP) and hybrid IR algorithm (iDose4, Philips) levels 1, 3, 5 and 7 (noise reduction 11, 23, 37, 56%, respectively). Noise, signal-to-noise (SNR) and contrast-to-noise ratio (CNR) in aorta and coronary arteries were measured. Coronary plaques were assessed using a Hounsfield unit (HU)-mapping method, according to five intervals: <51 HU, 51-100 HU, 101-150 HU, 151-350 HU and >350 HU. For each plaque, total absolute volume, absolute and percentage HU-interval volumes were calculated. ANOVA repeated-measure analyses were used.

RESULTS

Fifty-three patients (mean age 53.6 yo) were included. In comparison to FBP, IR reduced image noise ad 53%, increased SNR ad 111% and CNR ad 99% ($p<0.0005$, respectively). Plaque characterization performed in 35 patients for a total of 96 plaques showed a mean total plaque volume of 99.1±116.3 to 100.2±117.6 mm3 across all IR levels and FBP ($p=0.628$). In per-HU-interval analysis within the 101-150 HU interval, absolute plaque volume showed slight differences between FBP (11.7±12.6 mm3) and IR level 7 (10.8 ±11.7 mm3) ($p=0.03$) and between IR levels 5 (11.4±12.8 mm3) and 7 ($p=0.03$). For percentage volume, a slight difference was observed within the 101-150 HU interval between FBP (12.6± 5.1%) and IR level 7 (11.9±4.8%) ($p=0.04$). Absolute and percentage plaque volume was similar across other IR levels and HU-intervals.

CONCLUSION

Total coronary plaque volume measured at all IR noise reduction levels was similar to FBP. Plaque volumetric assessment in low HU-interval domains was slightly affected at high IR levels.

CLINICAL RELEVANCE/APPLICATION

Total coronary plaque volume with IR is similar to FBP. However low attenuation plaque volume, a marker for plaque vulnerability, is slightly modified at high IR levels.

SSQ03-04 Myocardial Involvement in Anderson Fabry Disease Can Be Assessed and Quantified Using Magnetic Resonance Post-contrast T1 Mapping

Thursday, Dec. 3 11:00AM - 11:10AM Location: S504CD

Participants
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Andreas M. Weng, Wurzburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Herbert Koestler, PhD, Wuerzburg, Germany (*Abstract Co-Author*) Research support, Siemens AG
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PURPOSE

Anderson Fabry disease (AFD) is a rare intracellular lipid disorder which can lead to LV-hypertrophy and myocardial fibrosis. We propose that besides late gadolinium enhancement (LGE), T1-mapping is a promising diagnostic tool in AFD allowing an early detection of cardiac involvement. Furthermore we suggest, that MRI findings correlate with serum biomarkers indicating myocardial damage.

METHOD AND MATERIALS

46 patients (20 LGE positive [group 1], 26 LGE negative [group 2]) with manifest AFD were examined. In addition, 28 healthy subjects were examined as a reference [group 3]. T1-mapping was performed with a modified Look-Locker IR sequence (MOLLI) at a 3T MR-scanner after i.v. gadolinium administration. Results were derived from 8 slices moving continuously from basal to apical. Separate ROIs were drawn in the anterior, inferior, septal, lateral and inferolateral wall. In addition, an average value from the entire myocardial ring (SAX) was acquired for each slice. Absolute T1 values were compared in between those three groups. In addition, T1 values of the patient groups were correlated with the biochemical markers NT-proBNP, Troponin T and lyso-Gb3.

RESULTS

Final results show visible changes in the T1-maps wherever fibrosis in the LGE imaging was observed. Absolute T1 values for several ROIs were significantly lower in group 1 compared to group 2 and 3 (inferolateral wall: $p<0.01$; others: $p<0.05$), even in areas where no fibrosis was detected by LGE imaging (anterior and septal wall). T1 mapping was not able to distinguish between LGE-negative patients and healthy controls. NT-proBNP and Troponin T levels were significantly higher in group 1 compared to group 2 ($p<0,01$). Lyso-Gb3 serum levels were elevated in 100% [group 1] and 86% [group 2] of patients, there was no significant difference in lyso-Gb3 values in between those groups.

CONCLUSION

Our data suggest that T1-mapping is a sensitive tool to detect early replacement fibrosis in AFD, and might be more sensitive than visual LGE analysis in the detection of regional myocardial involvement. Elevated levels of Troponin T and NT-proBNP indicate myocardial involvement and correlate with findings in cardiac MRI.

CLINICAL RELEVANCE/APPLICATION

T1 mapping may be useful to identify AFD patients with myocardial involvement. This method could be especially useful in follow up as it offers the possibility to absolutely quantify the extent of fibrosis and monitor therapy effects.

SSQ03-05 Image Quality of Cardiac Magnetic Resonance Imaging in Patients with an ICD System Designed for the MRI Environment

Thursday, Dec. 3 11:10AM - 11:20AM Location: S504CD

Participants
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Juerg Schwitter, MD, Lausanne, Switzerland (*Abstract Co-Author*) Research Consultant, Medtronic, Inc

PURPOSE

To evaluate the image quality performance of various cardiac MR pulse sequences in a clinical trial of patients (pts) implanted with an MR-conditional ICD system.

METHOD AND MATERIALS

The Evera MRI randomized clinical trial enrolled 275 pts from 42 centers world-wide. 263 pts were implanted with an Evera MRI single or dual chamber ICD and randomized to the MRI group (n=175) or control group (n=88). Per protocol 156 MRI pts underwent an MRI examination at 9-12 weeks post implant. Steady-state free precession (SSFP) and fast gradient echo (FGE) sequences were acquired each in short-axis (SA) and horizontal long axis (HLA) views to optimize image quality. Acquisitions with correct slice orientations on both, SA and HLA of at least one sequence type were graded for image quality using a 7-point scale (grade 1: excellent image quality, grade 6-7: non-diagnostic quality). Grades were analyzed by Generalize Estimating Equation. Presence and size of ICD- and lead-related artifacts were evaluated.

RESULTS

Complete cardiac MR data were obtained in 104 pts for SSFP covering the left ventricle (LV), in 89 pts for FGE on LV, in 103 pts for SSFP on the right ventricle (RV), and in 76 for FGE on the RV. The corresponding proportions of diagnostic image quality (grades 1-5) were 53% (55/104), 74% (66/89), 69% (71/103) and 84% (64/76), respectively. In 107 pts at least one evaluable sequence was obtained. The odds of having a better image quality (i.e. a lower grade) was greater for RV vs LV (OR: 1.8, 95% CI: 1.5-2.2, $p<0.0001$, regardless of sequence type) and greater for FGE vs SSFP (OR: 3.4, 95% CI: 2.5-4.7, $p<0.0001$, regardless of ventricle type). Compared to SSFP, the ICD-related artifacts on FGE were smaller (141.0±65 vs 75.3±56.7 mm, respectively, $p<0.0001$) irrespective of imaging plane. Lead artifacts were much smaller than ICD artifacts ($p<0.0001$); differences in lead artifact diameters between SSFP (8.3±3.3 mm) and FGE (10.2±3.2 mm) were small, but statistically significant ($p<0.0001$).

CONCLUSION

FGE produces better quality and smaller artifacts for cardiac MRI than SSFP in pts with an MRI ICD system. Diagnostic image quality is obtainable with FGE in 74% and 84% of studies of the LV and RV, respectively.

CLINICAL RELEVANCE/APPLICATION

Diagnostic image quality of cardiac MRI cine scans in patients with an ICD system designed for the MRI environment can be obtained in the majority of cases using fast gradient echo sequences.

SSQ03-06 Advanced Modelled Iterative Reconstruction (ADMIRE) in Coronary Computed Tomography Angiography (CCTA): Effect on Image Quality

Thursday, Dec. 3 11:20AM - 11:30AM Location: S504CD

Participants
Christina Kolb, Dresden, Germany (*Presenter*) Nothing to Disclose
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Michael Laniado, MD, Dresden, Germany (*Abstract Co-Author*) Reviewer, Johnson & Johnson
Ruth Strasser, 01307 Dresden, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose is to assess the effect of ADMIRE on image quality in CCTA.

METHOD AND MATERIALS

30 patients who underwent CCTA on a third generation dual source CT scanner were included in this retrospective study. CCTA datasets were reconstructed using filtered back projection (FBP) and increasing strength levels of ADMIRE 1-5. The signal-to-noise ratio (SNR) in the ascending aorta and the proximal part of both coronary arteries were determined for each data set. Furthermore, a qualitative evaluation of image quality was undertaken independently by two readers using a five-point scale. Repeated measures analysis of variance was used to compare SNR for different modes of image reconstruction. The Friedman test was applied to compare image quality scores.

RESULTS

CCTA was performed succesfully in all patients. In the ascending aorta, mean SNR (± SD) was 11.5 (± 4.3) in FBP, 12.9 (± 4.9) in ADMIRE 1, 14.5 (± 5.7) in ADMIRE 2, 16.3 (± 6.3) in ADMIRE 3, 19.4 (± 7.7) in ADMIRE 4 and 23.6 (± 10.6) in ADMIRE 5. In the proximal right coronary artery, mean SNR (± SD) was 13.2 (± 6.1) in FBP, 15.4 (± 7.0) in ADMIRE 1, 17.5 (± 7.9) in ADMIRE 2, 21.3 (± 10.5) in ADMIRE 3, 24.6 (± 12.3) in ADMIRE 4 and 30.1 (± 16.4) in ADMIRE 5. In the left main coronary artery, mean SNR was 11.7 (± 4.7) in FBP, 13.5 (± 5.8) in ADMIRE 1, 15.3 (± 6.4) in ADMIRE 2, 17.5 (± 7.1) in ADMIRE 3, 20.7 (± 8.2) in ADMIRE 4 and 25.1 (± 10.2) in ADMIRE 5. In the ascending aorta, the proximal RCA and the left main, higher strength levels of iterative reconstruction showed significantly higher SNR in comparison to all lower strength levels and FBP ($p < 0.001$ in all cases). Image quality scores improved significantly from FBP to ADMIRE 4 ($p < 0.05$) with each successive level of iterative reconstruction strength. However, image quality scores did not differ significantly between ADMIRE 4 and 5 datasets ($p > 0.05$).

CONCLUSION

ADMIRE significantly improves image quality in CCTA, both in regard to SNR and qualitative scores. However, as there was no significant difference between ADMIRE 4 and 5 for subjective image quality, this high strength levels can be used interchangeably, depending on the preference of the respective radiologist. As a consequence of our results, further dose reduction seems to be feasible in CCTA.

CLINICAL RELEVANCE/APPLICATION

As ADMIRE improves image quality compared to FBP, the use of ADMIRE has the potential for further reduction of CCTA radiation exposure while retaining adequate image quality.

SSQ03-07 Qualitative and Quantitative Evaluation of Myocardial Alterations by Grating-Based Phase-Contrast Computed Tomography

Thursday, Dec. 3 11:30AM - 11:40AM Location: S504CD

Participants
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PURPOSE

Grating-based phase-contrast computed tomography (gb-PCCT) relies on X-ray refraction rather than absorption to generate high-contrast images in biological soft tissue. The aim was to evaluate the potential of gb-PCCT for the depiction of structural changes in different cardiomyopathies.

METHOD AND MATERIALS

Samples of four human heart specimens from patients with hypertensive, ischemic and dilated cardiomyopathy and cardiac lipomatosis were examined. The gb-PCCT set-up consists of X-ray tube (40 kV, 70 mA), grating-interferometer and detector and allows the calculation of phase- and absorption-contrast data. Normal myocardium, fibrotic scars, diffuse interstitial fibrosis and fatty tissue were evaluated by visual inspection and quantitative absorption- and phase-contrast Hounsfield units (HUabs and HUp, respectively). Histopathology served as standard of reference. Measurements of diagnostic accuracy including sensitivity and specificity were calculated. Systematic differences in HUabs and HUp were assessed by ANOVA.

RESULTS

A total of 35 corresponding gb-PCCT and histopathology cross-sections were available. Normal myocardium was found in 35 (100%), fibrotic scars in 6 (17.1%), interstitial fibrosis in 7 (20%) and fatty tissue in 25 (71.4%) cross-sections and were accurately detected by gb-PCCT (sensitivity and specificity >90%). Mean HUp for normal myocardium, fibrotic scars, interstitial fibrosis and fatty tissue were 52.5, 86.6, 62.4 and -38.6. Corresponding mean HUabs were 54.1, 69.7, 62.3 and -258.9, respectively. We observed an overlap in HUabs for normal myocardium and interstitial fibrosis but not for HUp. Contrast-to-noise ratio was significantly higher in phase- than in absorption-contrast for myocardium/fat (32.7 vs. 7.2; $p<0.01$) and for myocardium/fibrotic scar (3.6 vs. 0.2; $p<0.01$).

CONCLUSION

Given its superior soft tissue contrast, gb-PCCT is able to depict structural changes in different cardiomyopathies, which can currently not be obtained by X-ray absorption based imaging methods.

CLINICAL RELEVANCE/APPLICATION

If current technical limitations can be overcome, gb-PCCT may evolve as a powerful tool for the anatomical assessment of cardiomyopathy.

SSQ03-08 Diagnostic Performance of Stress Perfusion Cardiovascular Magnetic Resonance with 1.5-T and 3-T Scanners in Comparison with Invasive Coronary Angiography

Thursday, Dec. 3 11:40AM - 11:50AM Location: S504CD

Participants
Sung Min Ko, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

3-T cardiovascular magnetic resonance (CMR) perfusion has shown higher diagnostic performance for detection of significant coronary artery disease (CAD) in comparison to 1.5-T perfusion. However, more data are needed for proving superiority of 3-T to 1.5-T perfusion. This study was aimed to compare the diagnostic performances of CMR perfusion at 1.5-T and 3-T in patients with suspected or known CAD.

METHOD AND MATERIALS

We prospectively enrolled 308 patients (221 men, 69.5±6.4 years) with suspected or known CAD. All patients were scanned at 1.5-T or 3-T including adenosine stress and rest perfusion and delayed enhancement imaging. Invasive coronary angiography (ICA) served as the reference method. Perfusion defects were interpreted visually by 2 radiologists with consensus. A coronary vessel was considered to be significantly stenosed if there was at least 1 segment with ≥ 70% lumen reduction.

RESULTS

The prevalence of CAD was 56%. Of 308 patients, 162 patients were scanned at 1.5-T and 146 patients at 3-T. Significant coronary stenoses and old myocardial infarction (MI) were found in 101 (62%) and 66 (41%) patients at 1.5-T and 70 (48%) and 27 (18%) patients at 3-T. Diagnostic accuracy, sensitivity, specificity, positive predictive value and negative predictive value for detection of significant coronary stenoses were 77%, 71%, 81%, 70%, and 82% at 1.5-T and 83%, 64%, 91%, 75%, and 86% at 3.0T. The diagnostic performance of 3-T perfusion imaging was not significantly greater than that of 1.5-T (area under receiver-operator characteristic [ROC] curve: 0.81 vs 0.76; p=0.159). The combined perfusion and delayed contrast enhancement CMR imaging did not provide incremental diagnostic value over perfusion CMR imaging only at both 1.5-T and 3-T in the diagnosis of CAD. In patients without old MI (n=215), diagnostic accuracy, sensitivity, specificity, positive predictive value and negative predictive value for detection of significant coronary stenoses were 80%, 57%, 84%, 44%, and 90% at 1.5-T and 85%, 60%, 92%, 69%, and 89% at 3-T. The diagnostic performance of 3-T perfusion imaging was significantly greater than that of 1.5-T (area under ROC curve: 0.79 vs 0.67; p=0.026).

CONCLUSION

3-T CMR perfusion imaging is superior to 1.5-T in detection of significant CAD in patients without old MI.

CLINICAL RELEVANCE/APPLICATION

3-T CMR perfusion is feasible to detect inducible myocardial ischemia consistent with significant CAD in clinical setting.

SSQ03-09 Comparison of the Plaque Attenuation Values on Non-enhanced- and Enhanced 320-row Coronary CT Angiographs Using a Subtraction Technique: In vivo Evaluation of the Effect of Intracoronary Attenuation on Coronary Plaque Measurements

Thursday, Dec. 3 11:50AM - 12:00PM Location: S504CD

Participants
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PURPOSE

The characterization of plaques based on their CT number is important for the detection of vulnerable atherosclerotic plaques. An earlier in vitro study showed that intravascular attenuation affected the attenuation of coronary atherosclerotic plaques. We attempted to validate this finding in vivo and here we introduce a new subtraction coronary CT angiography (CCTA) technique to address this issue.

METHOD AND MATERIALS

This prospective study received institutional review board approval; prior informed consent to participate was obtained from all patients. We performed subtraction CCTA on a 320-detector row CT scanner in 113 patients. Our inclusion criterion was 50-70% stenosis by non-calcified plaques in the proximal coronary artery. Patients with total occlusion and multi-vessel disease were excluded. Consequently, 30 patients (30 plaques) were included in this study. Two CT datasets, one with- and the other without coronary artery enhancement, were obtained to remove calcium from the images. The CT number of the plaque and the adjacent vessel lumen were measured in a circular region of interest (ROI) on curved planar reconstruction (CPR) images. The ROI setting was consistent between the two CT datasets. We performed linear regression analysis of the changes in the CT number (ΔHU) for the lumen and the plaque. We also evaluated the relationship between plaque attenuation on non-enhanced coronary artery images and luminal attenuation with and without contrast enhancement.

RESULTS

The ΔHU for the plaque and the lumen showed a strong correlation (r=0.62). There was no significant correlation between plaque attenuation on non-enhanced coronary artery images and luminal attenuation with and without contrast enhancement (r=0.14 and 0.2, respectively).

CONCLUSION

Intravascular attenuation modified the attenuation of coronary atherosclerotic plaques and CT images without coronary artery enhancement in subtraction CCTA may be helpful for the characterization of the plaques.

CLINICAL RELEVANCE/APPLICATION

Intravascular attenuation modified the attenuation of coronary atherosclerotic plaques in our in vivo validation study.

SSQ04

Chest (Pulmonary Nodule)

Thursday, Dec. 3 10:30AM - 12:00PM Location: E351

CH CT MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Christian J. Herold, MD, Vienna, Austria (*Moderator*) Nothing to Disclose

Sub-Events

SSQ04-01 Pulmonary Thin-Section MR Imaging with Ultra-Short TE vs. Low- and Standard-Dose Thin-Section CTs: Capability for Lung Nodule Detection and Nodule Type Evaluation

Thursday, Dec. 3 10:30AM - 10:40AM Location: E351

Participants
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PURPOSE

To compare the capability of pulmonary MR imaging with ultra-short echo time (UTE) for lung nodule detection and nodule type evaluation with thin-section low- and standard-dose CTs.

METHOD AND MATERIALS

170 consecutive patients (96 males: mean age, 70 years and 74 females: mean age, 70 years) with suspected pulmonary nodules at near-by hospital were examined with chest standard- and low-dose CTs (270 mA [SDCT] and 50 mA [LDCT]) and pulmonary MR imaging with UTE. According to standard-dose CT findings, all nodules were divided into solid and part-solid nodules and ground glass nodules. In each patient, probability of presence at each pulmonary nodule was assessed on all three methods by means of 5-point visual scoring system. To determine inter-observer and inter-method agreement for nodule detection, kappa statistics with $\chi 2$ test were performed. Then, ROC analyses were performed to compare detection capability among all methods. Finally, detection rate was compared each other by means of McNemar's test. To determine inter-observer and inter-method agreement for nodule type evaluation on each method, kappa statistics with $\chi 2$ test were also performed.

RESULTS

On nodule detection, inter-observer agreements on all methods ($0.81<\kappa<0.85$, $p<0.0001$) and inter-method agreement among all methods ($0.87<\kappa<0.96$, $p<0.0001$) were determined as almost perfect. Area under the curves (Azs) of all methods (SDCT: Az=0.97, LDCT: Az=0.96, MRI: Az=0.96) had no significant difference ($p>0.05$). In addition, detection rates of all three methods (SDCT: 92.0 [252/274] %, LDCT: 91.5 [247/270] %, and MRI: 91.5 [247/270] %) had also no significant difference ($p>0.05$). On nodule type assessment, inter-observer agreement of each method was almost perfect ($0.87<\kappa<0.91$, $p<0.0001$). In addition, inter-method agreements among all methods were also determined as almost perfect ($0.81<\kappa<0.89$, $p<0.0001$).

CONCLUSION

Pulmonary MR imaging with UTE is considered at least as valuable as low- and standard-dose CTs for lung nodule detection and nodule type evaluation.

CLINICAL RELEVANCE/APPLICATION

Pulmonary MR imaging with UTE is considered at least as valuable as low- and standard-dose CTs for lung nodule detection and nodule type evaluation.

SSQ04-02 Persistent Pulmonary Subsolid Nodules with Solid Parts of 5mm or Smaller: Their Natural Courses and Predictors for Interval Growth on Follow-ups

Thursday, Dec. 3 10:40AM - 10:50AM Location: E351

Participants
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PURPOSE

To investigate the natural courses of persistent pulmonary subsolid nodules (SSNs) with solid parts ≤5mm and the clinico-radiological predictors for their interval growth over follow-ups.

METHOD AND MATERIALS

From 2005 to 2013, natural courses of 213 persistent SSNs detected on chest CT (slice thickness ≤1.25mm) in 213 patients (mean age, 57.88 ± 10.38 years; range, 24-87 years) were evaluated in this study (median follow-up, 849 days; range, 90-2900 days). To identify significant predictors for interval growth, Kaplan-Meier analysis and Cox proportional hazard regression analysis were performed.

RESULTS

One-hundred thirty-six were pure ground-glass nodules (GGNs) (growth in 18; stable in 118) and 77 part-solid GGNs with solid parts ≤5mm (growth in 24; stable in 53). For 213 SSNs, lung cancer history (Hazard ratio (HR), 3.884; p=0.001), part-solid GGNs (HR, 3.570; p<0.001), and nodule diameter (HR, 3.576; p<0.001) were significant predictors for interval growth. In subgroup analysis, nodule diameter was an independent predictor for interval growth of both pure GGNs (HR, 6.620; p<0.001), and part-solid GGNs (HR, 2.749; p=0.037). For part-solid GGNs, lung cancer history (HR, 5.917; p=0.002) was another significant predictor for interval growth. The frequency of interval growth of pure GGNs ≥10mm (12.9%, 30.4%, 42.0%, 42.0%, 71.0% at 1, 2, 3, 4, 5 year's follow-up) and part-solid GGNs ≥8mm (11.5%, 38.0%, 43.6%, 78.9%, 78.9%) was significantly higher than those of pure GGNs <10mm (1.9%, 4.0%, 10.9%, 13.5%, 13.5%) (p<0.001) and part-solid GGNs <8mm (11.5%, 21.5%, 21.5%, 21.5%, 21.5%) (p=0.003), respectively.

CONCLUSION

Natural course of SSNs with solid parts ≤5mm was significantly different regarding their nodule types and nodule diameters, with which their managements can be subdivided.

CLINICAL RELEVANCE/APPLICATION

Nodule type and nodule diameter are significant predictors for interval growth of SSNs with solid parts ≤5mm, and managements of SSNs with solid parts ≤5mm can be categorized based on these predictors.

SSQ04-03 Ground Glass Nodule Detectability in Seven observers of Seventy-nine Clinical Cases: Comparison between Ultra-Low-Dose Chest Digital Tomosynthesis with Iterative Reconstruction and Chest Radiography by Receiver-Operating Characteristics Analysis

Thursday, Dec. 3 10:50AM - 11:00AM Location: E351

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PURPOSE

To compare ground glass nodules detectability (GGND) between ultra-low-dose chest digital tomosynthesis (ULD-CDT) with 2 different reconstruction algorithms and chest radiography (CR) by using low-dose computed tomography (LDCT) as the standard of reference (SOR).

METHOD AND MATERIALS

The Institutional Review Board approved this study and written informed consent was obtained. In a single visit each, 79 subjects underwent ULD-CDT at 120kV and 10mA, CR both in posterior-anterior and lateral direction and LDCT (effective dose: 0.081, 0.117 and 3.52 mSv, respectively). In each of 79 cases, 63 reconstructed coronal images were obtained using CDT (SONIALVISION Safire 17 radiography/fluoroscopy system, Shimadzu, Kyoto, Japan) with and without iterative reconstruction (IR). SOR as to GGN presence with the longest diameter (LD) of 3mm or more was determined based on LDCT images by consensus reading of two radiologists. Another seven radiologists independently recorded GGN presence and their locations by continuously-distributed rating. Receiver-operating characteristic (ROC) analysis and detection sensitivity (DS) was used to compare GGND of ULD-CDT with IR, ULD-CDT without IR and CR in total and subgroups classified by nodular LD (> or < 9mm) and CT attenuation value (CTAV) (> or < -600 Hounsfield of Unit (HU)). DS were also compared between any pairs of 4 sub-groups in each of three modalities using t-test.

RESULTS

For SOR, 105 GGNs were identified. The minimal and maximal LDs of GGN were 3.0 and 26 mm, respectively, with a mean LD of 8.56 mm. In total as well as any sub-group, GGND at ULD-CDT with IR was higher than either that at ULD-CDT without IR or CR, as area under ROC curve was 0.66 ± 0.02, 0.59 ± 0.01 and 0.52 ± 0.01, respectively ($p < 0.05$) . DS at ULD-CDT with IR in more attenuated GGNs (CTAV >-600 HU) was higher than that in less attenuated GGNs (47.5 ± 8.1% vs 26.6 ± 6.7%) ($p < 0.05$). DS at ULD-CDT with IR in larger GGNs (LD > 9mm) was higher than that in smaller GGNs (44.6 ± 7.7% vs 22.1 ±5 .4%) ($p < 0.05$).

CONCLUSION

ULD-CDT with IR demonstrated better GGND than that without IR or CR, with increased DS for larger or more attenuated GGNs.

CLINICAL RELEVANCE/APPLICATION

ULD-CDT with IR has a potential to be used for detection of larger and more attenuated GGN.

SSQ04-04 Breath-hold Lung MR Imaging for Nodule Detection: Combination of 3D mDixon and Black-blood Fat-saturated HASTE Sequences

Participants

Thursday, Dec. 3 11:00AM - 11:10AM Location: E351

Ryotaro Kamei, MD, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Yuji Watanabe, MD, Fukuoka, Japan (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV Research Grant, Bayer AG
Koji Sagiyama, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Kawanami, MD, Fukuoka, Japan (*Abstract Co-Author*) Research Grant, Bayer AG; Research Grant, Koninklijke Philips NV
Hiroshi Honda, MD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the diagnostic performance of breath-hold lung MR imaging as a part of whole-body PET/MR hybrid imaging with that of low-dose CT from PET/CT in the detection of nodular lesions.

METHOD AND MATERIALS

We included 21 consecutive patients who underwent diagnostic CT, PET/CT, and MR of the whole lung from August 2014 to March 2015. MR images were acquired using Ingenia 3.0T MR (Philips) or the 3.0T MR part of Ingenuity TF PET/MR (Philips). The MR protocol consisted of T1-weighted image (T1WI) with 3D modified Dixon (mDixon) sequence, and black-blood fat-saturated T2-weighted image (FS-T2WI) with Half-Fourier Acquisition Single-shot Turbo Spin-echo (HASTE) sequence. Both were performed with breath-hold, and the mean scan duration was 21.2 s for T1WI and 14.5 s (two stations) for FS-T2WI. Low-dose CT was performed under free breathing. Diagnostic CT images were used as the reference standard. The location, number, size, and characterization (solid, pure, or mixed ground-grass opacity [GGOs]) of nodular lesions were recorded. Two radiologists reviewed the MR and CT images from PET/CT in consensus, with an interval of one week. Lesion-based sensitivity and lung lobe-based specificity were calculated. Statistical analyses were performed with McNemar test and Wilcoxon signed-rank test.

RESULTS

Overall sensitivity and specificity were 64.6% (31/48) and 96.9% (62/64) for MR, and 77.1% (37/48) and 82.8% (53/64) for low-dose CT, respectively. On the MR images, 76.9% (30/39) of nodules measuring ≥5 mm were pointed out, while only 11.1% (1/9) of nodules <5 mm were detected. For nodules ≥5 mm, detection rates were 81.5 % (22/27) for solid lesions and 66.7% (8/12) for GGOs. The size of solid lesions on the MR images did not differ significantly from the reference group. On the other hand, mixed GGOs tended to appear smaller on T1WI, and pure GGOs were only visible on T2WI.

CONCLUSION

Breath-hold lung MR imaging with combined use of 3D mDixon T1WI and black blood FS-T2WI HASTE provides brief examination with acceptable diagnostic accuracy and could be feasible as a part of whole-body PET/MR hybrid imaging.

CLINICAL RELEVANCE/APPLICATION

Breath-hold lung MR imaging has fair sensitivity and good specificity to detect nodular lesions. In addition to previously reported T1WI, FS-T2WI might be necessary to accurately depict GGOs.

SSQ04-05 Value of [18F]Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography in Patients with Persistent Pulmonary Part-Solid Nodules Detected at CT

Thursday, Dec. 3 11:10AM - 11:20AM Location: E351

Participants

Jihang Kim, MD, Seongnam, Korea, Republic Of (*Presenter*) Nothing to Disclose
Kyung Won Lee, MD, PhD, Seongnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Although current National Comprehensive Cancer Network guidelines suggest [18F]fluorodeoxyglucose positron emission tomography/computed tomography (FDG-PET/CT) for the pretreatment evaluation of early stage non-small cell lung cancer, the role of FDG-PET/CT in patients with persistent pulmonary part-solid nodules is yet to be determined. The purpose of our study was to evaluate the incremental value of FDG-PET/CT in the pretreatment evaluation of non-small cell lung cancer detected as part-solid nodules at chest CT.

METHOD AND MATERIALS

From March 2011 through March 2015, 164 consecutive patients who underwent whole-body FDG-PET/CT for the pretreatment evaluation of non-small cell carcinoma detected as pulmonary part-solid nodules at chest CT were included. We analyzed the chest CT and FDG-PET/CT reports prospectively made by board-certified radiologists and nuclear medicine physicians as a part of our standard practice. The CT, FDG-PET/CT and histopathologic characteristics of the nodules were demonstrated and the incremental value of FDG-PET/CT over chest CT in the nodal or extrathoracic staging was evaluated.

RESULTS

For the pretreatment evaluation, FDG-PET/CT was performed in 164 patients with 181 part-solid pulmonary nodules (diameter; 23.4±8.2 mm, mean solid proportion; 67.8%). Among them, 156 patients with 172 nodules underwent subsequent surgical resection. All of the nodules were histopathologically confirmed as adenocarinoma (n = 1, 91, 51 and 29 for Tis, T1a, T1b, and T2a, respectively). In the retrospective analysis of prospective CT and FDG-PET/CT interpretations, only 4 and 3 patients were suspected to have lymph node metastases, respectively. In histopathologic confirmation, 5 of 156 patients had lymph node metastases and the maximum standardised uptake value of them varied from 1.2 to 6.1. The per-patient sensitivities of CT and FDG-PET/CT in detection of lymph node metastasis were 40% and 20%, respectively, and FDG-PET/CT showed no incremental value in nodal staging. While eight incidental extrathoracic malignancies were suspected at FDG-PET/CT, further diagnostic work-up revealed them as benign.

CONCLUSION

FDG-PET/CT showed no incremental value in the pretreatment evaluation of non-small cell lung cancer detected as part-solid

nodules at chest CT.

CLINICAL RELEVANCE/APPLICATION

In the pretreatment evaluation of non-small cell lung cancer detected as part-solid nodules at chest CT, additional imaging study with FDG-PET/CT is not necessary.

SSQ04-06 Optimal Window Settings to Improve Visual Detection of Ground-glass Nodules (GGN) - Effect on Agreement and Time-to-detection

Thursday, Dec. 3 11:20AM - 11:30AM Location: E351

Participants
Julia Alegria, MD, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Claudio S. Silva Fuente-Alba, MD, MSc, Santiago, Chile (*Abstract Co-Author*) Nothing to Disclose
Daniela Barahona, MD, Santiago, Chile (*Presenter*) Nothing to Disclose

PURPOSE

To assess different window settings for visual detection of ground glass nodules (GGN), regarding inter-reader agreement for localization and diameter, measurement bias and time-to-detection (TTD).

METHOD AND MATERIALS

IRB approved retrospective study. Chest CT dataset with 40 GGN and 10 sets with no detectable nodules, was designed. After de-identification, all datasets were presented to two thoracic radiologists (acting as reference standard) and a fellow, independently, in four different reading sessions two weeks apart from each other, using IMPAX PACS viewers. Only axial slices were analysed, no MPR or MIP reconstructions were allowed. The settings assessed were Lung Window (W 1500 UH, L -500 UH), Emphysema Window (W 800 UH, L -800 UH), Inverted Lung Window and Inverted Emphysema Window. Location, maximum diameter and TTD were recorded for each nodule. Interreader agreement for localization was analyzed with Cohen's Kappa statistics with 95% CI, diameters agreement with Lin's correlation-concordance coefficient Rho 95%CI with average bias assessed with Bland-Altman with 95% limits of agreement (LOM).

RESULTS

High agreement was identified in all settings with Kappa values for Lung Window (LW) 0.71 (0.53-0.78), Emphysema Window (EW) 0.72 (0.63-0.82), Inverted Lung Window (ILW) 0.71 (0.62-0.74) and Inverted Emphysema Window (IEW) 0.79 (0.73-0.88). Lin's Rho ranged from 0.85 (0.78-0.92) in LW, 0.80 (0.72-0.89) in EW, 0.89 (0.84-0.95) in ILW and 0.92 (0.88-0.96) in IEW. Bland-Altman analysis showed average bias in mm (LOM) of -0.64 (-4.19 to 2.9) in LW, -0.69 (-4.91 to 3.52) in EW, -0.29 (-3.75 to 3.17) in ILW and 0.09 (-2.83 to 3.02) in IEW. Average TTD ranged from 21.3 sec in LW to 58.1 sec in ILW, and was significantly higher in all settings in the fellow's readings versus thoracic radiologists' ($p<0.01$), with a reduced TTD for both groups only in IEW ($p<0.01$).

CONCLUSION

IEW provides a visual setting with high reader agreement, measurements concordance with low measurement bias, and reduced TTD for GGN detection.

CLINICAL RELEVANCE/APPLICATION

IEW could be used as a visual aid for identifying GGN, in a similar fashion as MIP reconstructions assist in solid nodule detection.

SSQ04-07 The Moment of Recognition: Method and Analysis of Gaze Behavior in the Search for Lung Nodules in CT Scans

Thursday, Dec. 3 11:30AM - 11:40AM Location: E351

Participants
Geoffrey D. Rubin, MD, Durham, NC (*Presenter*) Consultant, Fovia, Inc; Consultant, Informatics in Context, Inc; Research Consultant, General Electric Company;
Brian Harrawood, MS, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Sandy Napel, PhD, Stanford, CA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc
Justus E. Roos, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose
Kingshuk Choudhury, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To understand the relationship between the distance from a reader's gaze point to visible lung nodule and the momentary likelihood that the nodule will be recognized by the reader.

METHOD AND MATERIALS

Time-varying gaze paths were recorded while 13 radiologists interpreted 40 lung CT scans with between 3 and 5 synthetic nodules (5-mm diameter) embedded randomly within the lung parenchyma. Viewing conditions resulted in a 5° visual angle (approx. foveal limits) corresponding to a 100 pixel distance from the center of gaze. True positive (TP) gaze path segments, corresponding to all x, y, z gaze positions preceding each TP detection, were analyzed. The moment of recognition (MoR) was derived based upon analysis of gaze velocity and direction. Proceeding backwards in time from the reader's confirmation of detection, the trajectory of the gaze path was analyzed for a distinct deviation of the gaze point toward the nodule. We modeled nodule recognition as a Markov process characterized by R(d,z), the instantaneous probability of recognizing a nodule when the gaze is centered d pixels and z sections away from the target nodule.

RESULTS

R(d) was a decreasing function of d for all readers that was well approximated by an exponential distribution. Across readers, R(d) had a median(SD) of 84(43) and 90th percentile(SD) of 269(129) pixels. The average (SD) proportion of nodules that were recognized beyond the 100 pixel foveal limit was 51.2% (15.6%) indicating a substantial contribution of peripheral vision for lung

nodule detection. R(z) was roughly equal at CT sections that were 0, 1, and 2 from the nodule centroid and was smaller 3 sections away, with no significant difference across readers (p = 0.99).

CONCLUSION

The momentary likelihood of lung nodule recognition appears to decrease exponentially with distance from a lung nodule center. While on average approximately half of detected nodules are recognized with peripheral vision, readers rely on their peripheral vision for nodule detection to varying degrees. Further study of search behavior and nodule recognition may lead to strategies for greater consistency and sensitivity for lung nodules detected in CT scans.

CLINICAL RELEVANCE/APPLICATION

Understanding the process of lung nodule detection in CT scans is important to assuring that radiologists maximize their effectiveness in diagnosing lung disease.

SSQ04-08 Association of Focal Radiation Dose Adjusted on Body Cross Sections with Ground Glass Nodules Visibility and Quantification on Computed Tomography Images Using AIDR 3D: Comparison Among Ultra-Low- Dose, Low-Dose and Standard-Dose Scanning

Thursday, Dec. 3 11:40AM - 11:50AM Location: E351

Participants
Yukihiro Nagatani, MD, Otsu, Japan (*Presenter*) Nothing to Disclose
Hiroshi Moriya, MD, Fukushima-City, Japan (*Abstract Co-Author*) Nothing to Disclose
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Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
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Kiyoshi Murata, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the visibility, dimension and density of ground glass nodules (GGNs) on computed tomography (CT) images using AIDR 3D between ultra-low-dose scanning (ULDS) and low-dose scanning (LDS) and assess the association of size specific dose estimate (SSDE) with difference in the measured values between ULDS as well as LDS, and standard dose scanning (SDS).

METHOD AND MATERIALS

This was part of the ACTIve Study, a multi-center research project in Japan. The Institutional Review Board of each institution approved this study, and written informed consent was obtained. In a single visit, 50 subjects underwent chest CT (64-row helical mode) using identical 320-row scanners with different tube currents: 240 (SDS), 120 (LDS), and 20 mA (ULDS). GGN visibility was assessed by 3-grade scales (1: obscure to 3: definitely visible) using SDS as standard of referenceand compared between ULDS and LDS using t-test. Dimension and mean CT density (MCTD) of 71 larger GGNs with the diameter of 5mm or more and SSDE based on antero-posterior and lateral body width were determined as the average value of two-times measurements in cross sections including GGN center. Measured values were compared using Friedman and Wilcoxon signed rank test among ULDS, LDS and SDS. Pearson's correlation analyses were performed to assess the association of SSDE with relative value change between ULDS and SDS (RVC#(ULDS/SDS): 100(ULDS-SDS)/SDS) and between LDS and SDS (RVC#(LDS/SDS): 100(LDS-SDS)/SDS).

RESULTS

GGN visibilities were similar between ULDS and LDS (2.746 versus 2.774) (p=0.67). SSDE had mild negative correlation with RVC# (ULDS/SDS) in dimension and MCTD (r= -0.40, p<0.01 and r= -0.31, p<0.05). Dimensions were larger at ULDS than those at LDS and SDS (p<0.01) (88.1±73.7, 82.4±69.3 and 80.2±66.9, respectively), whereas, MCTD were similar among three dose levels (p=0.131), as -626±110 Hounsfield of Unit (HU) at ULDS, -619±117 HU at LDS and -614±120 HU at SDS.

CONCLUSION

In larger GGNs at ULDS, nodular exaggerating effect in association with decreased SSDE exceeded nodular obscuration deficit due to reduced MCTD by enhanced smoothing effect, and paradoxically may result in visibilities comparable to LDS.

CLINICAL RELEVANCE/APPLICATION

ULDS is optimal for larger GGN detection, whereas, higher dose scanning such as LDS could be desirable as quantification tool in follow-up examination of detected GGNs.

SSQ04-09 A New Quantitative Radiomics Approach for Non-Small Cell Lung Cancer (NSCLC) Prognosis

Thursday, Dec. 3 11:50AM - 12:00PM Location: E351

Participants
Jiangdian Song, PhD, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
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Yu Dongdong, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Feng Yang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jie Tian, PhD, Beijing, China (*Presenter*) Nothing to Disclose

PURPOSE

To determine if computed tomographic (CT) phenotypic features of Non-Small Cell Lung Cancer (NSCLC) have the predictive ability of auxiliary diagnosis for pathological type, TNM stage by a quantitative radiomics approach.

METHOD AND MATERIALS

The proposed method has been evaluated on a clinical dataset including 973 patients with NSCLC and a public dataset including 819 patients from the LIDC-IDRI database labelled by benign or malignancy. The proposed method consists of three phases: feature set extraction, key features selection and production. First we extracted a set of features, consisting of 3D features, Gabor features, texture features. Then a unified feature selection framework for general loss functions based on a generalized sparse regularizer was used for key feature selection. Then 25 key features were selected, the the key features were used to certify their prognostic ability.

RESULTS

A score of 83.21% accuracy for lung nodule classification on 819 patients from the LIDC-IDRI dataset was obtained by the features such as Gabor 'Entropy', wavelet 'Sum Entropy' and 'Gray Level Nonuniformity'. 83.80% pathology prediction accuracy between adenocarcinoma and squamous cell carcinoma was gained from the clinical dataset by the features such as 'Maximum 3D Diameter' and run length 'Long Run Emphasis'. And 84.40% diagnosis accuracy for the early phase cancer (T1, T2) and terminal cancer (T3, T4) classification in TNM staging was achieved by 'Energy' and run length 'Long Run High Gray Level Emphasis'.

CONCLUSION

Based on the key features selected from a predefined feature set we may provide a credible aided diagnosis for a tumor whose pathology type and TNM staging are unknown. The radiomics key features will be further expanded in larger data samples, which may provide more predictive information for clinical practice.Radiomics has a big potential to aid clinical diagnosis and treatment for NSCLC.

CLINICAL RELEVANCE/APPLICATION

By the new quantitative radiomics method a credible diagnosis of pathological type could be obtained, it may avoid invasive frozen section and anesthesia in the clinical surgery. TNM staging is an important reference for the assessment of tumor stage and now is always determined by doctor's subjective experience. The proposed radiomics method could provide a more objective and efficient clinical staging strategy.

SSQ05

Chest (Diffuse Lung Disease/Funtional Imaging)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S404CD

CH BQ CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Moderator*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA; Hiroto Hatabu, MD, PhD, Boston, MA (*Moderator*) Research Grant, Toshiba Corporation Research Grant, AZE, Ltd Research Grant, Canon Inc

Sub-Events

SSQ05-01 Distribution and Associated High-Resolution CT findings Predict Survival in Chronic Hypersensitivity Pneumonitis

Thursday, Dec. 3 10:30AM - 10:40AM Location: S404CD

Participants
Jonathan H. Chung, MD, Denver, CO (*Presenter*) Research Grant, Siemens AG; Royalties, Reed Elsevier
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Xi Zhan, MD,PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
David A. Lynch, MBBCh, Denver, CO (*Abstract Co-Author*) Research support, Siemens AG; Scientific Advisor, PAREXEL International Corporation; Consultant, Boehringer Ingelheim GmbH; Consultant, Gilead Sciences, Inc; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Veracyte, Inc;
Evans R. Fernandez Perez, Denver, CO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

It is unknown if the presence of air-trapping and disease distribution on chest CT, which may be a clue to the diagnosis, predicts mortality among patients with chronic hypersensitivity pneumonitis (CHP).

METHOD AND MATERIALS

The earliest CT chest scans from subjects with HP were scored. Fibrotic HP on CT was defined as presence of reticulation with associated traction bronchiectasis and/or bronchiolectasis. The predominant zonal and axial distribution of lung disease, the presence or absence as well as total percentage of lung involvement (to the nearest 5%) for air-trapping was scored. The most likely diagnosis with level of confidence (possible, probable, or definite) was also determined. A Cox proportional hazards (PH) model was used to identify independent predictors in time-to death analysis.

RESULTS

Of 82 subjects, 60 (73%) had fibrotic HP, and 22 (27%) had non-fibrotic HP on chest CT. The most common patterns were HP (43, 52%), UIP (19, 23%), NSIP (11, 13%), and other (9, 10%). Compared to other CT patterns, the HP pattern was most often zonally diffuse or upper and axially diffuse or peripheral ($p<0.01$). Compared with survivors, patients who died had lower FVC% predicted, were more likely to have pulmonary fibrosis, and were less likely to have ground-glass opacity on CT. In a Cox PH model, the presence of UIP pattern of fibrosis, axially diffuse disease, and absence of air-trapping/mosaic perfusion were independent predictors of survival (Hazard ratios 2.82 [p-value 0.02], 2.46 [p-value 0.01], and 0.39 [p-value 0.01]; respectively).

CONCLUSION

Chest CT has prognostic value in the setting of CHP.

CLINICAL RELEVANCE/APPLICATION

Chest CT may be a valuable biomarker in HP, aside from diagnosis and follow-up.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jonathan H. Chung, MD - 2013 Honored Educator

SSQ05-02 Prevalence of Pulmonary Fibrosis in Asymptomatic 1st Degree Relatives of Patients with Familial Pulmonary Fibrosis (FPF)

Thursday, Dec. 3 10:40AM - 10:50AM Location: S404CD

Participants
Jonathan H. Chung, MD, Denver, CO (*Presenter*) Research Grant, Siemens AG; Royalties, Reed Elsevier
Anna Peljto, Aurora, CO (*Abstract Co-Author*) Nothing to Disclose
Tasha Fingerlin, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
Marvin I. Schwarz, MD, Denver, CO (*Abstract Co-Author*) Nothing to Disclose

David Schwartz, Denver, CO (*Abstract Co-Author*) Nothing to Disclose
David A. Lynch, MBBCh, Denver, CO (*Abstract Co-Author*) Research support, Siemens AG; Scientific Advisor, PAREXEL International Corporation; Consultant, Boehringer Ingelheim GmbH; Consultant, Gilead Sciences, Inc; Consultant, F. Hoffmann-La Roche Ltd; Consultant, Veracyte, Inc;

PURPOSE

The purpose of this study was to determine the prevalence and pattern of HRCT pulmonary fibrosis in asymptomatic 1st degree relatives of patients with FPF.

METHOD AND MATERIALS

HRCT scans of 250 1st degree relatives of patients with FPF were scored by two thoracic radiologists using a variation of a sequential reading method previously described (Washko GR, et al. N Engl J Med. 2011 Mar 10;364(10):897-906). CT scans were scored as no, equivocal for, suspicious for, or definite pulmonary fibrosis. Presence of honeycombing and ground-glass opacity as well as extent of disease to the nearest 10% was also scored. HRCT diagnosis was also collected with level of confidence (possible, probable, definite).

RESULTS

222 of the 250 CT scans were considered technically adequate. In 15.3% (34/222), pulmonary fibrosis was present (definite or probable). In an additional 3.2% (7/222), presence of pulmonary fibrosis was scored as equivocal. In those with pulmonary fibrosis, an average of 6% (+/-7%) of the lung was involved. Honeycombing in these subjects was present in 14.7% (5/34) while ground-glass opacity was present in 23.5% (8/34). The extent of honeycombing was very small and on average closest to 0% in all subjects with honeycombing. The extent of ground-glass opacity was on average 9% (+/-8%). A high confidence pattern was identified in 38.2% (13/34) of subjects with pulmonary fibrosis: 6 UIP, 3 NSIP, 2HP, and 1 asbestosis.

CONCLUSION

Pulmonary fibrosis is common in asymptomatic relatives of patients with FPF.

CLINICAL RELEVANCE/APPLICATION

HRCT screening of asymptomatic relatives of patients with FPF should be considered.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jonathan H. Chung, MD - 2013 Honored Educator

SSQ05-03 Prediction of Survival with Baseline Extent and 1-year Change of Regional Disease Patterns at Thin Section CT in Idiopathic Pulmonary Fibrosis

Thursday, Dec. 3 10:50AM - 11:00AM Location: S404CD

Participants
Sang Min Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Beom Seo, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Min Lee, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Namkug Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Stockholder, Coreline Soft, Inc
Jin Woo Song, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To know if the baseline extent and 1-year change of regional disease patterns at thin-section CT (TSCT), which is measured with texture-based automated quantification system, can predict survival of idiopathic pulmonary fibrosis (IPF)

METHOD AND MATERIALS

Total 194 IPF patients (M:F = 153:41; 63.3 ± 7.8yrs) with TSCT scans at the time of diagnosis and 1 year after were included. Mean follow-up period of survival was 36.0 ± 18.9 months. Using in-house, texture-based automated system, the area percent of five regional disease patterns, including ground glass opacity (GGO), reticular opacity (RO), honeycomb (HC), emphysema (EM) and consolidation (CON) were quantified. The area percent of abnormal lung (AbN) and fibrosis (FIB) were calculated. The survival analyses were performed by constructing Kaplan-Meier disease-free survival curves. The association of baseline extent and 1-year change of TSCT measures with survival was assessed with Cox proportional hazards regression. Both univariable and multivariable analyses including age, sex, smoking, baseline and change of FVC%pred, DLCO%pred and SpO2% were performed.

RESULTS

Measured relative extents of AbN, HC, GGO, CON, EM, RO and FIB at baseline and 1-year follow-up TSCT were as follows; baseline: 43.0% ± 17.1, 7.0 ± 6.7, 12.3 ± 11.9, 2.9 ± 1.3, 3.9 ± 5.5, 16.8 ± 9.8, 23.9 ± 12.3; follow-up: 45.3 ± 19.5, 7.2 ± 7.6, 13.8 ± 11.6, 3.2 ± 1.5, 3.6 ± 5.6, 17.6 ± 11.6, 24.8 ± 14.4, respectively. Survival analysis indicate that disease-free survival of patients with higher baseline extent of AbN, HC, RO, FIB (cut-off value 35%, 10%, 25%, 20%, respectively) and increased extent of AbN, HC, RO, FIB at follow-up TSCT (cut-off value 5%) were significantly shorter than in patients with lower baseline extent and stable or decreased extent of those regional patterns (all $p<0.001$). Univariable analysis revealed that baseline FVC%pred, DLCO%pred, SpO2%, AbN, HC, RO, FIB, change of AbN, HC, RO, FIB were predictive of survival, After adjustment, the baseline extent of RO and change in extent of AbN were predictive of survival.

CONCLUSION

The baseline extent and 1-year change of regional disease patterns at TSCT, which is measured with texture-based automated quantification system, can predict survival of IPF patients.

CLINICAL RELEVANCE/APPLICATION

The baseline extent and change of regional disease patterns quantified with texture-base automated quantification system is useful in predicting survival of IPF patients.

SSQ05-04 Parallel Bands of Lung Involvement Along the Direction of Ribs: A New Sign of Systemic Sclerosis on Volume-rendered Computed Tomography of the Chest

Thursday, Dec. 3 11:00AM - 11:10AM Location: S404CD

Participants
Hanan Sherif, MD, Doha, Qatar (*Abstract Co-Author*) Nothing to Disclose
Ahmed-Emad Mahfouz, MD, Doha, Qatar (*Abstract Co-Author*) Nothing to Disclose
Maysa A. Mohamed, MBBS, Doha, Qatar (*Abstract Co-Author*) Nothing to Disclose
Ahmed Sayedin, MBBCh, Doha, Qatar (*Presenter*) Nothing to Disclose

PURPOSE

To differentiate between systemic sclerosis-related interstitial lung disease and usual interstitial pneumonia on volume-rendered computed tomography (CT) of the chest.

METHOD AND MATERIALS

The multi-detector CT examinations of the chest of 50 patients with systemic sclerosis and 50 patients with usual interstitial pneumonia have been post-processed to obtain volume-rendered images of the lungs. On these images, normally aerated lung parenchyma has been encoded blue and increased attenuation of lung parenchyma has been encoded white. The images have been randomized and provided to an experienced radiologist to note the presence or absence of parallel bands of increased attenuation of the lung parenchyma along the direction of the ribs (the parallel-band sign). Statistical analysis has been done by the chi-square test.

RESULTS

The parallel-band sign has been seen in 32 patients with systemic sclerosis-associated interstitial lung disease and in none of the patients with usual interstitial pneumonia. The parallel-band sign has sensitivity of 64.0%, specificity of 100.0%, positive predictive value of 100.0%, negative predictive value of 73.5%, and accuracy of 82.0% for the diagnosis of systemic sclerosis-associated interstitial lung disease on volume-rendered CT of the chest.

CONCLUSION

Lung involvement in systemic sclerosis-related interstitial lung disease may take the characteristic distribution of parallel bands at the surface of the lungs along the direction of the ribs. The parallel-band sign differentiates systemic sclerosis-related interstitial lung disease from usual interstitial pneumonia with high specificity on volume-rendered CT of the chest.

CLINICAL RELEVANCE/APPLICATION

The use of the parallel-band sign may help differentiate systemic sclerosis-associated interstitial lung disease from usual interstitial pneumonia, particularly if the interstitial lung disease precedes other manifestations of systemic sclerosis such as skin involvement, cardiac disease, or esophageal dilatation.

SSQ05-05 Regional Variation in Ventilation in the Asthmatic Human Lungs Using Magnetic Resonance Imaging and Computed Tomography

Thursday, Dec. 3 11:10AM - 11:20AM Location: S404CD

Participants
Wei Zha, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Stan Kruger, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Robert V. Cadman, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
David Mummy, MS, MBA, Madison, WI (*Presenter*) Nothing to Disclose
Nizar Jarjour, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
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Scott K. Nagle, MD, PhD, Madison, WI (*Abstract Co-Author*) Stockholder, General Electric Company Research Consultant, Vertex Pharmaceuticals Incorporated
Sean B. Fain, PhD, Madison, WI (*Abstract Co-Author*) Research Grant, General Electric Company Research Consultant, Marvel Medtech, LLC

PURPOSE

To investigate regional patterns of ventilation abnormalities in asthmatics with both automated and manual methods.

METHOD AND MATERIALS

A total of 83 asthmatic subjects (normal/moderate/severe: n=14/49/20) underwent hyperpolarized (HP) 3He magnetic resonance imaging (MRI), spirometry, and computed tomography (CT). The right and left lungs were segmented from proton MRI using a region-growing algorithm written in MATLAB and further separated into the lung lobes (right upper-RUL, middle-RML and lower-RLL; left upper-LUL and lower-LLL) by a deformable registration to lobar segmentation derived from CT (VIDA Diagnostics, IA). 3He was registered to proton using a rigid registration method. Ventilation defects were identified independently using both manual segmentation and an automated approach which corrected for B1 inhomogeneity, excluded pulmonary vasculature and determined defects adaptively. A linear mixed-effects model was used to perform the pairwise comparison of percent defect volume (PDV) amongst lobes. Spearman correlation was used to evaluate the association between PDV and spirometry. A $p<0.05$ is considered significant.

RESULTS

The automated defect quantification took ~3min versus 20min per study for manual segmentation. The two method yielded similar whole lung PDV ($p=0.12$). The whole lung PDV measured by both methods correlated inversely with the percent predicted forced

expiratory volume in 1 second (% FEV1) (manual/automated: ρ= -0.41, p=0.0002/ρ= -0.24, p=0.040) and % FEV1 over forced vital capacity (ρ= -0.46, p<0.0001/ρ= -0.32, p=0.0045). Both methods found PDV was significantly larger in the RML (automated: 8.21±13.64%) than all other lobes (all p<0.013). The RUL (5.52±8.83%) was less ventilated than the RLL (3.55±5.24%) and LLL (2.62±3.82%) with p<0.047. The automated method also suggested a more defected RUL than LUL (3.26±4.76%) with p=0.011 whereas the difference was not significant by manual measurements.

CONCLUSION

Compared to manual assessment, the automated approach provides comparable PDV measurements and similar association to spirometic measures. Both methods suggest the RML is most affected in asthmatic lungs and that the RUL is measurably more defected than RLL and LLL.

CLINICAL RELEVANCE/APPLICATION

The automated defect quantification can facilitate the application of HP 3He MRI as a potential tool for guiding bronchoscopic assessment of cellular and molecular markers of asthma progression.

SSQ05-06 Lobar Analysis of Hyperpolarised Xenon MR Lung Imaging (Xe-MRI) in Chronic Obstructive Pulmonary Disease (COPD)

Thursday, Dec. 3 11:20AM - 11:30AM Location: S404CD

Participants
Tahreema N. Matin, MBBS, Oxford, United Kingdom (*Presenter*) Nothing to Disclose
Mitchell Chen, DPhil,MBBS, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Xiaojun Xu, MSc, DPhil, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Tom Doel, DPhil, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Najib Rahman, MSc, DPhil, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Vicente Grau, PhD, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Annabel Nickol, Oxford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Fergus V. Gleeson, MBBS, Oxford, United Kingdom (*Abstract Co-Author*) Consultant, Alliance Medical Limited; Consultant, Blue Earth Diagnostics Limited; Consultant, Polarean, Inc;

PURPOSE

To determine lobar ventilation and apparent diffusion coefficient (ADC) values acquired using hyperpolarised xenon MR lung imaging (Xe-MRI) in subjects with chronic obstructive pulmonary disease (COPD), and to correlate these with quantitative CT (QCT) and pulmonary function tests (PFTs).

METHOD AND MATERIALS

Eighteen patients with COPD (stage II - IV GOLD criteria classification) underwent Xe-MRI at 1.5T, QCT and PFTs.Whole lung and lobar Xe-MRI parameters were obtained using semi-automated segmentation of multi-slice Xe-MRI ventilation images and Xe-MRI diffusion-weighted images (b =20.855sec/cm2) following co-registration to CT using in-house software. Percentage predicted PFT results were established.Whole lung and lobar QCT-derived emphysema was calculated from percentage of lung tissue with density of <-950 HU.Pearson's correlation coefficients were used to evaluate the relationship between imaging measures and PFTs.

RESULTS

Lobar Xe-MRI percentage ventilated volume and lobar Xe-MRI average ADC showed significant correlation with lobar QCT percentage emphysema (r=0.61, P<<0.001 and r=0.72, P<<0.001 respectively).Whole lung Xe-MRI average ADC showed significant correlation with the PFTs: percentage predicted transfer factor of the lung of carbon monoxide (TLCO) (r=-0.69, P<0.03) and percentage predicted functional residual capacity (FRC) (r=0.65, P<0.007). Whole lung QCT percentage emphysema showed a similar significant correlation with percentage predicted TLCO (r=-0.71, P<<0.001) and percentage predicted FRC (r=0.48, P<0.05).

CONCLUSION

This is the first study to generate lobar analysis of Xe-MRI ventilation and ADC. The excellent correlation of whole lung Xe-MRI average ADC with PFTs and lobar Xe-MRI derived measures with lobar QCT percentage emphysema provide supportive evidence for employment of this technique in patients with COPD. This is particularly relevant for those undergoing regional treatments, where Xe-MRI has the potential to accurately guide treatment options or predict post-treatment lung function.

CLINICAL RELEVANCE/APPLICATION

The potential clinical value of Xe-MRI regional lung assessment is becoming increasingly relevant with the possibility of regional lung treatments e.g. lung volume reduction surgery, endobronchial valve placement and radiotherapy. The excellent correlation of Xe-MRI with QCT-derived measures of COPD and PFTs suggests it may be of value in patients considered for these treatments.

SSQ05-07 MR Perfusion Parameters and Apparent Diffusion Coefficient in Lung Cancer: Relation to Microvessel Density Based on Surgical Specimen

Thursday, Dec. 3 11:30AM - 11:40AM Location: S404CD

Participants
Chin A Yi, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jae-Hun Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyeok-Jun Won, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Microvessel density is a direct biomarker of tumor angiogenesis. Perfusion parameters of dynamic contrast-enhanced MRI (DCE-MRI) and apparent diffusion coefficient (ADC) of diffusion-weighted MR imaging (DWI) can be measured as a quantitative, non-invasive, and repetitive method for the estimation of tumor angiogenesis in the lung cancer. The purpose of this study was to correlate MR perfusion parameters and ADC with microvessel density in lung cancers patients who underwent surgical resection.

METHOD AND MATERIALS

Ninety three patients (53 men, 40 women; age range, 40-79 years) with non-small cell lung cancers underwent diffusion-weighted and dynamic contrast-enhanced MR imaging before surgery. Surgical specimens were obtained and microvessel density was measured with immunohistochemistry staining for CD 31. Perfusion parameters (Ktrans; volume transfer coefficient, ve; fraction of extravascular extracellular space, vp; fraction of plasma space, T0; the time lag between bolus arrival times of arterial input function and tissue concentration) and ADC were measured and compared with quantitative histologic microvessel density by using the Pearson correlation test.

RESULTS

The significant positive correlations were found between microvessel density and Ktrans (r=0.22, P=0.03) and vp (r=0.29, P < .01). An inverse correlation was found between T0 and microvessel density (r=-0.34, P < .01), whereas no significant correlation was found between ADC and microvessel density.

CONCLUSION

Perfusion parameter such as Ktrans, ve, and T0 showed significant correlation with microvessel density in lung cancers, whereas no correlation was found between ADC and microvessel density.

CLINICAL RELEVANCE/APPLICATION

Perfusion parameter such as Ktrans, ve, and T0 may play a role as indirect biomarkers indicating the extent of microvessel density in lung cancers.

SSQ05-08 Pulmonary Perfusion Phase Imaging using Self-Gated Fourier Decomposition MRI Reveals Perfusion Inhomogeneities in Patients with Cystic Fibrosis

Thursday, Dec. 3 11:40AM - 11:50AM Location: S404CD

Participants
Simon Veldhoen, MD, Wurzburg, Germany (*Presenter*) Nothing to Disclose
Daniel Stab, St Lucia, Australia (*Abstract Co-Author*) Nothing to Disclose
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Thorsten A. Bley, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Herbert Koestler, PhD, Wuerzburg, Germany (*Abstract Co-Author*) Research support, Siemens AG

PURPOSE

Fourier Decomposition (FD) MRI provides site-resolved functional lung imaging without application of contrast media. Perfusion and ventilation-weighted images are reconstructed using a Fourier analysis of a non-triggered time series of morphologic lung images. In this work, we demonstrate that perfusion-weighted data also carries information regarding the pulmonary perfusion phase.

METHOD AND MATERIALS

Lung perfusion measurements were performed using SENCEFUL, an advancement of the FD technique, obtaining morphologic image series by cardiac and respiratory self-navigation of data sampled in quasi-random fashion. Signal variations over the cardiac cycle allow for determining perfusion-weighted images (perfusion amplitude) and the perfusion phase, which indicates the phase shift in the lungs in relation to a reference voxel in a central vessel (e.g. pulmonary trunk). Pulmonary perfusion amplitude and phase measurements on 3 volunteers and 3 cystic fibrosis patients were performed on a 1.5T system. A 2D FLASH sequence providing a DC signal acquisition for self-navigation was used.

RESULTS

Perfusion amplitude maps of the healthy subjects revealed homogeneous lung perfusion. In the perfusion phase maps, the perfusion-induced signal changes exhibited similar behavior in all lung parts. In contrast, the maps of the cystic fibrosis patients showed areas with reduced perfusion and a significantly higher phase dispersion. The attached image example of a 27 year old cystic fibrosis patient shows reduced perfusion e.g. in the upper lobes and the perfusion phase map reveals an higher phase dispersion when compared to the healthy volunteer. Similar results were found in the other examined volunteers and cystic fibrosis patients.

CONCLUSION

Signal intensities in lung MRI are pulsatile as a function of the cardiac triggered inflow. While a balanced perfusion phase in healthy volunteers indicates a homogeneous pulse wave velocity throughout the lungs, results in patients with cystic fibrosis show regionally varying delays.

CLINICAL RELEVANCE/APPLICATION

Based on a time series' FD, the maps describe a new contrast in pulmonary MRI. First measurements revealed that perfusion phase maps of cystic fibrosis patients differ from those of healthy subjects. Hence, the perfusion phase may contain valuable diagnostic information. Detailed examination of the diagnostic capabilities of FD based perfusion phase MRI is subject to future work.

SSQ05-09 Functional Evaluation of Chronic Lung Allograft Dysfunction with Novel Computed Tomography Lung Deformation Algorithms

Thursday, Dec. 3 11:50AM - 12:00PM Location: S404CD

Participants
Miho Horie, MSc, Toronto, ON (*Presenter*) Research Grant, Toshiba Corporation
Tomohito Saito, MD, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Joanne Moseley, Toronto, ON (*Abstract Co-Author*) Royalties, RaySearch Laboratories AB;
Shafique Keshavjee, MD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

Narinder S. Paul, MD, Richmond Hill, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Research Grant, Carestream Health, Inc

PURPOSE

Lung transplantation is the destination therapy for end stage chronic lung disease. Chronic lung allograft dysfunction (CLAD) limits the 5-year survival after lung transplantation (Tx). It is important to diagnose and distinguish the CLAD subtypes: Bronchiolitis Obliterans Syndrome (BOS) and Restrictive Allograft Syndrome (RAS). CLAD diagnosis with conventional techniques is limited, deformable registration provides qualitative and quantitative assessment of focal and global lung function. The purpose of this study is to determine the utility of using deformable registration CT data in the diagnosis of CLAD.

METHOD AND MATERIALS

A retrospective study of 30 patients post bilateral Tx followed with PFT and low dose lung CT (conventional tests) scheduled every 3mths. The study cohort had confirmed diagnosis, based on conventional tests and pathology: No-CLAD (n=10); BOS (n=10); RAS (n=10). The CT data was assessed qualitatively and quantitatively using finite element based image registration software (MORFEUS) to document changes in lung deformation between baseline and disease onset. Surface vector analysis was performed and indicated expansion (+) or contraction (-) of regional lung volume; the mean and percentage change for inward and outward vectors was compared using the Mann-Whitney U test.

RESULTS

Qualitative analysis: Upper lobe deformation; No-CLAD 20% (2/10); BOS 20% (2/10) and RAS 70% (7/10). Quantitative analysis: mean vector change from baseline (% change from baseline); for the right (R) and left (L) lungs. No-CLAD: R= +4.0mm (55%); L= +3.2mm (59%). BOS: R= +3.8mm (61%); L= +3.4mm (57%). RAS: R= -8.6mm (71%); L= -9.9mm (74%).

CONCLUSION

Deformable lung registration can quantitatively detect and distinguish between No-CLAD/BOS and RAS.

CLINICAL RELEVANCE/APPLICATION

Lung deformation analysis is a promising technique in evaluating the subtypes of CLAD and in assessing regional change when conventional techniques are limited.

SSQ06

Gastrointestinal (Quantitative Imaging)

Thursday, Dec. 3 10:30AM - 12:00PM Location: E350

GI BQ CT MI MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Claude B. Sirlin, MD, San Diego, CA (*Moderator*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;
Alexander R. Guimaraes, MD, PhD, Portland, OR (*Moderator*) Speakers Bureau, Siemens AG; Expert Witness, Rice, Dolan, Kershaw
Andrew D. Smith, MD, PhD, Jackson, MS (*Moderator*) Research Grant, Pfizer Inc; President, Radiostics LLC; President, Liver Nodularity LLC; President, Color Enhanced Detection LLC; Pending patent, Liver Nodularity LLC; Pending patent, Color Enhanced Detection LLC;

Sub-Events

SSQ06-01 3D Vibe-Dixon MR Sequence in Hepatic Fat Quantification: Inter-reader Reproducibility and Correlation to MRS Results in a Liver Donor Cohort

Thursday, Dec. 3 10:30AM - 10:40AM Location: E350

Participants
Chiara Pozzessere, MD, Siena, Italy (*Presenter*) Nothing to Disclose
Xiangyu Zhu, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Celia P. Corona-Villalobos, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
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Sandra L. Castanos Gutierrez, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Fatemeh Sobhani, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
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Li Pan, Baltimore, MD (*Abstract Co-Author*) Employee, Siemens AG
Ihab R. Kamel, MD, PhD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Liver steatosis is the most common liver disease in Western Countries and it may progress to steatohepatis and cirrhosis. Magnetic Resonance Spectroscopy (MRS) has been shown to strongly correlate with histology in fat quantification. However, MRS has some limitations such as breathing artifact and difficulties in avoiding vessels or bile ducts within the voxel. 3D VIBE-Dixon is a MR sequence which can quantify fat content. The aim of this study was to compare fat quantification of liver using 3D VIBE-DIXON to that using MRS.

METHOD AND MATERIALS

IRB approved this prospective, HIPAA compliant study. Thirty potential liver donors (14 males, 12 females; mean age 38 yo) underwent liver MR, including single voxel MRS, within the right (RL) and left lobe (LL) and axial 3D VIBE-Dixon. Liver biopsy was performed in 8 patients. Fat percentage (FP) was generated by MRS. Two readers blinded to MRS results independently quantified the FP on 3D VIBE-Dixon by drawing a ROI in both lobes in the same locations of the MRS voxels.Lin's concordance correlation was used to assess concordance between MRS and 3D VIBE-Dixon, for the two readers. Intraclass correlation coefficient was used to compare 3D VIBE-Dixon to histology. Inter-observer agreement was calculated. A $p \leq 0.05$ was considered statistically significant.

RESULTS

In the RL, mean FP was 5.8% by MRS, and 4.8% and 4.8% by 3D VIBE-Dixon for readers 1 and 2, respectively, with a strong concordance between the two technique (rho= 0.78 and 0.76 for reader 1 and 2, respectively, $p<0.001$). In the LL, mean FP was 5.2% by MRS, and 4.2% and 4% by 3D VIBE DIXON for readers 1 and 2, respectively, with medium concordance between the two sequences (rho=0.44 and 0.38 for readers 1 and 2, respectively). Inter-observer agreement was excellent in both RL and LL (rho=0.96 and 0.92, respectively, $p<0.001$). In the 8 patients who underwent biopsy FP by 3D VIBE-DIXON highly correlated to histological results (ICC=0.85).

CONCLUSION

In this prospective study, fat quantification using 3D VIBE-DIXON was highly reproducible, with strong correlation to MRS in the RL. Correlation was moderate in the LL, probably due to artifacts on MRS.

CLINICAL RELEVANCE/APPLICATION

3D VIBE-DIXON is a highly reproducible MR sequence, which may allow non-invasive fat quantification in the liver. Further studies with larger cohort and pathology comparison are required.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ihab R. Kamel, MD, PhD - 2015 Honored Educator

SSQ06-02 Inter-site Reproducibility of 2D MR Elastography Analysis for Hepatic Stiffness in a Cohort of Obese

Adults

Thursday, Dec. 3 10:40AM - 10:50AM Location: E350

Participants
William Haufe, San Diego, CA (*Presenter*) Nothing to Disclose
Curtis N. Wiens, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Catherine A. Hooker, BS, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Tanya Wolfson, MS, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Alan B. McMillan, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Paul Manning, MSc, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Kang Wang, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Scott B. Reeder, MD, PhD, Madison, WI (*Abstract Co-Author*) Institutional research support, General Electric Company Institutional research support, Bracco Group
Michael S. Middleton, MD, PhD, San Diego, CA (*Abstract Co-Author*) Consultant, Allergan, Inc Institutional research contract, Bayer AG Institutional research contract, sanofi-aventis Group Institutional research contract, Isis Pharmaceuticals, Inc Institutional research contract, Johnson & Johnson Institutional research contract, Synageva BioPharma Corporation Institutional research contract, Takeda Pharmaceutical Company Limited Stockholder, General Electric Company Stockholder, Pfizer Inc Institutional research contract, Pfizer Inc
Claude B. Sirlin, MD, San Diego, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;

PURPOSE

To assess the inter-site reproducibility of 2D magnetic resonance elastography (MRE) analysis for hepatic stiffness in obese adults

METHOD AND MATERIALS

In this HIPAA compliant, IRB approved study, obese (BMI ≥ 30 kg/m²) adults underwent 2D MRE on a 1.5T or 3.0T GE scanner at one of two sites. A passive driver produced 60 Hz acoustic shear waves through the liver, and MRE-generated wave images, magnitude images, and stiffness maps (elastograms) were transferred offline for manual analysis. Analysts at each of the two separate sites evaluated all exams from both sites. Analysts drew regions of interest (ROIs) on the elastograms in areas of the liver where parallel wave propagation was observed on the corresponding wave image. From these ROIs, stiffness values were recorded. Weighted average was applied to obtain a single per-liver stiffness value. Bland-Altman plot and intraclass correlation coefficient (ICC) were used to assess inter-site reproducibility. Paired t-test was used to examine systematic shifts.

RESULTS

87 adults (74 female, 13 male) underwent MRE. The mean (± standard deviation) age and BMI were 48.3 (± 12.5) years and 42.6 (± 5.8) kg/m2 respectively. Fourteen scans were considered unanalyzable by at least one of the two sites due to low signal-to-noise or poor wave propagation. Hence, data from 73 subjects were used in reproducibility analyses. ICC for the two sites was .833 [0.724, 0.898]. Mean (± standard deviation) stiffness values for site A and site B were 2.90 (± 1.06 kPa) and 3.13 (±1.15 kPa) respectively. A small, clinically non-meaningful, but statistically significant bias was observed (mean difference .23 kPa, paired t-test p=0.0016).

CONCLUSION

MRE analysis for hepatic stiffness from independent analysts at two separate sites had high reproducibility. There was a small systematic bias observed between the two participating study sites, which was not clinically meaningful in the context of staging liver fibrosis.

CLINICAL RELEVANCE/APPLICATION

In order for 2D MRE to be clinically useful in the staging of hepatic fibrosis, liver stiffness results must be analyst and site independent. Studies such as this will help demonstrate the reproducibility of MRE stiffness values.

SSQ06-03 ¹H-Magnetic Resonance Spectroscopy is Superior to Controlled Attenuation Parameter (CAP) in Assessing Liver Fat Content in Human Non-alcoholic Fatty Liver Disease (NAFLD)

Thursday, Dec. 3 10:50AM - 11:00AM Location: E350

Awards
Trainee Research Prize - Resident

Participants
Jurgen H. Runge, MD,PhD, Amsterdam, Netherlands (*Presenter*) Nothing to Disclose
Loek P. Smits, MD,MSc, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Joanne Verheij, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Aart N. Nederveen, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
U Beuers, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jaap Stoker, MD, PhD, Amsterdam, Netherlands (*Abstract Co-Author*) Research Consultant, Robarts Clinical Trials

PURPOSE

Non-alcoholic fatty liver disease (NAFLD) is an increasingly recognized health problem worldwide. Liver biopsy is the diagnostic standard, but liver fat content is preferably assessed noninvasively and quantitatively. Recently, the Controlled Attenuation Parameter (CAP) technique was introduced on the FibroScan®, a transient elastography device with FDA approval since 2013. Only limited data are available regarding CAP's accuracy compared to established quantitative measures. Therefore, we prospectively compared CAP and ¹H-Magnetic Resonance Spectroscopy (¹H-MRS) derived fat fractions (FF) against liver biopsy in a cohort of patients with NAFLD.

METHOD AND MATERIALS

Forty NAFLD patients (M/F: 29/11) with median (IQR) age of 52.6 (48.5-57.3) and BMI of 27.1 (25.4-33.1) were included in this IRB-approved study. Same-day 3T MRI and CAP measurement were performed by a single examiner within 27 (17-50) days of liver

biopsy, assessed by a single pathologist. ¹H-MRS derived FF and CAP values were compared between Brunt steatosis grades S0-S3 using Kruskall-Wallis and Mann-Whitney-U tests. Correlations were assessed with Spearman's. Diagnostic accuracies of CAP and FF to identify ≥S1 on biopsy were compared with ROC analyses.

RESULTS

Median FF differed (p<0.0001) between all histological steatosis grades at 1.0%(0.7-1.4), 6.1%(3.9-8.8), 17.4%(11.3-21.1) and 26.3%(25.0-30.1). Median CAP only differed between grades S0 and S2 (p=0.025) and S1 and S2 (p=0.006) at 260 dB/m (221-320), 281 dB/m (249-331), 330 dB/m (305-378) and 348 dB/m (321-353). FF (rs 0.90;95%-CI:0.81-0.95) correlated better (P=0.0002) with steatosis grades than CAP (rs 0.53;95%-CI:0.25-0.73). The area under the ROC curve (AUROC) to identify ≥S1 was higher (P=0.04) for ¹H-MRS at 0.98 (95%-CI:0.93-1.0) than for CAP at 0.76 (95%-CI:0.56-0.95). Optimal cut-off values of 4.1% and 261 dB/m resulted in sensitivity/ specificity/positive/negative predictive values of 89%/100%/100%/56% for ¹H-MRS and 89%/60%/ 94%/43% for CAP.

CONCLUSION

¹H-MRS derived FF differed between all four steatosis grades on biopsy, while CAP did not. Better correlation with histological features and superior AUROC to identify steatosis stage ≥S1 reaffirm ¹H-MRS as preferred method for noninvasive liver fat content assessment.

CLINICAL RELEVANCE/APPLICATION

¹H-MRS derived liver fat fractions show better diagnostic accuracy than CAP values for accurate noninvasive liver fat content assessment.

SSQ06-04 Assessment of Liver and Pancreas Iron Overload with a 3T MRI Multiecho GRE Sequence in Diffuse Liver Disorders: Rorrelation with Serum Ferritin and Liver Biopsy

Thursday, Dec. 3 11:00AM - 11:10AM Location: E350

Participants
Manuela Franca, MD, Porto, Portugal (*Presenter*) Nothing to Disclose
Angel Alberich-Bayarri, MD, Valencia, Spain (*Abstract Co-Author*) Nothing to Disclose
Luis Marti-Bonmati, MD, PhD, Godella, Spain (*Abstract Co-Author*) Nothing to Disclose
Graca Porto, Porto, Portugal (*Abstract Co-Author*) Nothing to Disclose
Helena Pessegueiro Miranda, Porto, Portugal (*Abstract Co-Author*) Nothing to Disclose
Joao A. Oliveira, Porto, Portugal (*Abstract Co-Author*) Nothing to Disclose
Francisca E. Costa, MD, Porto, Portugal (*Abstract Co-Author*) Nothing to Disclose
Jose Ramon Vizcaino Vazquez, Porto, Portugal (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Iron overload is associated with hereditary hemochromatosis, chronic transfusions, hemolytic conditions and diffuse liver diseases such as chronic hepatitis C, alcoholic liver disease and NAFLD. Pancreatic iron can be also found in some of these conditions. Our objective was to assess R2* values of the liver and pancreas in patients with chronic diffuse liver diseases, comparing the R2* values with serum ferritin levels and liver biopsy.

METHOD AND MATERIALS

A total of 99 consecutive patients with chronic diffuse liver disorders who underwent liver biopsy and abdominal MR examination were included. The 3T MR examination included a single breath-hold multiecho GRE sequence with 12 echoes. Iron related-R2* quantification was performed with a dedicated software selecting a ROI within the biopsied liver segment and also in the pancreas (head, body and tail). Liver biopsy was used as gold standard for liver iron deposits grading (0-4).

CONCLUSION

There is an excellent relationship between liver R2*-iron quantification against liver biopsy and serum ferritin, in different chronic liver disorders. Pancreas R2* is significantly correlated with serum ferritin, liver R2* and histologic iron grading.

CLINICAL RELEVANCE/APPLICATION

In patients with diffuse chronic liver disorders, pancreas R2* correlate with liver R2* and biopsy-proved liver iron overload.

SSQ06-05 Liver Volume-assisted Estimation of Liver Function Based on Gd-EOB-DTPA- enhanced MR-Relaxometry

Thursday, Dec. 3 11:10AM - 11:20AM Location: E350

Awards
RSNA Country Presents Travel Award

Participants
Michael Haimerl, Regensburg, Germany (*Presenter*) Nothing to Disclose
Niklas Verloh, Regensburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Claudia Fellner, MD, PhD, Regensburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Marcel D. Nickel, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG
Christian R. Stroszczynski, MD, Regensburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Wiggermann, Regensburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether liver function as determined by indocyanine green (ICG) clearance can be estimated quantitatively from gadoxetic acid (Gd-EOB-DTPA)-enhanced magnetic resonance (MR)- Relaxometry and to estimate the impact of liver liver volumes.

METHOD AND MATERIALS

132 patients underwent an ICG clearance test and Gd-EOB-DTPA-enhanced MRI, including MR-Relaxometry at 3 Tesla. A transverse

3D VIBE sequence with an inline T1 calculation was acquired prior to and 20 minutes post-Gd-EOB-DTPA administration. Volumetric analysis of respective livers was performed on Aquarius iNtuition Viewer (TeraRecon Inc.). The reduction rate of T1 relaxation time (rrT1) between pre- and post-contrast images and the liver volume-assisted index of T1 reduction rate (LVrrT1) were evaluated. The plasma disappearance rate of ICG (ICG-PDR) was correlated with the liver volume (LV), rrT1 and LVrrT1, providing an MRI-based estimated ICG-PDR value (ICG-PDRest).

RESULTS

Regression model showed a significant log-linear correlation of ICG-PDR with LV ($r = 0.31$; $p = 0.001$), T1post ($r = 0.62$; $p < 0.001$) and rrT1 ($r = 0.85$; $p < 0.001$). Assessment of LV and consecutive evaluation of multiple linear regression model revealed a stronger log-linear correlation of ICG-PDR with LVrrT1 ($r = 0.91$; $p < 0.001$), allowing for the calculation of ICG-PDRest.

CONCLUSION

Liver function as determined using ICG-PDR can be estimated quantitatively from Gd-EOB-DTPA-enhanced MR-Relaxometry. Volume-assisted MR-Relaxometry has a stronger correlation with liver function than does MR-Relaxometry.

CLINICAL RELEVANCE/APPLICATION

Global and regional liver function may be visualized by Gd-EOB-DTPA-enhanced MRI, which might be of importance for planning liver resections.

SSQ06-06 Liver Volume Predicts the Clinical Outcome of Patients with Decompensated Alcoholic Steatohepatitis

Thursday, Dec. 3 11:20AM - 11:30AM Location: E350

Participants
Maxime Ronot, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Romain Breguet, MD, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Catrina Hansen, Geneve, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Christoph D. Becker, MD, Thonex, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Laurent Spahr, Geneve, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Sylvain Terraz, MD, Geneva, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Matthieu Lagadec, MD, Clichy, France (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the prognostic value of abdominal multidetector computed tomography (MDCT) in patients with decompensated alcoholic steatohepatitis (ASH).

METHOD AND MATERIALS

This ancillary study was based on the analysis of data collected during a randomized trial on ASH treatment. Response to treatment was defined as the improvement of the baseline MELD score ≥3 points at 3 months. All patients underwent contrast-enhanced MDCT of the abdomen. The following parameters were measured: 1/ liver (DL) and spleen (DS) density on unenhanced images, and DL/DS ratio, 2/ liver volume-to-body weight ratio (VLBW), 3/ subcutaneous fat (FSC), visceral fat (FV) and muscular (M) surfaces at the level of L3-L4. Responders and non-responders were compared with uni-, multivariate and ROC analyses. Results were compared with a validation cohort of patients, clinically and biologically similar to the study cohort.

RESULTS

Fifty-eight patients (34 males; mean age, 56 years) were analyzed, including 34 (59%) responders. Baseline mean MELD and ABIC scores were 19 (13-28) and 8.3 (6.5-10.3). On multivariate analysis, VLBW (OR=3.73; 95%CI, 1.64-8.46; p=0.002) and FSC (OR=1.01; 95%CI, 1.00-1.02; p=0.022) were associated with response to treatment, with AUROC curves of 0.78±0.06 (p<0.001) and 0.66±0.07 (p=0.043), respectively. BMI, baseline MELD and ABIC scores, gender, DL/DS, FV and M were not different between the two groups. VLBW ≥ 2.4% predicted response with 88% and 63% sensitivity and specificity. In the validation cohort (n=24, 75% responders), the same cut-off value predicted response with 83% and 67% sensitivity and specificity.

CONCLUSION

In patients suffering from decompensated ASH, the liver volume appears to be a major positive prognostic factor. This simple morphometric parameter may be added to the initial evaluation of the liver disease to improve patient management.

CLINICAL RELEVANCE/APPLICATION

The liver volume-to-body weight ratio appears to be a major prognostic factor in patients with ASH. This morphometric parameter could be added to the initial workup of patients, to better predict the response to treatment and improve the management.

SSQ06-07 MRI Based Quantification of Hepatic Uptake and Excretion of Gadoxetic Acid: Preliminary Results

Thursday, Dec. 3 11:30AM - 11:40AM Location: E350

Participants
Daniel Truhn, MD, Cologne, Germany (*Presenter*) Nothing to Disclose
Alexander Ciritsis, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nienke L. Hansen, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Alexandra Barabasch, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Burkhard Maedler, Bonn, Germany (*Abstract Co-Author*) Researcher, Koninklijke Philips NV
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Nils A. Kraemer, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Recent research in liver MRI has shown that quantification of hepatic uptake of gadoxetic acid is a promising method for determination of local liver function and correlates well with established clinical measures of liver function. The aim of this study was to evaluate a method for combined measurement of hepatic uptake and excretion.

METHOD AND MATERIALS

After intravenous administration of gadoxetic acid, signal enhancement of liver tissue in 14 healthy patients was measured over the time course of 30 minutes. First, the data was assessed using previously published methods that do not consider excretion. Then, a dual inlet two compartment model was appended by a parameter describing the excretion of contrast medium into the bile. A least squares fit was performed to extract the following parameters: extra- and intracellular volume fraction, uptake and excretion rates, arterial and portal venous flow fractions. Results for the models without and with consideration of excretion were subsequently compared.

RESULTS

The dual inlet two compartment model provided the best agreement between modeled and measured signal values when compared to previously published methods that do not consider excretion of contrast agent. The mean value for the uptake rate in healthy liver tissue was 4.76+-0.54 /100/min. Excretion half-time was 21.9+-2.4 min.Inter-patient variance was significantly greater when conventional models (uptake only) models were applied. We found a significant deviation between modeled and measured signal values with an uptake rate of 3.56+-1.34 /100/min. Excretion rates could only be obtained with the dual inlet two compartment model.

CONCLUSION

The model not considering the excretion was only valid in the first 5 minutes of hepatic signal enhancement and failed over the course of 30 minutes. Accurate modeling of gadoxetic acid induced hepatic enhancement over a longer time course requires a dual inlet two compartment model. Including this parameter into models of liver tissue might lead to a more precise correlation between hepatic function and MRI.

CLINICAL RELEVANCE/APPLICATION

When aiming to measure hepatic function using MRI not only the hepatic uptake, but also the excretion should be taken into account to get better correlations between MRI and liver function.

SSQ06-08 The Attenuation Distribution Across the Long Axis (ADLA): Evaluation of Predictive Performance in a Large Clinical Trial

Thursday, Dec. 3 11:40AM - 11:50AM Location: E350

Awards
Trainee Research Prize - Medical Student

Participants
Nikita Lakomkin, Nashville, TN (*Presenter*) Nothing to Disclose
Allison Hainline, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose
Hakmook Kang, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose
M. S. Hutson, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose
Carlos L. Arteaga, Nashville, TN (*Abstract Co-Author*) Nothing to Disclose
Richard G. Abramson, MD, Nashville, TN (*Abstract Co-Author*) Consultant, ICON plc;

PURPOSE

Novel methods of image feature analysis may be a useful adjunct to standard methods of cancer treatment response assessment. The attenuation distribution across the long axis (ADLA) is a simple, easily extractable measure of lesion heterogeneity; in a recent preliminary study, ADLA measurements predicted overall survival (OS) better than RECIST 1.1. The purpose of this study was to evaluate the ability of the ADLA method to predict OS in a larger clinical trial.

METHOD AND MATERIALS

Under a data sharing agreement from Genentech (San Francisco, CA) and an IRB waiver from our institution, we obtained de-identified imaging and clinical data from RIBBON-1, a multi-site phase 3 trial of bevacizumab (Avastin) in metastatic breast cancer. We analyzed all RIBBON-1 patients treated with Avastin who had at least 1 liver metastasis measuring ≥ 15 mm on baseline contrast-enhanced CT. For each patient at every time point, up to 2 target liver lesions were evaluated using both RECIST 1.1 criteria and ADLA. The ADLA was obtained as the standard deviation of the post-contrast CT attenuation values in the portal venous phase across a long-axis diameter function. To define a treatment response using ADLA, Brier scores were computed to establish the optimal percent decrease for separating patients with longer OS. Using Kaplan-Meier survival analysis, the log-rank test was then used to evaluate the ability of a treatment response by ADLA measurements to predict OS. The ADLA method was then compared to RECIST 1.1 using a bootstrapping technique that generated 95% confidence intervals on the Brier scores for both approaches.

RESULTS

165 patients met inclusion criteria. Median OS was 461 days (range 60-916). The ADLA method discriminated patients with longer OS at an optimal threshold of a 21.5% decrease from baseline. At this threshold, a treatment response by the ADLA method successfully separated patients with longer OS ($p<0.001$). Furthermore, a treatment response by ADLA was superior to a response by RECIST 1.1 for discriminating patients with longer OS (95% confidence interval for the Brier score difference: [0.070-0.52]). Kaplan-Meier survival curves are shown below.

CONCLUSION

In retrospective data analysis from a large clinical trial, the ADLA method was superior to RECIST 1.1 for predicting overall survival.

CLINICAL RELEVANCE/APPLICATION

The ADLA measurement is an easily extractable parameter that may be useful for assessing cancer treatment response.

SSQ06-09 Differences of Target Lesion Selection Drives Variability of Response Assessment According to RECIST 1.1

Thursday, Dec. 3 11:50AM - 12:00PM Location: E350

Awards
RSNA Country Presents Travel Award

Participants
Yunus Alparslan, Aachen, Germany (*Presenter*) Nothing to Disclose
Jonas Schmoe, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Hanna Witte, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Annika Keulers, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, Bonn, Germany (*Abstract Co-Author*) Nothing to Disclose
Sebastian Keil, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To conduct a prospective systematic analysis of factors contributing to variability of response classification in RECIST1.1 beyond factors related to disease measurement, i.e. variability that persists even if dedicated software for response assessment is used.

METHOD AND MATERIALS

63 patients (60 ± 9 years) underwent a total 132 contrast-enhanced CT studies for initial staging or follow-up after systemic chemotherapy. A target or non-target lesion satisfying RECIST1.1 criteria could be identified in 52/63 patients (82.5%) and 113/132 (85.6%) of (re-)staging CT studies. Data were independently interpreted by three radiologists with > 4 years of experience who used specialized software (MintMedical) for standardized response assessment. Response was classified in complete or partial response (CR, PR), or stable or progressive disease (SD, PD), and stratified as progressive (PD) vs. non-progressive (CR, PR, SD).

RESULTS

Overall, readers agreed in terms of response classification in 58.4% of studies (66/113) and disagreed in 41.6% (47/113). In 50/113 studies, readers had chosen the same, and in 63/113 studies, readers had chosen different target lesions. Selection of the same target lesions was associated with an 88% rate (44/50) of agreement; selection of different target lesions was associated with a 74.6% rate (47/63) of disagreement. After dichotomizing response classes according to their therapeutic implication in PD vs. non-PD RECIST1.1 response classes, disagreement was observed in 17/113 staging examinations (15%). In 13 of these 17 patients (76.5%), readers had chosen different target lesions.

CONCLUSION

The basic assumption of standardized response assessment is that different readers should yield the same response classification for a given patient. In fact, however, different readers disagree in almost half of patient cases, and in 15%, they disagree even with regards to the basic distinction between PD vs. non-PD. Major source of variability appears to be the fact that different readers may choose different target lesions. The resulting variability between readers will not be compensated for by software tools for automated response assessment.

CLINICAL RELEVANCE/APPLICATION

Even with standardized RECIST readings and use of dedicated automated software, different radiologists will yield different results with regards to response classification, even with regards to broadly different categories (PD vs. non-PD).

SSQ07

Gastrointestinal (Colon and Appendix)

Thursday, Dec. 3 10:30AM - 12:00PM Location: E353C

GI CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Andrea Laghi, MD, Rome, Italy (*Moderator*) Speaker, Bracco Group Speaker, Bayer AG Speaker, General Electric Company Speaker, Koninklijke Philips NV
Rizwan Aslam, MBBCh, San Francisco, CA (*Moderator*) Research support, Bayer AG

Sub-Events

SSQ07-01 Diffusion-weighted MRI for Evaluating Ileocolonic Inflammation in Crohn' Disease

Thursday, Dec. 3 10:30AM - 10:40AM Location: E353C

Participants
Xuehua Li II, Guangzhou, China (*Presenter*) Nothing to Disclose
Xiaosong Jiang, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Zhongwei Zhang, MD, PhD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Xu Yan, Shanghai, China (*Abstract Co-Author*) Employee, Siemens AG
Canhui Sun, MD, PhD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Ziping Li, MD, PhD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the efficacy of Diffusion-weighted MRI (DWI) for evaluating ileocolonic inflammation in patients with Crohn' disease (CD).

METHOD AND MATERIALS

25 CD patients underwent MR enterography (MRE) with DWI using three b values of 50, 400 and 800 s/mm2 and ileocolonoscopy within one month. The conventional MRE findings (including mural thickness, T2 weighted signal intensity and contrast enhancement) and DWI signal intensity in bowel segments were qualitatively scored from 0 to 3. Apparent diffusion coefficient (ADC) map was generated by using monoexponential model. Disease activity was scored by simple endoscopic score for Crohn's disease (SES-CD) immediately after each endoscopy and was graded as inactive (0-2) and active CD (≥3). The relationship between SES-CD and MRI results was analyzed. All MRI results were interpreted by two radiologists who blinded to clinical data independently.

RESULTS

Of the 102 evaluated segments (terminal ileum=20, colon/rectum=82), 55 segments were active CD. The ADCs of active CD were significantly lower than those of inactive CD (P <0.001), while DWI scores were higher in active CD (P <0.001). The SES-CD correlated closely with ADCs (r =-0.92, P <0.001), followed by DWI scores (r =0.88, P <0.001), MRE+DWI scores (r =0.88, P <0.001) and MRE scores (r =0.85, P <0.001). ADCs discriminated between active and inactive CD with an area under the ROC curves of 0.99, followed by DWI scores (AUC=0.98), MRE+DWI scores (AUC=0.98) and MRE scores (AUC= 0.94). The threshold ADC of 1.59×10-3 mm2/s yielded 95.70% sensitivity and 96.40% specificity. Inter-observer agreements were good with regard to DWI scores (κ =0.65, P<0.001) and ADC measurement (intra-class correlation coefficient=0.97, P <0.001).

CONCLUSION

DWI and ADC correlate with disease activity in ileocolonic Crohn' disease with excellent diagnostic accuracy for differentiating active from inactive CD.

CLINICAL RELEVANCE/APPLICATION

DWI and ADC are conducive to assess disease activity of Crohn' disease.

SSQ07-02 Dual Energy Spectral CT for Assessing the Stages of Colon Cancer

Thursday, Dec. 3 10:40AM - 10:50AM Location: E353C

Participants
Yang Chuangbo, MMed, Xianyang City, China (*Presenter*) Nothing to Disclose
Chenglong Ren, Shanxi, China (*Abstract Co-Author*) Nothing to Disclose
Qi Yang, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Tian Xin, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Zhanli Ren, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Tian Qian, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Ma Guangming, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Taiping He, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the value of dual energy spectral CT in assessing the stages of colon cancer.

METHOD AND MATERIALS

This study was approved by our ethics committee. We retrospectively analyzed 47 colon cancer patients who underwent

preoperative dual-phase contrast enhanced spectral CT scans. Patients were divided into the well-differentiated group (A) and the poorly and undifferentiated group (B) based on the pathological findings for analysis. Iodine concentration (IC) for tumors was measured in arterial phase (AP) and venous phase (VP) on the iodine-based material decomposition images and normalized to that of aorta to obtain normalized IC (NIC). Tumor CT attenuation number was measured on the monochromatic image sets to generate spectral HU curve and to calculate a slope (k) for the curve: (CT(40keV)-CT(90keV))/50. Values of the 2 groups were compared and ROC study was performed to assess the differential diagnosis performance.

RESULTS

There were 18 well-differentiated cases (group A) and 20 poorly differentiated and 9 undifferentiated cases (group B). CT numbers on the 70keV images were statistically the same in both groups (48.61±9.03HU vs. 63.97±15.86HU, p>0.05). On the other hand, The IC, NIC and slope (k) values in AP for group A were significantly lower than those for group B (1.01±0.20mg/ml vs. 1.59±0.57mg/ml for IC; 0.12±0.03 vs. 0.19±0.09 for NIC; 1.41±0.29 vs. 2.03±0.85 for slope, all p<0.05). Using iodine concentration value of 1.13mg/ml in AP as a threshold, one could obtain an area-under-curve of 0.85 for ROC study with sensitivity of 81.8% and specificity of 71.4% for differentiating well-differentiated from poorly differentiated colon cancers. These values were significantly higher than the respective values of 72.7% and 64.3% with conventional CT numbers at 70keV.

CONCLUSION

Quantitative parameters obtained in spectral CT in the arterial phase improve accuracy for differentiating well-differentiated colon cancers from poorly differentiated and un-differentiated ones.

CLINICAL RELEVANCE/APPLICATION

Quantitative iodine concentration measurement in spectral CT may be used to improve accuracy for the differentiation of well-differentiated and poorly and un-differentiated colon cancers.

SSQ07-04 Extramural Venous Invasion Detected by Contrast-enhanced Multiple-row Detectors Computed Tomography (ceMDCT) as a Predictor of Synchronous Metastases in Patients with Colon Cancer

Thursday, Dec. 3 11:00AM - 11:10AM Location: E353C

Participants
Suxing Yang, Beijing, China (*Presenter*) Nothing to Disclose
Xun Yao, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xinghe Song, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yancheng Cui, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yingjiang Ye, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Nan Hong, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yi Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether extramural venous invasion (EMVI), detected by contrast-enhanced multiple-row detectors computed tomography (ceMDCT), can be used as an adverse feature to predict synchronous metastases in patients with colon cancer.

METHOD AND MATERIALS

Patients with pathology-proven colon cancer from January 2009-December 2013 were included in this retrospective study. Patients with other malignancies and/or intussusception were excluded. Two radiologists reviewed patients' ceMDCT images and reached a consensus on tumor classification and lymph node categorization in accordance with the American Joint Committee on Cancer (AJCC)-7th Edition. Furthermore, two radiologists reached a consensus regarding EMVI status, extramural tumor depth, and tumor location. Tumor and lymph node categories, and AJCC stage and tumor differentiation were determined from patients' pathology records. Synchronous metastases were confirmed by whole body ceMDCT within 3 months after initial diagnosis or by surgery, if available. Chi-squared and Fisher's exact tests were used to analyze the association between EMVI and tumor characteristics. Logistic regression analyses were performed to analyze whether EMVI status was a predictive factor of metastases in colon cancer.

RESULTS

250 patients were reviewed. EMVI was observed in 106 patients (106/250, 42.4%). In the EMVI-positive group, synchronous metastases were seen in 39 patients (39/106, 36.8%) while 10 (10/144, 6.9%) patients in the EMVI-negative group had confirmed metastases. EMVI was moderately associated with extramural tumor depth and AJCC stage (contingency coefficient 0.443 and 0.401 respectively, P<0.001), which were then excluded from all multivariable analyses. EMVI status and pathologic lymph node categories were demonstrated to be significant factors (Odds ratio 7.8 and 9.6, P<0.001) in predicting synchronous metastases.

CONCLUSION

EMVI may be used as a significant adverse feature to predict an increased risk of synchronous metastases in colon cancer patients.

CLINICAL RELEVANCE/APPLICATION

ceMDCT can demonstrate extramural venous invasion and is recommended for the initial evaluation of colon cancer before curative surgery and adjuvant chemotherapy.

SSQ07-05 Stercoral Perforation and Colorectal Cancer Perforation; Differentiating CT Features

Thursday, Dec. 3 11:10AM - 11:20AM Location: E353C

Participants
Sujin Ko, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Seong Sook Hong, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jiyoung Hwang, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun-Joo Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Hwan Bae, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the computed tomography (CT) signs associated with stercoral perforation and colorectal cancer perforation.

METHOD AND MATERIALS

From 8 years, all surgically and pathologically confirmed patients with stercoral perforation (n=8, mean age 68.3 years) or colon cancer perforation (n=11, mean age 66.3 years) were retrospectively reviewed by two board-certified radiologists blinded to the proven diagnosis. The following CT findings were evaluated and recorded for each patient: wall thickness of distal colon adjacent to perforation site, pattern of colon wall thickening and enhancement, length of thickened bowel wall, presence of fecaloma, degree of proximal colon dilatation, and pericolonic inflammation or presence of pericolonic abscess, and number of enlarged pericolonic lymph nodes. These findings were correlated with the pathologic diagnosis.

RESULTS

The mean thickness of the distal colonic wall adjacent to the perforation site was 13.6 mm in patients with colorectal cancer perforation and 5.1 mm with stercoral perforation, which was statistically different. There was a significant correlation between colorectal cancer perforation and eccentric wall thickening ($p<0.01$). CT findings of layered enhancing wall thickening ($p<0.01$) and presence of fecaloma in proximal colon ($p<0.01$) were significant findings for stercoral perforation. Patients with colorectal cancer displayed more pericolonic lymph nodes (mean 2.27, $p<0.05$).

CONCLUSION

Fecaloma in the proximal colon and layered enhancing wall thickening adjacent to perforation site are likely due to stercoral perforation. Eccentric bowel wall thickening at the distal portion of the perforation site with many enlarged pericolonic lymph nodes is most likely colorectal cancer perforation.

CLINICAL RELEVANCE/APPLICATION

Resection of the diseased segment of colon and exteriorization is sufficient for stercoral perforation, while extensive bowel resection with lymph node dissection is required for treatment of colorectal cancer perforation. Thus, distinguishing these two conditions and accurate preoperative diagnosis can facilitate early therapeutic management and improve survival.

SSQ07-06 Comparison of Diagnostic Performance of US Re-evaluation and CT Reassessment for Patients with Equivocal CT Findings of Acute Appendicitis

Thursday, Dec. 3 11:20AM - 11:30AM Location: E353C

Participants
Ji Ye Sim, MD, MS, Seongnam-Si, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hyuk Jung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Suk Ki Jang, Sungnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Woo Yeon, Sungnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Il Dong Kim, Sungnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
June-Sik Cho, MD, Daejeon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Ya Paik, Sungnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Rock Ha, Sungnam, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare diagnostic performance between US re-evaluation and CT reassessment for patients with equivocal CT findings of acute appendicitis, overall and coexistent inflammation group

METHOD AND MATERIALS

Our Institutional Review Board approved this retrospective study and waived informed consent. 115 patients who had equivocal CT findings of acute appendicitis and underwent US re-evaluation were included. All CTs were reviewed independently by two abdominal radiologists. They analyzed four CT findings (appendiceal wall enhancement, appendiceal wall thickening, intraluminal air in appendix, and a coexistent inflammatory lesion) and make a diagnosis of acute appendicitis. In US analysis, patients were categorized into positive and negative appendicitis, based on previous structured US reports. The diagnostic performance of CT reassessment and US re-evaluation, interobserver agreement of CT findings and the likelihood of appendicitis were calculated.

RESULTS

The overall AUC, sensitivity and specificity of US re-evaluation (0.960, 100% and 92.1%) was higher than CT reassessment (reviewer 1: 0.697, 51.9% and 87.5%, reviewer 2: 0.759, 66.7% and 85.2%). In the coexistent inflammation group, the AUC, sensitivity and specificity of US re-evaluation (reviewer 1 and 2: 0.990, 100% and 98.0%) were also higher than CT reassessment (reviewer 1: 0.607, 27.3% and 94.1%, reviewer 2: 0.561, 14.3% and 98.0%). Interobserver agreement of diagnosing appendicitis and alternative diagnosis were moderate (κ=0.44 and 0.51).

CONCLUSION

For patients with equivocal CT findings of acute appendicitis, US re-evaluation shows better diagnostic performance than CT reassessment in both of overall and coexistent inflammation group.

CLINICAL RELEVANCE/APPLICATION

When patient have equivocal findings of appendicitis on CT, US re-evaluation can improve diagnostic accuracy.

SSQ07-07 CT Differentiation of the Non-Mucocele Type Appendiceal Neoplasm: Benign versus Malignant

Thursday, Dec. 3 11:30AM - 11:40AM Location: E353C

Participants
Youngjong Cho, Seongnam, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hyuk Jung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Suk Ki Jang, Sungnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Woo Yeon, Sungnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to evaluate the feasible CT findings for differentiating malignant from benign lesions in cases of non-mucocele type appendiceal neoplasms.

METHOD AND MATERIALS

All consecutively registered patients with pathologic confirmed appendiceal neoplasms and pre-operative CT scans (n=60) were obtained over a 14-year period from January 2000 through December 2014. Of these patients, borderline malignancy (n=28) and mucocele type appendiceal neoplasm (n=4) were eliminated by pathologic reports and the remaining 28 patients with non-mucocele type appendiceal neoplasm finally formed the study sample. The patients were classified into benign and malignant group depending on their pathologic reports. The colonic type adenoma (n=3), mucinous cystadenoma (n=10), benign appendiceal neuroendocrine tumor (n=4), and ganglioneuroma (n=1) were included in the benign group and the colonic type adenocarcinoma (n=4), malignant appendiceal neuroendocrine tumor (n=3), lymphoma (n=1) and metastasis (n=2) formed into the malignant group. Two experienced radiologists analyzed the presence of mass, irregular wall thickening, perforation, cecal wall thickening, appendicolith, peritoneal thickening, ascites, lymphadenopathy suggestive of malignancy, and periappendiceal fat infiltrations in consensus reading. The CT results were compared for malignant and benign groups.

RESULTS

CT showed statistically significant difference in irregular wall thickening, presence of mass and perforation between the benign and malignant groups ($p < 0.05$). Cecal wall thickening, appendicolith, peritoneal thickening, ascites, lymphadenopathy suggestive of malignancy, and periappendiceal fat infiltrations did not exhibit significant difference between the benign and malignant groups ($p > 0.05$).

CONCLUSION

It is difficult to distinguish underlying malignancy from benign condition, regarding non-mucocele type appendiceal neoplasm. However, irregular wall thickening, presence of mass and perforation can be useful CT features associated with malignancy.

CLINICAL RELEVANCE/APPLICATION

Irregular wall thickening, presence of mass, and perforation can be applicable CT features in the pre-operative diagnosis of underlying malignancy concerning non-mucocele type appendiceal neoplasm.

SSQ07-08 Preoperative CT Predictors Associated with 30-day Adverse Events in Patients with Appendiceal Inflammatory Masses that Underwent Immediate Appendectomies

Thursday, Dec. 3 11:40AM - 11:50AM Location: E353C

Participants
Myung Sub Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Mi Sung Kim, MD, Koyang, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Dong Hyun Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hae Won Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hee-Jin Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Pyo Hong, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Heon-Ju Kwon, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate preoperative CT predictors that are associated with 30-day adverse events in patients that underwent an immediate appendectomy for appendiceal inflammatory masses.

METHOD AND MATERIALS

One hundred forty-four patients who underwent immediate appendectomy, and were diagnosed with an appendiceal inflammatory mass by the preoperative CT examination, were included. The main outcome was the 30-day adverse events. Patient demographics, preoperative CT and laboratory parameters were evaluated. Factors associated with 30-day adverse events were assessed using logistic regression analysis.

RESULTS

A total of 22 (15%) of the 144 patients had 30-day adverse events: 10 intra-abdominal abscesses, three wound infections, two cases of peritonitis, two small bowel obstructions, two intra-abdominal abscesses with peritonitis, one intra-abdominal abscess with wound infection, one intra-abdominal abscess with obstructed ileus, and one case of peritonitis with obstructed ileus. In univariate analysis, the presence of appendicolith (odds ratio [OR], 2.49; $p = 0.048$), and obstructed ileus (OR 3.79; $p = 0.01$) were associated with adverse events. Obstructed ileus (adjusted OR, 3.05; $p = 0.04$) was the only independent preoperative predictor associated with 30-day adverse events in patients with appendiceal inflammatory masses.

CONCLUSION

Obstructed ileus was an independent preoperative CT predictor associated with 30-day adverse events in patients that underwent immediate appendectomy for appendiceal inflammatory masses.

CLINICAL RELEVANCE/APPLICATION

Non-operative approach, such as percutaneous drainage or use of antibiotics might be considered if obstructive ileus was accompanied preoperatively in patients having appendiceal inflammatory mass.

SSQ07-09 Initial Performance of Radiologists and Radiology Residents in Interpreting Low-dose (2-mSv) Appendiceal CT

Thursday, Dec. 3 11:50AM - 12:00PM Location: E353C

Participants
Hyun Kyung Yang, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Yousun Ko, MPH, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Hee Lee, MD, Bucheon-Si, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hyunsik Woo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Soyeon Ahn, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bohyoung Kim, PhD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Perry J. Pickhardt, MD, Madison, WI (*Abstract Co-Author*) Co-founder, VirtuoCTC, LLC; Stockholder, Cellectar Biosciences, Inc; Research Consultant, Bracco Group; Research Consultant, KIT ; Research Grant, Koninklijke Philips NV
Mi Sung Kim, MD, Koyang, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Bin Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyoung Ho Lee, MD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively evaluate the initial diagnostic performance and learning curve of a community of radiologists and residents in interpreting 2-mSv appendiceal CT.

METHOD AND MATERIALS

The institutional review boards approved the study. We included 46 attending radiologists and 153 radiology residents from 22 hospitals, who completed an online training course of 30 2-mSv CT cases. Appendicitis was confirmed in 14 cases. Most of the readers had limited (≤ 10 cases, n = 32) or no (n = 118) prior exposure to low-dose (LD) appendiceal CT. The order of cases was randomized for each reader. Multi-reader multi-case receiver operating characteristic (ROC) analysis was performed. Generalized estimating equations were used to model the learning curves in diagnostic performance.

RESULTS

Diagnostic performance gradually improved with years of training. Average area under the ROC curve was 0.94 (95% confidence interval, 0.90, 0.98) 0.92 (0.88, 0.96), 0.90 (0.85, 0.96), and 0.86 (0.80, 0.92), for the attending radiologists, senior residents, second-year residents, and first-year residents, respectively. We did not observe any notable intra-reader learning curves over the training course of the 30 cases, except for a decrease in reading time. Diagnostic accuracy and sensitivity were significantly affected by the reader training level and prior overall experience with appendiceal CT, but not by the prior specific exposure to LD appendiceal CT.

CONCLUSION

The learning curve is likely prolonged and forms gradually over years by overall radiology training and clinical experience in general rather than by the exposure to LD appendiceal CT specifically.

CLINICAL RELEVANCE/APPLICATION

The clinical implementation of 2-mSv CT may be feasible in many hospitals, assuming qualified site radiologists can carefully supervise the practice. The learning curve is likely prolonged and forms gradually over years by overall radiology training and clinical experience in general rather than by the exposure to LD appendiceal CT specifically. Performance improves with years of CT experience, with senior residents' performance nearly matching that of attending radiologists.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Perry J. Pickhardt, MD - 2014 Honored Educator

SSQ08

ISP: Gastrointestinal (MR Technique)

Thursday, Dec. 3 10:30AM - 12:00PM Location: E353A

GI MR PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Hero K. Hussain, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Bachir Taouli, MD, New York, NY (*Moderator*) Consultant, Guerbet SA
Scott B. Reeder, MD, PhD, Madison, WI (*Moderator*) Institutional research support, General Electric Company Institutional research support, Bracco Group

Sub-Events

SSQ08-01 Gastrointestinal Keynote Speaker: New MRI Techniques in the Abdomen

Thursday, Dec. 3 10:30AM - 10:40AM Location: E353A

Participants
Bachir Taouli, MD, New York, NY (*Presenter*) Consultant, Guerbet SA

SSQ08-02 Shortened Breath-hold Contrast-enhanced MRI of the Liver Using a New Parallel Imaging Technique, CAIPIRINHA (Controlled Aliasing in Parallel Imaging Results in Higher Acceleration): A Comparison with Conventional GRAPPA Technique

Thursday, Dec. 3 10:40AM - 10:50AM Location: E353A

Participants
Masaki Ogawa, Nagoya, Japan (*Presenter*) Nothing to Disclose
Tatsuya Kawai, MD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Hirohito Kan, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Susumu Kobayashi, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Akagawa, Aichi, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazushi Suzuki, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Shunsuke Nojiri, Aichi, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshiyuki Ozawa, MD, PhD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuta Shibamoto, MD, PhD, Nagoya, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Respiratory motion artifact is one of the major causes of image degradation in dynamic contrast-enhanced imaging of the abdomen. The parallel imaging (PI) technique can decrease the acquisition time but lead to PI artifacts and a loss of signal-to-noise ratio (SNR) at a high acceleration factor (AF). They depend heavily on the geometry of the coil array used and various vendor-specific PI reconstruction techniques. The purpose of this study was to examine whether the shortened breath-hold 3-dimensional volumetric interpolated breath-hold examination (3D-VIBE) sequence for high AF using the controlled aliasing in parallel imaging results in higher acceleration (CAIPIRINHA) technique could substitute for the conventional sequence using generalized autocalibrating partially parallel acquisition (GRAPPA) in patients undergoing routine gadoxetic acid-enhanced liver MRI.

METHOD AND MATERIALS

30 patients with clinically suspected focal liver lesions were scanned using 3D-VIBE sequences with GRAPPA with AF=2 and AF=4 and CAIPIRINHA with AF=4 (acquisition times: 21, 14, and 12 seconds, respectively) at the same spatial resolution during the hepatobiliary phase on a 3T MRI scanner. Visual evaluations using a 3- or 5-point scale and SNR analysis were performed for the 3 sequences.

RESULTS

For CAIPIRINHA with AF=4, there was significantly less image noise in both visual evaluation and SNR analysis and fewer PI artifacts than for GRAPPA with AF=4 ($P<0.0005$); it was equal to GRAPPA with AF=2, and had fewer motion artifacts than GRAPPA with AF=2 and 4 ($P<0.0012$). The liver edge sharpness and hepatic vessel clarity, lesion conspicuity, and overall image quality were rated significantly higher with CAIPIRINHA with AF=4 than GRAPPA with AF=2 and AF=4 ($P<0.009$). For GRAPPA with AF=4, lesion conspicuity and overall image quality were rated significantly lower than for GRAPPA with AF=2 ($P<0.012$).

CONCLUSION

The shortened breath-hold 3D-VIBE sequence using the new CAIPIRINHA technique with a high AF of 4 was superior to the conventional GRAPPA sequence. The shortened breath-hold sequence using GRAPPA with a high AF of 4 worsened the image quality and lesion conspicuity.

CLINICAL RELEVANCE/APPLICATION

The shortened breath-hold 3D-VIBE sequence using the CAIPIRINHA with a high AF of 4 can reduce the acquisition time to almost half without significantly increasing image noises and artifacts.

SSQ08-03 New Quiet MR Sequences in Clinical Routine: First Experience in Abdominal Imaging

Thursday, Dec. 3 10:50AM - 11:00AM Location: E353A

Participants
Sebastian Fischer, MD, Frankfurt, Germany (*Presenter*) Nothing to Disclose
Markus Domschke, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Claudia Frellesen, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Patricia Dewes, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Jan-Erik Scholtz, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan Zangos, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Purpose of our study was to demonstrate the feasibility and limitations of acoustic noise reduction in a standard clinical MRI protocol for abdominal imaging.

METHOD AND MATERIALS

The acoustic noise and image quality were assessed for a standard liver imaging protocol including TSE and GRE sequences and compared to a protocol with new quiet optimizations in 17 patients with suspected liver lesions (10 men, 7 women; 58.7±12.0 years). For each sequence the SI, SNR and CNR were measured. Two independent, blinded readers with a different level of training interpreted both examinations, while scoring artefacts, the overall image quality, the delineation of the abdominal organs and the level of confidence in visualization of the anatomy and pathologies. Afterwards a side-by-side comparision for readers' image preference was performed.The means of the sound level measurements, the SI, SNR and CNR was compared in a paired comparative t-test using Holm-Sidak method. The Wilcoxon rank test determined differences in readers ratings and their level of agreement was derived from Spearman correlations.

RESULTS

Significant reduction of acoustic noise was measured for T2 TSE (-5.16 dBA) and T2 HASTE (-3.75 dBA) and less differences for T1 FLASH (-0.42 dBA) and T1 DIXON (-0.29 dBA). SI, SNR and CNR were significantly lower for quiet T2 TSE (-11.3%, -18.0%, -23.1%) and T2 HASTE (-25.4%, -46.2%, -37.7%) and higher for T1 DIXON (+4.6%, +32.0%, +24.4%). All sequences were independently rated with an comparable image quality and confidence in visualization of the anatomy and pathologies against the standard sequences, except from the quiet T1 FLASH sequences (structure identification -29,5%, diagnostic confidence -37.5%). Accordingly in the side-by-side comparison standard T1 FLASH sequences were strongly preferred against new quiet sequences, while less preference was observed for T2 TSE and T2 HASTE and no difference in T1 DIXON sequences. Inter-rater correlation was k=0,987 with p<0.001.

CONCLUSION

An acoustic noise reduction was achieved with the new quiet optimizations while maintaining diagnostic quality and confidence in T2 TSE, T2 HASTE and T1 DIXON sequences. The quiet T1 FLASH sequence seems not to be comparable with regard to image quality and diagnostic confidence.

CLINICAL RELEVANCE/APPLICATION

The results can be used to render MRI scans more patient-friendly in clinical practice, in particular for young, scared or elderly patients.

SSQ08-04 Intravoxel Incoherent Motion Diffusion-weighted Imaging is a Better Indicator of High Grade Hepatocellular Carcinoma Than Conventional Apparent Diffusion Coefficient

Thursday, Dec. 3 11:00AM - 11:10AM Location: E353A

Participants
Shintaro Ichikawa, MD, Chuo-Shi, Japan (*Presenter*) Nothing to Disclose
Utaroh Motosugi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Morisaka, MD, Kofu, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsuhiro Sano, MD, PhD, Chuo, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomoaki Ichikawa, MD, PhD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Onishi, MD, Yamanashi, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the utility of intravoxel incoherent motion (IVIM) derived parameters for discrimination of histological grade of hepatocellular carcinoma (HCC). Measurement reproducibility was also studied by assessing inter- and intra-reader variation.

METHOD AND MATERIALS

Fifty-eight patients with 60 pathologically confirmed HCCs underwent IVIM imaging with 11 b values (0-1000 s/mm2). The diffusion parameters, i.e., apparent diffusion coefficient (ADC), slow diffusion coefficient (D), fast diffusion coefficient (D*), and perfusion fraction (f) were calculated for all HCCs. All measurements were performed by two radiologists, and one of them repeated the measurements after a 4-week interval to minimize memory bias. These parameters were compared between lesions with high and low-to-moderate histologic grade using Wilcoxon test. Further, receiver operating characteristic (ROC) analysis was performed to evaluate the discrimination ability, and inter- and intra-reader agreements were analyzed with intraclass correlation coefficients (ICC).

RESULTS

The D and D* values (×10-3 mm2/s) were both significantly lower in high grade HCC than in low-to-moderate grade HCC for both observers ($P < 0.0183$) (D = 0.78 vs. 0.98 [reader 1-1st], 0.73 vs. 0.96 [reader 1-2nd], and 0.76 vs. 0.96 [reader 2]; and D* = 24.5 vs. 39.7 [reader 1-1st], 22.7 vs. 40.7 [reader 1-2nd], and 23.5 vs. 37.0 [reader 2]). The ADC values [×10-3 mm2/s] measured by reader 1-1st and f (%) measured by reader 1-2nd also showed a statistical difference (ADC = 0.99 vs. 1.14, and f = 27.1 vs. 21.8, $P < 0.0129$). The ROC analysis demonstrated that the D value had significantly greater Az values than the ADC for

discriminating high grade HCC from low-to-moderate grade HCC (0.859 vs. 0.753 [reader 1-1st], 0.885 vs. 0.635 [reader 1-2nd], and 0.816 vs. 0.651 [reader 2], P < 0.047). The inter- and intra-reader ICC values were excellent for D (0.814 and 0.851) and good for other parameters (ADC, 0.786 and 0.732; D*, 0.688 and 0.724; f, 0.689 and 0.623).

CONCLUSION

The IVIM-derived D values showed a significantly better diagnostic performance than the ADC values in differentiating high grade HCC from low-to-moderate grade HCC. The results by the two readers and repeated measurements by one reader are reproducible, especially for the D value.

CLINICAL RELEVANCE/APPLICATION

D values derived from IVIM modeling may be helpful in the preoperative differentiation of the histologic grade of HCC,

SSQ08-05 Quantification of Liver Fibrosis by T1rho MR - Phantom Validation and Pilot In-Vivo Imaging at 3T

Thursday, Dec. 3 11:10AM - 11:20AM Location: E353A

Participants
David T. Fetzer, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Xiang He, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Alessandro Furlan, MD, Pittsburgh, PA (*Abstract Co-Author*) Author, Reed Elsevier; Research Grant, General Electric Company
Kyongtae T. Bae, MD, PhD, Pittsburgh, PA (*Abstract Co-Author*) Patent agreement, Medtronic, Inc; Consultant, Otsuka Holdings Co, Ltd

PURPOSE

To assess the performance of T1rho MR in noninvasive fibrosis quantification through protein phantom validation, healthy subject reproducibility testing, and liver disease patient imaging.

METHOD AND MATERIALS

This prospective study was HIPAA-compliant and IRB-approved. T1rho imaging was performed on a Siemens MAGNETOM Trio 3T scanner with a phased-array body coil. Single-slice measurements were obtained using spin-lock preparation ranging from 10-80 msec followed by a balanced steady state free precession readout. T1rho values were calculated by single exponential fitting of the signal decay profile. Phantoms containing various concentrations of polysaccharides and proteins (cross-linked bovine serum albumin) were imaged. 19 healthy subjects (12M, 7F, mean age 30) were recruited; 11 liver disease subjects (8M, 3F, mean age 50) were enrolled following liver biopsy (fibrosis stages F1=2; F2=5; F3=2; F4=2). Correlation (Pearson r) was calculated between T1rho value and fibrosis stage, inflammatory grade, and degree of steatosis, as well as time since last meal and days since last alcoholic beverage.

RESULTS

In phantoms, T1rho values correlated strongly with protein concentration (r=0.97), further validating T1rho quantification. Good inter- and intra-subject reproducibility was demonstrated in healthy volunteers. In liver disease subjects, good correlation was found between T1rho and fibrosis stage (r=0.74). No significant correlation between T1rho and inflammatory activity was found (r=-0.26). There was a moderate negative correlation with degree of steatosis (r = -0.66). There was no significant correlation with hours since last meal or days since last drink (r=-0.12 and 0.16, respectively).

CONCLUSION

T1rho quantification was validated using a protein solution phantom. T1rho hepatic imaging is feasible at 3T in human subjects and values appear unaffected by food or alcohol intake. A positive correlation with fibrosis stage in disease subjects was found.

CLINICAL RELEVANCE/APPLICATION

T1rho values appear to correlate with macromolecular concentration and may provide an additional tool for noninvasive quantification of fibrosis, an important indicator of chronic liver disease severity.

SSQ08-06 Rectal Cancer: Short-Term Reproducibility of Intravoxel Incoherent Motion Parameters at 3.0T MR

Thursday, Dec. 3 11:20AM - 11:30AM Location: E353A

Participants
Hongliang Sun, MD, Beijing, China (*Presenter*) Nothing to Disclose
Yanyan Xu, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Wu Wang, MD, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the short-term test-retest reproducibility of IVIM (intravoxel incoherent motion) parameters of rectal cancer at 3.0T MR.

METHOD AND MATERIALS

Twenty-six patients with rectal cancer who underwent pelvis magnetic resonance imaging including diffusion-weighted imaging using eight b values (0 to 1000s/mm2) 30 min apart. IVIM parameters (D, pure diffusion; f, perfusion fraction; D*, pseudo-diffusion coefficient) were calculated by bi-exponential analysis. The values of interobserver IVIM parameters and test-retest parameters were compared by paired t-test or Wilcoxon test. The short-term test-retest reproducibility of IVIM parameters and the interobserver IVIM parameters variation were assessed by measuring repeatability coefficient and Bland-Altman limits of agreements. The repeatability coefficient was calculated as the range of IVIM parameters of two identical measurements for 95% of subjects. P<0.05 was considered to indicate a statistically significant difference.

RESULTS

The mean IVIM parameters values (D, f, D*) were (1.17±0.39) mm2/ms, (13.56±6.74) %, (46.76±77.74) mm2/ms, respectively. There were no significant differences in D, f, or D* values within two different observers on the same DW-MR scan (p=0.256,

p=0.088, p=0.112), and the corresponding repeatability coefficient and Bland-Altman biases were 11.1%, 55.4%, 40.3%; 1.0%, -8.0%, 2.9%, respectively. The repeatability coefficient and Bland-Altman biases for D, f and D* were 47.3%, 126.3%, 197.4% and 10.9%, -21.6%, 20.1%, respectively with short-term test and retest DW-MR scan.

CONCLUSION

Relatively good reproducibility of D value measurement were observed in rectal cancer between short-term test and retest IVIM imaging, compared to f and D* values. The IVIM parameters (f and D*) showed large repeatability coefficient and extent of 95% confidence interval. More efforts should be invested to improve the measurement reproducibility of IVIM parameters in rectal cancer.

CLINICAL RELEVANCE/APPLICATION

The Intravoxel Incoherent Motion (IVIM)-derived parameters are increasingly used for clinical management decisions in rectal cancer. However intravoxel incoherent motion (IVIM) parameters (f and D*) showed worse measurement reproducibility compared to D. In serial DW-MRI for rectal cancer evaluation such as treatment response, measurement variations should be considered.

SSQ08-07 Semi-quantitative Assessment of Respiratory Motion Compensation Techniques in T2-weighted Abdominal MR Imaging Using a Novel MRI-compatible Motion Platform

Thursday, Dec. 3 11:30AM - 11:40AM Location: E353A

Participants
Alberto Diaz de Leon, MD, Dallas, TX (*Presenter*) Nothing to Disclose
David T. Fetzer, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Qing Yuan, PhD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Joris Nofiele, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yokoo, MD, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Gaurav Khatri, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Daniel N. Costa, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
April A. Bailey, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Rajiv Chopra, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Ivan Pedrosa, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

For T2-weighted (T2) fast spin echo imaging of the abdomen, multishot (MSFSE) may be preferred over faster single shot (SSFSE) because of superior contrast-to-noise, increased sharpness and spatial resolution. However, studies evaluating the effect of motion on T2W strategies are lacking. Our goal was to assess the effects of respiratory motion on various k-space sampling and motion compensation approaches, utilizing a novel motion-simulating platform.

METHOD AND MATERIALS

Respiratory waveforms were recorded in a healthy volunteer by tracking diaphragm excursion during breath-hold, diaphragmatic drift, cough, and free-breathing. Waveforms were used to drive a computer-controlled MRI-compatible motion platform. Using a 3T Philips Ingenia and a 32-element phased-array coil, T2 axial images of a torso phantom were acquired during simulated respiratory motion using SSFSE, interleaved (iMSFSE) and sequential (sMSFSE) MSFSE, and a new MultiVane XD (MVXD) acquisitions. These were repeated during simulated free breathing without and with respiratory trigger (RT) and navigator (NAV) motion compensation. Three fellowship-trained radiologists, blinded to acquisition used, independently assessed motion artifacts, clarity of edges, signal uniformity, slice registration, and overall quality using a 5-point scale. Scores for each radiologist were normalized and analyzed by one-way ANOVA for equality of mean scores between acquisitions.

RESULTS

Imaging scores during breath-hold and cough showed no significant differences between acquisitions. During diaphragmatic drift and free breathing (without/with RT and NAV), SSFSE scores of motion artifacts, signal uniformity, and overall quality were superior to those of iMSFSE and sMSFSE, and statistically different ($p<0.01$). MVXD had better scores than iMSFSE and sMSFSE for all categories with RT and for motion artifact and signal uniformity with NAV, and these differences were significant ($p<0.01$).

CONCLUSION

Our novel MRI-compatible motion phantom allows detecting differences in the effects of respiratory motion in various k-space sampling and respiratory compensation techniques for T2W abdominal MRI. SSFSE and novel acquisitions such as MVDX resulted in better image quality scores.

CLINICAL RELEVANCE/APPLICATION

Phantom motion simulation studies enable systematic quality assessment of MR acquisitions during motion and facilitate development and validation of new motion-compensated MR imaging techniques.

SSQ08-08 Is 3D Non-rigid Registration Necessary in Hepatic DCE-MRI: A Repeatability Study

Thursday, Dec. 3 11:40AM - 11:50AM Location: E353A

Participants
Hongwei Liang SR, PhD, Nantong, China (*Presenter*) Nothing to Disclose
Fei Xing, Nantong, China (*Abstract Co-Author*) Nothing to Disclose
Jian Lu, Nantong, China (*Abstract Co-Author*) Nothing to Disclose
Peng Cao, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate necessity of three-dimensional non-rigid registration application in heptic dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) by the pharmacokinetic parameters' repeatability.

RESULTS

There is significant difference between means of discrepant pixels' value pre and post registration data in same slice(t=2.637,p<0.05). RPD box chart showed that mean of inter- and intra [Ktrans] ,[kep] and [Ve] of lesion, liver and sacrospinal muscle after registration was smaller than that before registration. Outliers and extreme value were reduced or disappeared for most pharmacokinetic parameters in pre and post registration comparison, with the exception of the [Ve] from liver in interobserver comparison (number of outliers pre/post- registration:0/3) and [kep] from lesion in intraobserver comparison (number of outliers pre/post- registration: 2/3). Repeatability of [Ktrans] and [kep] measured from lesion, liver and sacrospinal muscle was improved after registration in both inter- and intra-measurements. Concordance correlation coefficient(CCC) of [Ktrans], [kep],[Ve] obtained from lesion, sacrospinal muscle was augmented in post -registration group than that of in pre group(for example, CCC of interobserver comparison pre/post- registration:0.5561/0.8510).

CONCLUSION

The 3D non-rigid registration is relatively useful to improve the repeatability of pharmacokinetic parameters and necessary in hepatic DCE-MRI.

METHODS

This prospective study was approved by the institutional review board. 18 patients with confirmed hepatocellular carcinoma underwent DCE-MRI examination. We applied a 3D non-rigid registration on the dynamic enhanced sequence and pharmacokinetic parameters such as transfer constant [Ktrans], rate constant [kep], and relative extravascular eatracellular space [Ve] were obtained with a Reference Model. Firstly, we compared the value of each pixel in the same slice of pre and post-registration images and all the images in dynamic phases were studied. Paired t-test was used to evaluate the discrepant pixels in this two groups. [Ktrans], [kep] and [Ve] value of lesion, liver and sacrospinal muscle were obtained by the mean value of the fixed ROI in the same slice. Then, their values of pre and post registration groups were compared by using relative percent difference(RPD) and The Bland-Altman Plot method. Inter- and intra variations, repeatability and concordance correlation were performed for DCE-MRI quantitative parameters.

SSQ08-09 Limitations of Gd-EOB-DTPA-enhanced MRI: Can Clinical Parameters Predict Suboptimal Hepatobiliary Phase?

Thursday, Dec. 3 11:50AM - 12:00PM Location: E353A

Participants
Victoria Chernyak, MD, Bronx, NY (*Presenter*) Nothing to Disclose
Milana Flusberg, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Mariya Kobi, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Viktoriya Paroder, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Alla M. Rozenblit, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Hepatobiliary phase (HBP) of Gd-EOB-DTPA-enhanced MRI offers additional information not available with extracellular Gd agents. According to Liver Imaging Reporting and Data System (LI-RADS), adequate HBP is essential for reliable characterization of observations relative to the liver parenchyma. LI-RADS deems HBP to be adequate when liver parenchyma is unequivocally hyperintense relative to intrahepatic vessels. Suboptimal HBP would negate the advantage of Gd-EOB-DTPA. Thus, accurate prospective identification of patients who would have suboptimal HBP would be helpful in clinical practice. The goal of this study was to establish cut-off levels for clinical parameters which would predict suboptimal HBP.

METHOD AND MATERIALS

This retrospective study included patients with chronic liver disease who had hepatocellular carcinoma screening with Gd-EOB-DTPA-enhanced MRI between 1/1/11-3/1/13. For each case HBP was rated as adequate or suboptimal, based on LI-RADS criteria. The following laboratory data obtained within 3 months of MRI date was extracted: total bilirubin (TB), direct bilirubin (DB), serum glutamic oxaloacetic transaminase (SGOT), serum glutamic-pyruvic transaminase (SGPT) and alkaline phosphatase (ALP). Model For End-Stage Liver Disease (MELD) scores were calculated as $3.78\times\ln[TB] + 11.2\times\ln[INR] + 9.57\times\ln[creatinine] + 6.43$. Receiver operating curve (ROC) analysis was used to establish cut-off values for predicting suboptimal HBP.

RESULTS

Of 179 patients, 158 (88.3%) patients (91 [57.6% male) had adequate HBP and 21 (11.7%) patients (13 [61.9%] male) had suboptimal HBP, mean ages 57.7 [±9.9] years and 52.7 [±14.4] years, respectively (p=0.140). Areas under the curve for predicting suboptimal HBP were 0.86 (95%CI 0.78-0.94) for MELD score, 0.87 (95%CI 0.80-0.95) for TB, 0.92 (95%CI 0.86-0.97) for DB, 0.58 (95%CI 0.46 - 0.69) for SGOT, 0.39 (95%CI 0.27 - 0.51) for SGPT. Accuracy, positive likelihood ratios and cut-off values for predicting suboptimal HBP were, respectively: 88.6% and 11.5 for MELD score ≥16.7, 90.0% and 35.5 for TB ≥4.3 mg/dL, 92.9% and 71.0 for DB ≥1.3 mg/dL.

CONCLUSION

Values above cut-off levels of MELD score, direct and total bilirubin can predict suboptimal hepatobiliary phase with high accuracy.

CLINICAL RELEVANCE/APPLICATION

Prospective identification of patients with high likelihood of suboptimal HBP can help avoid administering a more costly agent to patents who would not benefit from its unique properties.

SSQ09

ISP: Genitourinary (Renal Mass Evaluation)

Thursday, Dec. 3 10:30AM - 12:00PM Location: E353B

GU CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Raghunandan Vikram, MBBS, FRCR, Houston, TX (*Moderator*) Nothing to Disclose
Daniele Marin, MD, Cary, NC (*Moderator*) Nothing to Disclose

Sub-Events

SSQ09-01 Genitourinary Keynote Speaker: Contemporary Challenges of Imaging Renal Masses

Thursday, Dec. 3 10:30AM - 10:40AM Location: E353B

Participants
John R. Leyendecker, MD, Dallas, TX (*Presenter*) Nothing to Disclose

SSQ09-02 Do Incidental Hyperechoic Renal Lesions Measuring ≤ 1cm Warrant Further Imaging? Outcomes of 161 Lesions

Thursday, Dec. 3 10:40AM - 10:50AM Location: E353B

Participants
Abimbola Ayoola, MD, New York, NY (*Presenter*) Nothing to Disclose
Andrew B. Rosenkrantz, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Although follow-up CT or MRI has been advised for further evaluation of incidental hyperechoic renal lesions on ultrasound (US), this approach is variably followed in clinical practice given the lack of robust data to guide optimal follow-up recommendations. Thus, the purpose of our study was to determine the outcomes of incidental hyperechoic renal lesions measuring ≤ 1cm based on a large single-center cohort in order to better inform management strategies for such lesions.

METHOD AND MATERIALS

We retrospectively identified 161 hyperechoic renal lesions on US measuring ≤ 1cm (mean size 0.7 ± 0.2 cm) that had either (a) a follow-up CT or MRI or (b) at least 2 year follow-up by US. Mean patient age was 63 ±13 years (range 30-88 years). The initial US and follow-up imaging were reviewed to assess for a change in size or definitive lesion characterization.

RESULTS

Follow-up imaging consisted of US in 23.0% (37/161), CT in 45.3% (73/161) and MRI in 31.7% (51/161). 57.1% (92/161) of lesions were confirmed as angiomyolipomas on CT or MRI. 19.9% (32/161) showed less than 4mm growth on long-term US follow-up (mean 62±26 months, range 24-110 months). 11.8% (19/161) had no correlate on CT or MRI. 6.2% (10/161) were too small to definitively characterize on CT. 3.1% (5/161) were not visualized on follow-up US. CT characterized one lesion (0.6%) as a stone and one lesion (0.6%) as a hyperdense cyst. One lesion (0.6%) on CT was an enhancing solid mass without macroscopic fat, presumed to represent an RCC, although was lost to follow-up. This lesion was not as hyperechoic as the renal sinus fat on the initial US.

CONCLUSION

The overwhelming majority of hyperechoic renal lesions ≤ 1cm with the classic US appearance of an angiomyolipoma were benign or stable on follow-up imaging. Thus, these lesions may not warrant any further imaging evaluation.

CLINICAL RELEVANCE/APPLICATION

To our knowledge, we have provided the largest study to date to assess outcomes of small hyperechoic renal lesions on follow-up imaging that support the benignity of this US finding.

SSQ09-03 Post-operative Outcomes of Cystic Renal Cell Carcinomas Defined on Pre-operative Computed Tomography: A Retrospective Study in 1315 Patients

Thursday, Dec. 3 10:50AM - 11:00AM Location: E353B

Participants
Jung Jae Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chan Kyo Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byung Kwan Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byong Chang Jeong, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seong Il Seo, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Post-operative outcomes of cystic renal cell carcinomas (RCCs) defined on preoperative imaging were not widely investigated and the cut-off of cystic proportion is arbitrary. We aimed to evaluate the post-operative outcomes of cystic RCCs defined on pre-operative computed tomography (CT) and to identify the optimal cut-off of cystic proportion in association with patients' prognosis.

METHOD AND MATERIALS

Our retrospective study included 1315 consecutive patients who received surgery for single sporadic RCC and had adequate pre-operative CT for analysis. The cystic proportion of RCC was calculated on pre-operative CT by a radiologist. The optimal cut-off of cystic proportion in RCC was explored by locating the minimum P value on log rank test regarding cancer-specific survival. The RCCs were categorized as cystic and non-cystic groups according to (1) conventional cut-off (i.e. proportion of cystic component≥ 75%) and (2) the optimal cut-off, and then cancer-specific and recurrence-free survival rates were compared between the two groups. The clinical, pathologic, and imaging variables were analyzed using the Cox regression analysis to determine the independent predictor of cancer-specific survival.

RESULTS

Of the 1315 RCCs, 107 (8.1%) were identified as cystic RCCs using the conventional cut-off. During a median follow-up of 4.9 years, patients with cystic RCC revealed neither metastasis nor recurrence after surgery. The cancer-specific and recurrence-free survival rates of cystic RCCs were significantly better than those of non-cystic RCCs (both $P < 0{\cdot}001$). In association with cancer-specific survival rate, the optimal cut-off of cystic proportion in RCC was 45%, and 197 (15.0%) patients were defined as cystic RCCs accordingly. On multivariate Cox regression analysis, cystic RCC defined by the optimal cut-off (45%) was one of the independent predictors of cancer-specific survival (hazard ratio, 0.34; $P = 0.03$).

CONCLUSION

Cystic RCCs defined on pre-operative CT are associated with low metastatic potential and favorable outcomes after surgery. Furthermore, the optimal cut-off of cystic proportion in association with cancer-specific survival is 45%.

CLINICAL RELEVANCE/APPLICATION

Cystic renal cell carcinomas (RCCs) defined by preoperative CT may be managed differently from non-cystic RCCs for selecting optimal treatment methods.

SSQ09-04 The Radiogenomic Risk Score: Construction of a Prognostic Quantitative, Noninvasive Image-based Molecular Assay for Renal Cell Carcinoma

Thursday, Dec. 3 11:00AM - 11:10AM Location: E353B

Participants
Neema Jamshidi, MD, PhD, Los Angeles, CA (*Presenter*) Nothing to Disclose
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Ronald L. Korn, MD, PhD, Scottsdale, AZ (*Abstract Co-Author*) Chief Medical Officer, Imaging Endpoints; Founder, Imaging Endpoints; Shareholder, Imaging Endpoints
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T S. Raviprakash, Umea, Sweden (*Abstract Co-Author*) Nothing to Disclose
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Michael D. Kuo, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Quantitative multi-gene assays are effective clinical decision making tools in oncology, however cost, risks associated with tissue procurement, and difficulty in framing subcellular information within a larger physiological context limits their overall utility. We evaluated the feasibility of reconstructing quantitative non-invasive molecular assays (NIMA) in clear cell renal cell cancer (ccRCC) using data extracted from a single computed tomography (CT) scan.

METHOD AND MATERIALS

In this IRB approved study, gene expression profile data and contrast enhanced CT scans from 70 ccRCC patients in a training set were initially analyzed. A NIMA for a previously validated ccRCC-specific SPC prognostic gene signature was constructed termed the Radiogenomic Risk Score (RRS), using the microarray data and a 28 trait image array to evaluate each CT scan using multiple regression of gene expression analysis. The predictive power of the RRS NIMA was then prospectively validated in an independent dataset (n=77) to confirm its relationship to the SPC gene signature and to quantify individual risk.

RESULTS

Our quantitative NIMA faithfully represents the tissue-based molecular assay it models. The RRS scaled with the SPC gene signature ($R=0.57$, $p=6.2e-4$, classification accuracy 70.1%, $p<0.001$) and predicted disease-specific survival (log rank $p<0.001$). Independent validation confirmed the relationship between the RRS and the SPC gene signature ($R=0.45$, $p=1.3e-4$, classification accuracy 68.6%, $p<0.001$) and disease-specific survival (log-rank $p<0.001$) and that it was independent of stage, grade and performance status (multivariate Cox model $p<0.05$, log-rank $p<0.001$).

CONCLUSION

A NIMA for the ccRCC-specific SPC prognostic gene signature that is predictive of disease-specific survival and independent of stage was constructed and validated confirming that quantitative NIMA construction is feasible.

CLINICAL RELEVANCE/APPLICATION

Non-invasive molecular assays can be constructed that efficiently capture both pre-specified quantitative molecular phenotypes as well as systems-level phenotypes not accessible by genomic-based tests alone, with a range of potential clinical applications including prognostication and patient stratification in human clinical trials.

SSQ09-05 CAD Derived Absolute Attenuation Discriminates Clear Cell Renal Cell Carcinoma from Benign Mimics and RCC Subtypes at Four-Phase MDCT

Thursday, Dec. 3 11:10AM - 11:20AM Location: E353B

Participants
Heidi Coy, Los Angeles, CA (*Presenter*) Nothing to Disclose
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War War Ko, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Currently, all solid enhancing non-fatty renal neoplasms are presumed to be malignant. Up to 30% of these lesions are benign, most commonly oncocytoma. Renal Cell Carcinoma (RCC) subtypes are a heterogeneous group treated by surgery, ablation or active surveillance with a prognosis based on histology. The purpose of our study is to determine if peak enhancement derived from volumetric 3D lesion contour and a Computer Aided Diagnostic (CAD) algorithm can discriminate clear cell RCC (ccRCC) from benign RCC mimics and RCC subtypes.

METHOD AND MATERIALS

With IRB approval for this HIPAA-compliant retrospective study, our pathology and imaging databases were queried to obtain a cohort of RCC, oncocytoma, and lipid-poor angiomyolipoma (AML) with preoperative multiphasic multidetector CT imaged with a four-phase renal mass protocol (unenhanced, corticomedullary (C), nephrographic (N), and excretory (E)). A whole lesion 3D contour was obtained in all phases with proprietary software. The CAD algorithm determined a 0.5cm diameter region of peak enhancement ≤300HU within the 3D lesion contour. All contours were confirmed by a radiologist. T-tests were used to compare peak multiphasic enhancement. P values <0.05 were considered significant.

RESULTS

206 patients (65% men, 35% women) with 223 unique renal masses (105 (47%) ccRCC, 41(18%) oncocytoma (O), 18 (8%) chromophobe RCC (chRCC), 45 (20%) papillary RCC (pRCC), 14 (6%) lipid-poor AML) were analyzed. In the C phase, CAD absolute peak attenuation of the ccRCC (174 HU) was greater than that of O (167 HU, p=0.333), chRCC (136 HU, p=0.007), pRCC (85 HU, p<0.0001), and lipid-poor AML (144 HU, p=0.004). In the N phase, CAD absolute peak attenuation of the ccRCC (144 HU) was greater than that of O (132 HU, p=0.015), chRCC (106 HU, p<0.0001), pRCC (103 HU, p<0.0001), and lipid-poor AML (115 HU, p<0.0001). In the E phase, CAD absolute peak attenuation of the ccRCC (118 HU) was greater than that of O (104 HU, p=0.001), chRCC (86 HU, p<0.0001), pRCC (86 HU, p<0.0001), and lipid-poor AML (98 HU, p=0.001).

CONCLUSION

CAD derived absolute attenuation discriminates ccRCC from indolent RCC subtypes and benign RCC mimics at four-phase MDCT

CLINICAL RELEVANCE/APPLICATION

CAD enhancement is a robust method to discriminate clear cell RCC from RCC subtypes and benign mimics, enabling clinicians to stratify patients to active surveillance, preoperative biopsy or surgical therapy.

SSQ09-06 Prognostic Value of Newly Proposed Response Criteria in Assessing Tumor Response in Advanced Renal Cell Carcinoma

Thursday, Dec. 3 11:20AM - 11:30AM Location: E353B

Participants
Hyunseon C. Kang, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose
Shiva Gupta, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Wei Wei, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Lina Lu, MS, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
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Haesun Choi, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Several new solid tumor response criteria have been proposed to overcome the limitations of traditional size based criteria. This study examines the prognostic value of these criteria, and the additive value of clinical risk factors, in patients with advanced renal cell carcinoma (RCC) treated with pazopanib.

METHOD AND MATERIALS

Fifty-seven patients with metastatic RCC, who were treated with pazopanib after progression with other targeted therapies, were studied retrospectively. Two sets of CTs (pre- and 1-3.5 months post-treatment) were reviewed by 2 abdominal radiologists. Tumor response on the post-therapy scan was evaluated with RECIST, Choi, modified Choi, MASS, the 10% threshold criteria, as well as a consensus subjective reader assessment, simulating radiologists' clinical interpretation. In addition to these criteria, combined criteria incorporating MSKCC risk factors + imaging criteria were used to define response groups. Response evaluations were correlated with overall survival (OS) and progression-free survival (PFS) using the log-rank test. Only patients with partial response (PR) or stable disease (SD) were included in the analysis of PFS.

RESULTS

The 6 patients with progressive disease (PD) by RECIST, and the 22 patients with PD by the subjective reader assessment, had

significantly worse OS compared to patients with SD or PR. There was no significant difference in OS between responders and nonresponders by Choi, modified Choi, or MASS criteria. When MSKCC risk factors were combined with imaging criteria, the combined criteria defined groups of patients with significantly worse OS. Patients with PR by modified Choi criteria showed significantly longer PFS compared to those with SD (p=0.033). PR and SD groups defined by other criteria did not show a significant difference in PFS. The MSKCC risk factors did not improve the prognostic ability of imaging-based criteria to predict patients with longer PFS.

CONCLUSION

Patients with PD by either RECIST or the subjective reader assessment had significantly worse survival compared to SD or PR groups. The addition of MSKCC risk factors significantly increased the predictive value of all criteria for OS. This effect was dominated by the MSKCC criteria, which were strongly correlated with survival.

CLINICAL RELEVANCE/APPLICATION

In the salvage therapy setting, the addition of clinical risk factors improves the predictive value of imaging-based tumor response criteria.

SSQ09-07 Diagnostic Accuracy of Unenhanced MRI for Suspicious Malignant Renal Lesions Inend Stage Renal Failure Patients with Acquired Cystic Disease

Thursday, Dec. 3 11:30AM - 11:40AM Location: E353B

Participants
Rafel Tappouni, MBBCh, FRCPC, Winston-Salem, NC (*Presenter*) Nothing to Disclose
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Keyanoosh Hosseinzadeh, MD, Winston-Salem, NC (*Abstract Co-Author*) Consultant, Bayer AG

PURPOSE

To determine sensitivity, specificity and accuracy of unenhanced MRI in detecting malignant lesions in end stage renal failure patients with acquired renal cystic disease (ARCD). To assess added value of diffusion weighted imaging (DWI) in characterizing lesions. To identify MRI features associated with malignant lesions.

METHOD AND MATERIALS

Unenhanced renal MRIs of 55 patients with ARCD were retrospectively reviewed in consensus by two blinded radiologists. Lesions less than 1 cm were excluded. Lesions were scored based on size, T1 and T2 signal, homogeneity, hemosiderin, and DWI on a 5 point scale: 1 as definitely benign, 2 as probably benign, 3 as indeterminate, 4 as probably malignant and 5 as definitely malignant. Preliminary scoring was performed without DWI and repeated with DWI. Scores 1-2 were grouped as benign and 3-5 as malignant.Sensitivity, specificity and accuracy of diagnosis was calculated by comparing to nephrectomy samples performed within 6 months of the MRI in 40 patients and five year imaging and clinical follow up in 15 patients. Stability over a 5 year period was deemed benign. Chi square test assessed the imaging features. Scores were renumbered to a 3-level confidence score: 0, indeterminate; 1, probably benign and malignant; 2, definitely benign and malignant, and a paired t-test was performed to compare confidense levels.

RESULTS

There were 26 cysts (8 nephrectomy, 18 imaging follow up) and 34 solid lesions including 1 urothelial carcinoma, 2 oncocytomas and 31 renal cell carcinomas. Lesion size ranged from 1-17cm.MRI features suggestive of malignancy included T1 iso or hyperintensity (p=0.0003), T1 heterogeneity (p=0.0037), T2 heterogeneity (p=0.0092), and presence of hemosiderin (p=0.0034). The sensitivity, specificity and accuracy for preliminary diagnosis versus final diagnosis using DWI were 82, 69, 77 and 82, 73, 78 respectively. The area under the receiver operator curve for the diagnosis with DWI was 0.8512. The addition of DWI resulted in an increase of the confidence score (p=0.001).

CONCLUSION

Unenhanced renal MRI is an accurate modality in characterizing lesions in ARCD. DWI can increase the confidence for the diagnosis of malignant renal lesions. T1 iso and hyperintensity, T1 and T2 signal heterogeneity and the presence of hemosiderin are associated with malignant lesions.

CLINICAL RELEVANCE/APPLICATION

Unenhanced renal MRI is accurate in the detection of malignant lesions in ARCD.

SSQ09-08 Impact of Imaging and Histological Findings on the Prognosis of xp-11 Translocation Renal Cell Cancer

Thursday, Dec. 3 11:40AM - 11:50AM Location: E353B

Participants
Pauley T. Gasparis, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose
Kumaresan Sandrasegaran, MD, Carmel, IN (*Abstract Co-Author*) Nothing to Disclose
Kevin A. Parikh, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
Kunal B. Gala, MBBS, MD, Mumbai, India (*Abstract Co-Author*) Nothing to Disclose
Clinton D. Bahler, MD, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose
Chandru P. Sundaram, Indianapolis, IN (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Xp11 translocation renal cell cancer (Xp11RCC) is an uncommon RCC (<1%) in the general population but accounts for 30% of RCC presenting under the age of 18 years. We wanted to identify imaging features at presentation and histological findings of the resected tumor that predicted overall survival (OS), progression-free survival (PFS), and the occurrence of local and distant metastases.

METHOD AND MATERIALS

Retrospective review of pathology database from Jan 2001 to Mar 2015 revealed 22 cases with Xp11RCC. Imaging findings at presentation were available in 18 of these cases. Detailed analysis of imaging findings for tumor size, calyceal invasion, necrosis, hemorrhage, exophytic growth, presence of local or distant metastases at presentation were recorded. Pathological findings including T-staging, margin positivity, Fuhrman grade and immunostain positivity were recorded. Clinical and imaging databases were used to determine OS, and PFS. Multivariate regression analysis and Kaplan-Meier survival statistics were performed.

RESULTS

Mean age at surgery was 40.2 (range 10-83) years. 15 of 22 patients were over 18 years. 1-, 2- and 3-year survivals were 88%, 79%, and 73% respectively. On CT / MRI, the majority of tumors enhanced to a lesser degree than adjacent cortex (13/18), were heterogeneous (11/18) and exophytic (14/18). Necrosis was seen in 5 tumors and correlated with larger tumor size ($p<0.01$), while calyceal invasion (seen in 6 tumors) did not ($p=0.07$). On multivariate logistic regression analysis, PFS correlated only with Fuhrman grade ($p=0.04$) and calyceal invasion ($p=0.05$) and recurrence of metastatic disease correlated only with initial tumor size ($p=0.05$). Age and gender at presentation, tumor heterogeneity, and necrosis did not correlate with prognosis. On analysis of overall survival, tumors > 5 cm had a substantially worse outcome than those < 5 cm (log rank test, Chi Square 6.73, $p<0.01$).

CONCLUSION

For staging scans of Xp11RCC, radiologists should assess tumor size and calyceal invasion as these have the most impact on survival. Unlike previous studies, we did not find younger patients to have better clinical outcomes.

CLINICAL RELEVANCE/APPLICATION

Calyceal invasion by tumor and tumor size > 5cm predict adverse outcome in Xp11 RCC.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Kumaresan Sandrasegaran, MD - 2013 Honored Educator
Kumaresan Sandrasegaran, MD - 2014 Honored Educator

SSQ09-09 How Does the Surrounding Background Fat Affect Enhancement of Exophytic Renal Lesions? A Phantom Study

Thursday, Dec. 3 11:50AM - 12:00PM Location: E353B

Participants
Adeel R. Seyal, MD, Chicago, IL (*Presenter*) Grant, Siemens AG
Atilla Arslanoglu, MD, Chicago, IL (*Abstract Co-Author*) Grant, Siemens AG
Faezeh Sodagari, MD, Chicago, IL (*Abstract Co-Author*) Grant, Siemens AG
Yuri Velichko, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Paul Nikolaidis, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Vahid Yaghmai, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the effect of surrounding tissue composition on renal lesion enhancement at multidetector computed tomography.

METHOD AND MATERIALS

Two phantoms (A and B) simulating renal lesions were constructed with 15 test tubes (1.5 cm in diameter) each. For phantom A, the tubes were embedded in fat (-90 HU); and for phantom B, the tubes were embedded in agar gel (neutral medium; 7.3HU). The tubes were filled with a serial dilution of iodinated contrast [iohexol (300mg/mL)]. Both phantoms were scanned twice using a 64-slice scanner at 120kVp and constant 150mAs. Attenuation was calculated by a centrally placed region-of-interest within each test tube and the surrounding medium and averaged over five slices for each acquisition. Mean of measurements from both acquisitions were used for analysis. The amount of contrast needed to attain an enhancement of 10HU and 20HU were determined. Regression, paired t and Wilcoxon signed rank tests were used for analysis.

RESULTS

Iodine concentration of 0.285 and 0.675 mg/mL resulted in enhancement of 10 HU and 20 HU, respectively, for a lesion surrounded by fat and 7.3 HU and 16.62 HU when lesion surrounded by neutral medium. At any given iodine concentration, the contrast enhancement was significantly greater for a lesion surrounded by fat when compared with the lesion surrounded by neurtal medium ($P<0.0001$).

CONCLUSION

A renal mass surrounded by fat tends to show greater enhancement compared with one surrounded by a neutral medium.

CLINICAL RELEVANCE/APPLICATION

Thresholds for enhancement may be different for renal lesions surrounded by fat when compared to intraparenchymal or partially exophytic lesions.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Vahid Yaghmai, MD - 2012 Honored Educator
Vahid Yaghmai, MD - 2015 Honored Educator

SSQ10

Genitourinary (Benign and Malignant Gynecological Diseases)

Thursday, Dec. 3 10:30AM - 12:00PM Location: E450B

GU MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Harris L. Cohen, MD, Memphis, TN (*Moderator*) Nothing to Disclose
Mindy M. Horrow, MD, Philadelphia, PA (*Moderator*) Spouse, Director, Merck & Co, Inc

Sub-Events

SSQ10-01 Fractal Analysis of the Leiomyoma before Uterine Artery Embolization Using Contrast-Enhanced MRI and Its Effect on the Outcome

Thursday, Dec. 3 10:30AM - 10:40AM Location: E450B

Participants
Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (*Presenter*) Nothing to Disclose
Nour-Eldin A. Nour-Eldin, MD,PhD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Tatjana Gruber-Rouh, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas Lehnert, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Renate M. Hammerstingl, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan Zangos, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To test whether fractal analysis of the leiomyoma using contrast-enhanced MRI correlates with the leiomyoma volume before and after uterine artery embolization (UAE) and with the percentage change at 3 month follow-up enabling its usage as a prognostic factor for treatment success.

METHOD AND MATERIALS

The study was retrospectively performed on 33 females (Mean Age: 44.85 +/- 3.95) with 64 leiomyomas. For fractal analysis; MRI images were exported and converted into 8-Bit greyscale images. The greyscale images were then loaded into the computer program ImageJ and analysis was performed using the FracLac plugin. The analysis was performed using the differential-box-counting method at 12 different grid positions. The Mean Fractal dimension for each leiomyoma was calculated by drawing a ROI around each leiomyoma. On the other hand the volume of each leiomyoma was calculated before and 3 months after UAE using contrast-enhanced MRI. The correlation between the mean Fractal dimension of each leiomyoma and its volume before and after UAE as well as the percentage change in leiomyoma volume was tested for statistical significance using Spearman-Rank Correlation test.

RESULTS

The mean Fractal Dimension of all leiomyomas was 1.0622 +/- 0.1472 (Range: 0.74 - 1.31). The mean leiomyoma volume before UAE was 97.38 ml +/- 160.86 (Range: 1.65 - 987.34). At follow-up the mean leiomyoma volume was 68.08 ml +/- 138.3 (Range: 0.15 - 875.05). The mean percentage volume change at follow-up was 52.54% [reduction] +/- 26.99 (Range: 40.05%[increase] - 96.57%[reduction]). A statistically significant strong positive correlation between the mean fractal dimension of each leiomyoma and its volume before and after UAE was observed (rho = 0.77, $p<0.0001$ and rho = 0.78, $p<0.0001$ respectively). A statistically significant strong negative correlation between the mean fractal dimension of each leiomyoma and its percentage volume change at 3 month follow-up was noted (rho = -0.68, $p<0.0001$).

CONCLUSION

The smaller the mean fractal dimension of a leiomyoma before UAE the higher will be the percentage volume reduction at 3 month follow-up after UAE.

CLINICAL RELEVANCE/APPLICATION

Leiomyomas with low mean fractal dimension tend to have a significantly better response at 3 month follow-up following UAE. Hence fractal dimension can be used as a prognostic factor for patient selection.

SSQ10-02 Color Doppler Evaluation Of Utero-Ovarian Circulation In Polycystic Ovarian Syndrome and Its Correlation With Hormonal and Biochemical Parameters

Thursday, Dec. 3 10:40AM - 10:50AM Location: E450B

Participants
Shivi Jain, MD, Varanasi, India (*Presenter*) Nothing to Disclose
Akanksha Singh, MD, Varanasi, India (*Abstract Co-Author*) Nothing to Disclose
Madhu Jain, MD, Varanasi, India (*Abstract Co-Author*) Nothing to Disclose
Ram C. Shukla, MD, MBBS, Varansi, India (*Abstract Co-Author*) Nothing to Disclose
Ashish Verma, MBBS,MD, Varanasi, India (*Abstract Co-Author*) Nothing to Disclose
Arvind Srivastava, Varanasi, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To find out the variations in utero-ovarian circulation and their association with various endocrinal and biochemical parameters in women with Polycystic Ovarian Syndrome (PCOS).

METHOD AND MATERIALS

65 patients of reproductive age group who had clinical and biochemical findings suggestive of PCOS by Rotterdam criteria (2003) were selected for TVS with Color Doppler study in early follicular phase (3rd-5th day of menstrual cycle). 58 age-matched women with normal clinical and biochemical parameters were taken as controls. The RI (Resistance Index), PI (Pulsatility Index) and PSV (Peak Systolic Velocity) of ovarian stromal and uterine arteries were assessed after the estimation of LH, LH: FSH ratio, free testosterone level, fasting Insulin level and fasting glucose:insulin ratio.

RESULTS

The mean value of LH, LH: FSH, free testosterone and fasting glucose:insulin ratio was significantly higher ($p<0.001$) in PCOS patients in comparison to control (LH 7.95 ± 1.34 vs 5.60 ± 0.51; LH: FSH=1.93 ± 0.17 vs 1.16 ± 0.22; free testosterone 3.63 ± 0.40 vs 1.71 ± 0.31; fasting glucose:insulin ratio 4.0 ± 0.60 vs 7.51 ± 0.49). The mean ovarian stromal RI, PI and PSV in PCOS was significantly lower ($p<0.001$) as compared to control (0.43 ± 0.08, 0.58 ± 0.10, 11.41 ± 2.53 vs 0.79 ± 0.21, 0.86 ± 0.03, 9.40 ± 0.73 respectively). Similarly, uterine artery PI was significantly higher ($p<0.001$) in PCOS when compared to control (3.05 ± 0.45 vs 2.43 ± 0.31). There was significantly negative correlation of ovarian stromal RI with serum LH: FSH ratio($r=0.617.p< 0.01$). The Uterine artery PI positively correlated with LH: FSH ratio($r=0.548$, $p<0.01$), free testosterone ($r=0.532$, $p< 0.01$), fasting Insulin($r=0.414$, $p< 0.01$), fasting glucose:insulin ratio ($r=0.484$, $p<0.01$) and inversely with ovarian stromal RI ($r=0.410$, $p<0.01$).

CONCLUSION

Hormonal dysfunction is responsible for hemodynamic changes in utero-ovarian circulation in patients with PCOS. Ultrasonography along with color Doppler plays a significant role in the diagnosis and monitoring of Polycystic Ovarian Syndrome.

CLINICAL RELEVANCE/APPLICATION

The decreased PSV and increased PI and RI of uterine artery may explain recurrent early abortions in PCOS. Significant negative correlation between ovarian stromal RI and LH: FSH ratio confirms hormonal dysfunction.

SSQ10-03 Contrast Enhanced 3D STIR T2-Weighted SPACE in Evaluating Sacral Nerve Plexus in Pelvic Endometriosis: Compared with Conventional 2D Sequence

Thursday, Dec. 3 10:50AM - 11:00AM Location: E450B

Participants
Xiaoling Zhang, Guangzhou, China (*Presenter*) Nothing to Disclose
Meizhi Li, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jian Guan, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Mingjuan Liu, MMEd, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Shurong Li, GuangZhou, China (*Abstract Co-Author*) Nothing to Disclose
Yan Guo, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Huanjun Wang, MD, GuangZhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively evaluate microstructural abnormalities in sacral nerve plexus in women with pelvic endometriosis at 3.0T MRI.

METHOD AND MATERIALS

Twenty women with clinically diagnosed pelvic endometriosis and 20 age-matched healthy women were enrolled in this study. In addition to conventional coronal 2D T2WI TSE imaging, contrast enhanced coronal 3D STIR T2-weighted SPACE was obtained to produce multiplanar (MPR) images. All examinations were assessed independently by two radiologists for the infiltration of the sacral plexus by endometriotic lesions and the abnormal anatomical features of the sacral plexus. Agreement between 2D- and 3D-sequences and inter-observer-agreement was evaluated using kappa-statistics.

RESULTS

The sacral nerve roots in healthy subjects and patients were clearly visualized on both sequences. The diameter of the sacral nerve roots in patients was larger than in the control group. Most of the patients with endometriosis displayed local thickening or indistinction in the fibers of sacral plexus. There were no significant difference between the results of the 2 radiologists ($F=2.563$, $P=0.086$). Contrast enhanced 3D STIR T2-weighted SPACE was preferable in evaluating sacral nerve plexus in pelvic endometriosis than regular 2D sequences.

CONCLUSION

Changes of the microarchitecture of the sacral nerve plexus were revealled in the patients with pelvic endometriosis on MRI. Contrast enhanced 3D STIR T2-weighted SPACE can display the infiltration of scaral nerve fibers by endometriotic lesions and the abnormal anatomical features of scaral nerve plexus.

CLINICAL RELEVANCE/APPLICATION

Contrast enhanced 3D STIR T2-weighted SPACE was applied as a method of magnetic resonance neurography to reveal the correlation between the changes of scracal plexus and chronic pelvic pain in patients with pelvic endometriosis .

SSQ10-04 MRI-US Fusion Imaging in Real-Time Virtual Sonography for the Evaluation of Pelvic Endometriosis: Preliminary Study

Thursday, Dec. 3 11:00AM - 11:10AM Location: E450B

Participants
Valeria Vinci, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Lucia Manganaro, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Silvia Bernardo, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Matteo Saldari, MD, PhD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Maria Eleonora Sergi, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Federica Capozza, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Real-time virtual sonography (RVS) is a new technique that uses magnetic navigation and computer software for the synchronized display of real-time US and multiplanar reconstruction MRI images. The purpose of this study was to evaluate the feasibility and ability of RVS to detect pelvic endometriosis.

METHOD AND MATERIALS

This study was conducted over a two-month period in march-april 2015 on 25 patients referred for a Clinical and US suspect of endometriosis. Patients underwent pelvic MRI at 3 T and fusion imaging was offered (Hitachi HI Vision Ascendus) . The MRI image dataset acquired at the time of the examination was loaded into the fusion system and displayed together with the US image on the same monitor. Both sets of images were then manually synchronized and image were registered using multiple planes MR imaging.

RESULTS

2patients had endometriosis of the vescico-uterine pouch, with urinary symptoms associated.7patients had endometriosis of the middle compartment mainly shown as ovarian endometriomas in 6 cases and adenomyosis in 3 cases.19had signs of endometriotic implants in the posterior compartment shown as fibrotic plaque over the serosal surface of the uterus and rectum in 12 cases. In 1 case there was a deep infiltrating intestinal endometriosis over the rectum. A retroflexed uterus was associated in 6 cases. 6 cases showed fibrotic strands between the uterus and the rectum with thickening of the uterosacral ligaments.Regarding endometriosis of the medial compartment, there was an overlap of data of 100% between MRI and RVS, both appearing superior to a standard US evaluation.Endometriosis of the vescico-uterine pouch was better visualized in MRI.Fibrotic strand were displayed in both methods with an overlap of 100%; on the contrary, relying on RVS it was more difficult to differentiate between active plaque and predominantly fibrotic plaque because of the difficulty in visualizing the hemorrhagic foci. However the infiltration of the bowel wall was better undressed in RVS.

CONCLUSION

Thanks to information from both US and MRI, fusion imaging allows better identification of the pelvic implants, superior to the standard US evaluation.

CLINICAL RELEVANCE/APPLICATION

Thanks to information from both US and MRI, fusion imaging allows better identification of the pelvic implants, superior to the standard US evaluation.

SSQ10-05 Diagnostic Value of MR Imaging to Diagnose Adnexal Torsion

Thursday, Dec. 3 11:10AM - 11:20AM Location: E450B

Participants
Sophie Beranger-Gibert, Paris, France (*Abstract Co-Author*) Nothing to Disclose
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Marcos Ballester, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Marie Bornes, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Marc J. Bazot, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Emile Darai, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Isabelle Thomassin-Naggara, MD, Paris, France (*Presenter*) Speakers Bureau, General Electric Company; Research Consultant, Olea Medical

PURPOSE

To retrospectively evaluate the diagnostic performance of MR imaging for the diagnosis of adnexal torsion (AT) in a series of patients with an equivocal adnexal mass at ultrasonography in a context of acute or sub acute pelvic pain.

METHOD AND MATERIALS

Our institutional ethics committee approved the study and granted a waiver of informed consent. All patients with acute or sub-acute pelvic pain undergoing MR exam for the exploration of an equivocal adnexal mass (January 2007 to December 2012) with surgical exploration or clinical and radiological follow up at least of 3 months were retrospectively included (n=58). Three radiologists blinded to the clinical, ultrasonographic and surgical data retrospectively and independently reviewed MR images. Features associated with AT were identified using univariate and recursive partitioning multivariate analysis.

RESULTS

Twenty-two patients (38%) had a diagnosis of AT. The accuracy of MR image interpretation by each reader was 83.8% (26/31), 90.3% (28/31), 83.8% (26/31) in a context of acute pelvic pain and 92.5% (25/27), 88,8% (24/27), 81.5% (22/27) in a context of sub acute pelvic pain for reader 1, 2 and 3 respectively. On multivariate analysis, whirlpool sign (OR=6.5 [1.36-31], p=0.01) and a thickened tube (OR=8.2 [1.2-56.8], p=0.03) were associated with adnexal torsion, with substantial inter-reader agreement (kappa 0.71-0.84, and 0.82-0.86, respectively). The presence of adnexal hemorrhagic content helps to predict ovarian viability (p=0.009)

CONCLUSION

MR imaging is an accurate technique for the diagnosis of adnexal torsion in the setting of patients with adnexal mass having acute or sub acute pelvic pain.

CLINICAL RELEVANCE/APPLICATION

MR imaging is an accurate second line technique to diagnose adnexal torsion without any pelvic irradiation with the ability to predict ovarian viability without any gadolinium injection.

SSQ10-06 Can Diffusion-weighted MR Imaging Differentiate Uterine Sarcomas from Leiomyomas?

Thursday, Dec. 3 11:20AM - 11:30AM Location: E450B

Participants
Jun Gon Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chan Kyo Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Jae Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Byung Kwan Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Differentiation uterine sarcoma from leiomyoma is a major challenge. The aim of this study was to investigate the utility of diffusion-weighted imaging (DWI) in differentiating uterine sarcomas from leiomyomas.

METHOD AND MATERIALS

Between January 2010 and August 2014, 188 patients with surgically confirmed 38 uterine sarcomas (16 leiomyosarcomas, 12 malignant mixed Mullerian tumors, 9 endometrial stromal sarcomas, and 1 undifferentiated pleomorphic sarcoma) and 150 leiomyomas were enrolled in this retrospective study. All patients underwent preoperative routine pelvic MR imaging at 3T, including DWI. DWI was obtained using a STIR single-shot echo-planar imaging technique with background suppression (b= 0 and 1000 s/mm2). The apparent diffusion coefficient (ADC) and signal intensity on T2-weighted imaging (T2SI) were calculated in the tumors, normal myometrium and gluteus muscle. In the differentiation of sarcomas from leiomyomas, various parameters (ADC, diffusion restriction, tumor-myometrium or gluteus muscle contrast ratio [TCRm or TCRg] on T2-weighted imaging, necrosis, hemorrhage, and size) were evaluated.

RESULTS

The mean ADC values of sarcomas (0.939 ± 0.253) were statistically lower than those of leiomyomas (1.347 ± 0.327 × 10-3mm2) ($p < 0.001$). For differentiating sarcomas from leiomyomas, the parameters including diffusion restriction, T2SI, TCRm, TCRg, necrosis and hemorrhage were statistically significant (all p -values < 0.001). At receiver operating characteristics curve analysis, the area under the curves of diffusion restriction and ADC in differentiating sarcomas from leiomyomas were 0.902 and 0.860, respectively and were statistically greater than other parameters (TCRm, TCRg, necrosis, hemorrhage and size) ($p < 0.05$): with a cutoff ADC value of 1.111 × 10-3mm2, the sensitivity and specificity were 79% and 80%, respectively. For the degree of diffusion restriction, sarcomas showed moderate or strong in 97% (37/38), while leiomyomas revealed absent or mild in 69% (104/150).

CONCLUSION

DWI at 3T may be a useful technique for the differentiation of uterine sarcomas from leiomyomas.

CLINICAL RELEVANCE/APPLICATION

As a noninvasive technique, preoperative DWI at 3T can be used to predict sarcomas in patients with uterine myometrial masses, which may give potential for planning treatment strategies.

SSQ10-07 Variations in Reporting Recommendations for Son Graphically Evaluated Endometrial Stripe in Post Menopausal Bleeding in a Subspeciality Practice

Thursday, Dec. 3 11:30AM - 11:40AM Location: E450B

Participants
Aoife Kilcoyne, MBBCh, Boston, MA (*Presenter*) Nothing to Disclose
Avinash R. Kambadakone, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Colin J. McCarthy, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Giles W. Boland, MD, Boston, MA (*Abstract Co-Author*) Principal, Radiology Consulting Group; Royalties, Reed Elsevier
Susanna I. Lee, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Debra A. Gervais, MD, Chestnut Hill, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Endometrial cancer is the most common gynecologic cancer in the United States. Early diagnosis and intervention is imperative to improve prognosis and survival. In the setting of postmenopausal vaginal bleeding (PMB), sonographically determined endometrial stripe thickness is an established criteria for predicting risk of cancer and thereby serving as a guide to trigger endometrial sampling. Current guidelines recommend tissue sampling for endometrial stripe measuring >5mm, however, there is limited data on adherence to these guidelines. The purpose of this study was to evaluate the variability in reporting recommendations for sonographically determined endometrial stripe thickness measuring 5mm in patients with PMB at a subspecialty practice in an academic teaching institution.

METHOD AND MATERIALS

In this ongoing study, we performed a review of the 'RENDER' radiology database to identify pelvic ultrasound exams performed on women aged 18-80years between January 1st 2009 and December 31st 2014 for evaluation of PMB. Using natural language processing, the radiology reports of these exams were then analysed for endometrial stripe thickness, reporting patterns in the body, impression of radiology report and the recommendations, if any. The search terms used for the focused search included 'endometrial stripe', '5mm', 'postmenopausal'. The variations in the reporting recommendations based on the endometrial stripe thickness were then evaluated.

RESULTS

Of the 253 reports reviewed, 58 (24.6%) were not relevant - the search identified patients with an endometrial stripe of greater or less than 5mm. In 74 reports (29.2%), no recommendation was made. In 73 reports (28.8%), endometrial biopsy was recommended. Other recommendations included: biopsy or imaging 14 (6%), no intervention 11 (4%), further imaging 8 (3%), gynaecology review 4 (2%), gynaecology review and biopsy 4 (2%), follow-up imaging 2 (1%).

CONCLUSION

In a subspecialty abdominal imaging practice at an academic institution, considerable variation exists on the reporting recommendation for evaluation of PMB with endometrial stripe thickness measuring 5mm with only 30% of reports adhering to established guidelines.

CLINICAL RELEVANCE/APPLICATION

The findings of this study highlight the need for development of standardised approaches/tools to bring about clarity in terms of management options/further investigation of abnormal endometrial thickening in the setting of postmenopausal bleeding.

Honored Educators

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Debra A. Gervais, MD - 2012 Honored Educator
Susanna I. Lee, MD, PhD - 2013 Honored Educator

SSQ10-08 Cystic Adnexal Lesions Analyzed by International Ovarian Tumor Analysis (IOTA) Criteria in Routine Clinical Practice

Thursday, Dec. 3 11:40AM - 11:50AM Location: E450B

Participants
Claire E. Beaumont, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Jessica B. Robbins, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Sadowski, MD, Madison, WI (*Presenter*) Nothing to Disclose
Mark A. Kliewer, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Lisa Barroilhet, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Laura Huffman, MD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Katherine E. Maturen, MD, Ann Arbor, MI (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc; Medical Advisory Board, GlaxoSmithKline plc

PURPOSE

The simple rules developed by the IOTA group direct management of adnexal cysts based on sonographic imaging features. The diagnostic performance of these criteria in routine practice has not been formally evaluated since the original study was published in 2010. The goal of our research is to determine how well the IOTA simple rules criteria perform in stratifying cystic lesions and detecting ovarian cancer in routine radiology practice.

METHOD AND MATERIALS

Patient consent was waived for this IRB approved retrospective review of transvaginal US studies on non-pregnant post-menarchal women performed between January-March 2011. Adnexal cysts larger than 3 cm were evaluated according to the IOTA rules. The incidence of benign adnexal lesions, borderline tumors and ovarian carcinoma was calculated. Surgical pathology, resolution on follow-up imaging and/or normal gynecological pelvic examination at 2 years were the accepted end points.

RESULTS

108 lesions in 104 women met inclusion criteria. Mean age=41±14 years; range=13-84. 3 lesions (2.8%) met simple rule 1 (malignant): 30% (1/3) were cystadenomas and 30% (1/3) carcinoma, with no borderline tumors. 95 lesions (88%) met simple rule 2 (benign): 10.5% (10/95) were benign ovarian neoplasms (dermoids=2; cystadenomas=8), with no borderline tumors or carcinomas. 10 lesions (9.2%) met simple rule 3 (indeterminate): 20% (2/10) were benign ovarian neoplasms, 20% (2/10) borderline tumors, and 10% (1/10) carcinoma. Thus, the IOTA rules gave a definitive (non-indeterminate) result in 98/108 (90.7%) of cases and correctly triaged 100% of borderline and malignant neoplasms either to further imaging evaluation or surgery.

CONCLUSION

The results of this pilot study indicate that the IOTA rules successfully detect borderline and malignant neoplasms. However, the vast majority of lesions in routine practice are benign in both sonographic appearance and clinical behavior. Full and nuanced evaluation of diagnostic performance in routine clinical practice will require a larger number of cancers, to be evaluated in our ongoing research.

CLINICAL RELEVANCE/APPLICATION

The IOTA simple rules were able to detect borderline and malignant ovarian neoplasms in our clinical practice and aided in directing women with such lesions to oncologic specialists.

Honored Educators

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Katherine E. Maturen, MD - 2014 Honored Educator

SSQ10-09 MR Imaging and Semi-automated Texture analysis for Differentiating Atypical Appearing Uterine Leiomyomas from Leiomyosarcomas

Thursday, Dec. 3 11:50AM - 12:00PM Location: E450B

Participants
Yuliya Lakhman, MD, New York, NY (*Presenter*) Nothing to Disclose
Joshua L. Chaim, DO, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Harini Veeraraghavan, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Diana S. Feier, MD, Cluj-Napoca, Romania (*Abstract Co-Author*) Nothing to Disclose
Hebert Alberto Vargas, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ramon E. Sosa, BA, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Debra A. Goldman, MS, New York, NY (*Abstract Co-Author*) Nothing to Disclose
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Robert Soslow, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Nadeem Abu-Rustum, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Hedvig Hricak, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Evis Sala, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether qualitative magnetic resonance (MR) imaging features and texture analysis (TA) can distinguish between atypical appearing uterine leiomyomas (ALM) and leiomyosarcomas (LMS)

METHOD AND MATERIALS

Forty-one women with ALM (n=22) or LMS (n=19) at histopathology and MRI between January 1, 2007 and December 31, 2013 were included in this retrospective study. Two readers (R1 and R2), blinded to histopathologic diagnoses, independently evaluated all cases. R2 manually segmented each tumor on axial T2-weighted image. Intensity based gray scale correlation matrix (GLCM) textures and Gabor edge based GLCM textures were computed for each segmented tumor. Relationships between clinical characteristics, imaging features, and histopathology were tested with Fisher's exact test. Each tumor was assigned a score of 0 to 4 based on the total number of most statistically significant features present. Diagnostic accuracy with exact 95% confidence intervals was calculated for each feature and score. Texture features were analyzed with a random forest (RF) classifier to automatically distinguish ALM from LMS. RF classifier was optimized by varying the number of decision trees and its performance was tested with five-fold cross validation.

RESULTS

Nodular borders, hemorrhagic foci, "T2 dark" areas, and central (±peripheral) unenhanced area(s) were significant predictors of LMS ($p<0.0001$ for each feature and reader). Sensitivity and specificity of each feature for LMS were 0.84/0.74 and 0.91/0.86 for nodular borders, 0.95/1.0 and 0.82/0.95 for hemorrhagic foci, 0.84/0.79 and 0.86/0.86 for "T2 dark" areas, and 0.95/1.0 and 0.73/0.68 for central (±peripheral) unenhanced area(s) for R1/R2, respectively. When any 3 of these features were detected in a lesion, the sensitivities and specificities were 1.0/0.95 and 0.95/1.0 for R1/R2, respectively. The best classification accuracy of computer-generated image features was achieved with 25 decision trees (AUC=0.86, sensitivity=0.95, specificity=0.69). The Gabor edge-based texture features were more relevant than the intensity based texture features for the classification.

CONCLUSION

Presence of certain qualitative MRI features can reliably distinguish ALM from LMS. Texture analysis as a semi-automated adjunct may add certainty to the diagnosis of LMS.

CLINICAL RELEVANCE/APPLICATION

MR imaging and semi-automated texture analysis are useful in distinguishing atypical appearing leiomyomas from leiomyosarcoma.

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Evis Sala, MD, PhD - 2013 Honored Educator

SSQ11

ISP: Informatics (Quality and Safety)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S403A

CT MR IN SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Woojin Kim, MD, Philadelphia, PA (*Moderator*) Co-founder, Montage Healthcare Solutions, Inc; Shareholder, Montage Healthcare Solutions, Inc; Board of Directors, Montage Healthcare Solutions, Inc; Advisory Board, Zebra Medical Vision Ltd
Kevin W. McEnery, MD, Houston, TX (*Moderator*) Advisor, Koninklijke Philips NV
Kevin L. Junck, PhD, Birmingham, AL (*Moderator*) Nothing to Disclose

Sub-Events

SSQ11-01 Informatics Keynote Speaker: Role of Informatics in Quality

Thursday, Dec. 3 10:30AM - 10:40AM Location: S403A

Participants
Woojin Kim, MD, Philadelphia, PA (*Presenter*) Co-founder, Montage Healthcare Solutions, Inc; Shareholder, Montage Healthcare Solutions, Inc; Board of Directors, Montage Healthcare Solutions, Inc; Advisory Board, Zebra Medical Vision Ltd

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Woojin Kim, MD - 2012 Honored Educator

SSQ11-02 How I Missed Your Cancer? An Eye-Tracking Study of Radiological Error in the Detection of Lung Nodules

Thursday, Dec. 3 10:40AM - 10:50AM Location: S403A

Participants
Gregory DiGirolamo, PhD, Worcester, MA (*Abstract Co-Author*) Nothing to Disclose
Zachary Zaniewski, Worcester, MA (*Presenter*) Nothing to Disclose
Max P. Rosen, MD, MPH, Worcester, MA (*Abstract Co-Author*) Stockholder, Everest Scientific Inc; Consultant, PAREXEL International Corporation; Stockholder, Cynvenio Biosystems, Inc; Medical Advisory Board, Cynvenio Biosystems, Inc

PURPOSE

Radiologists may miss findings on ~30% cases. These misdiagnoses can result from visual or cognitive/decision-making errors. Visual errors may include: Scanning errors-not visually fixating on the region that contains an abnormality. Cognitive/Decision errors include: Decision errors-visually fixating on an abnormality, but declaring it normal, and/or Recognition errors- visually fixating on the region of an abnormality, but not identifying it. We investigated conscious recognition errors and whether Radiologists might have unconscious detection of lung nodules despite no conscious recognition.

METHOD AND MATERIALS

6 experienced Radiologists interpreted 18 axial chest CT scans (9 normal and 9 abnormal), each consisting of 200-400 slices. There were 16 lung nodules in total across the 9 abnormal CT scans. The presence and location of lung nodules were identified by a mouse click. Using an Eye-Link 1000, we tracked the location and duration of eye fixations using an invisible (to the observer) grid on each image. Error rates were calculated as our main index of accuracy, and duration of eye movements in each grid region were used to determine if there was unconscious detection of a lung nodule.

RESULTS

On average, 8/16 (50%, +/- 9%) lung nodules were consciously identified, and registered by a mouse click. However, even when no conscious detection of the lung nodule was registered, Radiologists made significantly longer fixations to the grid regions where the lung nodules were located, ($p < .007$). Radiologists fixated longer in the grid region where a nodule was located when compared to any other region in that same image ($p < .02$), even when the nodule was not consciously detected. Radiologists also fixated longer in the grid region where a lung nodule was present (even when not consciously detected) than any grid region in a normal image, $p < .03$.

CONCLUSION

Our data suggest that even when not consciously recognized, experienced radiologists unconsciously detect the location of lung nodules.

CLINICAL RELEVANCE/APPLICATION

Many findings missed in clinical practice, may actually be detected unconsciously. The use of eye-tracking, or other technologies may improve Radiologists' performance.

SSQ11-03 Scanning Clinical Security Worldwide: Maps and Country Ratings

Thursday, Dec. 3 10:50AM - 11:00AM Location: S403A

Participants
Oleg S. Pianykh, Newton Highlands, MA (*Presenter*) Nothing to Disclose

Background

The fundamental standards of digital medical data exchange, such as DICOM and HL7, date back to the late 1980s. And although these standards went through countless enhancements, one particular aspect - security -remained virtually untouched. The main purpose of our work was to perform the first comprehensive study of clinical security worldwide.

Evaluation

We used DICOM and HL7 association establishment protocols to develop a fast, parallel-processing security-probing application. Testing each IP address for its openness to transmit medical data (with no actual data transferred), the application scanned the entire worldwide space of IP addresses in 3 weeks. Geolocation services were used to map each unsecure IP we identified. As a result, we compiled a comprehensive map of open clinical servers worldwide, with different levels of security threats.

Discussion

Our scan discovered 2774 DICOM servers worldwide, out of which 719 were open for medical data communications. HL7 results were similar. Each protocol was used to categorize our findings by different levels of security threats, and geolocation data - by countries and regions. As a result, we compiled clinical security ratings per country, per capita, and per IT infrastructure. We also built the first map of DICOM/HL7 adoption worldwide

Conclusion

Medical data archives, left wide-open to security threats, is by far the most common security problem, which needs to be addressed with a robust, standardized, and fully implemented solution. Our results demonstrate the full scope of this problem, and the areas where it needs to be solved first.

SSQ11-04 Institution Certification System for Low-Dose Lung Cancer CT Screening in Japan: Development of a New Web-based Image Evaluation Function

Thursday, Dec. 3 11:00AM - 11:10AM Location: S403A

Participants
Rikuta Ishigaki, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yoshihisa Muramatsu, PhD, Kashiwa, Japan (*Presenter*) Nothing to Disclose
Yuichiro Maruyama, MD,PhD, Komoro, Japan (*Abstract Co-Author*) Nothing to Disclose
Isao Yamaguchi, PhD, RT, Sakai, Japan (*Abstract Co-Author*) Nothing to Disclose
Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Research support, Siemens AG; ; ; ; ;
Yoshito Tabata, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masato Mori, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masafumi Shinozaki, RT, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Kouzou Hanai, PhD,RT, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

Background

In Japan, an institution certification system is being established by the Accreditation Council for Lung Cancer CT Screening. Given progress in database systems with a dose index registry (DIR) function known as the combined application dose index (CADI), the CADI system will be used to evaluate both dose and image quality. A special image evaluation function has been developed for this new use.

Evaluation

The CADI system consists of a CADI server and clients. Image data and dose information are compiled in DICOM and IHE-REM databases. Web-based access to the CADI server is possible from approved CADI clients, permitting image evaluation for lung cancer CT screening. This system was certified as meeting the IHE REM Profile at the NA Connectathon 2013, and the web-based access is WADO compliant.A demonstration study was conducted between January 5 and March 31, 2015. A chest phantom containing simulated lesions (LSCT-001, Kyoto Kagaku) was scanned using the CT screening protocols at each institution (16 institutions, 22 CT systems). CT images (as a 5 mm-slice and a 1 mm interval) and dose reports were sent to CADI clients and transferred to the CADI server, and dose information and image interpretation by certified radiologists were analyzed. The calculated CTDIvol values were 1.9±0.8 mGy (mean ± SD). The calculated DLP values were 65.1±26.7 mGy (mean ± SD).The submitted phantom images are reviewed for image quality and the detectability of the simulated lesions is assessed. The average detected diameter (mean ± SD) was 8.9±0.8 mm for the right lung (Design contrast = 100 HU) and 5.7±0.4 mm for the left lung (Design contrast = 270 HU).

Discussion

It is essential to ensure the appropriate image quality at reduced dose for CT screening in healthy people. Dose and image quality evaluations were performed from the CADI client on Web, and statistical analyses were performed. This allows standardization of CT screening across Japan; Institutions certified by the Accreditation Council will be able to provide reliable CT screening services.

Conclusion

We have developed a new web-based image evaluation function for the CADI system to establish an institution certification system for lung cancer CT screening.

SSQ11-05 Conventional X-ray Dose Analysis in Pediatrics Patients in Different Hospitals Using a Centralized Electronic Platform

Thursday, Dec. 3 11:10AM - 11:20AM Location: S403A

Participants
Eduardo Fraile Moreno, MD, PhD, San Sebastian de Los Reyes, Spain (*Presenter*) Nothing to Disclose
Carlos Benito, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Jose Carmelo Albillos, Alcorcon, Spain (*Abstract Co-Author*) Nothing to Disclose
Patricia Fraga Rivas, MD, Coslada, Spain (*Abstract Co-Author*) Nothing to Disclose
Esther Dominguez-Franjo, MD, PhD, Madrid, Spain (*Abstract Co-Author*) Nothing to Disclose
Josefa Galobardes Monge, MD, Parla, Spain (*Abstract Co-Author*) Nothing to Disclose
Trinidad Villarejo, Parla, Spain (*Abstract Co-Author*) Nothing to Disclose

Background

Imaging diagnostics studies using Xray modalities are increasing the impact on cumulative doseof irradiation delivered to patients. At the same time, a new legislation (2013/59/Euratom) will be put in place to register dose patient history on his Electronic Health Record. Dose is a concern for everybody in healthcare environment and especially sensitive when we speak about dose deliveredto kids.Our objective is to analyze variability on the dose in non-focused pediatric departments and determinate root causes to fix them.

Evaluation

The analysis for pediatric segment has been done in 6 hospitals connected in the same network The studies have been performed in Emergency departments with the same manufacturer and model of digital Xray equipments and same configuration.Data are storage on real time from modalities to a central server used to analyze them. Data from patient studies were collected over a period of one month. They were classified according to patient age (0-1 year; 1-5years; 5-10 years and 10-15 years) and gender. For each category of patient, the most used protocols were evaluated and their associated dose levels were collected. For each protocol, an alert threshold was calculatedbased on the usual clinical practice (2 times the percentile median).The root causes were classified (bad patient positioning, bad collimation on patient, pediatrics study protocol not selected, bad protocol selected depending on morphology) and measured.

Discussion

This analysis demonstrates that 15.28% of the extra dose applied to pediatric population is caused directly by misunderstanding or lack of knowledge of how to handle this type of patients. Most of these mistakes can be fixed by dose education through Change Acceleration Process (CAP) to take in account seriously the pediatric segment in radiology studies and specific trainings to remind Xray technology basis. Consciousness will be done with explanations of dose effect on kids (stochastics and determinists effects)

Conclusion

Dose monitoring electronic solution allow us reeucing the variability on the dose in non-focused pediatric departments and determinate root causes to fix them

SSQ11-06 Biometric Patient Identity Verification during Magnetic Resonance Imaging of the Brain Using Multi-planar Reconstruction Scout Image

Thursday, Dec. 3 11:20AM - 11:30AM Location: S403A

Participants
Yasuyuki Ueda, Fukuoka, Japan (*Presenter*) Nothing to Disclose
Junji Morishita, PhD, Fukuoka, Japan (*Abstract Co-Author*) Nothing to Disclose
Shohei Kudomi, Ube, Japan (*Abstract Co-Author*) Nothing to Disclose
Katsuhiko Ueda, BS, Ube, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Patient misidentification error management is one of the important factors of patient safety. We studied the use of magnetic resonance (MR) images for the purpose of biometric patient identity verification, and show the accuracy of verification performance for clinical use.

METHOD AND MATERIALS

Anatomy-related multi-planar reconstruction (MPR) images, including posterior surface of brainstem and the internal auditory canal (IAC), generated from one three-dimensional fast scout scan of each MR examination were used as biological-fingerprint images in this study. We calculated a correlation value as a similarity score between current and prior biological-fingerprint images. This procedure consists of three major steps, i.e., biological feature extraction, normalization, and calculation of correlation value. In order to evaluate the verification performance, we calculated a false rejection rate (FRR), a false acceptance rate (FAR) and a half-total error rate (HTER) by the discriminant analysis utilizing the squared Mahalanobis distance to declare the patient as genuine or an impostor. Moreover, to evaluate overall performance deliverance from a receiver operating characteristic (ROC) curve, the area under the ROC curve (AUC), and the equal error rate (EER) were calculated.

RESULTS

The database of this study consisted of 730 temporal pairs of MR examination of the brain. Many patients of this study have the following disorders: brain tumor and cerebrovascular angiopathy, and 168 patients have undergone surgical operation of the brain before the current examination. Our results indicated a high performance in verifying patients. Our method gave an HTER of 1.59% with an FAR of 0.023% (62/266,085), and an FRR of 3.15% (23/730). The AUC and EER were achieved at 0.998 and 1.37%, respectively.

CONCLUSION

Our method makes it possible to verify the identity of the patient only using some existing medical images without the addition of incidental equipment. We expect our method to be a key solution to patient misidentification problems.

CLINICAL RELEVANCE/APPLICATION

Our method is useful when we have no other way of confirming whether the registered patient information is correct or not and will contribute to patient misidentification error management caused by human errors.

SSQ11-07 CT Dose Monitoring and Management System Based on Open-source Software Resources and In-House Development

Thursday, Dec. 3 11:30AM - 11:40AM Location: S403A

Participants
Da Zhang, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Larry Barbaras, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Matthew R. Palmer, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The monitoring and management of radiation dose have become crucial requirements of modern radiology departments. Powerful open-source DICOM utilities could facilitate the implementation of professional-grade systems for collecting CT radiation dose data. However, the heterogeneity of dose data and inconsistent implementations of the DICOM SR standard among different CT models and vendors require additional customization and programming. We present the development, unique features, and clinical applicability of a CT dose tracking system based on freely-available software resources.

METHOD AND MATERIALS

Radiation dose structured reports (RDSR) are auto-transmitted from the CT scanners to a Conquest DICOM server. The server spawns two external processes: 1) 'dcm2xml' (from DCMTK) translates RDSR into XML; 2) a PowerShell script mines the XML data and populates database tables.Dose dashboards on the server provide query and display functionality for individual CT exams, while a data dump service provides massive output of dose records for periodic dose analysis and protocol management. Also, a web service that receives real-time queries from the dictation system returns customized dose strings for automatic inclusion in the radiologic reports.For protocol review, dose entries in the dumped data are cleaned and validated. Heterogeneous protocol identifiers are normalized and re-mapped to core protocol names, using a regular expression based method. Similar protocol names are grouped together for per-scanner analysis and cross-scanner comparison. The core protocols that comprise the majority of exams were identified, and summary data were prepared for visual analysis.

RESULTS

Over 5000 CT dose records per month have been collected from ten CT scanners (of 7 models and 3 vendors) distributed in three practice sites. Non-trivial inconsistencies in the adoption of RDSR capabilities, especially in the handling of protocol names, were observed. Comparison of dose performance across scanners and against national data was used to trigger root-cause analysis and protocol review.

CONCLUSION

Using open-source software resources and in-house expertise, a highly functional and customizable dose monitoring and management system can be developed with limited expense and effort.

CLINICAL RELEVANCE/APPLICATION

The developed dose tracking and reporting system could greatly facilitate the tasks of CT dose monitoring and management.

SSQ11-08 Implementation of a Virtual 'Learning from Discrepancy' Meeting: A Method to Improve Radiologist Attendance and Facilitate Shared Learning from Radiological Error

Thursday, Dec. 3 11:40AM - 11:50AM Location: S403A

Participants
Anoma Lalani Carlton Jones, MBBS, FRCR, London, United Kingdom (*Presenter*) Nothing to Disclose
Mary E. Roddie, MD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the effect on radiologist participation in learning from discrepancy meetings (LDMs) in a large radiology department spread across three hospital sites by establishing virtual LDMs using OsiriX (Pixmeo).

METHOD AND MATERIALS

Submitted radiological discrepancy cases were added to an OsiriX database after anonymisation with clinical information available at the time and any relevant previous imaging. Prepared cases were loaded onto iMacs in the radiology reporting rooms on each site. For each virtual LDM radiologists were given a 3-week period to review cases either on their own or in groups and send their feedback to the LDM convenor. The learning points and consensus feedback were attached to each case before it was added to a permanent LDM library on the iMacs. Attendance was recorded and compared with that from the previous 4 years of conventional meetings. We obtained radiologist feedback comparing the two types of LDM using an anonymous online questionnaire sent out after the first year of virtual LDMs.

RESULTS

Numbers of radiologists attending increased significantly from a mean of 12.5 ± 3.1 for the conventional LDM to 27.3 ± 6.2 for the virtual LDM ($p < 0.0001$) and the percentage of radiologists achieving the UK standard of participation in at least 50% of LDMs per year (the UK standard) rose from an average of 18% to 68%. The number of cases submitted per meeting rose significantly from an average of 11.1 ± 2.9 for conventional LDMs to 15.2 ± 6.2 for virtual LDMs ($p < 0.02$). Analysis of 30 returned questionnaires showed that radiologists welcomed being able to review cases at a time and place of their choosing and at their own pace. They reported that were able to give more honest feedback in the absence of peer pressure. Many felt that the LDM library was a useful educational resource and had changed their clinical practice by highlighting frequently occurring errors.

CONCLUSION

Replacement of conventional LDMs rotating between hospital sites in a large radiology department by virtual LDMs improved radiologist participation in the process of group learning from radiological discrepancy and increased the number of submitted cases.

CLINICAL RELEVANCE/APPLICATION

Introduction of a virtual 'learning from discrepancy' meeting (LDM) and an LDM library can increase radiologist participation in the process of learning from discrepancy and increase the number of cases submitted.

SSQ11-09 Does Dose Awareness Increase after Implementation of a Dose Monitoring Software in Computed Tomography

Thursday, Dec. 3 11:50AM - 12:00PM Location: S403A

Participants
Christina Heilmaier, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Niklaus Zuber, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Dominik Weishaupt, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Dose monitoring becomes more and more important and is an important part of quality control. We wanted to examine whether dose awareness of medical staff increased after a dose monitoring software was installed and implemented in clinical routine.

METHOD AND MATERIALS

Dose data of two computed tomography scanners was collected from April 2014 to February 2015. We used a dose management software to separately analyze data from April to June 2014 (period 1) and July 2014 to February 2015 (period 2). Starting July 2014 radiographers were instructed look for and answer alarms ('alerts') when dose exceeded predefined thresholds. Chi-square tests were applied to check for statistical significant changes in number and reasons for alerts between both periods. Thresholds were set as 75th-percentile of the distribution of dose length product (DLP, Gy*cm).

RESULTS

A total of 13,217 scans were conducted (period 1, n=4,943; period 2, n=8883) and dose data was successfully transferred to the software in all cases. A total of 609 alerts occurred (period 1, n=293; period 2, n=316), mean alert quota 5%. Comparison of both periods showed a significant decrease of mean alert quota in period 2 (4%; period 1, 6%; $p<0.001$). Decline was mainly caused by a reduced number of notifications due to patient off-centering (period 1, n=129; period 2, n=77; $p<0.001$), which means patient was not positioned properly in the isocenter of the scanner. Relative number of high body weight alerts (BMI≥25 kg/m2) grew in period 2 (51%, n=160; period 1, 36%. n=106), but difference was not statistical significant ($p=0.159$). All other alert causes were comparable in both periods ($p>0.05$): scan repetition due to severe motion artifacts (period 1, n=32, 11%; period 1, n=36, 11%), osteosynthesis material (OSM) in scanning area and leading to dose up-regulation (period 1, n=24, 8%; period 2, n=28, 9%) and others such as imaging on spine-board (period 1, n=3, 1%; period 2, n=15, 5%).

CONCLUSION

A dose monitoring software can be successfully implemented in clinical routine and increases dose awareness in medical staff, thereby leading to a reduction of the number of dose alerts due to human error.

CLINICAL RELEVANCE/APPLICATION

Implementation of a dose monitoring software in clinical routine can be successfully accomplished and is an important tool for increasing dose awareness in medical staff, thereby improving quality assurance and patient safety.

SSQ12

Molecular Imaging (New Tracers/Methods)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S504AB

CT MI MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Brian M. Rodgers, MD, Rockville, MD (*Moderator*) Nothing to Disclose
Bernadette V. Marquez, PhD, Saint Louis, MO (*Moderator*) Nothing to Disclose

Sub-Events

SSQ12-01 Hyperpolarized 13C MRI for Non-Invasive Assessment of Liver Injury in a Mouse Model

Thursday, Dec. 3 10:30AM - 10:40AM Location: S504AB

Participants
Michael A. Ohliger, MD, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose
Irene Marco-Rius, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Robert A. Bok, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Jacquelyn J. Maher, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Cornelius Von Morze, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Subramaniam Sukumar, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Zihan Zhu, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Zhen J. Wang, MD, Hillsborough, CA (*Abstract Co-Author*) Nothing to Disclose
Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;
Daniel B. Vigneron, PhD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company
John Kurhanewicz, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Liver injury and inflammation may lead to liver fibrosis, portal hypertension and cirrhosis. There is currently no method to image liver inflammation. Hyperpolarized 13C MRI is an emerging tool for imaging metabolism. Increased conversion of [13C]pyruvate to [13C]lactate has been observed in a mouse model of arthritis. We hypothesize that lactate production may be a marker of acute liver injury.

METHOD AND MATERIALS

11 male CD1 mice were treated via IP injection with either 1 ul/g of the hepatotoxin CCl4 (n=6) to induce liver injury, or with vehicle alone (n=5, control group). Mice were imaged with a 14 T preclinical MRI scanner prior to and 48 hours after treatment. 350 ul of 80mM [1-13C]pyruvic acid was polarized in a Hypersense DNP polarizer (Oxford Instruments) and injected via tail vein. Metabolite images were obtained for pyruvate, alanine and lactate at 29 s using a fast spectrally-selective 3D imaging sequence (resolution 2x2x3.3 mm). Metabolite images were overlayed onto T2 images. An ROI was drawn on the center liver slice avoiding large vessels. Ratios of lactate and alanine to pyruvate were measured. Mice were sacrificed and livers stained for histology. Liver damage graded by an experienced hepatologist blinded to the imaging.

RESULTS

Imaging was successful in all 11 mice before and after treatment. Histologic liver damage was seen in 5/6 CCl4-treated mice. Mean lactate/pyruvate ratio was significantly higher after CCl4 treatment (2.8, SD 0.9) than for untreated mice (1.8, SD 0.6, $p<0.05$) or the control group (1.7, SD 0.5, $p<0.05$). Mean alanine/pyruvate ratio was also significantly higher after CCl4 treatment (2.2, SD 0.6) than for untreated mice (1.3, SD 0.6, $p<0.05$) or the control group (1.4, SD 0.4, $p<0.05$). There was no significant difference in either ratio between the pre-treatment and the control group.

CONCLUSION

Treatment of mice with a single dose of the hepatotoxin CCl4 leads to a significant and rapid rise in hepatic lactate and alanine production measured by hyperpolarized 13C MRI. Future experiments will determine whether the observed lactate and alanine production results from activated inflammatory cells within the liver or metabolic alterations within hepatocytes themselves.

CLINICAL RELEVANCE/APPLICATION

Hyperpolarized 13C MRI is a promising tool for non-invasively imaging evaluating liver injury and inflammation.

SSQ12-02 Synthesis and Characterization of Novel Hydrophilic Molecules for 19F-MR Contrast Imaging

Thursday, Dec. 3 10:40AM - 10:50AM Location: S504AB

Participants
Eric Tanifum, PhD, Houston, TX (*Presenter*) Nothing to Disclose
Matthew Liaw, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Robia Pautler, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Ananth Annapragada, PhD, Houston, TX (*Abstract Co-Author*) Stockholder, Marval Pharma Ltd Stockholder, Alzeca Biosciences LLC Stockholder, Sensulin LLC Stockholder, Abbott Laboratories Stockholder, Johnson & Johnson

PURPOSE

Conventional MRI contrast agents employ paramagnetic metal ions to generate contrast in 1H MRI scans. While this approach is

Conventional MRI contrast agents employ paramagnetic metal ions to generate contrast in 1H MRI scans. While this approach is highly sensitive, specificity and unambiguous quantification of signal is challenging and metal ion toxicity is a concern so other alternatives are sought. 19F presents a great potential for reasons including: spectroscopic properties of 19F are similar to 1H therefore existing 1H MRI hardware can be used for 19F MRI with minimal modifications; no endogenous 19F in soft tissue so the potential to generate a directly quantifiable signal with high contrast-to-noise ratio. However, almost all 19F-based agents utilize perfluorocarbons (PFCs), with several drawbacks: highly hydrophobic (limiting formulation to water emulsions) and magnetically diverse 19Fs (result in diffuse 19F MR images). We report novel hydrophilic fluorinated molecules with magnetically equivalent 19Fs, amenable to aqueous formulations for molecular imaging.

METHOD AND MATERIALS

Hydrophilic moieties were linked to fluorinated moieties with equivalent 19Fs, to generate water-soluble monomer units and then condensed to dimers and oligomers with high 19F content. Structures were confirmed by NMR and MS. Liposome formulation was achieved using standard protocols and size distribution determined by DLS. 19F content was assessed by UV-VIS and 19F NMR, and 19F MRI scans performed using a TurboRARE 3D scan in a 9.4 T Bruker instrument equipped with a 1H/19F dual-tunable volume RF coil.

RESULTS

Molecular synthesis was achieved in excellent yields, and 1H and 19F NMR indicated purity of the final products at >97%. All compounds dissolved readily in saline to give 500 mM to 1 M solutions used to prepare stable liposome formulations. 19F MR scans showed that formulations are detectable at 2-5 mM concentrations of the molecules, comparable to the high micromolar to milimolar intravoxel concentrations required for Gd contrast detection.

CONCLUSION

This is a new and facile paradigm to formulate 19F MRI contrast agents in aqueous media and their use to prepare stable liposome formulations, a proven nanoparticle platform for both passive and active delivery of contrast for molecular imaging, highlights the potential of this approach.

CLINICAL RELEVANCE/APPLICATION

We believe this approach will have significant impact on molecular imaging.

SSQ12-03 [^{11}C]Me@HAPTHI - A Novel PET-ligand for the Norepinephrine Transporter - Part 1: Target Affinity and Radiosynthesis

Thursday, Dec. 3 10:50AM - 11:00AM Location: S504AB

Participants
Christina Rami-Mark, MSc, Vienna, Austria (*Presenter*) Nothing to Disclose
Neydher Berroteran-Infante, MSc, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Alexander Hoepping, Radeberg, Germany (*Abstract Co-Author*) Employee, ABX GmbH
Marcus Hacker, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Markus Mitterhauser, Vienna, Austria (*Abstract Co-Author*) Speaker, General Electric Company
Wolfgang Wadsak, Vienna, Austria (*Abstract Co-Author*) Speaker, General Electric Company; Consultant, THP Medical; Research Grant, ABX GmbH; Research Grant, Rotem GmbH

PURPOSE

The norepinephrine transporter (NET) has been demonstrated to be relevant to a multitude of neuro-psychiatric and cardiovascular pathologies. Due to the wide range of possible applications for PET imaging of the NET together with the limitations of currently available radioligands, novel NET-PET tracers are seriously needed.

METHOD AND MATERIALS

Precursor, HAPTHI ((S)-1-(4-amino-3-hydroxybutyl)-3-phenyl-1,3-dihydrobenzo[c] [1,2,5]thiadiazole 2,2-dioxide), and reference compound, Me@HAPTHI ((S)-1-(3-hydroxy-4-(methylamino)butyl)-3-phenyl-1,3-dihydrobenzo[c][1,2,5]thiadiazole 2,2-dioxide), were custom-synthesized by ABX.For optimization of radiosynthesis conditions, small-scale reactions (< 2GBq) were performed. The influence of various reaction conditions, i.e. reaction temperature, solvent and base, precursor concentration and radiomethylation agent, was investigated. The automation of the N-^{11}C-methylation reaction was done on a TRACERlab FX C Pro synthesizer (GE Healthcare).The affinity of new radiolabeled ligand was determined in a NET-expressing membrane binding protocol.

RESULTS

In the radiochemical evaluation, best results were obtained with sodium hydroxide catalysis in 2-butanone (MEK) as solvent for 2min at 75°C using 2mg/mL precursor HAPTHI. Thereby, 54.0 ± 8.3% radiochemical incorporation yield was achieved. These optimum reaction parameters were subsequently used in the fully automated radiosynthesizer. So far, 7 large-scale radiosyntheses were performed, yielding 2.2 ± 2.0GBq (18.9 ± 13.3%, corrected for decay) of sterile, formulated [^{11}C]Me@HAPTHI within 36min. A mean specific activity of 46.8±28.5 GBq/µmol was found in the large-scale syntheses. Full radiopharmaceutical quality control took 5min and showed that radiochemical purity always exceeded 98%.Affinity of reference compounds, Me@HAPTHI, using human NET membranes evinced a Kd of 0.21 ± 0.07nM (n≥9). For determination of selectivity, additionally the affinity towards human DAT and SERT membranes were measured and revealed >10µM for DAT and 409 ± 43nM for SERT, respectively, (n≥5). Hence, selectivity of Me@HAPTHI towards NET was determined as DAT/NET>1947.6 and SERT/NET=9757.

CONCLUSION

This study confirms an outstanding affinity and selectivity of the title compound towards human NET as well as its feasible radiochemical preparation for further preclincal evaluations ans future in-vivo applications.

CLINICAL RELEVANCE/APPLICATION

N/A

SSQ12-04 [^{11}C]Me@HAPTHI - A Novel PET-ligand for the Norepinephrine Transporter - Part 2: Preclinical Evaluation

Thursday, Dec. 3 11:00AM - 11:10AM Location: S504AB

Participants
Christina Rami-Mark, MSc, Vienna, Austria (*Presenter*) Nothing to Disclose
Wolfgang Wadsak, Vienna, Austria (*Abstract Co-Author*) Speaker, General Electric Company; Consultant, THP Medical; Research Grant, ABX GmbH; Research Grant, Rotem GmbH
Cecile Philippe, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Chrysoula Vraka, MSc, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Marcus Hacker, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Markus Mitterhauser, Vienna, Austria (*Abstract Co-Author*) Speaker, General Electric Company

PURPOSE

The norepinephrine transporter (NET) has been demonstrated to be pivotal in many neuro-psychiatric and cardiovascular pathologies. [^{11}C]Me@HAPTHI, a novel potential NET-PET tracer, was shown to have a high target affinity and selectivity. Hence, further in vitro evaluation regarding blood-brain-barrier (BBB) penetration, stability and binding properties in autoradiography on different tissues is required.

METHOD AND MATERIALS

LogD was assessed using HPLC (Donovan and Pescatore J Chrom A, 2002). Immobilized artificial membrane (IAM) chromatography was performed using a standard method (Vraka C et al. EJNMMI, 2014) to achieve Pm (permeability) values.For evaluation of stability, incubation with human liver microsomes was performed. Plasma protein binding was determined quantifying the free fraction (ff) in human pooled plasma (Huang Y et al. J Cereb Blood Flow Metab, 2002). In vitro autoradiography was performed on human brain tissue (cortex, thalamus, hippocampus, cerebellum, and hypothalamus) as well as rat heart. Non-specific binding was determined with excess Nisoxetine (10µM). For competition, non-radioactive FMeNER-D2 and Me@HAPTHI were added. After 1h at room temperature, incubation was stopped and slices were processed on phosphor imaging films.Post-autoradiographic processing of the slices was done by Nissl staining in order to facilitate morphological mapping. Immunohistochemical (IHC) staining experiments were performed on rat and human tissue cryo-slices, vicinal to the slices used for autoradiography.

RESULTS

Excellent affinity (Kd of 0.21±0.07nM) and selectivity (DAT/NET>1940; SERT/NET=9700) were already shown for [^{11}C]Me@HAPTHI. Now, both logD (2.27±0.01) and Pm (1.15±0.25) were found to be in a range for expectable BBB penetration. After 60min incubation with human liver microsomes, 99.6±0.3% of the tracer were still intact. ff was found to be 8.2±0.3%.In the autoradiographic experiments, highest uptake of [^{11}C]Me@HAPTHI was observed in NET-rich regions identified with IHC and a concentration dependent binding displacement was seen for both competitors.(see figure)

CONCLUSION

Side from its high affinity and selectivity, we now demonstrated [^{11}C]Me@HAPTHI's stability, expectable BBB penetration and specific binding in autoradiography. This encourages us for in vivo application in small animal PET experiments and future clinical trials.

CLINICAL RELEVANCE/APPLICATION

N/A

SSQ12-05 Multimodal Imaging of Insulin-dependent Triglyceride-rich lipoprotein Uptake into Brown Adipose Tissue at 7T MRI and Intravital Microscopy

Thursday, Dec. 3 11:10AM - 11:20AM Location: S504AB

Participants
Caroline Jung, Hamburg, Germany (*Presenter*) Nothing to Disclose
Markus Heine, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Harald Ittrich, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Jorg Heeren, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Nils Mangels, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim was to determine the metabolic activity of brown adipose tissue (BAT) and its dependence on signalling pathway mediated by the anabolic hormone insulin using superparamagnetic iron oxide nanoparticles (SPIO - for MRI) or quantum dots (QD - for intravital microscopy (IVM)) embedded into triglyceride-rich lipoproteins (TRL).

METHOD AND MATERIALS

BAT activity of C57BL/6J wild-type was stimulated by treatment with the β3 receptor agonist CL316,243. Inhibition of insulin secretion during the course of BAT activation was performed using the potassium channel agonist diazoxide. All mice were starved for 4 hours before imaging. MRI at 7T ClinScan (Bruker) was performed before and 20 minutes after iv injection of TRL-SPIOs using a T2*w Multiecho-GRE sequence (TR/TEfirst 400/2ms, ETL 12, ES 1ms, FA 25°). ΔR2* in BAT was estimated. In addition to the MRI set up, IVM analysis was performed for real time imaging of TRL-QD uptake into BAT. In order to quantify TRL clearance, the fate of radioactively labelled TRLs were analysed under the same experimental conditions.

RESULTS

While no signal difference in BAT before and after the injection of TRL-SPIO was detectable for control mice, a significant signal drop and increase of ΔR2* (82.9s-1; p<0.001) was estimated for CL treated, BAT activated mice. Inhibition of insulin signalling resulted in a significant lower uptake of TRL-SPIO into BAT (ΔR2* = 21.1s-1; p<0.001). MRI results were confirmed by IVM analyses and by quantitative metabolic studies using radioactive lipid tracers. In both setups inhibition of insulin secretion using diazoxide abolished TRL uptake into BAT.

CONCLUSION

β3-receptor activation via CL with following acute insulin release lead to BAT activation, which can be visualised in vivo by MRI

β3 receptor activation via CL with following acute insulin release lead to BAT activation, which can be visualised in vivo by MRI using TRL-SPIO and estimating ΔR2*. Accordingly, the inhibition of insulin signalling blocks TRL uptake into BAT. Thus, MRI can visualize physiological lipid processing in the vascular endothelium of activated BAT.

CLINICAL RELEVANCE/APPLICATION

MRI in combination with nanoparticle-labelled lipoproteins can be used to noninvasively monitor the molecular pathway of insulin-dependent lipoprotein metabolism.

SSQ12-06 Using MPI as High Temporal Resolution Imaging Technique for in Vivo Bolus Tracking of Ferucarbotran in Mouse Model

Thursday, Dec. 3 11:20AM - 11:30AM Location: S504AB

Participants
Caroline Jung, Hamburg, Germany (*Presenter*) Nothing to Disclose
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Martin Hofmann, Dipl Phys, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael G. Kaul, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
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Harald Ittrich, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Kolja Them, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic particle imaging (MPI) is a new radiologic imaging method, potentially capable of rapid 3D dynamic imaging of magnetic tracer. The goal of this study was to follow and visualize the intravenous injected nanoparticles in real time through cardiovascular system at MPI.

METHOD AND MATERIALS

MPI scans of FVB mice (n=4) were carried out using a 3D imaging sequence (1 T/m gradient strength, 10 mT drive-field strength, FOV 40x40x20 mm3). After a first baseline control measurement a dynamic scan consisting of 100 000 repetitions (duration of about 35min and temporal resolution of 21.5ms per 3D volume) was performed. After the 13953th repetition 50µl ferucarbotran (Resovist, Bayer Schering Pharma AG) was injected into the tailvein via pump (53.7ml/h). As MPI delivers no anatomic information, MRI scans at 7T ClinScan (Bruker) were performed before and after MPI examination using a T2-weighted 2D turbo spin echo sequence (FOV 32mm, matrix 256x256, TR 1100ms, TE 28ms). The reconstruction was performed on the MPI console (ParaVision 6.0/MPI, Bruker). Image fusion was done using additional image processing software (Imalytics, Philips). The dynamic information was extracted using self-written software using the Julia programming environment.

RESULTS

The combined MR-MPI measurements were carried out successfully. No dislocation of the mouse was observed. In the sagittal views it is clearly visible how the tracer enters the vena cava inferior before it moves to the heart and then into the liver. (Fig. 1 shows different time points over a range of 1.5 s). By co-registration with MRI the anatomical regions were identified. Due to the frame rate of about 46 volumes per second a signal modulation with the frequency of the heart beat is detectable and a heart beat of 520bpm can be appreciated. Moreover the bloodflow velocity of approximately 5cm/s in the vena cava can be estimated.

CONCLUSION

The high temporal resolution of MPI allows real-time imaging and bolus tracking of intravenous injected nanoparticles and offers a tool to estimate blood flow velocity. MRI was successful used for anatomical informations.

CLINICAL RELEVANCE/APPLICATION

Blood flow velocity measurements by MPI may allow the estimation of luminal narrowing in atherosclerotic disease.

SSQ12-07 In Vivo Noninvasive Characterization of Brown Adipose Tissue in Rat by Spectral CT

Thursday, Dec. 3 11:30AM - 11:40AM Location: S504AB

Awards
Molecular Imaging Travel Award

Participants
Xin-Gui Peng, MD,PhD, Nanjing, China (*Presenter*) Nothing to Disclose
Zhen Zhao, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Di Chang, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Shenghong Ju, MD, PhD, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Brown adipose tissue (BAT) has lower lipid content, more abundant iron content and mitochondrion campared to white adipose tissue (WAT). Our study is to evaluate the lipid/water and iron/water content in both types of adipose tissure using material decomposition and effective atomic number of spectral CT.

METHOD AND MATERIALS

The animal study was approved by the institutional Committee on Animal Research. Six Wistar rats (14 weeks, 304g ±12g) underwent Spectral CT scan (GE, Discovery CT750 HD). Data were transmitted to AW4.6 workstation to obtain base material mappings, including fat (water) based imaging and iron (water) based imaging. The fat/water and iron/water concertraction of brown adipose tissue (interscapular) and white adipose tissue (visceral) were measured on base material mapping. In addition, we also calculate the effective atomic number of both types of adiopse tissue. Statistical analysis was performed with independent sample t test.

RESULTS

The base fat (water) material concentration of BAT was significantly lower than that of WAT (587.29 ± 187.61mg/cm3 and 1587.43 ± 70.11mg/cm3, respectively; P< 0.001). However, the water (fat) concentration of BAT was significantly higher than that of WAT (395.81±189.53mg/cm3, and -655.1 ± -69.141mg/cm3, respectively; P<0.001). The based iron (water) material concentration of BAT was significantly higher compared to WAT (-4.92±1.80mg/cm3 and -13.80 ± 0.36mg/cm3, respectively; P<0.001). Water (iron) concentration of BAT was also higher than that of WAT (989.33±7.29mg/cm3 and 951.63±-5.49mg/cm3, respectively; P<0.001). The effective atomic number of BAT was significant higher than that of WAT (6.95±0.28 and 4.7±0.11, respectively; P< 0.001).

CONCLUSION

The quantification of base material concentration and effective atomic number analysis of spectral CT revealed different characterization of both types of adipose tissue.

CLINICAL RELEVANCE/APPLICATION

It is anticipated that spectral CT provided a new noninvasive method to be translated to a clinical setting for evaluating the difference of adipose tissue and monitoring the responses to specific therapeutic strategies.

SSQ12-08 Does Iterative CT Reconstruction for Attenuation Correction Impact PET Images? A Qualitative and Quantitative Assessment for Next-Generation Digital Detector PET/CT

Thursday, Dec. 3 11:40AM - 11:50AM Location: S504AB

Awards
Molecular Imaging Travel Award

Participants
Katherine Binzel, PhD, Columbus, OH (*Presenter*) Nothing to Disclose
Jun Zhang, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Philip Bardos, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Veena A. Nagar, MD, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Implementation of iterative CT reconstruction (ICR) allows for significant dose reduction while generating equivalent visual quality to conventional CT doses. In this study we determine if there is any quantitative impact of using ultra-low dose ICR for attenuation correction of PET data, compared to filtered back projection (FBP).

METHOD AND MATERIALS

Clinical patients received 13 mCi FDG prior to imaging on the Vereos TF 64 PET/CT (Philips). Attenuation CTs were performed using 120 kV and 50 mAs for the PET imaging volume, skull to mid-thighs. PET images were reconstructed in two different modes, standard CT FBP and iDose4 ICR. The PET images were visually and quantitatively evaluated in a blinded fashion. The quantitative assessment focused on ROI assessment in target lesions in patients and background tissues.

RESULTS

A total of 30 datasets from 15 patients were evaluated. On visual assessment of the PET images benefits from the use of ICR for attenuation correction were apparent with markedly reduced impact from streaking artifacts. The quantitative analysis revealed that the overall SUVmax of PET images with iteratively reconstructed attenuation CTs was 0.5% higher for all tissue types [non-significant difference]. In target lesions the percent difference ranged from 0.5% to 1.4% increased SUVmax's over SUVmax's determined from PET images with FBP CT, none having any lower values.

CONCLUSION

Iterative CT reconstruction enables significant reduction of the x-ray dose required to obtain attenuation correction images for PET. This study validates that there is no impact on the quantitative readout compared to FBP reconstructed attenuation CTs. The visual appearance of the PET images appeared to be improved at locations where streaking artifacts were visible on FBP reconstructed CTs. Iterative reconstructed CTs can and should be used on next-generation PET/CT systems.

CLINICAL RELEVANCE/APPLICATION

Iterative CT reconstruction enables significant reduction of the x-ray dose required to obtain attenuation correction images for PET, while simultaneously improving the appearance of image artifacts.

SSQ12-09 Generalized Syntheses of Tumor Targeted Yolk/Shell Structured Multifunctional Nanosystems

Thursday, Dec. 3 11:50AM - 12:00PM Location: S504AB

Awards
Molecular Imaging Travel Award

Participants
Christopher England, PhD, Madison, WI (*Presenter*) Nothing to Disclose
Feng Chen, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Hao Hong, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Shreya Goel, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Stephen Graves, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Todd Barnhart, Madison, WI (*Abstract Co-Author*) Nothing to Disclose
Weibo Cai, PhD, Palo Alto, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this work is to develop a generally applicable protocol for synthesizing yolk/shell structured multifunctional nanosystems to be used for tumor targeted PET image-guided drug delivery.

METHOD AND MATERIALS

Upconversion nanoparticle (UCNP, with NIR-in-NIR-out upconversion luminescence) was used as the initial example. UCNP was first coated with a dense silica (dSiO2) shell, forming UCNP@dSiO2, followed by re-growth of a shell-thickness controllable mesoporous silica nanoshell (MSN) to form UCNP@dSiO2@MSN. A Na2CO3 etching protocol was used to selectively etch away dSiO2, leaving behind yolk/shell structured nanoparticles denoted as UCNP@HMSN. A step-by-step surface engineering process was then adopted to conjugate (or label) NOTA, polyethylene glycol (PEG) linkers, TRC105 (an anti-CD105 antibody), and 64Cu to form 64Cu-UCNP@HMSN-PEG- TRC105. Both hydrophobic (i.e. Sunitinib) and hydrophilic (i.e. Doxorubicin) drugs could be loaded inside UCNP@HMSN. Systematic in vivo PET imaging and biodistribution studies were performed in 4T1 tumor-bearing mice to evaluate and confirm tumor targeting capability, validated by in vitro/ex vivo studies.

RESULTS

TEM confirmed successful synthesis of UCNP@HMSN. By changing the 'yolk' to superparamagnetic iron oxide nanoparticle (SPION) or quantum dot (QD), we confirmed the general applicability of this protocol. In vitro CD105 targeting in HUVEC (CD105+) and MCF-7 (CD105-) cells showed strong/specific binding of FITC-conjugated UCNP@HMSN-PEG-TRC105 to CD105+ cells with negligible non-specific binding. In vivo tumor targeting and PET imaging demonstrated CD105-specific targeting of 64Cu-UCNP@HMSN-PEG-TRC105 in 4T1 tumor-bearing mice, with peak tumor uptake of ~6.5 %ID/g at 6 h post-injection. CD105 specificity was confirmed by blocking and ex vivo histology studies.

CONCLUSION

This work demonstrates the feasibility of developing targeted yolk/shell structured nanosystems for in vivo imaging. With UCNP, QD, SPION, or other nanocrystals inside each yolk/shell structure, this nanoplatform is highly versatile for future tumor targeted multimodality image-guided drug delivery.

CLINICAL RELEVANCE/APPLICATION

We report the generalized syntheses of yolk/shell structured nanosystems for tumor targeted PET imaging and drug delivery, with potential future applications as theranostic agents for the concurrent imaging and treatment of cancer.

SSQ13

Musculoskeletal (Arthritis)

Thursday, Dec. 3 10:30AM - 12:00PM Location: E451A

MK CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Leon Lenchik, MD, Winston-Salem, NC (*Moderator*) Nothing to Disclose
Brady K. Huang, MD, San Diego, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSQ13-01 Calcium Pyrophosphate Deposition Disease Detected with MRI Is Associated with Accelerated Cartilage Degeneration-Data from the Osteoarthritis Initiative

Thursday, Dec. 3 10:30AM - 10:40AM Location: E451A

Participants
Alexandra S. Gersing, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
Benedikt J. Schwaiger, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Ursula R. Heilmeier, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
John A. Lynch, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Charles E. McCulloch, San Francisco, CA (*Abstract Co-Author*) Instructor, F. Hoffmann-La Roche Ltd Expert Witness, Mallinckrodt plc Consultant, Mallinckrodt plc
Lynne S. Steinbach, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Link, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Research funded, General Electric Company; Research funded, InSightec Ltd; Royalties, Springer Science+Business Media Deutschland GmbH; Research Consultant, Pfizer Inc;

PURPOSE

To evaluate sensitivity of different MRI sequences regarding detection of calcium pyrophosphate deposition disease (CPPD) lesions within cartilage and menisci and to longitudinally analyze if CPPD lesions are associated with accelerated cartilage degeneration.

METHOD AND MATERIALS

Subjects with radiographic evidence of CPPD (n=90, age 67.7±7.3y, 50 females) were randomly selected from the Osteoarthritis Initiative and frequency matched for age, sex, baseline KL and BMI to controls without CPPD (n=90). On AP knee radiographs, CPPD status was determined. Sensitivity of T1-weighted 3D FLASH, 3D DESS, 2D intermediate (IW) and proton density (PD)-weighted sequences obtained at 3T MRI was assessed in randomized order by two radiologists blinded to radiographic CPPD status, by grading visualization and morphology of cartilage and meniscal CPPD lesions, as well as focal cartilage degeneration at baseline and after 48 months. For analysis multivariate regression models were used to examine associations between CPPD lesions detected with MRI and with radiographs as well as longitudinal changes of cartilage morphology.

RESULTS

Lesion count in menisci and cartilage of the tibiofemoral joint detected by different MRI sequences correlated significantly with degree of CPPD determined on radiographs (r(FLASH)=0.73, r(DESS)=0.68, r(IW)=0.51, r(PD)=0.40, P<0.001). Overall, visualization of cartilage lesions was significantly higher rated in FLASH (P<0.05) and significantly more CPPD lesions were detected with FLASH compared to DESS, IW and PD sequences (for each, P<0.05). Progression of focal cartilage degeneration was significantly higher in subjects with CPPD compared to controls (P=0.03). At the patella, lesion count was highest, progression of cartilage degeneration was most significant compared to other compartments (P=0.03) and a significant association between progression and lesion count was found (r=0.64, P=0.03).

CONCLUSION

Our findings demonstrate that T1W FLASH gradient echo sequences were superior to other sequences in detection of CPPD lesions in cartilage. Moreover CPPD was associated with faster progression of cartilage focal degeneration over 48 months compared to controls and occurred most often at the patella.

CLINICAL RELEVANCE/APPLICATION

MR T1-weighted gradient-echo FLASH sequence allows detection and quantification of CPPD lesions within cartilage and menisci, and may be used to predict progression of focal cartilage degeneration.

SSQ13-02 Study of 640-slice Dynamic Volume CT Perfusion and Pathological Changes on Acute Gouty Arthritis of Knee-joint in Rabbit Model

Thursday, Dec. 3 10:40AM - 10:50AM Location: E451A

Participants
Yabin Hu, MD, Qingdao, China (*Presenter*) Nothing to Disclose
Qing Yang, Qingdao, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess 640-slice dynamic volume CT perfusion imaging of acute gout arthritis in rabbit.

METHOD AND MATERIALS

preparation of acute gout arthritis model. 35 rabbits were randomly divided into two groups: experimental group (30 rabbits) and

control group(5 rabbits).The right knee-joints of experimental group was injected with sodium urate solution and polymyxin, and no treatment was for the control group. The experimental group was divided into six subgroups randomly with five rabbits in each one, and for every 4h, 16h, 32h, 48h, 60h, and 60h after injection, one experimental subgroup underwent CT perfusion scan. The control group was scanned for once at any time. Then time-density curves (T-DC) were depicted, and the values of blood flow (BF), blood volume (BV), clearance rate (CL), and microvessel density (MVD) were computed in the right knee-joints containing experimental and control groups. Rabbits were killed after perfusion, and their right knee-joints were taken for pathologic examination.

RESULTS

BF, BV, CL and MVD in the experimental group were significantly higher than those in the control group(Independent-samples T test, $P<0.05$). BF, BV, CL and MVD in experimental group were different at those six intervals(one-way ANOVA and LSD t test, $P<0.05$). 4h, 16h, and 32h after the injection, BF, BV, and MVD in the experimental group increased slowly, and the peak values were found at 32h. Between 32h ~ 48h, the peak values were relatively stable, and after 48h ~ 72h, they decreased slowly. Between 4h ~ 48h, CL showed a slow ascent,peaking at 48h,and between 48h ~ 60h, the peak was relatively stable with a slow decrease about 60 ~ 72h.

CONCLUSION

Dynamic volume CT can reflect the hemodynamic changes of acute gouty arthritis in rabbit models. The peak of inflammation and newborn microvessels emerge between 32h ~ 48h, and after that time, the inflammation is in remission with decrease of the number of microvessels. The high perfusion area is consistent with the distribution of newborn microvessels.

CLINICAL RELEVANCE/APPLICATION

Dynamic-Volume CT can reflect the hemodynamic changes of acute gouty arthritis in rabbit models and the high perfusion area is consistent with the distribution of newborn microvessels.

SSQ13-03 The Role of US and Magnetic Resonance Imaging In Early Detection of Psoriatic Arthritis; Comparison With Radiographic and Clinical Findings

Thursday, Dec. 3 10:50AM - 11:00AM Location: E451A

Participants
Mohammed F. Amin, MBBCh, El-Minia, Egypt (*Presenter*) Nothing to Disclose

PURPOSE

To detect early spondyloarthropathy in patients with psoriasis using both ultrasonography and magnetic resonance imaging comparing those with conventional radiography (x-ray), and clinical assessment.

METHOD AND MATERIALS

This prospective study was carried out on 50 patients with skin or nail psoriasis, their age ranged between 17 and 75 years, with a mean of 44.8 ± 17.5 years, the duration of psoriasis ranged between 0.5 and 40 years with a mean of 8.7 ± 8.7 years. There were 29 males (58%) and 21 females (42%). Plain x ray to both hands, wrists, feet, lumbar spine, and sacroiliac joint in different radiologic positions, - Ultrasonographic examination to the small joints of both hands and feet as well as sites of enthesopathy in the lower limbs and MRI: Lumbar spine and sacroiliac joint done to detect early changes.

RESULTS

Abnormal US findings involving at least one finger and/or toe were seen in 9/50 patients, while only 3 patients had one or more X-ray abnormalities. Thirty seven patients (74%) had GUESS ≥ 1 at a higher percentage than tenderness revealed by clinical examination (46%), while plain radiography showed abnormalities in only 13 (26%) patients. There was a statistically significant association between arthritis and clinical enthesitis. Fourteen patients had inflammatory back pain (28%), Magnetic resonance imaging demonstrated evidence of inflammation in the spine in 21 (42%) patients and sacroiliitis in 2 (4%) patients. ct early changes.

CONCLUSION

US is a non invasive tool, proved to be useful early detection of synovial abnormalities in the fingers and toes of patients with suspected PsA. MRI provide valuable help in early detection of psoriatic arthritic changes of the spine and sacroiliac joints. The use of US and MRI offers the opportunity for early diagnosis and early appropriate treatment .aging demonstrated evidence of inflammation in the spine in 21 (42%) patients and sacroiliitis in 2 (4%) patients. ct early changes.

CLINICAL RELEVANCE/APPLICATION

US is a non invasive tool, proved to be useful early detection of synovial abnormalities in the fingers and toes of patients with suspected PsA. MRI provide valuable help in early detection of psoriatic arthritic changes of the spine and sacroiliac joints.

SSQ13-04 Styloid Process Elongation on Cervical Spine CT is Associated with Ankylosing Spondylitis but not with DISH

Thursday, Dec. 3 11:00AM - 11:10AM Location: E451A

Participants
Gal Yaniv, MD, PhD, Ramat Gan, Israel (*Presenter*) Nothing to Disclose
Salim Bader, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Natalia Lev Levi, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Gahl Greenberg, Tel Aviv, Israel (*Abstract Co-Author*) Nothing to Disclose
Oshri Mozes, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Merav Lidar, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Iris Eshed, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate if styloid process (SP) elongation, thought to occur due to enthesopathy, is associated with two common enthesitis-

related diseases: ankylosing spondylitis (AS) and diffuse idiopathic skeletal hyperostosis (DISH).

METHOD AND MATERIALS

Cervical spine CT examinations of patients with DISH (n=41, Resnick criteria), AS (n=23, NY criteria) and a control group of patients with no radiological signs of DISH or AS (n=54) were retrospectively evaluated. The DISH group was further divided into patients with/without cervical DISH. The length of right and left SP was measured independently by two readers on coronal- and sagittal-oblique reformats. The average right and left styloid length and average length per person were compared between the groups.

RESULTS

Patients' demographic characteristics were similar between the DISH and control groups (average age: 68.2±15.7/69.2±12.7 years, M/F ratio: 24:17/ 35:19, respectively, p>0.05). AS group's age was significantly lower (average age: 53±15 years, p<0.0001) and, composed mainly of men. Inter-reader reliability of SP measurements was excellent in all groups (ICC=0.998, p<0.0001). The AS group but not the DISH group had significantly (p<0.02) longer SP compared to the controls (AS: 38.8±9.6 mm, DISH: 34.9±9 mm, Control: 31.2±10.1 mm). SP length was not different between the two DISH groups (cervical DISH/non-cervical DISH: 35.1±9/34.8±9, p>0.05).

CONCLUSION

Compared to the controls, significant SP elongation is associated with AS but not with DISH patients. Our findings may be caused by different enthesopathy-related pathophysiology.

CLINICAL RELEVANCE/APPLICATION

Clinical and radiographic differentiation between AS and DISH may be challenging. The present observation provides an additional differentiating tool to the radiologist's diagnostic armamentarium.

SSQ13-05 Sacroiliac Joint Alterations on CT Examinations of the Lumbar Spine in Patients Younger than 40 years Old: Prevalence and Radiologists' Awareness

Thursday, Dec. 3 11:10AM - 11:20AM Location: E451A

Participants
Eyal Klang, Ramat Gan, Israel (*Presenter*) Nothing to Disclose
Merav Lidar, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Iris Eshed, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the prevalence and awareness of reading radiologists for the presence of structural post-inflammatory and other sacroiliac-joint (SIJ) pathologies on lumbar-spine CTs of young patients with low back pain (LBP).

METHOD AND MATERIALS

499 lumbar-spine CT examinations (8/2012 - 1/2014) of patients 18-40 years old with LBP were retrospectively reviewed. Exams in which the entire SIJs were not visualized were excluded. The SIJs were scored in consensus by a musculoskeletal radiologist and a senior radiologist (study reading) for the presence of structural SIJ findings suggesting the presence of inflammatory sacroiliitis (modified NY criteria). Other SIJs pathologies and anatomic variants were also recorded. The original readings for these exams (all by senior radiologists) were compared to the study reading. 100 CT examinations were re-evaluated for reliability assessment (Intra-class Correlation Coefficient, ICC).

RESULTS

484 CTs were included (M:F 272:212, average age: 31.6 years). A total of 150 (31%) SIJ alterations were registered [Grade 1-4 sacroiliitis=66(13.6%); Grade 1=29(5.9%), Grade 2=21(4.3%), Grade 3=14(2.9%), Grade 4=2(0.4%), (ICC: r=0.6, P<0.0001); osteitiscondensans-ilii=38(7.8%), diffuse idiopathic skeletal hyperostosis=24(5%), degenerative changes=22(4.5%) and accessory SIJ=22(4.5%)]. The SIJs were referenced 39 times (8.0%) in the original readings; sacroiliitis:1, sclerotic changes:2, degenerative changes:12 and normal SIJ:24. Total diagnostic accuracy for these reports only and for the entire readings were 49%/69% respectively and 13%/1.3% respectively for the pathological findings.

CONCLUSION

Sacroiliitis and other SIJ alterations are highly prevalent in individuals younger than 40 years of age with LBP, albeit, majority of these alterations are not recognized nor reported by senior radiologists thus delaying efficacious treatment in spondyloarthritis (SpA) patients.

CLINICAL RELEVANCE/APPLICATION

Increased awareness for SIJ alterations on lumbar spine CTs may allow for earlier diagnosis and therapy in young SpA patients leading to improved quality of life and deterring irreversible changes.

SSQ13-06 Pixel-by-Pixel Arterial Spin Labeling Blood Flow Pattern Variation Analysis for Depiction of Rheumatoid Synovitis

Thursday, Dec. 3 11:20AM - 11:30AM Location: E451A

Participants
Taro Sakashita, Sapporo, Japan (*Presenter*) Nothing to Disclose
Tamotsu Kamishima, MD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Sugimori, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Atsushi Noguchi, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Michihito Kono, Obihiro, Japan (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Atsumi, MD, PhD, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose
Minghui Tang, Sapporo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate noninvasively hyperemia of inflamed synovial tissue (pannus) of rheumatoid arthritis (RA), the arterial spin labeling (ASL) blood flow pattern variation (BFPV) map, which is the post labeling delay (PLD) time-independent variation in relative blood flow pattern, is introduced. The purpose of this prospective study was to test the feasibility of the BFPV map to distinguish pannus from other tissues.

METHOD AND MATERIALS

Eight patients (7 women and 1 man) with RA of the wrist or finger joints participated in the study. Dynamic contrast-enhanced LAVA sequences for detecting the extent of pannus formation as gold standard and 3D pulsed continuous ASL (pCASL) sequences (repetition time/echo time 4397-4852/10.704 ms, slice thickness 4 mm, number of slices 36, labeling duration 1450 ms, PLD 1025,2025 ms) for quantitative assessment of tissue perfusion were applied at 3 T (GE MEDICAL SYSTEMS, DISCOVERY MR750w). Pixel-by-pixel temporal changes of relative blood flow per PLD time were calculated from pCASL perfusion images with two different PLD times and were imaged as BFPV map. BFPV values of the radial or ulnar artery, pannus, and surrounding tissue were measured and compared by the Tukey test. Color-coded BFPV maps for quantifying pannus volume were imaged by setting threshold values on the BFPV map. The independent t-test was used to analyze pannus volume between two groups of patients classified depending on whether or not pannus formation was detected on the dynamic images.

RESULTS

There was a statistically significant difference in the BFPV values between artery and pannus, pannus and surrounding tissue, and artery and surrounding tissue ($p<0.001$) because of the advantage of precise tissue characterization related to the blood flow pattern of the labeled arterial spins. The patients showing apparent pannus formation showed a significantly larger volume of pannus on the color-coded BFPV map than the patients showing no or limited pannus formation ($p=0.023$).

CONCLUSION

This approach may be capable of depicting the extent of the synovial disease quantitatively and noninvasively without the need to determine the appropriate PLD time to allow the label to reach the tissue of interest.

CLINICAL RELEVANCE/APPLICATION

Pixel-by-Pixel Arterial Spin Labeling Blood Flow Pattern Variation introduced in this study may be capable of evaluating the extent of the synovial disease quantitatively and noninvasively.

SSQ13-07 Detection of Synovitis in Rheumatoid Arthritis and Differentiation to Healthy Volunteers by Means of a 2D Optical Imaging System in Comparison to MRI

Thursday, Dec. 3 11:30AM - 11:40AM Location: E451A

Participants
Jan Neumann, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Klaus Thuermel, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Reinhard Meier, MD, PhD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively compare an Indocyanine Green (ICG)-enhanced fluorescence optical imaging (FOI) system and contrast-enhanced 3T MRI with a composite reference consisting of MRI, FOI and clinical examination for the detection of synovitis in the hands of patients with rheumatoid arthritis and the differentiation to healthy volunteers.

METHOD AND MATERIALS

20 Patients (90% female, mean age = 59.1) with moderate to severe rheumatoid arthritis and 13 healthy volunteers (60% female, mean age = 26) were clinically examined and scanned with FOI (mivenion GmbH, Germany) and 3T MRI (Philips, Netherlands). The degree of inflammation in the metacarpophalangeal, proximal and distal interphalangeal joints of both hands on FOI and MRI was graded objectively by three independent radiologists on a 4-point-ordinate scale (0: no inflammation, 1: mild, 2: moderate, 3: severe) according to the OMERACT RAMRIS score. Results were compared using a composite reference consisting of MRI, FOI and clinical examination.

RESULTS

Evaluating 2862 joints of 20 patients and 13 volunteers using a composite reference, OI had a sensitivity of 51.5% and a specificity of 90.7%, MRI had a sensitivity of 77.4% and a specificity of 88.8% and clinical examination had a sensitivity of 42.7% and a specificity of 90.2% for the detection of synovitis.

CONCLUSION

The evaluated ICG enhanced OI system showed limitations in the detection of synovitis in patients with RA.

CLINICAL RELEVANCE/APPLICATION

Despite its advantages of its minimal invasiveness, lower costs and easy operability the OI system appears to be of limited value for the clinical routine.

SSQ13-08 MRI-detected Markers of Inflammation Especially in Overweight Persons Increase Risk of Incident Osteoarthritis: The POMA Study

Thursday, Dec. 3 11:40AM - 11:50AM Location: E451A

Participants
Frank W. Roemer, MD, Boston, MA (*Presenter*) Chief Medical Officer, Boston Imaging Core Lab LLC Research Director, Boston Imaging Core Lab LLC Shareholder, Boston Imaging Core Lab LLC
Ali Guermazi, MD, PhD, Boston, MA (*Abstract Co-Author*) President, Boston Imaging Core Lab, LLC; Research Consultant, Merck KgaA; Research Consultant, Sanofi-Aventis Group; Research Consultant, TissueGene, Inc; Research Consultant, OrthoTrophic; Research Consultant, AstraZeneca PLC

Michael Hannon, Oakland, PA (*Abstract Co-Author*) Nothing to Disclose
Tomoko Fujii, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Robert Boudreau, PhD, Pittsburgh, PA (*Abstract Co-Author*) Nothing to Disclose
Kent C. Kwoh, MD, Pittsburgh, PA (*Abstract Co-Author*) Advisory Panel, Pfizer Inc Data Safety Monitoring Board, Novartis AG

PURPOSE

To assess whether presence of inflammation measured as joint effusion and Hoffa-synovitis differs between normalweight, and overweight/obese persons that develop incident OA two years prior the diagnosis of radiographic OA and to assess whether risk of OA differs for men and women.

METHOD AND MATERIALS

We studied 355 knees drawn from the Osteoarthritis Initiative study that developed incident ROA. They were matched 1:1 by gender, age, and baseline Kellgren-Lawrence grade to a control knee. MR images were acquired at 3 T systems. MRIs were read for Hoffa- and effusion-synovitis at the visit two years prior to incidence defined as P-2. Subjects were classified as normal weight (BMI < 25), overweight (BMI ≥25 and <30) or obese (BMI ≥ 30) at OAI enrollment. Bivariate logistic regression was used to assess the risk of synovitis and effusion at P-2 in subjects (N = 225 cases) that developed radiographic OA comparing overweight and obese subjects to normal weight subjects as the reference. Conditional logistic regression (N = 218 matched pairs) was used to assess the risk of ROA for the interaction of synovitis at P-2 and BMI category stratified by gender.

RESULTS

For men and women combined, among those who developed ROA there was no increased risk of synovitis in the combined overweight/obese BMI subgroup but being overweight was associated with an increased risk of effusion (OR 2.21, CI 1.11, 4.43). The distribuition for the different categories for women was 31.7%, 35.3% and 33.0%. Using overweight women without synovitis as the reference, obesity without synovitis was associated with a greater risk of OA (OR 2.87, CI 1.21,6.83) in women, as was being overweight with synovitis (OR 3.26, CI 1.39, 7.65). For men, these associations were not found. Table 1 gives a detailed overview of these results.

CONCLUSION

For those who would develop OA, an increased risk of effusion was observed for the combined overweight/obese group at P-2 but not for synovitis. In regard to interaction of BMI with synovitis, the presence of synovitis increases risk of ROA in overweight women while obese women had an increased risk for ROA without synovitis.

CLINICAL RELEVANCE/APPLICATION

Presence of inflammation seems to play a role especially in overweight women whereas obese women have an increased risk for ROA even in the absence of imaging markers of inflammation confirming that both mechanical load and inflammation play a role in OA incidence at least for women.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Ali Guermazi, MD, PhD - 2012 Honored Educator

SSQ13-09 Ultrashort TE Evaluation of Osteochondral Junction Alterations in Early Osteoarthritis

Thursday, Dec. 3 11:50AM - 12:00PM Location: E451A

Participants
James MacKay, MBBCHIR, MRCP, Norwich, United Kingdom (*Presenter*) Nothing to Disclose
Samantha B. Low, MBChB, Norwich, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andoni P. Toms, FRCR, PhD, Norwich, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the characteristics of the osteochondral junction (OCJ) in individuals with possible early osteoarthritis (OA) compared with normal controls using ultrashort echo time (UTE) MR imaging. The OCJ has been implicated in the pathogenesis of OA.

METHOD AND MATERIALS

Ten healthy controls (group 1) and ten patients aged between 40-50 years old with possible early OA (non-traumatic knee pain, but no conventional radiographic or MR features of OA - group 2) underwent 3T MR imaging of the knee using a 2D UTE sequence. UTE has shown the ability to depict the normal OCJ as a high signal intensity (SI) linear structure.Qualitative grading of the UTE high SI line at the medial (MT) and lateral tibial (LT) plateau OCJ was performed (present/focally or diffusely absent). Quantitative analysis involved creating regions of interest (ROI) at the MT OCJ, LT OCJ and in the femoral metaphysis (background ROI). The peak OCJ SI ratio was calculated by measuring the peak SI across the OCJ ROIs using averaged craniocaudal SI profiling, then dividing by the mean SI of the background ROI to standardize between studies. MT and LT peak OCJ SI ratios were compared between groups using Mann-Whitney tests. Measurements were performed by two independent observers, with reliability assessed using the intraclass correlation coefficient (ICC).

RESULTS

A high SI line at the OCJ was visualized at the MT and LT of all group 1 subjects. This was focally or diffusely absent in 5/10 group 2 participants at the MT and 4/10 group 2 participants at the LT.There was a significant difference ($p < 0.001$) in MT peak OCJ SI ratio between group 1 (mean ±SD = 0.85 ±0.10) and group 2 (0.77 ±0.12). There was no significant difference ($p = 0.19$) in LT peak OCJ SI ratio between group 1 (0.81 ±0.23) and group 2 (0.80 ±0.13). The technique demonstrated substantial interobserver reliability, with ICC = 0.65 (95% CI 0.53-0.74).

CONCLUSION

Qualitative and significant quantitative differences in the UTE appearance of the MT OCJ were seen in individuals with possible OA compared with normal controls.

CLINICAL RELEVANCE/APPLICATION

Quantitative UTE analysis has potential as a biomarker of early OA by detecting early pathological changes at the OCJ.

SSQ14

Musculoskeletal (Soft Tissue Tumor)

Thursday, Dec. 3 10:30AM - 12:00PM Location: E451B

MK CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Laura W. Bancroft, MD, Orlando, FL (*Moderator*) Royalties, Wolters Kluwer nv
David M. Panicek, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSQ14-01 Improved Detection of Melanoma Metastases Using Iodine Maps from Dual Energy CT

Thursday, Dec. 3 10:30AM - 10:40AM Location: E451B

Awards
Trainee Research Prize - Resident

Participants
Monika Uhrig, MD, DIPLPHYS, Heidelberg, Germany (*Presenter*) Nothing to Disclose
David Simons, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Heinz-Peter Schlemmer, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Increasing workload for radiologists demands innovative solutions to preserve high quality of reports. Dual energy CT (DECT) provides contrast media mapping without a precontrast scan and allows high-contrast visualization of enhancing lesions. Goal of this study is to evaluate the potential of iodine maps (IM) from DECT to improve detection of melanoma metastases.

METHOD AND MATERIALS

75 DECT scans (thorax (T) and abdomen (A)) from 75 melanoma patients were retrospectively analyzed. For each patient 3 conventional image reconstructions (T: lung kernel (B70f very sharp) 1mm axial and soft tissue kernel (D20f smooth) 3 mm axial, A: soft tissue kernel (D20f smooth) 3 mm axial) were performed. With commercially available software, the spectral information from DECT data was used to generate IM in axial 3 mm slices (for lung parenchyma additional 1 mm slices). These maps are comparable to color coded CT images, but the displayed voxel values base exclusively on materials which the algorithm identifies as contrast media. To facilitate radiological assessment, an overlay of IM and conventional CT (cCT) was provided. A radiologist analyzed initially cCT and afterwards the IM. Number, localization and characterization of lesions detected additionally by assessing the IM were reported.

RESULTS

In 29 patients in total 44 lesions (17 metastases) were additionally detected on IM. All lesions could retrospectively be identified on cCT and were located in the liver (34%), inter- or intramuscular (23%), subcutaneous (9%), lung (7%), mesenterial (5%), intestinal (5%), mediastinal (5%), skeleton (4%), pancreas (2%), vagina (2%), supraclavicular (2%) and peritoneal (2%). Lung findings include 2 pulmonary emboli.

CONCLUSION

In view of increased workload powerful tools supporting a fast and accurate assessment of radiological images are essential. This study demonstrates that IM from DECT improve detection of metastases as well as relevant secondary findings like pulmonary emboli in staging examinations of melanoma patients. To the best of our knowledge, the potential of iodine maps for lesion detection in staging examinations has not been shown before.

CLINICAL RELEVANCE/APPLICATION

Increased workload bears the risk of impaired quality of CT reports. IM from DECT improve detection of metastases and relevant secondary findings without increasing radiation dose.

SSQ14-02 Diagnostic Performance of Diffusion-weighted and Dynamic Contrast Enhanced (DCE) MR Images for Evaluating Soft-tissue Tumors

Thursday, Dec. 3 10:40AM - 10:50AM Location: E451B

Participants
You Seon Song, Busan, Korea, Republic Of (*Presenter*) Nothing to Disclose
In Sook Lee, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jong Woon Song, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Il Moon, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic efficacy of diffusion-weighted (DW) and dynamic contrast enhanced (DCE) MR images for evaluating soft-tissue tumors.

METHOD AND MATERIALS

Between September 2012 and March 2015, 102 patients (57 female, 45 male, age range, 11-86 years; mean age, 47.7 years) who

had soft-tissue tumors performed MR examinations including DWI and DCE images. We investigated the size and signal intensities of the mass on conventional MR images. On DWI, we obtained the values of ADC (apparent diffusion coefficient) and evaluated the presence or absence of diffusion restriction visually. We obtained the values of Ktrasn, Kep, Ve, and iAUC, and time-concentration curve (TCC) of 7 types on DCE images. These results were compared between benign and malignant lesions statistically.

RESULTS

Malignant lesions were 28 cases and benign 74. DWIs were not obtained adequately in 8 cases. For differentiating between benign and malignant lesions, the sex of patient, and the size and signal intensities of the mass were not significant. However, the age of patient and the margin of the mass were significant. On DWI, the values of minimum and mean ADC and the presence or absence of diffusion restriction visually were significant. On DCE MR images, the values of Ktrans, Kep, iAUC and the types of TCC were significant.

CONCLUSION

For the differentiating benign and malignant soft-tissue lesions, added DWIs and DCE MR images were very effective and thus these quantitative evaluations might be necessary.

CLINICAL RELEVANCE/APPLICATION

There are many indistinct cases in the differentiation of benign from malignant lesions with only conventional MR images. In the future, the quantitative analyses by using functional MR images might be helpful for distinguishing between benign and malignant soft tissue lesions.

SSQ14-03 Does CT Imaging Have the Ability to Identify the Dedifferentiated Component (DDLPS) in a Retroperitoneal Well Differentiated Liposarcoma (WDLPS)?

Thursday, Dec. 3 10:50AM - 11:00AM Location: E451B

Participants
Jieqi Wang, BA, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Priya R. Bhosale, MD, Houston, TX (*Presenter*) Nothing to Disclose
Datla G. Varma, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Corey T. Jensen, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Tara L. Sagebiel, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Madhavi Patnana, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Chitra Viswanathan, MD, Houston, TX (*Abstract Co-Author*) Consultant, Hollister Incorporated
Neeta Somaiah, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the CT imaging features which may predict the presence of a DDLPS component within a retroperitoneal WDLPS.

METHOD AND MATERIALS

49 treatment naive patients with WDLPS (12) or DDLPS (37) who underwent computed tomography (CT) were included in the study following approval of the institutional review board. Three Radiologists evaluated the studies independently in a blinded fashion on a diagnostic workstation for < or >25% fat, presence of a ground glass nodule (a nodule having as attenuation lower than adjacent psoas muscle and hazy internal architecture),enhancing nodule (higher attenuation than psoas muscle), necrotic nodule (enhancing nodule with central areas of low attenuation), capsule surrounding the mass, septations, calcification (popcorn, spiculated or curvilinear), and final diagnosis of WDLPS or DDLPS.Statistical analysisMultivariate logistic regression model with generalized estimating equations (GEE) method was used to correlate imaging features with pathology. P-values of 0.05 or less were considered statistically significant. Kappa Statistics were performed to assess agreement of the 5 features by all the three radiologists.

RESULTS

The accuracy, sensitivity, specificity, positive predictive value and negative predictive values to diagnose the DDLPS in the WDLPS were 75.5%, 91.7%, 70.2%, 50.0% and 96.3%, 79.6%, 91.7%, 75.7%, 55.0% and 96.5% and 73.3%, 91.7%, 67.6%, 47.8% and 96.5% for reader 1, 2 and 3. All three readers showed almost perfect agreement in overall diagnosis based on Kappa statistics [95%confidence interval r= 0.83 (0.63 to 0.99)]. The presence of an enhancing nodule was highly suggestive of DDLPS (P< 0.02).

CONCLUSION

The presence of an enhancing nodule is highly specific for the diagnosis of DDLPS component in a retroperitoneal WDLPS.

CLINICAL RELEVANCE/APPLICATION

Imaging may help guide appropriate biopsy of the dedifferentiated component within a well differentiate liposarcoma which can further help streamline patient management

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Priya R. Bhosale, MD - 2012 Honored Educator

SSQ14-04 Value of US Imaging in the Diagnosis of Epidermal Cysts

Thursday, Dec. 3 11:00AM - 11:10AM Location: E451B

Participants
Vasiliki Perlepe, MD, Brussels, Belgium (*Presenter*) Nothing to Disclose
Nicolas Michoux, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose

Bruno C. Vande Berg, MD, PhD, Brussels, Belgium (*Abstract Co-Author*) Consultant, Bone Therapeutics SA
Frederic E. Lecouvet, MD, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose
Liliane Marot, Woluwe-St Lambert, Belgium (*Abstract Co-Author*) Nothing to Disclose
Jacques Malghem, MD, Brussels, Belgium (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the ultrasonographic appearance of subcutaneous soft-tissue tumors and pseudo-tumors with a focus on epidermal cysts.

METHOD AND MATERIALS

112 small subcutaneous nodules (mean maximum size: 9.7mm) with US imaging and pathologic correlation were included in this retrospective study. The histopathology revealed 7 ganglion cysts, 24 epidermal cysts, 10 pilomatricomas, 47 benign tumors (including 25 lipomas), 9 malignant tumors and 15 various lesions. One MSK radiologist with 20 years of experience analysed several US imaging features of the lesions: morphology, margins, size, echogenicity, Doppler signal, peripheral halo, focal intra-dermal penetration, relative skin thinning opposite to the mass, posterior acoustic enhancement, lateral shadows. ROC analysis was performed to evaluate the performance of individual parameters and that of a multi-parametric model using logistic regression in the specific identification of epidermal cysts.

RESULTS

Best imaging parameters were posterior acoustic enhancement (AUC = 0.87, Se = 100%, Sp = 65%), lateral shadows (AUC = 0.83, Se = 75%, Sp = 91%), Doppler signal=0 (AUC = 0.75, Se = 86%, Sp = 63%), well-defined margins (AUC = 0.74, Se = 96%, Sp = 27%), relative skin thinning (AUC = 0.71, Se = 100%, Sp = 35%) and focal intra-dermal penetration (AUC = 0.65, Se = 42%, Sp = 89%), showing a performance ranging from moderate to good. A multi-parametric model based on 4 parameters (posterior acoustic enhancement, well-circumscribed margins, lateral shadows and Doppler) allowed diagnosis of epidermal cysts with a very good performance (AUC = 0.96, Se = 91%, Sp = 94%).

CONCLUSION

A computer-aided decision based on a multi-parametric model of US imaging features of subcutaneous lesions allows diagnosis of epidermal cysts. Further tests on a larger cohort of patients are needed to confirm the performance of the present model.

CLINICAL RELEVANCE/APPLICATION

Ultrasound is a reliable imaging technique for the diagnosis of epidermal cysts.

SSQ14-05 Indeterminate Soft Tissue Tumors: How Good is Noncontrast Imaging with Quantitative DWI at Distinguishing Benign from Malignant Disease Compared with Contrast-enhanced Imaging?

Thursday, Dec. 3 11:10AM - 11:20AM Location: E451B

Participants
Filippo Del Grande, MD, MBA, Baltimore, MD (*Presenter*) Nothing to Disclose
Shivani Ahlawat, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Ty K. Subhawong, MD, Miami, FL (*Abstract Co-Author*) Nothing to Disclose
Laura M. Fayad, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the added value of contrast enhanced sequences (static [CE] and dynamic [DCE]) to noncontrast imaging (T1, fluid-sensitive and quantitative diffusion weighted imaging [DWI] with apparent diffusion coefficient [ADC] mapping) for distinguishing benign and malignant soft tissue tumors (STTs).

METHOD AND MATERIALS

Forty-three patients with indeterminate STTs referred for biopsy underwent 3T MRI with conventional noncontrast (T1-weighted, fluid-sensitive), DWI (b-values 50, 400, 800 with ADC mapping), and post-contrast imaging (DCE at 7 second time resolution, delayed static CE). Two readers independently reviewed imaging in 4 sessions (conventional noncontrast alone, conventional + DWI/ADC maps, conventional + DWI/ADC maps + CE images, conventional + DWI/ADC maps + CE + DCE all together). Readers recorded the likelihood of malignancy by a 5 point scale (definitely benign, probably benign, possibly malignant, probably malignant, definitely malignant) at each session; interobserver variability (weighted kappa (k)) and accuracy (ROC analysis) were calculated.

RESULTS

Of 43 indeterminate STTs, 31 were benign and 12 were malignant. The accuracy for distinguishing benign and malignant disease (ROC analysis in Figure 1) was highest with the addition of DCE (area under curve (AUC) 0.87 for both readers), although non-contrast imaging (conventional and quantitative DWI) performed similarly to imaging with the addition of static CE sequences (AUC 0.82-0.78 and 0.82-0.81 for 2 readers respectively). Inter-observer agreement was highest with contrast (k 0.83(CE) and 0.82(DCE)), but was lower for non-contrast conventional without (k 0.55) or with DWI (k 0.66).

CONCLUSION

The addition of DCE sequences increases the diagnostic performance of MRI to distinguish benign and malignant STTs. Although non-contrast sequences alone (conventional and DWI) offer diagnostic performance similar to conventional sequences with static CE, their inter-reader reliability is lower.

CLINICAL RELEVANCE/APPLICATION

Non-contrast imaging with DWI offers reasonable diagnostic performance for characterizing STTs for malignancy, if intravenous contrast is administered, DCE is likely more valuable than static CE imaging.

SSQ14-06 Exploring the Value of Fiber Tractography Used for Describing Relations of Soft Tissue Tumors and the Peritumoral Muscle

Thursday, Dec. 3 11:20AM - 11:30AM Location: E451B

Participants
Lingxin Kong, Dalian, China (*Presenter*) Nothing to Disclose
Qingwei Song, MD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Zhang Lina, Da Lian , China (*Abstract Co-Author*) Nothing to Disclose
Shaowei Zheng, Dalian, China (*Abstract Co-Author*) Nothing to Disclose
Shao Wu Wang, MD, Dalian, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study value of the diffusion tensor imaging, fiber tracer Tractography (FT) on soft tissue tumors and relationship of the tumor around muscle on 3.0 T MRI.

METHOD AND MATERIALS

1.General Information:Collected 30 patients with soft tissue mass during the period of from June 2014 to March 2014 in our hospital. 16 cases of men in, 14 cases of women. All will be divided into three groups: 12 cases in intermuscular malignant tumor group; 12 cases in intermuscular benign tumor group; And 6 cases in intramuscular tumor group.2. Observe indicator:According to the FT reconstruction image form and FS-T2WI signal changed muscle into four types. Type I: peritumoral muscles appear only displacement change, muscle fiber continuous, muscle FS-T2WI signal has no exception. Type II: peritumoral muscle appear edema or inflammatory change, FS-T2WI sequences signal increased, muscle fiber bundle is still continuous. Type III: Tumor invasive peritumoral muscle fibers, but a certain number of fiber bundles can still imaging, FS-T2WI sequence signal unevenly increased. Type IV: Tumor will destroyed peritumoral muscle, muscle fiber bundle interruption.3. Statistical methods:Muscle outside benign group and malignant group, within muscle tumor group FT reconstruction type composition differences result using the Fisher's exact probability method test.

RESULTS

83.33% of intermuscular benign tumor group tumor showed the type I; 41.67% of intermuscular malignant tumor group showed type III,25% of intermuscular malignant tumor group showed type IV;100% intramuscular tumor group showed type IV, difference had statistical significance (P = 0.00).

CONCLUSION

FT reconstructions can reflect tumor growth way, intuitive shows the degree of muscle fiber infringement, outside benign and malignant peritumoral muscle with different kinds of FT reconstruction, within the intramuscular tumor peritumoral muscle FT reconstruction showed type IV.

CLINICAL RELEVANCE/APPLICATION

FT reconstructions can reflect tumor growth way, intuitive shows the degree of muscle fiber infringement, outside benign and malignant peritumoral muscle with different kinds of FT reconstruction, within the intramuscular tumor peritumoral muscle FT reconstruction showed type IV.

SSQ14-07 Role of the PET-CT in the Evaluation of the Extra Osseous Soft Tissue Sarcomas

Thursday, Dec. 3 11:30AM - 11:40AM Location: E451B

Participants
Sikandar M. Shaikh, DMRD, Hyderabad, India (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the role of the extra osseous soft tissue sarcomas by using fused positron emission tomography/computed tomography (PET/CT) .To evaluate the usefulness for the clinicians in decision making more than standard CT +/- magnetic resonance imaging (MRI) imaging .

METHOD AND MATERIALS

A retrospective study was done to evaluate the role of PET-CT in cases of pathologically proven extra osseous soft tissue sarcomas. Eighteen patients were included in the study with different locations of soft tissue tumors. PET-CT was done after injecting the FDG contrast after one hour .All the adult age group patients were included in the inclusion criteria which included the various parameters of histology, staging, imaging data, imaging reports, treatments, follow-up, and disease status were compiled. A 6-variable scoring system (tumor involvement, regional disease detection, distant metastases detection, malignant determination, tumor avidity, change in treatment) to examine imaging utility was devised.

RESULTS

In 12 patients (67%), PET/CT was superior to CT/MRI, while the latter was superior in only 3 patients (16%). Neither modality was superior in 3 patients (16%). PET/CT was able to identify regional or distant disease by staging in 8 patients (44%), while CT/MRI did not (0%). CT/MRI showed more potentially involved tissue than in PET/CT. In 8/18 patients (44%), PET/CT could better distinguish between malignant and non-malignant tissue; 10/18 patients (56%) were equivocal. The use of PET/CT led to a documented change in the patient's treatment plan in 11/18 patients (61%), compared to 1/18 change for CT/MRI (5%). In looking at overall utility of PET/CT vs. CT/MRI in the 6 variables, PET/CT scored significantly higher (Chi-squared, P = 0.02).

CONCLUSION

For extraossseous soft tissue sarcomas , PET/CT is more helpful in evaluating the regional and distant disease involvement, and differentiating from malignant and non-malignant lesions. Compared to CT/MRI data, PET/CT has a greater impact on the treatment and management of patients.

CLINICAL RELEVANCE/APPLICATION

THUS PET-CT HAS IMPORTANT ROLE IN EVALUATING THE SOFT TISSUE SARCOMAS.

SSQ14-08 Detection of Soft Tissue Sarcoma Recurrence: Use of Additive Qualitative and Quantitative Diffusion-weighted MR Imaging to Standard MR Imaging at 3.0 T

Thursday, Dec. 3 11:40AM - 11:50AM Location: E451B

Participants
Borim Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Won-Hee Jee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Investigator, Bayer AG; Research support, Bayer AG ;
So-Yeon Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon-Yong Jung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chan-Kwon Jung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Seung Han Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yang-Guk Chung, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To retrospective determine the added value of diffusion-weighted imaging (DWI) to standard magnetic resonance imaging (MRI) to detect recurrent soft tissue sarcoma after surgical resection at 3.0 T.

METHOD AND MATERIALS

The institutional review board approved this retrospective study and informed consent was waived. From June 2009 through April 2014, 30 patients without residual tumor referred for postoperative surveillance of soft tissue sarcoma underwent 3T MRI including DWI. Two independent musculoskeletal radiologists first scored standard MRI. Then, they assessed a combination of standard MRI and qualitative and quantitative DWI. Interobserver agreement for apparent diffusion coefficient (ADC) measurement in recurrent soft tissue sarcoma was assessed using intraclass correlation coefficient (ICC). The receiver operating characteristic (ROC) curve with areas under the curve (AUC) was obtained for diagnostic performance.

RESULTS

There were 13 histologically proved recurrent soft tissue sarcoma in nine patients. In qualitative analysis of DWI, all recurrent soft tissue sarcoma revealed hyperintensity relative to skeletal muscle. In quantitative analysis of recurrent soft tissue sarcoma, median ADCs of two readers were 1025 (774-1092) μm2/sec and 996 (801-1126) μm2/sec, respectively, showing excellent interobserver agreement (ICC = 0.900). Sensitivity, specificity and accuracy of each reader were 69%, 81%, and 77%; 92%, 57%, and 71% on standard MRI alone, whereas 100%, 95%, and 97%; 92%, 95%, and 94% on standard MRI combined DWI, respectively. AUCs of a combination of standard MRI and DWI were higher than those of standard MRI alone: 0.824 vs 0.969 (P = .029), and 0.866 vs 0.958 (P = .127) for each reader, respectively.

CONCLUSION

The addition of DWI to standard MRI improves the detection of recurrent soft tissue sarcoma at 3.0 T.

CLINICAL RELEVANCE/APPLICATION

DWI should be added to standard MRI protocols to help detect the recurrent soft tissue sarcoma.

SSQ14-09 3D Volumetric MRI with Isotropic Resolution: Improved Speed of Acquisition, Spatial Resolution and Assessment of Lesion Conspicuity in Patients with Recurrent Soft Tissue Sarcoma

Thursday, Dec. 3 11:50AM - 12:00PM Location: E451B

Participants
Shivani Ahlawat, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Carol Morris, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Laura M. Fayad, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

PURPOSE

To assess 3D volumetric MR sequences with isotropic resolution for acquisition speed, image quality and lesion conspicuity in detecting recurrent soft tissue sarcomas (STS).

METHOD AND MATERIALS

15 subjects with resected STS and histologically-proven recurrent disease underwent MRI with axial and coronal T1-weighted (spin echo, 5mm slice thickness) and fluid-sensitive sequences (5mm slice thickness). Coronal 3D volumetric T1-weighted sequences (fat-suppressed volume-interpolated breath-hold examination, TR/TE 3.7/1.4, 9.5° flip angle, 1-mm-thick sections) were obtained before and after intravenous contrast administration, with subtraction imaging (subtraction of pre-contrast from post-contrast 3D acquisitions) and multiplanar reconstructions (MPRs) in the axial and sagittal planes. Acquisition times for spin echo T1-weighted sequences in 2 planes and 3D sequences were reported. Two musculoskeletal radiologists reviewed imaging for image quality (artifacts>50%, artifacts 25-50%, no substantial artifacts), conspicuity of recurrent lesions (contrast-to-noise ratio (CNR)) on unsubtracted and subtracted 3D images, size of recurrences and distance from nearest joint on MPR views. Descriptive and intraclass correlation statics were given.

RESULTS

For 15 recurrent tumors, average imaging times were significantly reduced for 3D imaging compared with 2-plane T1-weighted imaging (317.6 vs 745.2 seconds). Image quality was rated as having no substantial artifacts in 15/15. Lesion conspicuity was significantly improved for subtracted vs unsubtracted images (CNR 52.9+/-8.9 vs 5.0+/-3.0, p = 0.00064). Recurrent lesion size ranged from 0.7 to 5.7 cm, with average size of 2.5 cm, and measurements on 3D sequences offered excellent interobserver agreement between readers (ICC 0.98 for lesion size and ICC 0.96 for recurrence-to-joint distance with MPR views).

CONCLUSION

T1-weighted 3D volumetric sequences with isotropic resolution offer higher spatial resolution, multiplanar capability, and significantly faster acquisition times than spin echo T1-weighted imaging. In addition, higher lesion conspicuity is achieved with subtraction imaging than unsubtracted images for detecting recurrent STS.

CLINICAL RELEVANCE/APPLICATION

A T1-weighted 3D volumetric sequence is a fast alternative to spin echo imaging for 3-plane anatomic post-contrast imaging, and can be coupled with subtraction imaging for greater lesion conspicuity in the detection of recurrent tumors.

SSQ15

ISP: Nuclear Medicine (Emerging Methods and Techniques)

Thursday, Dec. 3 10:30AM - 12:00PM Location: S505AB

CT MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Moderator*) Nothing to Disclose
Don C. Yoo, MD, Providence, RI (*Moderator*) Nothing to Disclose

Sub-Events

SSQ15-01 Nuclear Medicine Keynote Speaker: Advances in Clinical Optical Imaging

Thursday, Dec. 3 10:30AM - 10:50AM Location: S505AB

Participants
Jan Grimm, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

SSQ15-03 Focal 18F-FDG Uptake in PET-MRI Indicates Activated Facet Arthrosis and Guides Facet Block Therapy: A Prospective Pilot Study in 11 Patients Suffering from Neck Pain

Thursday, Dec. 3 10:50AM - 11:00AM Location: S505AB

Participants
Lino Sawicki, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Buchbender, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Frank Floeth, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the potential role of 18F-FDG-PET/MRI in detecting activated facet arthrosis and its impact on therapy.

METHOD AND MATERIALS

Eleven consecutive patients with musculosceletal neck pain (mean pain on visual analogue scale (VAS)> 7, median duration 9 months, no radiculopathy or myelopathy) were prospectively enrolled in this study. Mean and maximum standard uptake values (SUVmean/max) were measured one hour after injection of 18F-FDG in each facet joint and patient. On STIR-images bone signal intensity (SI) ratios between each facet joint and Th1 vertebral body (reference site) were measured and calculated. Post-hoc Mann-Whitney-U-Test (MWU) was performed to identify differences in SUVmean, SUVmax and bone SI ratio on STIR images between normal, arthrotic and activated arthrotic facet joints. Focal tracer uptake in a facet joint served as target for CT guided infiltration using local anesthetics and corticosteroids. In patients without focal uptake, facet blocks were performed to the segment of maximum cervical osteoarthritis. Neck pain was measured before and after the infiltration on VAS.

RESULTS

18F-FDG-PET/MRI detected focal tracer uptake along the facet joint capsule in 6 of 11 patients (average SUVmax: 3,5 +/- 0,9; average SUVmean: 2.5 +/- 0.9) with good match to the patients' pain localization. Posthoc MWU revealed significantly higher SUVmax, SUVmean and bone SI Ratio on STIR images in activated facet arthrosis than in normal or arthrotic facet joints ($p<0.001$). Correlation was strong between bone SI Ratio on STIR images and SUVmax ($P=0.66$; $p<0.001$) as well as SUVmean (0.67; $p<0.001$). Targeted facet block in patients with activated facet arthrosis led to a higher reduction of pain activity than in patients without activated facet arthrosis (VAS reduction 24h post infiltration: -5.2 +/-1.2 vs. -0.8 +/-0.4; $p=0.004$).

CONCLUSION

18F-FDG PET/MRI can detect activated facet arthrosis and thus might facilitate identification of patients suitable for successful targeted infiltration therapy.

CLINICAL RELEVANCE/APPLICATION

Identifying suitable patients for facet joint infiltration is important for therapy success. PET/MRI can detect activated facet arthrosis and thus facilitate succesful infiltration therapy.

SSQ15-04 Volumetric, Metabolic and CSF Biomarkers Profile in Different Subtypes of MCI

Thursday, Dec. 3 11:00AM - 11:10AM Location: S505AB

Participants
Artur Coutinho, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
Fabio H. Porto, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Silvana Prando, DIPLPHYS, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Fabio L. Duran, DSc, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Livia Spindola, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Maira O. Oliveira, MSc, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Patricia H. Vale, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

Carla R. Ono, MD,PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Ricardo Nitrini, MD, PhD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Sonia M. Brucki, MD,DSc, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose
Carlos A. Buchpiguel, MD, Sao Paulo, Brazil (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Mild cognitive impairment (MCI) is a transitional stage between normal aging and dementia, particularly Alzheimer's disease (AD). There are few reports investigating multiple biomarkers of non-amnestic MCI (naMCI) as a single group, in comparison to amnestic subtypes (aMCI) and a normal elderly control group (CG). Our study investigated: a) regional brain glucose metabolism (rBGM) with [18F]FDG-PET and volume-based morphometry with magnetic resonance imaging (MRI) of a naMCI group in comparison to CG and aMCI, and b) the profile of amyloid-β peptide, tau and p-tau proteins in the cerebrospinal fluid (CSF) of naMCI and aMCI groups.

METHOD AND MATERIALS

114 subjects composed three groups: naMCI (N = 38), aMCI (N = 46) and CG (N = 30). All subjects underwent brain MRI and [18F]FDG-PET. Imaging data was analysed with the software SPM8. A subsample (naMCI = 33, aMCI = 38) underwent a lumbar puncture in order to assess levels of amyloid-ß peptide, tau and phosphorylated tau protein levels in the CSF.

RESULTS

There was no difference in demographic characteristics and CSF biomarkers between the naMCI and aMCI groups. Both MCI groups had lower rBGM in relation to CG in the precuneus. Additional right prefrontal lobe hypometabolism was seen in naMCI. aMCI group had bilateral mesial and polar temporal lobe volume reduction in comparison to naMCI and CG. No significant volumetric reduction in mesial temporal lobes was seen in naMCI.

CONCLUSION

Amnestic MCI showed metabolic and volumetric profiles classically related to MCI due to AD, while naMCI group shared a similar metabolic pattern (reduced precuneus rBGM) and prefrontal hypometabolism, but had fewer areas of volumetric reduction.

CLINICAL RELEVANCE/APPLICATION

Non-amnestic subtypes (naMCI) present with executive, attention, visuospatial and language dysfunctions. A lower conversion rate to dementia, specially AD, is seen in naMCI than in amnestic MCI. An outstanding question is whether naMCI and aMCI have different biomarker profiles. There are few reports investigating multiple biomarkers of naMCI as a single group in comparison to aMCI and cognitively normal elderly subjects (CG). Our study characterizes naMCI as a heterogeneous group, less related to classical AD and different from aMCI. This group should be better prospectivelly investigated in order to search for specific biomarkers indicating risk of developing different kinds of neurodegenerative disorders.

SSQ15-05 The Usefulness of the Dopamine Transporter Volume Estimated by C-11 PE-2I PET/CT in Diagnosing Parkinsonism-Novel Parameter for Quantifying the Total Amount of Dopamine Transporter

Thursday, Dec. 3 11:10AM - 11:20AM Location: S505AB

Participants
Shigeki Nagamachi, MD, PhD, Miyazaki, Japan (*Presenter*) Nothing to Disclose
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Hiroshi Takashima, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In the diagnosis of Parkinsonism, C-11 PE2I (N- (3-iodoprop -2E-enyl)-2β-carbomethoxy-3β-(4-methyl-phenyl)nortropane) is useful radiopharmaceutical for its high binding selectivity and specificity to dopamine transporter (DAT) .The study was done to evaluate the usefulness of novel parameter, dopamine transporter volume (DTV) that was calculated with C-11 PE-2I PET/CT, in diagnosing Parkinsonism.

METHOD AND MATERIALS

Twenty-six patients with Parkinsonism, 15 idiopathic Parkinson diseases (PD) and 11 Parkinsonism of other cause (PS) were evaluated. All patients were done two kinds of examination, C-11 PE-2I PET/CT and iodine-123-labeled metaiodobenzylguanidine (123I-MIBG) myocardial scintigraphy. Three dimensional VOI (volume of interest) was automatically drawn around striatum respectively on C-11 PE-2I PET/CT images. Both sided maximum standardized uptake value (SUVmax) and dopamine transporter volume (DTV) were obtained. The threshold value for calculating DTV was 40% of SUVmax. On MIBG scintigraphy, Heart to mediastinum ratio (H/M) and washout ratio (WR) were calculated from early (E) and delayed (D) chest planar images. Correlation analysis between all C-11 PE-2I PET/CT parameters and MIBG parameters were done. In addition, all parameters were compared between PD and PS.

RESULTS

Both sides DTV showed positive correlation with both the early and delayed H/M (correlation coefficients were from 0.35 to 0.48). In addition, mean value of both sides DTV in PD were significantly lower compared with those in PS (Right TV: 4.26ml vs. 8.67ml, Left TV: 3.92ml vs. 9.59ml).. However, SUVmax showed no statistical significance.

CONCLUSION

Novel parameter, dopamine transporter volume (DTV), obtained from C-11 PE-2I PET/CT was useful parameter for quantifying conditions of dopamine transporters in Parkinsonism. In addition, it was also useful parameter in differentiating PD from PS.

CLINICAL RELEVANCE/APPLICATION

Dopamine transporter volume (DTV) that is calculated by C-11 PE-2I PET/CT will be additional useful indices in the differential diagnosis of Parkinsonism.

SSQ15-06 The Role of SPECT/CT for Non-visualization in Breast Cancer Sentinel Lymph Node Procedures

Thursday, Dec. 3 11:20AM - 11:30AM Location: S505AB

Participants
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Renato Valdes Olmos, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

Single Photon Emission Computed Tomography with integrated CT (SPECT/CT) is complementarily used to planar lymphoscintigraphy to depict sentinel nodes (SN) in patients with invasive breast cancer. An important indication is SN detection in breast cancer patients showing non-visualization on planar images. In our institution, SN procedures for patients with previous breast surgery and/or radiotherapy, neo-adjuvant chemotherapy led to an increase of non-visualization on planar imaging. The present study is to (re)evaluate the contribution of SPECT/CT in breast cancer patients showing no apparent drainage on planar lymphoscintigraphy in terms of SN identification rate.

METHOD AND MATERIALS

Between 1st of July 2008 and 6th of November 2014 in total 1982 patients underwent a SN breast procedure, using intratumoral tracer administration. SPECT/CT scans for non-visualization on planar lymphoscintigraphy were acquired for 298 (15%) breast cancer patients. Ninety-one (30.5%) patients had previous surgery or radiation therapy at the same breast prior to the SN procedure and 40 (13.4%) were scheduled for neo-adjuvant chemotherapy. If SN non-visualization persisted on SPECT/CT images, a second radiotracer injection with repeated scintigraphy was performed when logistics allowed this. Univariate analysis was performed to examine if specific subgroups, such as age, BMI, T-stage or previous treatment, have influence on visualization rates of SPECT/CT.

RESULTS

SPECT/CT visualized one or more SN in 22.8% (68/298). Univariate analysis of subgroups revealed no significant factors influencing SPECT/CT visualization. In patients with persistent non-visualization on SPECT/CT and having a reinjection, the SN visualization rate reached 60.3% (38/63).

CONCLUSION

The visualization rate of SPECT/CT after non-visualization on planar imaging was lower than the SN visualization after reinjection, in an evaluation including all new breast cancer SN indications. We adjusted our institutional protocol for non-visualization on planar lymphoscintigraphy, reserving SPECT/CT imaging only for patients with persistent absence of drainage after reinjection.

CLINICAL RELEVANCE/APPLICATION

The indication SN breast SPECT/CT imaging is often debated. We propose an adequate role for SPECT/CT in case of non-visualization on planar imaging and thereby safe time and money and above all improve the workflow for breast cancer patients.

SSQ15-07 Does Tc-99m Tilmanocept Offer Shorter Patient Through-Put Time Than Tc99m Sulfur Colloid for Sentinel Lymph Node Mapping in Malignant Melanoma?

Thursday, Dec. 3 11:30AM - 11:40AM Location: S505AB

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Sung M. Kim, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Adam Berger, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tc99m tilmanocept has been recently introduced for radionuclide sentinel lymph node (SLN) mapping and intraoperative identification via hand-held gamma probes. Its rapid movement from the injection sites to the mannose receptors in tumor-draining lymph nodes theoretically should shorten the study time compared to the traditional SLN mapping tracer, Tc99m sulfur colloid (Tc99m SC). The latter had been previously used in our laboratory, which required 40 to 45 minutes after injection for visualization of all lymph nodes in patients with malignant melanoma.Our goal was to determine the minimum scan completion time that Tc99m tilmanocept requires with the objective of expediting subsequent transport to the operating suite.

METHOD AND MATERIALS

0.5 mCi of Tc99m tilmanocept were injected intradermally in 4 divided doses around the tumor. Images were acquired at 5, 10, 20, 30, and 40 minutes after injection, the same protocol used for Tc99m SC. The presence and number of lymph nodes seen at 20 minutes were compared to that seen at 40 minutes.

RESULTS

A total of 34 consecutive patients underwent SLN mapping with Tc99m tilmanocept. In all 34 patients, all lymph nodes seen in the final 40-minute image were identified in the 20-minute image.

CONCLUSION

In malignant melanoma, SLN mapping with Tc99m tilmanocept involves a total imaging time of 20 minutes, i.e. one-half of the time reuired for Tc99m SC.

CLINICAL RELEVANCE/APPLICATION

Tc99m tilmanocept is more time-efficient than Tc99m SC for SLN mapping in malignant melanoma thereby facilitating patient

through-put.

SSQ15-08 Initial Clinical Experience with Intra-procedural Bremsstrahlung Imaging using a Portable Gamma Camera during Yttrium-90 Microsphere Administration

Thursday, Dec. 3 11:40AM - 11:50AM Location: S505AB

Participants
Chadwick L. Wright, MD, PhD, Lewis Center, OH (*Presenter*) Nothing to Disclose
Bill S. Majdalany, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Ali A. Rikabi, MD, Dublin, OH (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

The intraarterial administration of Yttrium-90 (90Y) microspheres is clinically used to specifically embolize and locally delivery high-dose radiation therapy to otherwise unresectable malignant/metastatic liver lesions. This 90Y decay produces additional bremsstrahlung radiation that can be detected and imaged with conventional gamma cameras. Typically, bremsstrahlung imaging is performed after 90Y radioembolization to qualitatively assess and verify deposition of 90Y microspheres in the liver.

METHOD AND MATERIALS

A large field-of-view portable gamma camera (LFOVPGC, Ergo, DigiRad) equipped with a medium-energy collimator was used to image 90Y bremsstrahlung radiation in the interventional suite. Pre-procedural static images of background radioactivity and patient's chest and abdomen were obtained. Dynamic chest imaging was performed during the 90Y microsphere administration to assess for any active 90Y microsphere shunting. Post-procedural static images of the chest and abdomen were also obtained. These LFOVPCG images were then compared with routine post-procedural bremsstrahlung planar and SPECT/CT images (Symbia, Siemens).

RESULTS

Three 90Y microsphere administrations were included. When compared with routine post-procedural bremsstrahlung imaging, the LFOVPCG yielded evaluable images for qualitatively assessing 90Y biodistribution. In all cases, dynamic imaging of the chest verified no active shunting of 90Y microspheres into the lungs during the radioembolization procedure. Likewise, LFOVPCG imaging confirmed 90Y microsphere deposition in the liver.

CONCLUSION

These initial findings demonstrate that 90Y bremsstrahlung radiation can be readily imaged with a LFOVPGC in the interventional suite and these images are comparable to routine post-procedural bremsstrahlung images. It appears feasible that intra-procedural LFOVPGC bremsstrahlung imaging can be integrated into the interventional workflow for the purposes of rapid verification of 90Y microsphere deposition in the liver. Further validation of this LFOVPGC imaging approach may obviate the need for subsequent post-procedural bremsstrahlung planar imaging.

CLINICAL RELEVANCE/APPLICATION

This clinical study evaluates the feasibility for LFOVPGC imaging in the interventional suite to provide real-time imaging assessment of 90Y bremsstrahlung radiation during radioembolization.

SSQ15-09 Evaluation and Clinical Quantification of Neoplastic Lesions and Physiological Structures in TOF-PET/MRI and Non-TOF/MRI – A Pilot Study

Thursday, Dec. 3 11:50AM - 12:00PM Location: S505AB

Participants
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Edwin ter Voert, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
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Paul Stolzmann, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Patrick Veit-Haibach, MD, Zurich, Switzerland (*Abstract Co-Author*) Research Grant, Bayer AG; Resaarch Grant, F. Hoffmann-La Roche Ltd; Research Grant, General Electric Company

PURPOSE

To clinically assess a new PET/MRI technology in which the PET-component features a new PET- detector and time-of-flight (TOF) technology. Thus, we compared SUVmax/mean of neoplastic lesions and physiological structures between TOF- and non-TOF-PET/MRI imaging. We qualitatively evaluated image quality derived from TOF-PET/MRI, non-TOF-PET/MRI reconstruction and FDG-PET/CT. Lastly we did clinical measurements to evaluate the PET- detector sensitivity in order to better understand the background of our clinical results.

METHOD AND MATERIALS

Twenty-seven oncological patients were prospectively enrolled and evaluated with FDG-PET/CT and PET/MRI (15 M/ 12 F; mean age 56 ±10 y). Time between injection and PET/CT was 62.4 ±7.6 min, consecutive start of imaging of PET/MRI was 104.6 min±18.2 after injection. To assess the differences between TOF and non-TOF, all PET-images of the PET/MRI were reconstructed twice -with and without TOF. To compare lesion and tissue characterization between both reconstructions, malignant lesions as well as physiological structures were compared. Furthermore, PET image quality, artifacts, image sharpness, noise and lesion detectability were assessed as well. Count rates between both systems were also compared.

RESULTS

All malignant lesions and the majority of physiologic tissue (except the subcutaneous fat, spleen and blood pool) showed a good correlation concerning SUV (max and mean) measurements between PET/CT, non-TOF and TOF reconstructions. The general image

quality was rated statistically significant superior in non-TOF ($p<0.001$) and TOF-reconstruction in PET/MRI ($p<0.01$) compared to PET/CT. Furthermore, TOF-PET/MRI was rated superior concerning image quality ($p<0.05$) compared to non-TOF PET/MRI. The ratio of emitted/received events between both systems (PET/CT and PET/MRI) was 2.78

CONCLUSION

PET/MRI with TOF is reliable concerning SUV quantification and image quality. The technical promise of an improved sensitivity of the new PET-detector in this PET/MRI device could be confirmed in a clinical setting.

CLINICAL RELEVANCE/APPLICATION

PET/MRI with TOF demonstrates reliable SUV quantification and improved image quality compared to non-TOF based and offers superior sensitivity of the PET-detector.

SSQ16

Neuroradiology (Advances in Neuro CT and MR Imaging)

Thursday, Dec. 3 10:30AM - 12:00PM Location: N228

NR CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Mohannad Ibrahim, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Rajan Jain, MD, Northville, MI (*Moderator*) Nothing to Disclose

Sub-Events

SSQ16-01 Ultra-Low and Standard Radiation Dose Head CT Scans Post-Processed with Model-Based Iterative Reconstruction (IR): Improved Image Quality / Artifact Reduction versus Adaptive Statistical IR and FBP

Thursday, Dec. 3 10:30AM - 10:40AM Location: N228

Participants
Markus Y. Wu, MD, Boston, MA (*Presenter*) Nothing to Disclose
Shervin Kamalian, MD,MSc, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Stuart R. Pomerantz, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company
Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Research support, General Electric Company Stockholder, General Electric Company

PURPOSE

The purpose is to compare the image quality and artifact reduction of model-based iterative reconstruction (MBIR), adaptive statistical IR (ASIR), and filtered back projection (FBP), for post-processing both low and standard radiation dose head CT exams.

METHOD AND MATERIALS

We compared 35 standard radiation-dose and 35 ultra-low dose unenhanced head, face and sinus CT studies from Feb-Mar 2015 on a 64-slice scanner, reconstructed at 0.625 and 5 mm slices using FBP, ASIR-90% blend, and MBIR-NR40. Gray-white matter (GM/WM) signal- and contrast-to-noise ratios (SNR, CNR) were computed from Hounsfield Unit measurements. Blinded visual ratings by an experienced neuroradiologist were performed for 15 cases from each group that had MRI reference-standard. Rated areas included: posterior fossa artifact/beam hardening, deep GM/WM matter differentiation, sharpness of aqueduct of sylvius margins, and bleed/infarct (if present). Analysis of variance, T-test, and Kruskal-Wallis test were used.

RESULTS

Mean CTDI radiation dose was 10.6 ± 5.2 mGy for the ultra-low and 40.1 ± 12.9 mGy for the standard-dose groups. Mean CNR for the low-dose group was 1.1 ± 0.4 FBP, 1.5 ± 0.5 ASIR, and 2.5 ± 0.6 MBIR (all $P < 0.001$). Mean CNR for the standard-dose group was 1.5 ± 0.4 FBP, 2.1 ± 0.6 ASIR, and 2.6 ± 0.6 MBIR ($P < 0.001$). All GM/WM-SNRs were similarly higher in exams processed with MBIR versus FBP or ASIR ($P<0.05$). Blinded qualitative review of all three rated areas in the low-dose group showed better image quality with MBIR ($P<0.05$). Standard-dose scans with MBIR had markedly better reduction of beam hardening effect and streak artifact in the posterior fossa versus ASIR and FBP ($P < 0.001$). Of the 6 cases with MR-proven pathology in the standard-dose group, MBIR was superior or equal to ASIR in 5 cases (83%).

CONCLUSION

Compared to FBP and ASIR, MBIR improves overall image quality in ultra-low dose head CT scans and markedly reduces beam hardening effect and streak artifact in the posterior fossa in standard-dose exams.

CLINICAL RELEVANCE/APPLICATION

There is strong interest in lowering radiation dose while maintaining image quality and reducing artifact in clinical head CT scans. MBIR shows great potential in achieving this goal.

SSQ16-02 A Novel Tube Current Modulaton Scheme in CT Perfusion Imaging to Reduce Radiation Dose and Improve Image Quality

Thursday, Dec. 3 10:40AM - 10:50AM Location: N228

Participants
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Charles M. Strother, MD, Madison, WI (*Abstract Co-Author*) Research Consultant, Siemens AG Research support, Siemens AG License agreement, Siemens AG
Guang-Hong Chen, PhD, Madison, WI (*Abstract Co-Author*) Research funded, General Electric Company; Research funded, Siemens AG

PURPOSE

Despite the relatively high radiation dose used in CT perfusion (CTP), the quality of CTP maps is not always great. It is critical to develop methods to simultaneously reduce radiation dose and further improve image quality. The purpose of this work is to demonstrate that the use of a new tube current modulation scheme and iterative image reconstruction algorithm can achieve a factor of five radiation dose reduction with improved CTP maps.

METHOD AND MATERIALS

The limiting factors to the CTP maps were identified using a newly developed four-dimensional imaging chain model. This model enabled a fundamental understanding of how bias and noise were generated, amplified, and propagated to the final functional maps. As a result, the baseline image noise was discovered to be the primary factor impacting final CTP image quality. Once this limiting factor was identified, a novel tube current modulation scheme was developed to increase the mAs level for the baseline image acquisition to reduce noise, while lowering the exposure level and applying iterative reconstruction for the remaining acquisitions. The net result of this mA modulation scheme was a total radiation dose reduction by a factor of five. The proposed method was validated through an IACUC-approved in vivo canine stroke model. An additional CTP dataset acquired at high exposure level (300%) was used as the reference for image quality and quantitative accuracy, with which CTP maps acquired at both standard and reduced doses (20%) were compared.

RESULTS

In addition to the factor of five dose reduction with the proposed tube current modulation scheme, the canine CTP maps demonstrated significant reduction in both bias and noise. The 20% dose dataset demonstrated only 10% bias and 14% relative increase in noise compared with the 300% dose reference dataset. In comparison, the conventional CTP technology generated 700% bias and 540% relative increase in noise at 20% dose.

CONCLUSION

The proposed new tube current modulation scheme in conjunction with an iterative reconstruction algorithm enables a radiation dose reduction by a factor of five and improved quality in CTP maps.

CLINICAL RELEVANCE/APPLICATION

The technique proposed here allows for lowering radiation dose while improving the quality of perfusion maps, both of which are crucial for patient selection for endovascular therapy of acute ischemic strokes.

SSQ16-03 Low Dose CT Perfusion Using Projection View-Sharing

Thursday, Dec. 3 10:50AM - 11:00AM Location: N228

Participants
Thomas B. Martin, BS, Los Angeles, CA (*Presenter*) Nothing to Disclose
John M. Hoffman, BS, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Abstract Co-Author*) Institutional research agreement, Siemens AG; Research support, Siemens AG; ; ; ; ;
Danny J. Wang, PhD, Los Angeles, CA (*Abstract Co-Author*) Research Grant, Siemens AG Research Grant, Biogen Idec Inc Shareholder, Translational MRI, LLC

PURPOSE

CT Perfusion (CTP) is widely used in clinical practice for the evaluation of cerebrovascular disorders such as acute ischemic stroke. However, CTP involves high radiation dose (>=~200mGy) as the X-ray source remains continuously on during the scan. The purpose of this study is to present a novel low dose CTP technique using a projection view-sharing reconstruction algorithm originally developed for dynamic MRI - "K-space Weighted Image Contrast" (KWIC) - under substantially reduced dose conditions in both phantom and a clinical case.

METHOD AND MATERIALS

A clinical CTP scan (45s, 1160 projections per turn, 1s/turn, CTDIvol 217 mGy) was retrospectively undersampled to correspond to 50% and 25% of the original dose. The data sets were reconstructed using filtered back projection (FBP) and KWIC, based on an angle bisection scheme. In KWIC, FFT was performed on each projection to form a "k-space" like CT data space. As a projection view-sharing technique, KWIC preserves undersampled CTP quality by proportionately increasing the number of encoded projections for more distant regions of "k-space". An FBP reconstruction was used as the fully sampled gold standard. The above procedures were also performed on a FORBILD head phantom, including reconstructions down to 12.5% of the original set of projections, containing simulated time-varying objects. A map of the relative cerebral blood volume (rCBV), and the time-to-peak (TTP) and the full width half-maximum (FWHM) of the dynamic values were computed to assess potential dispersions in the dynamic CTP signals between the image reconstructions.

RESULTS

The rCBV map, TTP, and the FWHM for all of the KWIC CTP reconstructions were unaffected by the undersampling/dose reduction (down to 25% dose) compared to the fully sampled FBP reconstruction.

CONCLUSION

This pilot study demonstrates that KWIC preserves image quality and perfusion metrics at a reduced number of projections and that the unique contrast weighting of KWIC could provide substantial dose-savings for perfusion CT scans.

CLINICAL RELEVANCE/APPLICATION

This technique may substantially reduce dose to patients undergoing CTP exams; alternatively, patients could potentially have multiple low dose CTP exams to have their diseases monitored more regularly, which could improve patient outcome.

SSQ16-04 Efficacy of Fine Focal Spot Scanning in CT Carotid Angiography

Thursday, Dec. 3 11:00AM - 11:10AM Location: N228

Participants

Kenneth K. Lau, MBBS, FRANZCR, Melbourne, Australia (*Presenter*) Nothing to Disclose
Lawrence Chia Wei Oh, MBBS, Melbourne, Australia (*Abstract Co-Author*) Nothing to Disclose
Kevin Buchan, Melbourne, Australia (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ahilan Kuganesan, Clayton, Australia (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT carotid angiography (CTCA) has been established as an important imaging tool for carotid artery assessment, in particular prior to surgical/radiological intervention. Its advantages in comparison to digital subtraction angiography (DSA) are shorter examinaton, non-invasive nature, less procedural complications and the ability to study soft tissue structure around the blood vessels. Calcified plaques are common at carotid bifurcations that produces beam-hardening artifact and often limits an accurate luminal assessment. The latest improvement of tube technology permits the use of fine focal spot (FFSS) in CTA that may provide better spatial resolution. The aim of this retrospective study was to assess the efficacy of FFSS in vessel wall clarity improvement and calcification artifact reduction on CTCA.

METHOD AND MATERIALS

Consecutive adult patients of all age and gender who presented for CTCA were included. Patients who did not give consent or whose images were markedly degraded by metal and motion artifacts were excluded. All CTCA were scanned with standard focal-spot size (SFSS) in initial 4 months while with FFSS in the following 4 months. Vessel clarity and calcifications artefacts of aortic arch, brachiocephalic, subclavian, common carotid, carotid bifurcation, internal carotid, external carotid and vertebral arteries were randomly and blindly assessed using 5-point scale by 2 blinded radiologists. Results were compared.

RESULTS

There were 43 patients (mean age of 60) with 97 calcified arterial segments in SFSS and 48 patients (mean age of 62) with 113 calcified arterial segments in FFSS. 30% patients have >50% carotid artery stenosis. Interobserver agreement was excellent (κ= .834). Mann-Whitney test showed FFSS performed significantly better for vessel clarity (U: 48238.50, p < .001,r: 0.556) and calcification artefact reduction (U: 2040.50, p< .001,r: 0.564). The carotid bifurcation lumen were better defined in FFSS.

CONCLUSION

FFSS technique improves vessel clarity and reduces calcification blooming artefacts in CTCA which aids accurate assessment of vascular pathology.

CLINICAL RELEVANCE/APPLICATION

The lumen of the carotid bifurcation is often obscured by blooming artifacts from calcified plaques that may lead to misleading result. The FFSS scanning technique may become an future imaging tool to minimize this diagnostic difficulty and provide better plaque morphology assessment.

SSQ16-06 Computer Automated Methods to Determine Brain Glioma Volume and Its Efficiency in Comparison to the Expert Estimation

Thursday, Dec. 3 11:20AM - 11:30AM Location: N228

Participants
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Morteza Sanei Taheri, MD, Tehran, Iran (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tumor volume parameter is one of the most important prognostic factors in glioma. Determining the glioma tumor volume is a problematic task due to its irregularity in shape, involvement of different parts of brain and wide variety in contrast enhancement degrees. Objectives of the study were to design image processing-based software to determine the volume of glioma and evaluating its efficiency in comparison with radiologist estimation.

METHOD AND MATERIALS

The software was designed and calibrated based on 7 pathologically approved glioma patients. The software exploited enhancement regions in FLAIR and T1 Gadolinium contrast MRI using image segmentation technique to determine tumor volume, based on region growing of manually selected seed points. Consecutively, the volumes of brain glioma in 42 cases were estimated by an expert radiologist as well as the designed software and the data was analyzed for comparison.

CONCLUSION

Estimation of brain glioma volume with the designed software has the same accuracy as the expert estimation in a more time efficient manner. The main application restriction for the designed software is its limitation to well-enhanced regions after Gadolinium injection.

CLINICAL RELEVANCE/APPLICATION

Tumor volume is a main prognostic factor in brain glioma. Volume estimation by software via segmentation technique had the same accuracy as expert reading in a time efficient manner.

SSQ16-07 Spectroscopic Imaging with High Spatial Resolution and Ultra Short TE* at 3 and 7 Tesla- A Comparison

Thursday, Dec. 3 11:30AM - 11:40AM Location: N228

Participants
Stephan Gruber, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Eva Heckova, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

Lenka Minarikova, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Bernhard Strasser, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Gilbert Hangel, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Siegfried Trattnig, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Wolfgang Bogner, MSc, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic resonance spectroscopic imaging (MRSI) of the brain allows to map several metabolites and provide complementary metabolic information to the conventional MR imaging methods. High field systems (e.g. 7 T) offer increased SNR and spectral resolution which can be transformed to the increased spatial resolution or better characterization of overlapping metabolites (e.g. NAA and NAAG). In addition FID-CSI with ultra short acquisition delays (TE*) adds additional SNR, in particular for J-coupled resonances. We compared MRSI in six volunteers using a FID-CSI sequence with high spatial resolution und ultra-short TE* of 1.5 ms at 3 and 7 Tesla.

METHOD AND MATERIALS

Six healthy volunteers (5m/1f; age: 28.3±2.4) were measured at 3T and 7T (3T Trio, 7T Magnetom, Siemens, Erlangen, Germany) using a 32-channel head coil. A FID-CSI sequence with 64×64 phase encoding steps, FOV=220×220mm2, TR=600ms, TE*=1.5ms, in plane voxel size 3.4×3.4 mm2, and a slice thickness of 10 mm was used (scan time 30min). Spectra were processed using LCModel. Metabolic maps were created using Matlab and MINC (Minc tools; v2.0; McConnell Brain Imaging Center,Montreal, Canada). SNRs were computed using the pseudo-replica method in time domain.

RESULTS

Satisfactory data quality was achieved from all subjects measured at 3 T and 7 T. SNR was 2.8 times higher at 7 T compared to 3 T. CRLBs were below 10% for all metabolites measured at 7 T including glutamate and glutamine. Compared to techniques using pre-localization techniques (e.g. STEAM, PRESS) FID-CSI allows to acquire whole slices. The high matrix size and hamming filtering prevented fat contamination from the sculp. With the high in-plane resolution of 3.4×3.4 mm2 metabolic maps showing anatomical details could be created.

CONCLUSION

This study revealed 2.8 times higher SNR and decreased CRLBs of brain metabolites measured with MRSI at 7 T compared to that measured at 3T. We could compute metabolic maps with anatomical details at both field strengths. Improved spectral resolution allowed NAAG separation from NAA at 7 T but not at 3 T. In addition the ultra-short acquisition delay allows to quantify J-coupled metabolites even measured with a high spatial resultion.

CLINICAL RELEVANCE/APPLICATION

MRSI at 7T can be performed with high spatial resolution and ultrashort TE*. This allows the quantification of metabolites such as NAAG, glutamate, glutamine and myo-Inositol with low CRLBs.

SSQ16-08 Optimized Clinical MRI Protocols for Ex Vivo Whole Brain - A New Tool for Radiology-Pathology Correlation

Thursday, Dec. 3 11:40AM - 11:50AM Location: N228

Participants
Mary Bruno, RT, New York, NY (*Presenter*) Nothing to Disclose
Ryan Brown, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Guillaume Madelin, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Pippa Storey, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Henry Rusinek, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Timothy M. Shepherd, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Autopsies with neuropathology protocols are used to investigate sudden, unexpected patient deaths, but it is difficult to obtain correlation to a clinical MRI of the brain because of nervous tissue MRI property changes linked to the postmortem interval, chemical fixation and temperature differences. We measured these changes, then adapted MRI sequence pulse parameters to re-create a robust clinical MRI protocol for ex vivo whole brain imaging.

METHOD AND MATERIALS

Donated ex vivo whole brains immersion-fixed in formalin for 2 weeks were washed in phosphate-buffered saline for 8 weeks with repeated solution exchanges. Inversion recovery and multiecho sequences at 3-T MRI showed the T1/T2 values of gray and white matter decreased to 267/73 and 168/43 ms respectively in formalin-fixed ex vivo whole brains. Multiple MRI sequences were adjusted iteratively for these relaxation changes based on spin dynamics theory to give consistent image contrast, resolution and quality compared to in vivo MRI protocols.

RESULTS

Optimal MRI sequences at 3-T were different compared to standard in vivo MRI protocols - a) FLAIR: TR/TE/TI= 3000/45/1100 ms, 0.5 x 0.5 x 2-mm resolution, b) TSE T2: TR/TE = 5000/76 ms, 0.5 x 0.5 x 0.8-mm resolution, c) 3-D Gradient Echo: TR/TE = 20/10 ms with 18o flip angle, 0.46-mm isotropic resolution, and d) Diffusion Tensor Imaging: TR/TE = 3500/90 ms, b-values = 0, 1000 & 2000 s/mm2 with 64 directions, 3-mm isotropic resolution. Decreased echo-train-length also reduced gray-white blurring. Volumetric 3-D image contrast is degraded by the short T1's, but may be improved by a multi-segmented approach. The overall scan required <2 hrs overnight using an outpatient 3-T scanner and 64-channel coil.

CONCLUSION

We successfully created a "clinical" MRI protocol for ex vivo brains with similar image quality and contrast to routine radiology protocols. This can be used for detailed radiology-pathology correlations in clinical cases of sudden death. The protocol also may help detect abnormalities in Sudden Unexplained Death in Epilepsy (SUDEP) or directly correlate MRI property changes with underlying Alzheimer's pathology.

CLINICAL RELEVANCE/APPLICATION

We describe an ex vivo whole brain MRI protocol that recapitulates standard clinical protocols well to guide clinical or research radiology-pathology studies in a variety of patient populations.

SSQ16-09 Amide Proton Transfer Imaging of Neonatal Brain Development and Brain Injury: A Preliminary Study

Thursday, Dec. 3 11:50AM - 12:00PM Location: N228

Participants
Yang Zheng, Shenyang, China (*Presenter*) Nothing to Disclose
Xiaoming Wang, MD, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate neonatal brain development and injury at the internal environmental level with the application of amide proton transfer (APT) imaging by measuring the APT values of several part of the brain.

METHOD AND MATERIALS

A total of 51 neonatal patients who underwent MR examination were enrolled in the study. Among them, there were 38 newborns with no abnormalities and 13 cases with brain injury who underwent conventional MR (T1WI, T2WI, DWI) examination. After obtaining informed consent and permission of clinicians, routine MR was followed by additional APT scan. APT imaging is single slice scanning, performed at the basal ganglia level in all neonates, and in the case group, with increased localization at the level of lesion, and with the contralateral relatively normal area as self-control. The APT values of bilateral frontal subcortical white matter, basal ganglia and occipital subcortical white matter were measured for all neonates, as well as the APT values of the lesion and contralateral areas. Several statistical methods were used for statistical analysis.

RESULTS

In the control group, bilateral frontal subcortical white matter, basal ganglia and occipital subcortical white matter had no significant difference in APT value ($P > 0.05$). Between the different parts of the brain, APT values were significantly different ($P < 0.05$), and were associated with gestational age linear positive correlation. In the case group, there were significant differences in APT values between the lesion side and contralateral area, being significantly lower in lesion side than the contralateral side ($P < 0.05$). In the case group, the APT values of different parts of the brain were lower than the control group with the same gestational age ($P < 0.05$).

CONCLUSION

From changes in the protein and pH level in the neonatal brain, APT imaging can help understand neonatal brain development and evaluate brain injury.

CLINICAL RELEVANCE/APPLICATION

Amide proton transfer (APT) imaging is a noninvasive imaging method of MR, and it is capable of detecting mobile cellular proteins and peptides and monitoring pH effects.

SSQ17

Neuroradiology (Advanced Neuroimaging of Alzheimer Disease)

Thursday, Dec. 3 10:30AM - 12:00PM Location: N229

NR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Duygu Tosun, San Francisco, CA (*Moderator*) Research Grant, Eli Lilly and Company
Gloria C. Chiang, MD, San Francisco, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSQ17-01 Hippocampus MRI T1 Texture's Relation to Established Alzheimer's Disease Biomarkers and Prediction of Progression

Thursday, Dec. 3 10:30AM - 10:40AM Location: N229

Participants
Mads Nielsen, PhD, Copenhagen, Denmark (*Presenter*) Stockholder, Biomediq A/S Research Grant, Nordic Bioscience A/S Research Grant, SYNARC Inc Research Grant, AstraZeneca PLC
Lauge Sorensen, Copenhagen, Denmark (*Abstract Co-Author*) Research funded, Biomediq A/S
Akshay Pai, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Christian Igel, Copenhagen, Denmark (*Abstract Co-Author*) Research funded, Biomediq A/S
Martin Lillholm, PhD, Copenhagen, Denmark (*Abstract Co-Author*) Employee, Biomediq A/S Shareholder, Biomediq A/S

PURPOSE

The hippocampus texture as recorded in T1 MRI has been shown to be a strong predictor of conversion from MCI to probable AD and has been suggested for enrichment of AD trials. We investigate the relation of the hippocampal texture to CSF amyloid and tau load, and glucose metabolism of the hippocampus and it's potential prediction of conversion in amyloid and tau positive subject respectively.

METHOD AND MATERIALS

The study dataset consisted of the 504 subjects from the "complete annual year 2 visits" standardized Alzheimer's Disease Neuroimaging Initiative (ADNI) dataset including 234 baseline MCI subjects. MRI analysis consisted of segmenting the hippocampi using cross-sectional FreeSurfer (v.5.1.0), computation of the baseline hippocampal fraction (HF, hippocampal volume divided by intra-cranial volume), hippocampal atrophy (baseline, 12 month, 24 month regression percentage volume loss), and texture scoring of the hippocampus using our in-house method. CSF amyloid (AB42), respectively total tau (t-tau), and tau phosphorylated at the threonine 118 position (p-tau) were defined as positive by AB42 <= 192 pg/ml, t-tau >= 93 pg/ml, and p-tau >= 23 pg/ml. Normalized FDG-PET measurements constrained to the hippocampus were averaged over left and right hippocampus. Age and gender adjustment was performed.

RESULTS

The subpopulations having available amyloid, tau, and FDG-PET measurements did not significantly differ from the full 504 subjects in age, gender, MMSE, or HF. Hippocampal texture predicted conversion from MCI to AD in 12 months with an AUC of 0.71. In AB42, p-tau and t-tau positive subjects, the AUC of MCI to AD conversion were respectively 0.71, 0.72, and 0.69 (not significantly different from the whole population). The Pearson's R between hippocampus texture and AB42, p-tau, t-tau, FDG-PET, and hippocampal atrophy was respectively -0.32, 0.31, 0.28, -0.62, and 0.50. All AUC's and R's remained significant after decorrelation using HF.

CONCLUSION

Hippocampal texture predicts MCI-to-AD conversion independent of AB42, p-tau, t-tau. It relates weakly to AB42, p-tau, t-tau and strongly to glucose metabolism and future hippocampal atrophy.

CLINICAL RELEVANCE/APPLICATION

Hippocampus MRI T1 texture is a promising marker for prediction of fast Alzheimer's progression and enrichment of clinical trials.

SSQ17-02 Default Mode Network Structural-functional Connectivity and Beta-Amyloid Pathology in Autosomal Dominant Familial Alzheimer's Disease

Thursday, Dec. 3 10:40AM - 10:50AM Location: N229

Awards
Trainee Research Prize - Resident

Participants
Jeffrey W. Prescott, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose
P. M. Doraiswamy, MD, Durham, NC (*Abstract Co-Author*) Research Consultant, Bristol-Myers Squibb Company Research Consultant, Eli Lilly and Company Research Consultant, Neuronetrix, Inc Research Consultant, Medivation, Inc Research Grant, Bristol-Myers Squibb Company Research Grant, Eli Lilly and Company Research Grant, Neuronetrix, Inc Research Grant, Medivation, Inc Stockholder, Sonexa Therapeutics, Inc Stockholder, Clarimedix, Inc Speaker, Forest Medical, LLC
Jeffrey R. Petrella, MD, Durham, NC (*Abstract Co-Author*) Advisory Board, Johnson & Johnson Speakers Bureau, Quintiles Inc Advisory Board, Piramal Enterprises Limited

PURPOSE

Early onset familial Alzheimer's disease (FAD) is inherited in an autosomal dominant manner and provides a model for studying how amyloid may affect disease onset and synaptic failure. Our goal was to use data from Dominantly Inherited Alzheimer's disease Network (DIAN) to evaluate relationships between structural connectivity, functional connectivity, and amyloid burden.

METHOD AND MATERIALS

Baseline data from controls and mutation carriers from the national DIAN study were analyzed. Subjects' T1 scans were automatically segmented using FreeSurfer. A standard functional parcellation atlas was mapped to each subject (Yeo et al, J Neurophysiol, 2011). Functional connectivity was calculated as the average timeseries correlation among regions in the DMN of the functional atlas. Structural connectivity was calculated as the global efficiency of the tractographic connections between regions in the DMN, weighted by the number of fibers. Whole cortex amyloid SUVr was calculated from Pittsburgh compound B PET images, performed by the DIAN imaging core group. A general linear model examined the relationship between functional connectivity, structural connectivity and amyloid burden after covarying for age, sex, education, cognitive status (MMSE), and genetic mutation status (yes or no). Also, a correlation analysis was performed to examine relationships between structural-functional connectivity, age, and mutation status. A p-value less than 0.05 was considered significant.

RESULTS

76 subjects from DIAN were analyzed. 38 subjects had an FAD mutation (24 normal cognition (NC), 3 mild cognitive impairment (MCI), 11 dementia (AD)). 38 subjects did not have an FAD mutation (37 NC, 1 MCI). There was a significant association between functional and structural connectivity; specifically, as structural global efficiency decreased, functional timeseries correlation decreased. Functional and structural connectivity significantly decreased with age in mutation carriers, but not in controls.

CONCLUSION

Among DIAN subjects, there is a significant association between functional and structural connectivity metrics. There is a significant decrease in functional and structural connectivity with increasing age in mutation carriers, but not in controls.

CLINICAL RELEVANCE/APPLICATION

Evaluation of structural-functional connectivity breakdown in subjects with FAD may provide imaging biomarkers for patients in the preclinical stages of AD.

SSQ17-03 Comparison of Several Computational Pipelines for Atrophy Computation in Longitudinal Alzheimers Studies

Thursday, Dec. 3 10:50AM - 11:00AM Location: N229

Participants
Akshay Pai, Copenhagen, Denmark (*Presenter*) Nothing to Disclose
Stefan Sommer, PhD, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Sune Darkner, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Lauge Sorensen, Copenhagen, Denmark (*Abstract Co-Author*) Research funded, Biomediq A/S
Jon Sporring, Copenhagen, Denmark (*Abstract Co-Author*) Co-founder, DigiCorpus ApS Shareholder, DigiCorpus ApS
Mads Nielsen, PhD, Copenhagen, Denmark (*Abstract Co-Author*) Stockholder, Biomediq A/S Research Grant, Nordic Bioscience A/S Research Grant, SYNARC Inc Research Grant, AstraZeneca PLC

PURPOSE

To evaluate the newly developed diffeormorphic image registration framework using stationary velocity fields parameterized by wendland kernel bundle framework in atrophy estimation. In this study, we compare the diagnostic group separation (Alzheimer's and Normals) abilities of the proposed framework against other state-of-art registration schemes and the Boundary shift integral (BSI) based on atrophy scores in several brain regions.

METHOD AND MATERIALS

Baseline and month 12 MRI scans from the "complete annual year 2 visits" 1.5-T standardized ADNI dataset were used [169 normal controls (NC), 101 AD]. Segmentations for atrophy quantifications were obtained using Freesurfer cross-sectional pipeline. Each image was corrected for intensity inhomogenities using N3 from freesurfer. Each of baseline and month 12 scans were non-linearly aligned using the proposed framework and existing methods like SyN, NiftyReg, LCC-Demons. Atrophy was then estimated from the deformation field of the proposed framework using the proprietary Cube Propagation and on the rest, using Jacobian determinants. Atrophy was estimated in the regions of whole brain (WB), hippocampus (Hip), Ventricles, Medial temporal lobe (MTL), Cortical gray matter (CGM), entorhinal cortex (ENCTX) and fusiform gyrus (FG). BSI was also used to evaluate atrophy in the regions of WB, Hip and Ventricles.

RESULTS

The proposed framework yields better AUC and Cohens'D for AD v/s NC when compared to the other registration schemes. The highest separation (AUC/Cohen's D) among the registration frameworks was using the proposed framework - WB 0.76/ 0.94, hippocampus 0.82/1.26, MTL 0.86/1.43, CGM 0.85/1.29, ENCTX 0.80/1.13 and FG 0.76/0.98. Overall, BSI provided a better separation on WB (0.81/1.18), hippocampus (0.86/1.15). However, BSI was not designed to provide scores for any other region.

CONCLUSION

Although, BSI provides a better separation, the method can be used only in regions the software is designed for, for instance whole brain, hippocampus and ventricles. The proposed registration framework not only provides good comparable group separation (and better than other registration frameworks), it provides the flexibility to measure atrophy in any user-defined region.

CLINICAL RELEVANCE/APPLICATION

The proposed method can reliably estimate atrophy in any brain region unlike BSI which is specifically designed to estimate atrophy only in certain regions of the brain.

SSQ17-04 Altered Spontaneous Activity in aMCI and AD Revealed by Resting-state fMRI

Thursday, Dec. 3 11:00AM - 11:10AM Location: N229

Participants
Hong Xiang Yao SR, PhD, Beijing, China (*Presenter*) Nothing to Disclose
Ning Yu An, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To distinguish Alzheimer's disease(AD) and amnestic mild cognitive impairment(aMCI) from healthy aging by the alteration of amplitude in the time domain(AM) in resting-state fMRI.

METHOD AND MATERIALS

We hypothesized that AD and aMCI patients show abnormal AM of intrinsic brain activity in some specific regions. To prove this hypothesis, we recruited 35 AD patients, 27 aMCI patients and 27 age- and gender-matched normal controls(NC) and they all received resting-state fMRI examination and neuropsychological tests. Then, we investigated the altered AM patterns in aMCI and AD compared with the NC group. In addition, we also expected to find the relationship between the strength of AM and the cognitive abilities of the aMCI and AD subjects compared with NC.

RESULTS

At the voxel level, two regions (that's the posterior cingulate cortex (PCC)/precuneus (PCu) and the left caudate) were identified showed significant altered AM values (Figure 1, A). Post hoc analysis showed that the main difference was found between the AD and NC subjects (Figure 1, B)At the regions level, compared with NC, totally 28 regions were found with significant impaired AM value in aMCI and AD subjects. According to the altered pattern and anatomical locations, these regions can be combined into five clusters which includes the PCC)/PCu, cuneus (Cun), right caudate, left caudate, left inferior temporal gyrus (ITG) (Figure 2). Compared with NC and aMCI subjects, the most obvious areas of change located in the three regions including PCC/PCu, Cun and left caudate in AD (Figure 3). Compared with normal controls, only the region of PCC/PCu showed decreased AM value in aMCI.Importantly, the alteration of AM was significantly correlated with cognitive abilities measured by MMSE(Figure 4).

CONCLUSION

AM is a useful method to distinguish AD and aMCI from NC. Our results indicated that default mode network and the other cortical regions had been destroyed in aMCI and AD, which might be a potential biomarker for early diagnosis of aMCI and AD.

CLINICAL RELEVANCE/APPLICATION

AM is a new method of resting-state fMRI and helpful for the early diagnosis of AD and aMCI.

SSQ17-05 Quantitative MR R2* Imaging and Arterial Spin Labeling Brain Perfusion Assessment in Alzheimer Disease

Thursday, Dec. 3 11:10AM - 11:20AM Location: N229

Participants
Marica T. Maccarone, MD,PhD, Chieti, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberto Esposito, MD,PhD, Chieti, Italy (*Abstract Co-Author*) Nothing to Disclose
Simone Salice, MD, Chieti, Italy (*Abstract Co-Author*) Nothing to Disclose
Giacomo Caracciolo, Chieti, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefano Delli Pizzi, Chieti, Italy (*Abstract Co-Author*) Nothing to Disclose
Piero Chiacchiaretta, Chieti, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonio Ferretti, PhD, Chieti, Italy (*Abstract Co-Author*) Nothing to Disclose
Armando Tartaro, MD, Chieti, Italy (*Presenter*) Nothing to Disclose

PURPOSE

Cerebral iron deposition plays a key role in pathophysiology of neurodegenerative processes. Iron concentrations are elevated in cortical and basal ganglia regions in Alzheimer Disease (AD), indicating a disruption of its homeostasis. Higher iron concentrations in AD may increase the possibility of free iron catalyzing lipid peroxidation leading to cell membrane damage and cell death. The aim of this study is to investigate the correlation of brain iron accumulation with the severity of vascular damage and cerebral perfusion in mild-AD patients.

METHOD AND MATERIALS

18 mild-AD patients evaluated by means of neuropsychological tests were enrolled in the study and compared with 18 aged matched healthy volunteers. Iron concentration was derived from R2* measurements obtained with multi-echo gradient echo sequences (1 mm in-plane resolution, slice thickness 4 mm, 30 axial slices; TR= 68 ms; TE1=4.9 ms, delta TE = 4.9 ms, 12 echoes) and data were collected from 14 ROI in cortical and subcortical grey matter. Regional cerebral blood flow (CBF) was obtained by means of a pseudocontinuous Arterial Spin Labeling (pCASL) sequence (T2* EPI; TR/TE = 4000/11 ms, 35 tag-control volumes consisting of 19 slices with 3.5x3.5x6 mm3 resolution; label duration = 1650 ms, post label delay = 1600 ms, background suppression pulses). Vascular damage was evaluated on conventional images according to Fazekas scale.

RESULTS

R2* shows a significant correlation with the severity of white matter vascular damage in the right frontal cortex ($p>0.05$) and with Mini Mental State Examination (MMSE; $p<0.02$) in the left frontal cortex in mild AD group compared to controls. CBF modifications in mild-AD patients shows no significant correlation with MMSE and a significant correlation with vascular damage ($p<0.05$) in the left lateral orbito-frontal cortex. Moreover a significant decreased CBF was observed in bilateral nucleus caudatus in mild-AD group ($p<0,05$) compared to controls.

CONCLUSION

Iron concentration positively correlates with the severity of vascular impairment and negatively correlates with CBF in mild-AD patients, indicating that it may be used as biomarkers to evaluate the progression of AD.

CLINICAL RELEVANCE/APPLICATION

Quantification of brain metal ion content and distribution may be a predictive marker for early diagnosis, assessment of treatment strategies or therapeutic target in AD.

SSQ17-06 A Follow-up Study of Disrupted Functional Brain Connectivity in Alzheimer's Disease

Thursday, Dec. 3 11:20AM - 11:30AM Location: N229

Participants
Xiangzhu Zeng, MD, Beijing, China (*Presenter*) Nothing to Disclose
Huishu Yuan, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Ying Liu, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zheng Wang, MS, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The change patterns of damage on neural networks of Alzheimer's disease (AD) is still largely uncertain. The aim of this study is to investigate cerebral network' changes of AD patients in about 1.5 years.

METHOD AND MATERIALS

Patients with AD (n=15, 4men, mean age 72.1 ±6.21 years, mean MMSE scores for first examination 19.6±6.13, mean scores for second examination 19.4±5.28) and healthy control subjects (HC, n=15, 6men, mean age 68.3±8.22 years, mean MMSE scores 29.2±0.92) were recruited. Resting-state functional data was obtained using a single-shot echo-planar imaging (EPI) sequence on SIEMENS TrioTim 3T scanner. The acquisition parameters were as following: EPI sequence TR=2000ms, TE= 30ms, slice thickness= 5 mm, slices=30, voxel size= 3.4×3.4×5.0 mm3, scan time=7min. HC subjects were scanned once and all AD patients were examined twice. The average scanning interval was 16.8±11.33 months in AD patients.All resting-state fMRI data were processed by GRETNA, small world parameters of global and local network were obtained including Gamma, Lambda, normalized regional nodal efficiency (EFi) and betweenness (BCi).

RESULTS

Small-world parameters of AD-First and AD-Second slightly decreased compared with HC respectively (Sparsity 10%-30%) (Fig1). For nodal EF, AD-First in left inferior parietal (r=0.44, p=0.02), right angular gyrus (r=0.42, p=0.03), left rectus (r=0.40, p=0.03) and AD-Second in right superior orbital Frontal lobe (r=0.40, p=0.04), right supplementary motor area (r=0.40, p=0.04), bilateral rectus (r=0.43, p=0.02 for left, r=0.45, p=0.01 for right) are positive correlation with MMSE score(Fig2). Nodal BC on AD-First in right medial orbital frontal lobe (r=0.40, p=0.03) is positive and in right precuneus (r=-0.42, p=0.02) is negative correlation with MMSE; BC on AD-Second in bilateral supplementary motor areas (r=0.46, p=0.02 for left, r=0.47, p=0.01 for right) and right medial orbital frontal lobe (r=0.41, p=0.03) are positive correlation with MMSE (Fig2). (r>=0.4 or r<=-0.4, p<0.05)

CONCLUSION

Brain network had a slight decline in the optimal small-world architecture in the progression of AD. The involved nodes which have positive and negative correlation of nodal BC and EF with MMSE score exhibited underlying dynamic disrupted patterns of functional connectivity in AD.

CLINICAL RELEVANCE/APPLICATION

Resting-state fMRI is a useful noninvasive tool to identify the disrupted functional connectivity in progression of AD.

SSQ17-07 Comprehensive, Radiological Evaluation of Strategic Structures in Patients with Mild Cognitive Impairment and Early Alzheimer's Disease

Thursday, Dec. 3 11:30AM - 11:40AM Location: N229

Participants
Tomasz Nesteruk, MD, Warsaw, Poland (*Abstract Co-Author*) Nothing to Disclose
Marta J. Nesteruk, MD, Warsaw, Poland (*Abstract Co-Author*) Nothing to Disclose
Maria Styczynska, PhD, Warsaw, Poland (*Abstract Co-Author*) Nothing to Disclose
Jerzy M. Walecki, MD, PhD, Warszawa, Poland (*Presenter*) Nothing to Disclose

PURPOSE

The aim of the study was to evaluate the diagnostic value of two measurement techniques in patients with cognitive impairment. The first was automated volumetry of the hippocampus, entorhinal cortex, parahippocampal gyrus, posterior cingulate gyrus, cortex of the temporal lobes, corpus callosum and the second was fractional anisotropy (FA) measurements of the corpus callosum in diffusion tensor imaging technique.

METHOD AND MATERIALS

Ninety six patients underwent brain magnetic resonance imaging - 33 healthy controls (HC), 33 patients with diagnosed mild cognitive impairment (MCI) and 30 patients with probable AD of mild degree (AD). Severity of the dementia was evaluated with the neuropsychological battery test. Volumetric measurements were performed automatically with FreeSurfer imaging software. Measurements of the FA values were performed manually with region of interest tool.

RESULTS

Volumetric measurement of the temporal lobe cortex had the highest correct classification rate - 68,7%, the lowest was for the FA measurements of the corpus callosum. - 51%. Highest sensitivity and specificity when discriminating patients MCI vs early AD was achieved with the volumetric measurement of the corpus callosum - these are 73% and 71% and the correct classification rate was 72%. Highest sensitivity and specificity when discriminating HC and patients with early AD was achieved with the volumetric measurement of the entorhinal cortex - these are 94% and 100% and the correct classification rate was 97%. Highest sensitivity and specificity when discriminating HC and patients with MCI was achieved with the volumetric measurement of the temporal lobe cortex - these are 90% and 93% and the correct classification rate was 92%.

CONCLUSION

Diagnostic value varied depending on the measurement technique. Volumetric measurements proved to be the strongest imaging biomarker which allowed distinction between groups of patients. Corpus callosum volume assessment proved to be useful tool in discriminating patients MCI vs early AD.

CLINICAL RELEVANCE/APPLICATION

By evaluation of the two measurement methods authors wanted to find the best imaging technique, which would help clinicians to evaluate patients and make the correct diagnosis.

SSQ17-08 Heritability of Brain Atrophy on MRI in Advanced Age: A Twin Study of Healthy Middle-aged to Elderly Japanese Adults

Thursday, Dec. 3 11:40AM - 11:50AM Location: N229

Participants
Matthew W. Lukies, MBBS, Osaka, Japan (*Presenter*) Nothing to Disclose
Yoshiyuki Watanabe, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose
Soshiro Ogata, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Kayako Omura, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD, Suita, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Brain atrophy, a common finding on MRI, is part of the aging process and neurodegenerative diseases. The purpose of this study was to determine the heritability of brain atrophy and volume in advanced age using classical twin analyses of healthy Japanese middle-aged to elderly adult twin volunteers.

METHOD AND MATERIALS

74 individuals, 20 monozygotic (MZ) twin pairs (10MM 10FF, mean age 61y min 42y max 75y) and 17 dizygotic (DZ) twin pairs (8MM 8FF 1MF, mean age 64y min 41y max 85y), were selected with advanced age and gender match from the Osaka University Center for Twin Research registry. 3D T1 volume images from 3.0T MRI were used to measure volumes (L) for white matter (WM), grey matter (GM), cerebrospinal fluid (CSF) and total brain volume (TBV calculated as WM + GM) with statistical parametric mapping (SPM) 12 (University College London). Volume differences, correlations, twin modelling and heritability estimates (H2), controlled for age and gender, were performed using statistical platform R (v3.1.2) with OpenMx (v2.0.1).

RESULTS

The one male-female DZ twin pair was excluded due to significant difference in mean TBV based on gender (Welch two sample t-test p=0.027). For all twins together, TBV (coefficient -0.450, $p<0.01$) and GM (-0.528, $p<0.01$) negatively correlated with age, where as CSF (0.646, $p<0.01$) positively correlated with age and WM (-0.055, p=0.64) was not significant. The differences in volume measurements between monozygotic twin pairs were significantly smaller than those for dizygotic twin pairs (T-TEST: TBV p=<0.01, GM $p<0.01$, WM $p<0.01$, CSF p=0.03).Heritability (H2) estimates on AE (additive genetics / unique environment) models for TV, GM and WM were 92.73%, 93.39% and 87.12% respectively. AE models were selected based on Akaike information criterion (AIC) for best fit and simplicity in twin studies. CSF best fit with a CE (common environment / unique environment) model, implying a stronger correlation with age and/or gender rather than heritance.

CONCLUSION

Brain volume and atrophy have strong heritability of around 90% into advanced age, as demonstrated in this Japanese twin population. Further analysis of heritability of atrophy in specific brain locations is planned.

CLINICAL RELEVANCE/APPLICATION

Atrophy is a common finding on MRI of adult and elderly brains. It is important to consider the strong heritability of brain volume when making associations with disease.

SSQ17-09 Integrative Bayesian Analysis of Neuroimaging-Genetic Data with Application to Cocaine Dependence

Thursday, Dec. 3 11:50AM - 12:00PM Location: N229

Participants
Shabnam Azadeh, Houston, TX (*Presenter*) Nothing to Disclose
Brian Hobbs, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Liangsuo Ma, Richmond, VA (*Abstract Co-Author*) Nothing to Disclose
David A. Nielsen, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
F. Gerard Moeller, Richmond, VA (*Abstract Co-Author*) Nothing to Disclose
Veera Baladandayuthapani, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To explore the underlying neurobiology of white matter integrity of cocaine-dependent subjects by integrative neuroimaging-genetic analysis of diffusion tension imaging (DTI) and genetic, demographic and clinical features.

METHOD AND MATERIALS

We propose a novel computationally efficient method called integrative Bayesian analysis of neuroimaging-genetic (iBANG) to analyze large-scale imaging-genetics data. The iBANG methods uses a three-step component-wise analysis pipeline (i) estimate the association between each genetic and demographic variable via voxel- based Bayesian model averaging and obtain posterior probability maps (PPMs), (ii) incorporate spatial information pertaining to voxel locations to smooth the PPMs, and (iii): use Bayesian false discovery rates to delineate regions of brain activation while controlling for multiple testing. Our methods are motivated by and applied to a retrospective study in cocaine addiction where voxel-wise fractional anisotropy (FA) values were acquired over the white matter space spanning the entire brain in addition to twenty-one candidate SNPs known to be previously associated with addiction.

RESULTS

Our study suggests that the impact of GAD1a (rs1978340) and GAD1b (rs769390) SNPs on FA values of the white matter of the brain was extensive in comparison to the other SNPs using iBANG. Significantly a total of 5217 voxel locations associated with GAD1a and the total number of 1332 voxel locations associated with GAD1b were found. Both GAD1a and GAD1b SNPs are associated with synthesis of GABA which plays a critical role in drug-reward and drug seeking behavior. Figure 1 depicts the multi-slice sagittal views of the neuroanatomic locations of significant regions in the white matter of the brain that were impacted by GAD1a. FA values on the white matter of the brain were significantly impacted by cocaine abuse to the extent of 3100 voxels.

CONCLUSION

GAD1a and GAD1b SNPs are associated with synthesis of GABA led to FA enhancement in the most regions of the John Hopkins University (JHU) white matter atlas. Cocaine consumption caused FA diminishment in the most regions of the JHU white matter atlas.

CLINICAL RELEVANCE/APPLICATION

Cocaine abuse and some of the candidate SNPs, GAD1a and GAD1b, show noticeable impact on FA alteration of white matter which cause changes on white matter integrity of the brain.

BRS-THA

Breast Thursday Poster Discussions

Thursday, Dec. 3 12:15PM - 12:45PM Location: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

FDA Discussions may include off-label uses.

Participants
Sarah M. Friedewald, MD, Chicago, IL (*Moderator*) Consultant, Hologic, Inc; Research Grant, Hologic, Inc

Sub-Events

BR267-SD-THA1 Association of Breast Density with Breast Cancer Risk in Screening Mammography

Station #1

Participants
Natasa Katavic, MD, Zagreb, Croatia (*Presenter*) Nothing to Disclose
Kristina Bojanic, MD, Osijek, Croatia (*Abstract Co-Author*) Nothing to Disclose
Kristina Kralik, Osijek, Croatia (*Abstract Co-Author*) Nothing to Disclose
Tibor Santo, Osijek, Croatia (*Abstract Co-Author*) Nothing to Disclose
Kristina Vidacic, Osijek, Croatia (*Abstract Co-Author*) Nothing to Disclose
Mirta A. Pacovski, MD, Osijek, Croatia (*Abstract Co-Author*) Nothing to Disclose
Miroslav Sikora, Osijek, Croatia (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to assess the distribution of breast density of the patients with detected breast cancer during mammography screening, and to evaluate the association of high mammographic density and breast cancer.

METHOD AND MATERIALS

We used data from National Breast Screening Programme in a single county. Women age 50-69 years have been invited every two years for mamography screening. 52962 mamography exams have been done during 5 years at 5 mammography units.Density analysis was performed from one craniocaudal and one mediolateral view from both breasts. The percent of the area of the mammogram occupied by radiologically dense breast tissue was determined by two independent radiologists who estimated visually the proportion of the occupied area.According to ACR (American College of Radiology) criteria breast density has been categorized into four groups: 1-almost entirely fatty, 2-scattered fibro-glandular densities, 3- heterogeneously dense, 4-extremely dense.Each woman with detected carcinoma was added her matching control: the woman of same age and same place of living.Patients were divided into low density breast tissue group (ACR density group 1-2) and high density breast tissue group (ACR 3-4) and data was compared between these two groups.

RESULTS

Out of 230 detected breast cancers, 6% were stage 0, 47% stage I, 17% stage II and 28% stage III/IV, according to AJCC criteria.Mammographic density distribution in breast cancer patients was as following: 47.64% in ACR1 group; 36.32% ACR2; 13.21% ACR3 and 2.83% ACR4.Low mammographic density (<50% parenchyma) had 83% patients in breast cancer group vs 89% controls; high mamographic density (>50% parenchyma) had 17% breast cancer patients vs 11% controls.There was no significant difference in mamographic density between brast cancer and control group: Fisher's exact test p=0.083 (OR=1.65 95% CI=0.97-2.81; z=1.85, p=0.064).

CONCLUSION

Our results suggest that higher mammographic densities were not associated with higher risk of breast cancer among menopausal women. Majority of screened woman have low breast density. Mamography is efficient method for early detection of nonpalpabile breast cancer.

CLINICAL RELEVANCE/APPLICATION

Mamography is the best tool for population-based breast cancer screening.

BR268-SD-THA2 Diagnostic Performance of Hybrid PET/MR for Determination of Preoperative Lymph Node Status in Patients with Breast Cancer

Station #2

Participants
Eun-Jung Kong, Daegu, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ihn-Ho Cho, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of the study was to evaluate diagnostic performance of hybrid PET/MRI for determining preoperative lymph node status.

METHOD AND MATERIALS

Two hundred thirty-six women with histologically proven breast cancer were recruited to undergo preoperative PET/MR imaging. Among them, 184 patients fulfilled the inclusion criteria (invasive carcinoma, no previous operation, no neoadjuvant chemotherapy). MR Imaging of the breast including a dynamic contrast enhanced series and diffusion weighted imaging (DWI) was performed with a dedicated breast coil according to ACR guidelines. PET data was acquired simultaneously for 8 minutes. Axillary lymph nodes were

identified on obtained images and following parameters were evaluated: long axis, cortical thickness, shape, presence of fat hilum, apparent diffusion coefficient (ADC) and FDG avidity. Histologic results served as the gold standard.

RESULTS

Sentinel lymph node biopsy was performed in 122 cases, axillary dissection in 62 cases. 70 patients exhibited ALN metastases, of whom 15 were classified as micrometases. Mean size of breast mass was 2.1 ±1.5 cm. Macrometastatic ALN showed high FDG uptake, longer axis, thicker cortex, more frequent morphologic abnormalities, higher signal intensity at DWI and higher ADC values with statistical significance. No significant difference between micrometastatic ALN and benign ALN in PET/MR imaging. The sensitivity, specificity and accuracy of PET for determining ALN metastasis were 84%, 58% and 68%, respectively. Those are 77%, 84% and 82% in considering both PET with morphologic change and 81%, 66% and 72% in considering PET, morphologic change and DWI, respectively.

CONCLUSION

PET/MR imaging techniques showed high accuracy in the preoperative evaluation of axillary status in patients with breast cancer. Additional information by DWI is unlikely to be useful in predicting metastatic ALN.

CLINICAL RELEVANCE/APPLICATION

(dealing with PET/MR) 'PET/MR imaging techniques for metabolism and anatomic change showed high accuracy in the preoperative evaluation of axillary status. Additional information by DWI is unlikely to be useful in predicting metastatic ALN. PET/MR scan is recommended in the initial evaluation of breast cancer.'

BR269-SD-THA3 Role of Peritumoral Stromal Tissue Stiffness Obtained on Shear Wave Elastography for the Prediction of Malignancy

Station #3

Participants
Su Min Ha, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hye Sun Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hee Jung Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ki Chang Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hak Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joo Hee Cha, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Young Chae, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Jung Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the role of tumor and peritumoral stromal tissue stiffness obtained using shear wave elastography (SWE) for the prediction of malignancy.

RESULTS

There were 85 (64%) malignant and 48 (36%) benign lesions. Normalized Emean of tumor, border, and peritumoral stroma of malignant lesions were significantly higher than those of benign lesions (P<0.001). This difference of Emean between two groups was highest in the border (median ± interquartile range; 3.375 ± 1.728 vs. 1.594 ± 0.686, P<.001) and proximal peritumoral stroma (4.96 ± 3.19 vs. 1.31 ± 0.50, P<.001).On multivariate analysis, odds ratio for the prediction of malignancy was 2.26 for tumor border, 5.93 for 1st peritumoral stroma, 4.06 for 2nd peritumoral stroma, and 2.57 for 3rd peritumoral stroma (P <.001 for all). Odds ratio of intratumoral Emean was 1.64, which didn't reach statistical significance (P=.064). Slope of curve through inner tumor to peritumoral stroma was 0.607 for malignant lesions and -4.16 for benign lesions, which shows significant difference.

CONCLUSION

Stiffness of inner tumor, border, and peritumoral stroma obtained on SWE was significantly different between benign and malignant lesions, and the difference was highest in the border and proximal stroma.

CLINICAL RELEVANCE/APPLICATION

On SWE, stiffness of peritumoral stromal tissue in addition to inner tumor could provide a valuable information to predict malignancy.

BR271-SD-THA4 Do Women with Dense Breasts Have Higher Radiation Exposure During Screening Mammography?

Station #4

Participants
Jonathan Nguyen, MD, Boston, MA (*Presenter*) Nothing to Disclose
James Patrie, MS, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Jennifer A. Harvey, MD, Charlottesville, VA (*Abstract Co-Author*) Researcher, Hologic, Inc; Researcher, VuCOMP, Inc; Researcher, Matakina Technology Limited; Shareholder, Matakina Technology Limited; Shareholder, Hologic, Inc

PURPOSE

The maximum phantom dose in mammography is 3.0 mGy. However, actual dose to patients can vary widely. Specifically, the association of patient factors such as breast density with dose is not well documented in the literature.

METHOD AND MATERIALS

Patient demographics and x-ray techniques were collected for 434 sequential patients undergoing screening mammography at our institution over one month. Information included patient age, weight, height, compression thickness, radiographic technique, and mean glandular dose (MGD) were collected for each exposure. Breast density was calculated quantitatively using volumetric density software (Volpara). For each parameter investigated we determined the median value, 1st, and 3rd quartiles.

RESULTS

For patients, the median age was 58 years (1st quartile 51; 3rd quartile 66) and median BMI was 26.8 (23.3; 31.7). Median volumetric breast density was 5.6 mm3 (3.9; 8.7). Median compression thickness was 63.0 mm (53.5; 73.5). Median glandular doses for the left and right breasts were 1.68 mGy and 1.75 mGy, respectively.Multivariate regression analysis demonstrated a statistically significant correlation between radiation dose and all of the follow variables: age (p 0.021), breast laterality (p <0.001), BMI (p 0.038), breast density (p <0.001), and compression thickness (p <0.001). The covariate adjusted estimates between the 3rd and 1st quartiles showed that compression thickness was the primary determinant of radiation dose accounting for approximately 80% of dose, followed by breast density (10%), age (<5%), and BMI (<5%).

CONCLUSION

Increasing compression thickness had the greatest effect on increasing the MGD per exposure. Breast density has a minor impact, and BMI and age have minimal impact on MGD.

CLINICAL RELEVANCE/APPLICATION

Breast density is a minor determinant of patient dose in screening mammography.

BR270-SD-THA5 Readout-segmented Echo-planar Imaging Guided Proton MR Spectroscopy in the Detection of Choline Concentration in Breast Lesions

Station #5

Participants
Kun Sun, Shanghai, China (*Presenter*) Nothing to Disclose
Caixia Fu, Shenzhen, China (*Abstract Co-Author*) Employee, Siemens AG
Fuhua Yan, MS, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To qualitatively and quantitatively investigate the feasibility and effectiveness of Readout-segmented Echo-planar Imaging guided proton MR Spectroscopy for characterizing breast lesions.

METHOD AND MATERIALS

This study was institutional review board approved, and informed consent was obtained from each patient. Between February 2014 to July 2014, 258 female patients (mean age, 50 years; age range, 25 ~ 82 years) with 258 lesions larger than 1 cm were performed readout-segmented Echo-planar Imaging guided single-voxel MRS with external reference solution and retrospectively analyzed. The qualitative approach was identified as total composite choline compounds (tCho) peak of signal- to-noise (SNR) of ≥2 to represent malignancy. The quantitative approach was identified as tCho concentration equal to or greater than the cut-off value to represent malignancy. All lesions were retrospectively divided into two groups (mass- and non-mass-type lesions) based on the dynamic contrast enhanced images.

RESULTS

Histologically, 183 lesions were malignant; 75 were benign. The mean tCho SNR in malignant lesions was 6.23 ± 3.30 AU/ml, compared with 1.26 ±1.75 AU/ml in benign lesions. With a tCho SNR threshold level of 2.0 AU/ml, the sensitivity, and specificity for MRS was 95% (174/183), 85% (64/75). The area under the ROC curve was 0.93. The mean tCho concentration was 3.17 ± 2.03 mmol/kg for malignancy, 0.86 ± 0.83 mmol/kg for benignancy. With a cut-off level of 1.76 mmol/kg, the sensitivity and specificity for MRS was 74.9% (137/183), 93.3% (70/75). The area under the ROC curve was 0.90. There was no significant difference between qualitative and quantitative approaches in the area of ROC curve (P = .12). There was also no significant difference in the detection of tCho between mass group and non-mass group, not only in malignant lesions (qualitatively: P = .506 and quantitatively: P = .066), but also in benign lesions (qualitatively: P = .199 and quantitatively: P = .690).

CONCLUSION

Readout-segmented Echo-planar Imaging guided MRS for the detection of Choline Concentration is feasible, and can be used for the differentiation of benign and malignant breast lesions in both enhanced mass lesions and non-mass lesions.

CLINICAL RELEVANCE/APPLICATION

Improved imaging quality of DWI based on Readout-segmented Echo-planar Imaging will allow for better positioning the ROI for MRS acquisition in both enhanced mass lesions and non-mass lesions.

BR164-ED-THA6 The MRI Features of Breast Cancer: Intrinsic Subtypes and Response to Neoadjuvant Therapy

Station #6

Participants
Kazunori Kubota, MD, PhD, Bunkyo-Ku, Japan (*Presenter*) Nothing to Disclose
Tomoyuki Fujioka, MD, PhD, Bunkyo-ku, Japan (*Abstract Co-Author*) Nothing to Disclose
Kaori Okazawa, MD, Bunkyo-ku, Japan (*Abstract Co-Author*) Nothing to Disclose
Emi N. Yamaga, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Akira Toriihara, Bunkyo-Ku, Japan (*Abstract Co-Author*) Nothing to Disclose
Yukihisa Saida, MD, Bunkyo-Ku, Japan (*Abstract Co-Author*) Nothing to Disclose
Ukihide Tateishi, MD, PhD, Setagaya-Ku, Japan (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is:1. To review and understand the MRI features of each intrinsic subtype and the characteristics of response to neoadjuvant therapy.2. To disscuss the new evaluation method after neoadjuvant therapy.

TABLE OF CONTENTS/OUTLINE

A. Introduction - Definition of intrinsic subtypes - Neoadjuvant therapy and response evaluation methodB. MRI features of each intrinsic subtype - Luminal type breast cancers - HER 2 positive breast cancers - Triple negative breast cancersC. MRI characteristics of response to the neoadjuvant therapy and prediction of the pathological CR - Luminal type breast cancers - HER 2 positive breast cancers - Triple negative breast cancersD. DisucussionThe major teaching points of this exhibit are:1. Imaging

characteristics of the intrinsic subtypes differ, and the response to the adjuvant therapy also differs within the subtypes.2. Breast MRI is clinically useful in the prediction of tumor response after neoadjuvant therapy.

GIS-THA

Gastrointestinal Thursday Poster Discussions

Thursday, Dec. 3 12:15PM - 12:45PM Location: GI Community, Learning Center

GI

AMA PRA Category 1 Credit ™: .50

Participants
Koichi Hayano, MD, Boston, MA (*Moderator*) Nothing to Disclose
Manish Dhyani, MBBS, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

GI384-SD-THA1 A Simple Ultrasonographic Score for the Accurate Detection of Inflammatory Activity in Crohn's Disease

Station #1

Participants
Kerri Novak, MD, Calgary, AB (*Presenter*) Research Grant, AbbVie Inc Research Grant, Johnson & Johnson
Gilaad Kaplan, Calgary, AB (*Abstract Co-Author*) Nothing to Disclose
Remo Panaccione, MD, Calgary, AB (*Abstract Co-Author*) Research Consultant, Abbott Laboratories
Subrata Ghosh, MD, FRCPC, Calgary, AB (*Abstract Co-Author*) Research Consultant, Abbott Laboratories
Stephanie R. Wilson, MD, Calgary, AB (*Abstract Co-Author*) Research Grant, Lantheus Medical Imaging, Inc; Equipment support, Siemens AG; Equipment support, Koninklijke Philips NV

PURPOSE

Cross-sectional imaging is central in the diagnosis and management of Crohn's disease, an immune mediated disease of the bowel often leading to transmural damage. Safe, non-radiation based modalities are preferred, given young age of onset. Ultrasound is accurate in detection of disease activity, however a simple validated score for inflammatory activity is not widely used. The aim of this study was to evaluate grey scale parameters that contribute most to disease activity and devise a clinically applicable score.

METHOD AND MATERIALS

This was an IRB approved, single center prospective study evaluating patients with established Crohn's disease monitored with sonography, before and after treatment with adalimumab. Patients were evaluated with ileocolonoscopy (scored using validated indices) and ultrasound within 2 weeks of endoscopy at time zero and either at 6 or 12 months depending on clinical indication. A score was developed based on ordinal logistic regression using a proportional odds model. The final model included only variables with p values < 0.05. Disease severity was classified according to endoscopic score with the most significant grey scale variables weighted to classify individuals into different severity levels. ROC curves were plotted to demonstrate the discriminative and predictive capacity of the scoring system developed.

RESULTS

A total of 63 patients were included, 24 had 2 endoscopic examinations, while 39 had 1, giving a total of 87 US and endoscopic comparisons. The average age is 40.7 years, 28 females and 35 males. The most common disease distribution was ileocolonic 59% (37/63), with 30% (19/63) having terminal ileal and 8% (5/63) with colonic disease. Three grey scale parameters were significantly associated with inflammatory activity, including bowel wall thickness (p=0.046) mesenteric inflammatory fat (p=0.006) and lymph nodes (p=0.028). Based on the novel score, the ROC curve for distinguishing patients with inactive or mild disease from those with active disease was 0.89 while distinguishing normal from any activity was 0.81.

CONCLUSION

US is accurate in the detection of clinically significant disease activity compared to endoscopy and may be a surrogate to endoscopy to guide management.

CLINICAL RELEVANCE/APPLICATION

This simple score may provide a standardized approach to sonographic CD activity measurement across centers.

GI385-SD-THA2 Iodine Load Reduction at Hepatic Dynamic CT using Virtual Monochromatic Imaging with a Fast kVp Switching Dual-Energy CT

Station #2

Participants
Tomoko Hyodo, MD, Osaka-Sayama, Japan (*Presenter*) Nothing to Disclose
Seishi Kumano, MD, Osakasayama, Japan (*Abstract Co-Author*) Nothing to Disclose
Junko Nakanishi, RT, Osaka-Sayama, Japan (*Abstract Co-Author*) Nothing to Disclose
Masanobu Uemura, Osakasayama, Japan (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Kudo, Osaka, Japan (*Abstract Co-Author*) Consultant, BTG International Ltd Consultant, Bayer AG Consultant, Guerbet SA Consultant, Nordion, Inc Consultant, Koninklijke Philips NV Consultant, Jennerex Biotherapeutics, Inc Research Grant, BTG International Ltd Research Grant, Bayer AG Research Grant, Koninklijke Philips NV Research Grant, Nordion, Inc Research Grant, Threshold Pharmaceuticals, Inc Research Grant, Guerbet SA Founder, PreScience Labs, LLC CEO, PreScience Labs, LLC
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Hideyuki Fukui, Osakasayama, Japan (*Abstract Co-Author*) Nothing to Disclose
Norihisa Yada, Osaka-Sayama, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazunari Ishii, MD, Osakasayama, Japan (*Abstract Co-Author*) Nothing to Disclose
Teruhito Mochizuki, MD, Toon, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To validate a protocol with reduced iodine load for hepatic dynamic CT using virtual monochromatic image (VMI) with adaptive statistical iterative reconstruction (ASiR) of dual-energy CT (DECT) data.

METHOD AND MATERIALS

The institutional review board approved this study. We firstly conducted a phantom experiment to determine an optimal iodine load and ASiR level for VMI at 60keV, which is the least possible energy level for application of ASiR (protocol A). Then we conducted a clinical study in which 54 patients suspected of liver diseases underwent three-phase dynamic CT with protocol A; the other 54 patients were selected by propensity score matching out of 510 patients underwent full iodine load with single-energy CT (SECT at 120kVp) (protocol B; 50% ASiR used). We measured CT attenuation values (mean and standard deviation) of the liver parenchyma and the erector spinae muscle in all phases, the aorta in hepatic arterial phase, and the portal vein in portal venous phase. The mean CT attenuation values and contrast-to-noise-ratio (CNR) of each structure, and image noise were compared between the two protocols, by using equivalence test at an A level of .05. We also performed visual analyses including image contrast, Image noise, streak artifacts and overall image quality, each using a 4-point score, which were assessed by Mann-Whitney test.

RESULTS

In the phantom study, 420mgI/kg iodine load and image reconstruction at 60 keV with 50% ASiR was considered adequate for protocol A. The clinical study showed equivalency in any of the CT attenuation values, image noise in all phases, and CNR for the liver parenchyma between the two protocols. CNR for the aorta and the portal vein were not equivalent; those in protocol A tended to be larger than those in protocol B. The significant difference between the two protocols was not detected in any of the visual analyses (P> .05).

CONCLUSION

VMIs at 60keV with 50% ASiR allow 30% reduction of iodine load while maintaining comparable image quality to full iodine load with the SECT imaging.

CLINICAL RELEVANCE/APPLICATION

In DECT imaging, VMI reconstruction at lower keV can allow reduction in iodine dose, which can contribute the reduction of risk of contrast-induced nephropathy.

GI386-SD-THA3 Diffusion-weighted MR Enterography for Treatment Monitoring after Medical Therapy in Crohn's Disease: A Prospective Intra-individual Longitudinal Study

Station #3

Participants
Jimi Huh, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Seong Ho Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyung Jo Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Nieun Seo, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Bo-Kyeong Kang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yedaun Lee, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Despite several cross-sectional studies that showed correlations between diffusion-weighted imaging (DWI) parameters and bowel inflammatory severity in Crohn's disease (CD), longitudinal studies directly comparing pre- and post-treatment states have not been reported. This prospective study is to determine the accuracy of DWI for monitoring bowel inflammation of CD after medical therapy.

METHOD AND MATERIALS

Thirteen patients with ileocolic CD prospectively underwent MR enterography (MRE) and colonoscopy within 1 week's time both before and after 1 to 2 years of medical therapy (with immunosuppressive agents in most patients). MRE included contrast-enhanced imaging (CEMRE) and DWI (b =900 s/mm²). A total of 31 index lesions, defined as a continuous area with the most severe inflammation in each anatomical bowel segment visible on both DWI and CEMRE, including 10 terminal ileal, 10 right colic, 2 transverse, 5 descending, 3 sigmoid, and 1 rectal lesions were followed. Changes in inflammation of the index lesions was visually assessed as worsened, stable, decreased, and complete remission (CR) independently using DWI and CEMRE. Apparent diffusion coefficient (ADC) values were measured. The data were analyzed with endoscopic findings as the reference standard.

RESULTS

Eighteen and 13 lesions achieved partial improvement and CR, respectively, at the endoscopic follow-up. DWI and CEMRE correctly identified improved (by any degree) inflammation in 81% (25/31) and 90% (28/31) lesions, respectively (P =.179 by GEE). They distinguished CR from partial improvement with the sensitivity of 85% (11/13) and 77% (10/13), respectively, and the specificity of 61% (11/18) and 67% (12/18), respectively, with no significant difference (P =1 by GEE). DWI and CEMRE readings concurred for improved inflammation in 77% (24/31) lesions and for CR in 81% (25/31) lesions. ADC values significantly increased after treatment (1.56±0.34 [x(1/10)³ mm²/s] vs. 2.12±0.64, P <0.001 by GLMM; actual increase in 27/31 lesions). The ROC curve area for distinguishing CR from partial improvement was 0.812 for post-therapy ADC and 0.744 for ADC change.

CONCLUSION

DWI could demonstrate improved inflammation after medical therapy and distinguish CR from partial improvement fairly accurately in CD.

CLINICAL RELEVANCE/APPLICATION

DWI can be an option for treatment monitoring of CD, in particular, when a contrast-enhanced examination is difficult to perform.

GI387-SD-THA4 Accuracy of MR-determined Hepatic Proton Density Fat Fraction (PDFF) and Histology-determined Fat Fraction for Estimation of Triglyceride Concentration in Twenty-one Ex-vivo Human Livers

Station #4

Participants
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Elhamy R. Heba, MBBCh, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Tanya Wolfson, MS, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Amol Shah, MD, La Jolla, CA (*Abstract Co-Author*) Nothing to Disclose
Gavin Hamilton, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Michael Peterson, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Lisa Clark, MPH, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Anthony Gamst, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Michael S. Middleton, MD, PhD, San Diego, CA (*Abstract Co-Author*) Consultant, Allergan, Inc Institutional research contract, Bayer AG Institutional research contract, sanofi-aventis Group Institutional research contract, Isis Pharmaceuticals, Inc Institutional research contract, Johnson & Johnson Institutional research contract, Synageva BioPharma Corporation Institutional research contract, Takeda Pharmaceutical Company Limited Stockholder, General Electric Company Stockholder, Pfizer Inc Institutional research contract, Pfizer Inc
Jeffrey B. Schwimmer, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Claude B. Sirlin, MD, San Diego, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;

PURPOSE

To assess the accuracy of magnetic resonance (MR)-determined hepatic proton density fat fraction (PDFF) and histology-determined fat fraction (histology-FF) for estimation of triglyceride concentration ([TG]) in ex-vivo human liver using biochemically-determined liver [TG] as a reference standard.

METHOD AND MATERIALS

Twenty-one postmortem whole livers were obtained from the National Disease Research Interchange and scanned at 3T using a cardiac coil within 48 hours of death. Donors (31 - 67 [mean 55 ± 11] yrs; 11 female) had or were at risk for hepatic steatosis based on medical history. Five 1.5-cm radius circular locations were selected in each specimen. Unenhanced two-dimensional axial spoiled gradient-recalled-echo images of the specimens were obtained. Using published MR techniques, MR spectroscopy (MRS), magnitude-based MRI (M-MRI), and complex-based MRI (C-MRI) hepatic PDFF estimations were computed at each location. Six biopsies were also obtained at each location (thirty biopsies per liver): three for histologic analysis to determine histology-FF and three for biochemical analysis to determine [TG]. The average of [TG] at each location was used as a reference standard for that location. Regression analyses were performed for [TG] versus MRS-PDFF, M-MRI-PDFF, C-MRI-PDFF, and histology-FF. R^2's with bootstrap-based bias-corrected, accelerated 95% confidence intervals were computed and served as metrics of accuracy. Pairwise comparisons of the R^2's were performed using bootstrap-based tests to adjust for within-liver dependence.

RESULTS

MRS-PDFF, M-MRI-PDFF, C-MRI-PDFF, histology-FF and [TG] of liver specimens ranged from 0.1 - 23.5%, -7.4 - 26.3%, 1.3 - 21.2%, 0 - 70 %, and 1.2 - 31.3 mg/100g respectively. The R^2's from the regression models between [TG] and MRS-PDFF, M-MRI-PDFF, C-MRI-PDFF, and histology-FF were 0.95 (0.86 - 0.98), 0.90 (0.62 - 0.97), 0.92 (0.55 - 0.99), and 0.92 (0.78 - 0.94) respectively. The differences between R^2's were not statistically significant (all $p>0.05$).

CONCLUSION

In this ex-vivo study, using biochemically-determined liver [TG] as a reference standard, MR-determined hepatic PDFF and histology were accurate for estimation of hepatic [TG].

CLINICAL RELEVANCE/APPLICATION

This study helps to validate the MR-determined hepatic PDFF as an accurate biomarker of hepatic steatosis.

GI388-SD-THA5 Noninvasive Liver Iron Content Grading by MR R2* Relaxation: Initial Results in Patients Suspected of Liver Iron-overload

Station #5

Participants
Xianfu Luo, Yangzhou, China (*Presenter*) Nothing to Disclose
Jingtao Wu, Yangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively assess the feasibility of magnetic resonance (MR) R2* relaxation for evaluation of liver iron content (LIC) in patients suspected of having liver iron-overload.

METHOD AND MATERIALS

Fifty-six subjects suspected of liver iron overload (serum ferritin concentrations > 500 μg/L) were enrolled in our study. All subjects examined with MR liver scanning. Thirty-four of 56 subjects undergone FerriScan scanning. Hepatic relaxation parameter including R2* and R2 were acquired with gradient-echo sequences and FerriScan, respectively. Correlations between MR measurements were analyzed. The liver iron content (LIC) obtained from FerriScan was set as a reference standard. Based on LIC scale thresholds used in iron chelation therapy, receiver operating characteristic (ROC) analysis was used to calculate the cutoff values and corresponding sensitivity and specificity.

RESULTS

Hepatic R2* value was 346.90 Hz ± 382.89 and range from 26.47 Hz to1,503.10 Hz. MR relaxation R2* was significantly correlated with FerriScan determined LIC. (with correlation coefficients 0.974,95% confidence interval 0.947-0.987, $P < 0.0001$). To discriminate among different LIC thresholds of 1.8, 3.2, 7.0, and 15.0 mg Fe/g, the corresponding optimal cutoff values were 55.11, 86.25, 144.52, and 375.13 Hz, respectively. The area under the receiver operating characteristic curves (AUCs) for R2* kept above 0.99 for all LIC thresholds.

CONCLUSION

MR relaxation R2* value was highly correlated with liver iron content determined by FerriScan. It could accurately quantify and stratify liver iron accumulation in patient.

CLINICAL RELEVANCE/APPLICATION

MR relaxation R2* value might be useful for guiding iron chelation therapy and monitoring the effects of chelation therapy.

GI390-SD-THA7 Quantitative Evaluation of the Potential Replacement of Abdominal CT-perfusion Measurements by Single-acquisition Dual-energy Iodine Concentration Maps

Station #7

Participants
Stephan Skornitzke, Heidelberg, Germany (*Presenter*) Nothing to Disclose
Franziska Fritz, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Mayer, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Marco Koell, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Jens Hansen, DIPLPHYS, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Gregor Pahn, DIPLPHYS, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Miriam Klauss, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Lars Grenacher, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Hans-Ulrich Kauczor, MD, Heidelberg, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Bayer AG; Speakers Bureau, Boehringer Ingelheim GmbH; Speakers Bureau, Siemens AG; Speakers Bureau, Novartis AG; Speakers Bureau, GlaxoSmithKline plc ; Speakers Bureau, Almirall SA
Wolfram Stiller, PhD, DIPLPHYS, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Evaluation of the potential replacement of conventional abdominal CT-perfusion measurements in pancreatic carcinoma by quantitative single-acquisition dual-energy (DE) iodine concentration maps acquired at the peak of the tissue-enhancement curve (tmax), and assessment of an associated reduction in radiation dose.

METHOD AND MATERIALS

For 18 patients with histologically verified pancreatic carcinoma CT-perfusion sequences were dynamically acquired in DE mode at tube potentials of 80kVp and 140kVp with tin filtration over 51 seconds (34 acquisitions; 1 every 1.5s) using dual-source CT (Somatom Definition Flash; Siemens Healthcare, Forchheim, Germany). After deformable motion-correction perfusion maps were calculated from the 80kVp datasets using software developed in-house implementing the Maximum-slope model. For each patient, one quantitative iodine concentration map was calculated from the DECT acquisition at tmax by means of three-material decomposition. Regions of interest (ROIs) were placed at identical locations for both functional images inside both carcinoma and healthy pancreatic tissue, and correlation between perfusion values and iodine concentrations measured in the ROIs was calculated.

RESULTS

tmax occurred on average 35.9±4.2s after starting contrast agent injection. Average perfusion values differed significantly between healthy tissue and carcinoma (89.7±28.6ml/100ml/min vs. 40.9±21.8ml/100ml/min; $p<0.0001$), as well as average iodine concentrations measured at tmax (2.3±0.8mg/ml vs. 1.3±0.6mg/ml, $p<0.0001$). Correlation between measured perfusion values and iodine concentrations was high (0.81) at tmax. Average reduction in effective radiation dose was 95% when comparing a single DECT acquisition at tmax to the 80kVp CT-perfusion sequence (0.18mSv vs. 3.87mSv).

CONCLUSION

Correlation between quantitative iodine concentration and conventional abdominal CT-perfusion measurements was high, and a statistically significant difference in measured iodine concentrations was found between healthy pancreatic tissue and carcinoma. These results indicate that iodine maps acquired at tmax might be suited for replacing abdominal CT-perfusion measurements, allowing for a large reduction in patient dose.

CLINICAL RELEVANCE/APPLICATION

Abdominal CT-perfusion measurements might be replaced by single-acquisition quantitative DECT iodine concentration maps that provide similar functional information at lower radiation exposure.

GI163-ED-THA8 Pancreatic Cysts: Pathological Classification, MRI Characteristics and Differential Diagnosis

Station #8

Participants
Pardeep K. Mittal, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
Lauren F. Alexander, MD, Atlanta, GA (*Abstract Co-Author*) Spouse, Stockholder, Abbott Laboratories; Spouse, Stockholder, AbbVie Inc; Spouse, Stockholder, General Electric Company
Peter A. Harri, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Juan C. Camacho, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Courtney A. Coursey Moreno, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

• To demonstrate MRI characteristics and pathological classification of pancreatic cysts .• To educate participants about the classic MRI findings of cystic pancreatic lesions and their mimics

TABLE OF CONTENTS/OUTLINE

• Review the pathophysiology of cystic pancreatic masses.• Differential diagnosis of cystic lesions based on the pathological classification as well as typical patient profile and pertinent imaging patterns, such as location, calcification, mural nodularity, and

communication with the pancreatic ducts.• Illustrate MRI features of various cystic pancreatic masses, including serous cystadenoma, mucinous cystic pancreatic tumor (adenoma and carcinoma), IPMN, adenocarcinoma, solid pseudopapillary neoplasm and cystic neuroendocrine tumor.• Demonstrate lesions that can mimic primary pancreatic cystic masses, such as pseudocysts, lymphoepithelial cyst, squamoid cyst and intraductal tubular carcinoma etc. SUMMARYMany cystic pancreatic masses are found incidentally on abdominal imaging. Distinguishing magnetic resonance imaging characteristics and the patient history enable radiologists to narrow the differential diagnosis of pancreatic cystic lesions without exposing patients to ionizing radiation.

GI240-ED-THA9 Pictorial Essay of Sacral and Presacral Lesions

Station #9

Participants
Peter D. Filev, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Courtney A. Coursey Moreno, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Pardeep K. Mittal, MD, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Timothy W. Ng, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

TEACHING POINTS

Describe the clinical spectrum of common and uncommon lesions arising from the presacral and scaral space. Identify imaging features (CT and primarily MR) to differentiate the described lesions. Develop a differential diagnosis for sacral and presacral lesions.

TABLE OF CONTENTS/OUTLINE

Outline of sacral and prescral lesions organized into categories by tissue of origin: developmental, osseous, hematologic, neurogenic, infectious/inflammatory, and miscellaneous.Dedicated focus on several important lesions from each of the above categories which will include: a brief overview of epidemiology, clinical relevance, anatomy; MRI and/or CT imaging characteristics; and differential considerations.A brief list of examples (one example from each category): chordoma (developmental), neurofibroma (neurogenic), osteoblastoma (osseous), sacroilitis (infectious/inflammatory), chloroma (hematologic), retroperitoneal fibromatosis (miscellaneous).

GI320-ED-THA10 Hepatic Steatosis: The Fickle Finger of Fat

Station #10

Participants
Maryam Rezvani, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose
Marc Tubay, MD, Pueblo, CO (*Abstract Co-Author*) Royalties, Reed Elsevier
Akram M. Shaaban, MBBCh, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Olpin, MD, Salt Lake City, UT (*Abstract Co-Author*) Nothing to Disclose

TEACHING POINTS

1. Recognize the patterns of fatty liver disease on CT and MRI, as well as the underlying pathophysiology of each.2. Understand that focal fatty change can mimic, obscure or indicate metastatic disease.3. Non-invasively differentiate focal fatty change from metastatic disease thereby avoiding unnecessary biopsies, incorrect cancer staging and undue anxiety due to inconclusive imaging studies.

TABLE OF CONTENTS/OUTLINE

1) Imaging diagnosis of hepatic steatosis:a) Ultrasoundb) Computed tomographyc) Magnetic resonance imaging2) Patterns of fatty liver disease:a) Diffuse b) Lobar/segmentalc) Nonsegmentald) Subcapsulare) Perivascularf) Peritumoralg) Nodular

Honored Educators

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Maryam Rezvani, MD - 2015 Honored Educator
Akram M. Shaaban, MBBCh - 2015 Honored Educator

GI026-EB-THA Diffuse and Multifocal Pancreatic Diseases: Main Morphologic and Functional Imaging Features

Hardcopy Backboard

Participants
Pietro A. Bonaffini, MD, Monza, Italy (*Presenter*) Nothing to Disclose
Manuel Patino, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Dushyant V. Sahani, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Consultant, Allena Pharmaceuticals, Inc

TEACHING POINTS

Pancreatic diseases present not only as focal lesions but also with a diffuse involvement or as multiple localizations widespread within the entire gland. They are often incidentally discovered in patients with no specific symptoms or without pancreatic dysfunction and tend to demonstrate imaging features that frequently overlap each other. The main teaching points of this exhibit are: The diagnosis and the management of pathologies with a diffuse involvement of the pancreas mostly rely on the combined evaluation of clinical history, laboratory data and imaging findings (both morphologic and functional techniques). The knowledge of role, contributions and limitations of available imaging techniques in this setting remains mandatory for radiologists and proper patient overview.

TABLE OF CONTENTS/OUTLINE

To discuss advantages and pitfalls of morphologic (ultrasound/US, endoscopic US/EUS, multidetector computed tomography/MDCT, magnetic resonance imaging/MRI) and functional (i.e. positron emission tomography/PET) imaging techniques. To briefly report incidence, risk factors, symptoms and laboratory parameters of diffuse pancreatic diseases. To present the main imaging features of diffuse/multifocal pancreatic involvement: inflammatory and autoimmune diseases, infections, neoplastic and infiltrative disorders.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Dushyant V. Sahani, MD - 2012 Honored Educator
Dushyant V. Sahani, MD - 2015 Honored Educator

NRS-THA

Neuroradiology Thursday Poster Discussions

Thursday, Dec. 3 12:15PM - 12:45PM Location: NR Community, Learning Center

NR

AMA PRA Category 1 Credit ™: .50

Participants
Pratik Mukherjee, MD, PhD, San Francisco, CA (*Moderator*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company;

Sub-Events

NR358-SD-THA1 Pretreatment Apparent Diffusion Coefficient Values in Predicting Induction Chemotherapy Response in Locally Advanced Nasopharyngeal Carcinoma

Station #1

Participants
Guo Wei, PhD, BeiJing, China (*Presenter*) Nothing to Disclose
Luo Dehong, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Lin Meng, BeiJing, China (*Abstract Co-Author*) Nothing to Disclose
Li Lin, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhao Yanfeng, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yang Liang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhou Chunwu, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study was to predict response to induction chemotherapy in patients with locally advanced nasopharyngeal carcinoma (NPC) by pretreatment apparent diffusion coefficient (ADC) values.

METHOD AND MATERIALS

35 patients with locally advanced NPC underwent ADC studies prior to 2-weeks induction chemotherapy. The patients were divided into CR (complete response) group,PR (partial response) group and SD (stable disease) group according to the tumor response at the end of treatment. The responders include CR and PR group. The patients were divided into non-keratinizing undifferentiated carcinoma group and non-keratinizing differentiated carcinoma group according to the pathological type. The patients were divided into T2 group,T3 group and T4 group according to the T-staging (UICC 2010). Independent-Samples T test was used to compare the pretreatment ADC parameters between each groups .

RESULTS

The average pretreatment ADC values of CR, PR, responders and SD group were 0.70±0.06×10-3 mm2 /s, 0.72±0.04×10-3 mm2 /s,0.71±0.04×10-3 mm2 /s and 0.85±0.02×10-3 mm2 /s. The average pretreatment ADC value of the SD group was significantly higher than the PR group and responders . The average pretreatment ADC value of children-adolescents and adults group were 0.73±0.07×10-3 mm2 /s and 0.75±0.07×10-3 mm2 /s, which showed no significant differences. The average pretreatment ADC value of non-keratinizing undifferentiated carcinoma and non-keratinizing differentiated carcinoma group were 0.76±0.08×10-3 mm2 /s and 0.74±0.06×10-3 mm2 /s, which showed no significant differences. The average pretreatment ADC values of T2,T3 and T4 group were 0.78±0.05×10-3 mm2 /s,0.77±0.07×10-3 mm2 /s and 0.75±0.08×10-3 mm2 /s. Although there were no significant differences between T2,T3 and T4 group, a trend towards lower ADC was observed with increasing tumour T-staging.

CONCLUSION

Pretreatment ADC value is a valuable quantitative parameter used for predicting induction chemotherapy response in locally advanced nasopharyngeal carcinoma.

CLINICAL RELEVANCE/APPLICATION

ADC value is a valuable parameter used for predicting induction chemotherapy response in locally advanced nasopharyngeal carcinoma

NR359-SD-THA2 Effect of Single-energy Projection-based Metal-artifact Reduction Algorithm on the Computed Tomography Detection of Oral Cavity Cancers

Station #2

Participants
Kenichiro Hirata, Kumamoto, Japan (*Presenter*) Nothing to Disclose
Daisuke Utsunomiya, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masafumi Kidoh, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Seitaro Oda, MD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Yamashita, MD, Kumamoto, Japan (*Abstract Co-Author*) Consultant, DAIICHI SANKYO Group
Yoshinori Funama, PhD, Kumamoto, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

We investigated the effect of the single-energy projection-based metallic artifact reduction (SEMAR) technique on tumor visualization and staging in patients with oral cavity cancers.

METHOD AND MATERIALS

Contrast-enhanced CT was performed on 40 patients with dental metalwork. Of these, 18 patients had pathologically confirmed

Contrast-enhanced CT was performed on 40 patients with dental metalwork. Of these, 18 patients had pathologically confirmed cancer. CT attenuation and noise in the oral cavity were compared between the conventional and SEMAR images. Two radiologists visually graded the diagnostic confidence on a 5-point scale from 1 (definitely absent) to 5 (definitely present). The SEMAR value was assessed in a receiver operating characteristic (ROC) curve analysis.

RESULTS

SEMAR image artifact was significantly lower than the conventional image (38.4±18.0 HU vs. 187.7±162.7 HU; P<0.01). Reviewers-1 and -2 detected 10 and 7 more lesions with SEMAR, respectively. Areas under the curve for conventional and SEMAR reconstruction were 0.761 and 0.942, respectively, for reviewer-1 and 0.701 and 0.864, respectively, for reviewer-2.

CONCLUSION

SEMAR reconstruction significantly improved oral cavity cancer visualization and the diagnostic confidence level by removing artifacts and noise from dental metalwork.

CLINICAL RELEVANCE/APPLICATION

SEMAR algorithm can reduce metal artifact due to dental metalwork and improve diagnostic performance of oral cavity cancer.

NR360-SD-THA3 Value of Diffusion Tensor Imaging in Differentiating Malignant from Benign Parotid Gland Tumors

Station #3

Participants
Koji Takumi, Kagoshima, Japan (*Presenter*) Nothing to Disclose
Yoshihiko Fukukura, MD, PhD, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroto Hakamada, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Junichi Ideue, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Yuichi Kumagae, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Aya Umanodan, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Kiyohisa Kamimura, MD, PhD, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Masanori Nakajo, MD, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Yoshiura, MD, PhD, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether diffusion tensor imaging (DTI) can help differentiate malignant from benign parotid gland tumors.

METHOD AND MATERIALS

The study population consisted of 52 patients with 58 parotid tumors (24 Warthin tumor, 19 pleomorphic adenomas, 6 other benign tumors, and 9 malignant tumors). Single-shot echo planar DTI was performed in the transverse plane with diffusion gradients along 30 noncollinear directions (b = 1000 sec/mm2) at 3T. Apparent diffusion coefficient (ADC) and fractional anisotropy (FA) in each parotid lesion were measured within an ovoid region of interest (ROI) drawn as large as possible. Care was taken to avoid vessels and cystic parts within the tumors. The ADC and FA values were compared between benign and malignant tumors by using the Mann-Whitney U test. The receiver-operating characteristic (ROC) analysis was used to assess the ability of the ADC and FA values to differentiate malignant from benign tumors. Sensitivity and specificity were calculated by using a threshold criterion that would maximize the average of sensitivity and specificity.

RESULTS

Mean ADC and FA values were 0.85 ± 0.24 × 10^{-3} mm^2/s and 0.30 ± 0.12 in malignant tumors, and 1.19 ± 0.50 ×10^{-3} mm^2/s and 0.17 ± 0.05 in benign tumors, respectively. ADC values showed no significant difference between malignant and benign tumors (p=.056). FA values of malignant tumors were significantly higher than those of benign tumors (p<.001). The area under the ROC curve of FA was significantly higher than that of ADC (0.891 vs. 0.702, p<.005). ADC at the cut-off value of 0.95 and FA at the cut-off value of 0.23 for diagnosing malignant tumors had sensitivity of 88.9 and 77.8%, and specificity of 46.9 and 87.8%, respectively.

CONCLUSION

Diffusion tensor imaging, especially FA, can help differentiate malignant from benign parotid gland tumors.

CLINICAL RELEVANCE/APPLICATION

Diffusion tensor imaging can improve diagnostic performance in the characterization of parotid tumors.

NR361-SD-THA4 Spectroscopic Imaging with High Spatial Resolution and Ultra Short TE* at 3 and 7 Tesla - A Comparison

Station #4

Participants
Stephan Gruber, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Eva Heckova, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Lenka Minarikova, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Bernhard Strasser, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Gilbert Hangel, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Siegfried Trattnig, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Wolfgang Bogner, MSc, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic resonance spectroscopic imaging (MRSI) of the brain allows to map several metabolites and provide complementary metabolic information to the conventional MR imaging methods. High field systems (e.g. 7 T) offer increased SNR and spectral resolution which can be transformed to the increased spatial resolution or better characterization of overlapping metabolites (e.g. NAA and NAAG). In addition FID-CSI with ultra short acquisition delays (TE*) adds additional SNR, in particular for J-coupled

resonances. We compared MRSI in six volunteers using a FID-CSI sequence with high spatial resolution und ultra-short TE* of 1.5 ms at 3 and 7 Tesla.

METHOD AND MATERIALS

Six healthy volunteers (5m/1f; age: 28.3±2.4) were measured at 3T and 7T (3T Trio, 7T Magnetom, Siemens, Erlangen, Germany) using a 32-channel head coil. A FID-CSI sequence with 64×64 phase encoding steps, FOV=220×220mm2, TR=600ms, TE*=1.5ms, in plane voxel size 3.4×3.4 mm2, and a slice thickness of 10 mm was used (scan time 30min). Spectra were processed using LCModel. Metabolic maps were created using Matlab and MINC (Minc tools; v2.0; McConnell Brain Imaging Center,Montreal, Canada). SNRs were computed using the pseudo-replica method in time domain.

RESULTS

Satisfactory data quality was achieved from all subjects measured at 3 T and 7 T. SNR was 2.8 times higher at 7 T compared to 3 T. CRLBs were below 10% for all metabolites measured at 7 T including glutamate and glutamine. Compared to techniques using pre-localization techniques (e.g. STEAM, PRESS) FID-CSI allows to acquire whole slices. The high matrix size and hamming filtering prevented fat contamination from the sculp. With the high in-plane resolution of 3.4×3.4 mm2 metabolic maps showing anatomical details could be created.

CONCLUSION

This study revealed 2.8 times higher SNR and decreased CRLBs of brain metabolites measured with MRSI at 7 T compared to that measured at 3T. We could compute metabolic maps with anatomical details at both field strengths. Improved spectral resolution allowed NAAG separation from NAA at 7 T but not at 3 T. In addition the ultra-short acquisition delay allows to quantify J-coupled metabolites even measured with a high spatial resultion.

CLINICAL RELEVANCE/APPLICATION

MRSI at 7T can be performed with high spatial resolution and ultrashort TE*. This allows the quantification of metabolites such as NAAG, glutamate, glutamine and myo-Inositol with low CRLBs.

NR363-SD-THA6 Diagnostic Value of Single-source Dual-energy Spectral CT for Papillary Thyroid Microcarcinomas

Station #6

Participants
Lin Li, MD, Beijing, China (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the detection ability and diagnostic accuracy of spectral CT for papillary thyroid microcarcinomas (PTMCs), in comparison with high frequency ultrasound.

METHOD AND MATERIALS

31 patients with suspected PTMC underwent contrast-enhanced neck CT with dual-energy spectral CT mode. The CT scanning parameters for the fast kVp-switching between 80 and 140 kVp were: tube current fixed at 260mA; helical pitch 0.984 and rotation speed 0.7s/r. CT images were divided into 2 groups: 140 kVp polychromatic images and monochromatic images. Two radiologists analysed all CT images. Ultrasonography of thyroid was performed with a 7- to 12-MHz linear array transducer by an experienced radiologist. The number, size, shape, location, boundaries, density (internal echo), calcification of nodules in the gland and cervical lymph nodes were observed and recorded. The detection ability and diagnostic accuracy for the primary lesion and metastatic cervical lymph node of the two methods were determined by comparing the results to the pathology reports after surgery. Statistical analyses were done using SPSS 19.0.

RESULTS

46 lesions in 31 patients were confirmed PTMC by pathology. The mean size of lesions was 0.69±0.04 cm. The optimal energy level for obtaining the best lesion-to-thyroid CNR in spectral CT was 65.83±2.01keV. The polychromatic images, monochromatic images and high frequency ultrasound showed 40, 44, and 45 lesions with detection rates of 87.0%, 95.7% and 97.8% respectively. There was no significant differences in the diagnostic performance by using the two diagnostic methods to display the shape, boundaries, density (echo) and microcalcifications (P>0.05). 25 patients (80.6%) were confirmed with lymph node metastasis involved 82 levels in total. Preoperative CT and ultrasound diagnosed lymph node metastasis in 67 and 63 levels respectively. The sensitivity and specificity of ultrasound and spectral CT to diagnose cervical lymph node metastasis were (76.8% and 99%) and (81.7% and 99.3%) respectively. There was no significant difference in the diagnostic accuracy obtained by spectral CT and ultrasound (p=0.125).

CONCLUSION

Spectral CT images were superior to polychromatic images and similar to frequency ultrasound in the detection ability and diagnostic accuracy.

CLINICAL RELEVANCE/APPLICATION

Single-source dual-energy computed tomography imaging is helpful in the detection and diagnosis the PTMCs.

BRS-THB

Breast Thursday Poster Discussions

Thursday, Dec. 3 12:45PM - 1:15PM Location: BR Community, Learning Center

BR

AMA PRA Category 1 Credit ™: .50

Participants
Sarah M. Friedewald, MD, Chicago, IL (*Moderator*) Consultant, Hologic, Inc; Research Grant, Hologic, Inc

Sub-Events

BR272-SD-THB1 Pure Architectural Distortion on Digital Breast Tomosynthesis with Histopathologic Correlation

Station #1

Participants
Jamie Hui, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Lilian Wang, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate cases of pure architectural distortion on digital breast tomosynthesis (DBT) with histopathologic correlation.

METHOD AND MATERIALS

In this institutional review board approved, HIPAA compliant single institution study, a retrospective query of digital mammograms with adjunct DBT from January 2014 to December 2014 reporting the finding of architectural distortion without associated mass was performed. DBT images were reviewed to determine lesion size, 1 view or 2 view visualization, and lesion conspicuity compared to 2D mammography. Available ultrasound (US) and MRI exams were also reviewed for presence of a corresponding abnormality. Final BIRADS assessment, biopsy pathology, surgical pathology, and patient demographics were recorded for each patient.

RESULTS

In this study, 32 cases of pure architectural distortion on DBT were identified in 31 patients. Architectural distortion was seen on 2 views (27/32) and demonstrated an US correlate (19/32) in the majority of cases. On diagnostic evaluation, 27 were assessed as BIRADS category 4 or 5, 4 as BIRADS category 3, and 1 as BIRADS category 2. Core needle biopsy or surgical excision was performed in 26 cases. Histologic findings were malignant in 13 of 26 (50%) lesions: 11/13 (85%) invasive and 2/13 (15%) DCIS. All malignancies were either pathologic nuclear grade 1 or 2. Visualization of malignant lesions was either equivalent (2/13) or better visualized (11/13) by DBT compared to 2D mammography. An US correlate was seen in 11 of 13 (85%) malignant lesions. Four of the 13 benign lesions were radial scar or complex sclerosing lesion, all better visualized by DBT. No definite correlation was identified between DBT lesion size and presence of an US correlate or between presence of an US correlate and nuclear grade. Of invasive carcinomas, DBT overestimated tumor size while ultrasound, when measurement included the echogenic rim, most accurately predicated pathologic tumor size.

CONCLUSION

Architectural distortion without associated mass on DBT is malignant in 50% of cases, all of low or intermediate nuclear grade. Improved visualization of distortion on DBT may favor detection of low grade malignancies associated with desmoplastic reaction.

CLINICAL RELEVANCE/APPLICATION

DBT enhances the visualization of pure architectural distortion and detection of low grade malignancies.

BR273-SD-THB2 Breast MRI as a Problem-solving Study in the Evaluation of Microcalcifications; Is It Worth Performing?

Station #2

Participants
Akiko Shimauchi, MD, Sendai, Japan (*Presenter*) Nothing to Disclose
Youichi Machida, MD, PhD, Chuo-City, Japan (*Abstract Co-Author*) Nothing to Disclose
Mitsuhiro Tozaki, MD, PhD, Kamogawa, Japan (*Abstract Co-Author*) Nothing to Disclose
Ichiro Maeda, Kawasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Naoko Mori, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose
Kei Takase, MD, PhD, Sendai, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate utility of problem-solving breast MRI for calcifications found at mammography (MG).

METHOD AND MATERIALS

A HIPPA compliant IRB approved retrospective review of our database from 1/2010 to 12/2011 identified 173 breast MRI studies performed for evaluation of mammographic calcifications before percutaneous biopsy. All malignant lesions were proven by biopsy and women who did not undergo tissue sampling were followed up for at least 2 years.

RESULTS

Of the 173 calcifications, final assessments were positive (BI-RADS category(C) 4 or 5) for 77 cases and negative (C2 or 3) for 96 cases by MG, positive (C4 or 5) for 44 cases and negative (C1, 2, or 3) for 129 cases by MRI. 38 cases (22%) were proven to be malignant (27 ductal carcinoma in situ (DCIS), 8 invasive cancers, 3 DCIS with microinvasion) and 135 (78%) were benign. Sensitivity, specificity, positive predictive value and negative predictive value were 86.8% (33/38), 67.4% (44/135), 42.9% (33/77)

and 94.8% (5/96) for MG, and 86.8% (33/38), 91.9% (124/135), 75.0 (33/44) and 96.1% (124/129) for MRI. Of the 69 C4 cases (25 malignant, 44 benign), MRI led to correct benign diagnoses in 39 cases (89%, 39/44). Of the 88 C3 cases (5 malignant, 83 benign), MRI upgraded 11 cases to C4, five of which were proven to be DCIS (5.6%, 5/88) (3 intermediate grade, 2 high-grade), and the rest were benign (6.8%, 6/88). MRI depicted 8 additional findings at different locations from the calcifications, three of which were diagnosed as cancers (1.7%, 3/173) (1 IDC, 1 ILC with IDC, and 1 low-grade DCIS), and the rest were benign (4.6%, 5/173). The false negative rate of MRI was 13.2% (5/38) due to 1 non-enhancing low-grade DCIS, 1 low- grade and 1 intermediate- grade DCIS likely obscured by moderately or markedly enhancing parenchyma, and 1 low- grade and 1 intermediate-grade DCIS seen as benign-appearing linear NME that were judged as C3 by MRI reading. All of the MR false-negative malignancies were judged as C4 by MG.

CONCLUSION

MRI may be a useful tool as a non-invasive work-up of mammographic calcifications; MRI would have avoided 89% of benign biopsies, helped correctly upgrade C3 calcifications to C4 in 5 women, and identified 2 additional invasive carcinomas in our series. All MRI-negative carcinomas were non high-grade DCIS.

CLINICAL RELEVANCE/APPLICATION

MRI could help confirm the presence and absence of breast carcinoma, for women with mammographic calcifications.

BR274-SD-THB3 Tomosynthesis Increases the Use of BI-RADS Category 3

Station #3

Participants
Allison Lippert, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Heather R. Peppard, MD, Charlottesville, VA (*Abstract Co-Author*) Consultant, Siemens AG; Research Grant, Hologic, Inc
Carrie M. Rochman, MD, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Jennifer A. Harvey, MD, Charlottesville, VA (*Abstract Co-Author*) Researcher, Hologic, Inc; Researcher, VuCOMP, Inc; Researcher, Matakina Technology Limited; Shareholder, Matakina Technology Limited; Shareholder, Hologic, Inc
James Patrie, MS, Charlottesville, VA (*Abstract Co-Author*) Nothing to Disclose
Brandi T. Nicholson, MD, Charlottesville, VA (*Presenter*) Consultant, Siemens AG

PURPOSE

Tomosynthesis (DBT) improves sensitivity and specificity of screening mammograms (sMG). This study assessed the impact of DBT on the rate of Breast Imaging Reporting and Data System (BI-RADS) category 3 (BR3) after recall for BI-RADS category 0 (BR0) sMG.

METHOD AND MATERIALS

Retrospective, HIPAA-compliant, and IRB approved. Women, age 18 and older, were included in the study if they had a BR0 sMG from April 1, 2009 - March 27, 2015 and were given a BR3 at diagnostic (Dx) evaluation. Women evaluated for axillary adenopathy were excluded. Patients were divided into three groups based on the date of the sMG and the use of DBT. sMG from April 1, 2009 - March 31, 2012 were 'pre-DBT'. sMG from April 1, 2012 - March 27, 2015 without DBT were "no-DBT" and with DBT were 'yes-DBT". The electronic medical record was used to obtain the total number of sMG, BR0 sMG, BR3 after recall, finding type, use or not of DBT, use or not of ultrasound (US), and patient's age and breast density. The Kruskal Wallis and Pearson's Chi-Square Tests were used.

RESULTS

A total of 89,010 sMG were performed from April 1, 2009 - March 27, 2015 with 284 patients and 299 lesions meeting inclusion criteria with 17 lesions in 17 patients excluded for axillary adenopathy. For BR0 lesions, in the "pre-DBT" group (n=6523), 1.3% (n=87) (95% CI: [1.1, 1.6%]) became BR3, in the "no-DBT" group (n=7359), 1.9% (n=141) (95% CI: [1.6, 2.3%]) became BR3, and in the "yes-DBT" group (n=385), 10.1% (n=39) (95% CI: [7.3, 13.6%]) became BR3. The odds that a BR0 sMG lesion became BR3 at Dx was 1.45 times greater (95% CI: [1.11, 1.89]) for "no-DBT" than for "pre-DBT" (p=0.007), 8.33 times greater (95% CI: [5.55, 12.50]) for "yes-DBT" than for "pre-DBT" (p<0.001), and 5.88 times greater (95% CI: [4.00, 5.00]) for "yes-DBT" than for "no-DBT" (p<0.001). The recall rates (RR) were 15.4% (95% CI: [15.2, 15.9%]) for "pre-DBT", 16.8% (95% CI: [16.4, 17.2%]) for "no-DBT" and 11.8% (95% CI: [10.7, 13.0%]) for "yes-DBT" sMG. The RR differed between three groups (p<0.001 for all). Frequency of focal asymmetry (71.4%, p=0.011) and use of US (100%, p=0.010) was highest in the "yes-DBT" group. There were no differences in age or breast density.

CONCLUSION

The use of DBT was associated with increased use of BR3 in patients who were recalled from an abnormal sMG, with decreased RR at sMG, in our practice.

CLINICAL RELEVANCE/APPLICATION

The use of DBT increased the frequency of BI-RADS category 3, highlighting an area for future investigation.

BR276-SD-THB4 Replacement of Single-view Mediolateral Oblique (MLO) Digital Mammography to Synthesized Mammography with Digital Breast Tomosynthesis (DBT) Images: Comparison of Diagnostic Perfomance and Radiation Dose with Two-view DM with or without MLO DBT

Station #4

Participants
Hyo-Jin Kang, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jung Min Chang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Eun Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joongyub Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Won Hwa Kim, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sung Ui Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Min Sun Bae, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Woo Kyung Moon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic performance and radiation dose of single-view cranio-caudal (CC) digital mammography (DM) plus mediolateral oblique (MLO) synthesized mammography (SM) with digital breast tomosyntehsis (DBT) in comparison with two-view digital mammography (DM) and two view DM with MLO DBT.

METHOD AND MATERIALS

This study was approved by our institutional review board and informed consent was obtained in all patients. Between October and November 2014, paired two-view DM and single MLO DBT images were obtained from 130 women (median age, 52.1 years). Four independent retrospective reading sessions (two-view DM, single-view CC DM with MLO SM, two-view DM with DBT, and single-view CC DM and MLO SM with DBT) were performed in random order by 3 blinded radiologists and the likelihood of malignancy (%) and BI-RADS categories of each lesion were assessed. Areas under receiver operating characteristic curve (AUC), sensitivities, and specificities were compared for each arm using histopathologic results as the reference standard. Average glandular dose (AGD) of DM and MLO DBT were calculated from DICOM headers for images obtained with automatic exposure settings.

RESULTS

Among 159 lesions in 130 patients, 27 were malignant (mean tumor size, 3.27±2.5cm). When using MLO SM and DBT instead of MLO DM, mean AGD revealed a less than 10% increase (mean±SD, 5.78 mGy±1.07). A slight higher mean AUC was noted compared to two-view DM, but it was statistically not significant (P=0.302). Mean AGD of two-view DM with MLO DBT was 8.45 mGy±1.32 per patient, which was 60% higher than that of two-view DM alone (5.3 mGy±0.6, P<0.001). Mean AUCs for two-view DM and DM+SM was 0.881 and 0.848, respectively (P=0.142). When DBT was added, the mean AUC increased to 0.914 (P=0.016) and 0.907 (P=0.073), and sensitivities increased to 82.7%, and 81.5%, respectively (all P<0.009), albeit with minimal specificity increment (P>0.05).

CONCLUSION

Combined use of single-view CC DM and MLO SM with DBT showed similar diagnostic performance to two-view DM with minimal radiation dose increment. Two-view DM with MLO DBT showed highest diagnostic performance among all, but a significant radiation dose increment was observed.

CLINICAL RELEVANCE/APPLICATION

Diagnostic performance can be improved with the addition of MLO DBT to two-view DM. Replacement of MLO DM with SM and DBT showed a small increase in radiation dose, but no gain in diagnostic performance.

BR275-SD-THB5 Relationship of Apparent Diffusion Coefficient and Tumor Inflammatory Cell Infiltrate in Patients with Estrogen Receptor-Positive Breast Cancer

Station #5

Participants
SoHee Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Hee Jung Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hee Jin Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Gyungyub Gong, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hak Hee Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joo Hee Cha, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Young Chae, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Woo Jung Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the relationship of apparent diffusion coefficient (ADC) and tumor inflammatory cell infiltrate as prognostic predictor in patients with estrogen receptor (ER)-positive breast cancer.

METHOD AND MATERIALS

Institutional review board was obtained. From July 2014 to October 2014, we reviewed 80 consecutive patients (range, 28-77 years; mean, 52 years) with ER-positive breast cancer who underwent preoperative breast MRI and definitive surgery. All patients underwent read-out segmented diffusion-weighted imaging (DWI) at 3T scanner. One radiologist drew the region-of-interest (ROI) in the tumor on DWI and obtained minimum, maximum, and mean tumor ADCs including ADC difference. On pathology, we reviewed tumor-infiltrating lymphocyte (TIL), peritumoral lymphocyte infiltrate, tumor cellularity, central fibrosis, stromal pattern, and Ki-67. Mann-whitney, Kruskal-Wallis test and spearman's correlation coefficient were used for the statistical analysis.

RESULTS

Patients with peritumoral lymphocyte infiltrate at invasive margin had higher ADC difference and minimum tumor ADC (P= .045 and .006) than those without peritumoral lymphocyte infiltrate. Tumors with high tumor cellularity and high Ki-67 had significantly lower mean ADC (0.98 vs. 0.90 x 10-3 mm2/sec, P=.017; 1.00 vs. 0.90 x 10-3 mm2/sec, P=.012). Tumors with high Ki-67 had higher ADC difference and lower minimum ADC than those with low Ki-67 (P=.029, and .018). TIL ranged from 1% to 60% and the mean was 9.4%. However, any of ADC parameter was not different between low and high TIL groups (P>.05). Mean ADC was negatively correlated with tumor cellularity (r=-0.246; P=.028) and Ki-67 (r=-0.262, P=.022). Minimum ADC was also negatively correlated with Ki-67 status (r=-0.231, P=.039).

CONCLUSION

In ER-positive breast cancer, tumor ADC parameters were significantly different according to peritumoral lymphocyte infiltrate, tumor cellularity, and Ki-67 status.

CLINICAL RELEVANCE/APPLICATION

Tumor ADC parameters obtained on DWI would reflect the prognostic information and biological features in patients with ER-positive breast cancer.

BR181-ED-THB6 Molecular Breast Imaging: An Adjunct Diagnostic Modality for Breast Cancer Evaluation

Station #6

Participants
Gaiane M. Rauch, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose
Beatriz E. Adrada, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Monica L. Huang, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Rosalind P. Candelaria, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Elsa M. Arribas, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Wei T. Yang, MD, Houston, TX (*Abstract Co-Author*) Researcher, Hologic, Inc
Kelly Cox, BS, RT, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Lumarie Santiago, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Srinivas C. Kappadath, PhD, Houston, TX (*Abstract Co-Author*) Research Grant, General Electric Company

TEACHING POINTS

Molecular Breast Imaging (MBI) generates functional images based on physiological processes within breast tissue, while conventional breast diagnostic imaging is based on anatomy and morphology. MBI can improve detection of multifocal and multicentric breast cancer, allow detection of contralateral breast cancer and may lead to change in patient's management. MBI can be used for an early assessment of tumor's response to neoadjuvant chemotherapy (NAC) and indicate if treatment should be altered or prolonged in order to achieve optimal response prior to surgery. MBI can be used for assessment of residual cancer burden after NAC and help in correct surgical planning, segmentectomy versus mastectomy.

TABLE OF CONTENTS/OUTLINE

MBI principles, physiological mechanisms, imaging techniques. MBI lexicon, diagnostic accuracy and radiation dose. Role of MBI for initial staging of the breast cancer. Use of MBI for assessment of tumor response to NAC and residual disease before surgery. Comparison of MBI with other breast imaging modalities. MBI challenges and advantages.

PS50

Thursday Plenary Session

Thursday, Dec. 3 1:30PM - 2:45PM Location: E450A

MR NM PH

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

PS50A RSNA/AAPM Symposium: PET/MR Imaging: Translation to Practice

Participants
Paul E. Kinahan, PhD, Seattle, WA (*Moderator*) Research Grant, General Electric Company; Co-founder, PET/X LLC

LEARNING OBJECTIVES

1) Describe the motivations underlying dual-modality PET/MR imaging systems. 2) Describe the role of PET/MR imaging in clinical practice and research studies. 3) List the challenges and potential solutions of advanced PET/MR imaging.

PS50B PET/MR Imaging in Practice: A Clinical Perspective

Participants
Jonathan E. McConathy, MD, PhD, Saint Louis, MO (*Presenter*) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc

LEARNING OBJECTIVES

View learning objectives under main course title.

The advent of integrated PET/MRI systems suitable for clinical use represents a major technological advance and a new frontier in multi-modality imaging. Advantages of integrated PET/MRI include reduced radiation exposure, high soft tissue contrast, motion correction, and advanced MR techniques coupled with the power of molecular imaging with PET acquired in a single session. These characteristics of PET/MRI are well suited to a range of applications in oncologic, neurologic, and cardiovascular imaging. However, important issues including cost versus patient benefit, added complexity, quantitative accuracy, and physician training need to be addressed before PET/MRI becomes widely used for routine clinical imaging. This presentation will provide an update and overview of the current as well as potential future uses of clinical PET/MRI with a focus on oncology. Promising applications for oncologic imaging including pediatric populations, neuro-oncology, lymphoma, colorectal cancer, cervical cancer, prostate cancer, and multiple myeloma will be discussed. Key aspects of imaging protocols, study interpretation, limitations, and future directions based on our clinical experience as well as results from other centers will be emphasized.

PS50C PET/MR Imaging in Practice: A Research Perspective

Participants
Bruce R. Rosen, MD, PhD, Charlestown, MA (*Presenter*) Research Consultant, Siemens AG

LEARNING OBJECTIVES

View learning objectives under main course title.

Abstract

The field of molecular imaging has grown at a rapid rate in recent years, as imaging technologies enable ever-finer examination of the human brain and other organs, and as clinicians and researchers alike seek to understand the mechanisms that underlie conditions such as cancer, heart disease, brain disorders and diabetes. Early detection of disease and monitoring of potential therapeutic interventions requires technology sensitive to the subtle changes that occur at the cellular and molecular level. PET and MRI are widely used in vivo for both clinical and research applications. Used with novel MR, nuclear, and multimodal probes, these imaging modalities have begun to revolutionize the types of questions that can be asked in vivo, permitting examination of physiological and pathological functions in living cells, tissues, and organs at their most basic level. Used in combination, the individual strengths of MRI and PET can inform one another to yield new insights that expand the types of physiological information that can be gained through in vivo imaging and thus also expand the impact of human health imaging by enlarging the window of anatomical size, time scales, resolution, sensitivity, and specificity of detection for which imaging is currently used. Combined MR-PET imaging technology allows investigators to employ the benefits of MRI such as phased array coils for high speed, high resolution functional imaging, while simultaneously acquiring quantitative metabolic or receptor-specific neurochemical data. Simultaneous MR-PET imaging has the distinct advantage of spatial co-registration of biochemical function with anatomical structure. Perhaps more importantly, MR-PET allows researchers to temporally co-register physiological data using PET and functional MRI (fMRI), such that the hemodynamic information from fMRI may be used to feed quantitative analysis of PET data. Using this information, researchers can understand the interplay between blood flow, receptor occupancy, and metabolism-as well as the contributions of each in disease and therapy response. As such, combined MR-PET has significant clinical potential to impact not only all aspects of patient care, from screening to disease assessment and therapy monitoring, but also to lead to new dual-modality MR-PET probes that can provide complementary information for precise quantitative assessment of biological function not obtainable in other ways.

SPSH52

Hot Topic Session: Molecular Neuroimaging in Dementia: State-of-the-Art and Emerging Techniques

Thursday, Dec. 3 3:00PM - 4:00PM Location: E350

NR BQ MI MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
Satoshi Minoshima, MD, PhD, Salt Lake City, UT (*Moderator*) Royalties, General Electric Company; Consultant, Hamamatsu Photonics KK; Research Grant, Hitachi, Ltd; Research Grant, Nihon Medi-Physics Co, Ltd; Research Grant, Astellas Group; Research Grant, Seattle Genetics, Inc;
Alexander Drzezga, MD, Cologne, Germany (*Moderator*) Research Grant, Eli Lilly and Company; Speakers Bureau, Siemens AG; Speakers Bureau, General Electric Company; Speakers Bureau, Piramal Enterprises Limited; Research Consultant, Eli Lilly and Company; Research Consultant, Piramal Enterprises Limited; ; ; ; ; ;

Sub-Events

SPSH52A Potential of Amyloid Imaging versus MRI in the Diagnostic Workup of Dementia

Participants
Clifford R. Jack JR, MD, Rochester, MN (*Presenter*) Stockholder, Johnson & Johnson; Research Consultant, Eli Lilly and Company; ;

LEARNING OBJECTIVES

1) Explain the utility of structural MRI and amyloid PET in characterizing the pattern of neurodegeneration and pathologic involvement in dementia syndromes. 2) Identify the advanced MRI techniques that provide information on disease pathophysiology in dementia. 3) Discuss cases for which MRI and amyloid PET would provide critical information for clinical assessment.

ABSTRACT

Development of molecular imaging agents for fibrillar β-amyloid (Aβ) positron emission tomography (PET), brought molecular imaging of Alzheimer's disease (AD) pathology into the spotlight. Large cohort studies with longitudinal follow-up in cognitively normal, mild cognitive impairment and AD patients indicate that Aβ deposition can be detected many years, even decades before the onset of symptoms with molecular imaging and its progression can be followed longitudinally. The role of molecular imaging in AD clinical trials is growing rapidly especially in an era when preventive interventions are designed towards eradicating the pathology targeted by molecular imaging agents. The utility of Aβ PET in differential diagnosis of AD is greatest when there is no pathologic overlap between the two dementia syndromes such as in frontotemporal lobar degeneration and AD. However Aβ PET alone may be insufficient in distinguishing dementia syndromes that commonly have overlapping Aβ pathology, such as dementia with Lewy bodies and vascular dementia, which represent the two most common dementia pathologies after AD. MRI is recommended during the initial evaluation of dementia, in order to determine potentially treatable causes such as tumors, subdural hematoma or normal pressure hydrocephalus. In addition, presence and extent of cerebrovascular disease, which may contribute to cognitive impairment and dementia, can be determined during this initial MRI evaluation. Pattern of structural MRI changes reflect neurodegenerative pathology and are closely associated with the clinical disease severity in AD. Although Aβ deposition is the most common pathologic process observed in dementia patients, other pathologic processes such as loss of neuronal integrity and connectivity can be measured with the advanced MRI techniques and complement Aβ PET.

URL

SPSH52B Imaging Inflammation and Molecular Pathology in Dementia

Participants
Ana M. Catafau, MD, PhD, Barcelona, Spain, (ana.catafau@piramal.com) (*Presenter*) Employee, Piramal Imaging GmbH

LEARNING OBJECTIVES

1) Explain potential clinical applications of different molecular pathology PET tracers. 2) List different targets for neuroinflammation PET imaging. 3) Describe advantages and disadvantages of different PET targets for neuroinflammation imaging. 4) Identify challenges for the development of molecular pathology tracers for neurodegenerative disorders.

ABSTRACT

Clinical classifications of neurodegenerative disorders are often based on neuropathology. The term „proteinopathies" includes disorders that have in common abnormal proteins as a hallmark, e.g. amyloidoses, tauopathies, synucleopathies, ubiquitinopathies. Different proteins can also co-exist in the same disease. To further complicate the pathophysiology scenario, not only different proteins, but also cells are believed to play an active role in neurodegeneration, in particular those participating in neuroinflammatory processes in the brain, such as activated microglia and astrocytes. In clinical practice, differentiating pathophysiology from clinical symptoms to allow accurate clinical classification of these disorders during life, becomes difficult in absence of biomarkers for these pathology hallmarks. PET imaging can be a useful tool in this context. Using PET tracers targeting misfolded proteins it will be possible to identify the presence or absence of the target, to depict the cerebral distribution and to quantify the protein load in different cerebral regions, as well as to monitor changes over time. Beta-amyloid is one of the proteins involved in neurodegenerative disorders, which is currently suitable to be imaged by means of PET. Research efforts are currently ongoing in order to identify new PET tracers targeting non-amyloid PET tracers for neurodegeneration. This presentation will focus on the investigational PET tracers targeting tau and alpha-synuclein as misfolded proteins, and activated microglia and astrocytes as cellular targets for neuroinflammation.

URL

SPSH52C Tau Imaging. Scientific Tool or Diagnostic Biomarker?

Participants
Jonathan E. McConathy, MD, PhD, Saint Louis, MO (*Presenter*) Research Consultant, Eli Lilly and Company; Research Consultant, Blue Earth Diagnostics Ltd; Research Consultant, Siemens AG; Research support, GlaxoSmithKline plc

LEARNING OBJECTIVES

1) Participants will be familiar with the current status of PET tracers targeting tau that are being used in human research studies and understand their potential roles in therapeutic trials and clinical neuroimaging.

ABSTRACT

Imaging biomarkers for Alzheimer's disease (AD) and other neurodegenerative diseases are playing an increasingly important role in both research and patient care. Abnormal deposition of the tau and beta-amyloid proteins are pathologic hallmarks of AD, and several PET tracers targeting tau are now available for human research studies. The optimal use and sequencing of imaging biomarkers in the evaluation of cognitive impairment and dementia are active areas of investigation. In this presentation, current and potential future applictions of tau-PET will be discussed in the context of both research studies and possible clinical applications.

SPSH53

Hot Topic Session: 4D Flow Cardiac MRI

Thursday, Dec. 3 3:00PM - 4:00PM Location: S402AB

CA MR

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

FDA Discussions may include off-label uses.

Participants
J. Paul Finn, MD, Los Angeles, CA (*Moderator*) Research Grant, Bracco Group; ; ;
Robert M. Steiner, MD, Philadelphia, PA (*Moderator*) Consultant, Educational Symposia; Consultant, Johnson & Johnson

Sub-Events

SPSH53A 4D Flow: Overview of Techniques and Applications

Participants
James C. Carr, MD, Chicago, IL (*Presenter*) Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA

LEARNING OBJECTIVES

1) Understand the basic principles behind flow imaging with MRI. 2) Become familiar with various techniques for 4d flow. 3) Briefly introduce current and future clinical applications for 4D flow.

SPSH53B Assessment of Congenital Heart Disease with 4D Flow

Participants
Christopher J. Francois, MD, Madison, WI (*Presenter*) Research support, General Electric Company

LEARNING OBJECTIVES

1) How can 4D Flow MRI be used in congential heart disease? 2) What evidence supports the use of 4D Flow MRI in congenital heart disease? 3) What are current challenges of performing 4D Flow MRI in congential heart disease? 4) What are the future directions for 4D Flow MRI in congential heart disease?

ABSTRACT

How can 4D Flow MRI be used in congential heart disease? Free breathing high resolution magnetic resonance angiography Flow visualization Flow quantification What evidence supports the use of 4D Flow MRI in congenital heart disease? Summarize published data validating flow quantification and distribution in CHD What are current challenges of performing 4D Flow MRI in congential heart disease? Shorten scan time Respiratory and cardiac motion Accuracy of flow quantification What are the future directions for 4D Flow MRI in congential heart disease? Energy losses in CHD Combining 4D Flow MRI with computational fluid dynamics and 3D printing

URL

Active Handout:Christopher Jean-Pierre Francois

http://abstract.rsna.org/uploads/2015/15007123/SPSH53B.pdf

SPSH53C 4D Flow Applications in Adult Cardiovascular Diseases

Participants
Michael D. Hope, MD, San Francisco, CA, (michael.hope@ucsf.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Assess the potential clinical utility of recent advancements in 4D Flow imaging for adult cardiovascular disease. 2) Discuss possible clinical applications of unique 4D Flow hemodynamic parameters including regional aortic pulse wave velocity, flow displacement and helicity, and turbulence.

SPSH53D Clinical Processing of 4D Flow for Congenital and Acquired Structural Heart Disease

Participants
Albert Hsiao, MD, PhD, San Diego, CA, (hsiao@ucsd.edu) (*Presenter*) Founder, Arterys, Inc; Consultant, Arterys, Inc; Research Grant, General Electric Company

LEARNING OBJECTIVES

1) Clinical validation for quantitative flow and function. 2) Large volume data sets, data handling, compressed-sensing iterative reconstruction. 3) Background eddy-current correction. 4) Routine clinical cardiovascular 4D Flow cases.

Active Handout:Albert Hsiao

http://abstract.rsna.org/uploads/2015/15047996/SPSH53D.pdf

SPSH54

Hot Topic Session: Imaging-guided Radiation Therapy

Thursday, Dec. 3 3:00PM - 4:00PM Location: S404AB

CT MR NM RO

AMA PRA Category 1 Credit ™: 1.00
ARRT Category A+ Credit: 1.00

Participants
Lei Xing, PhD, Stanford, CA (*Moderator*) Research Grant, Varian Medical Systems, Inc

Sub-Events

SPSH54A Projection and Volumetric X-ray Imaging and Their Roles in Image-Guided Radiation Therapy

Participants
Ning Jeff Yue, PhD, New Haven, CT, (yuenj@rutgers.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the current status of x-ray imaging modalities that are used in radiotherapy 2) Explain the roles and importance of 2D, 3D and 4D x-ray Imaging in radiotherapy. 3) Assess the limitation of current x-ray imaging modality in radiotherapy. 4) Explore the potential imaging technical advancement in radiotherapy.

ABSTRACT

SPSH54B Recent Advancements in PET/CT and PET/CT-Guided Radiation Therapy

Participants
Stephen R. Bowen, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of 3D and 4D PET/CT in radiation therapy planning. 2) Understand the role of PET/CT in treatment response assessment for adaptive radiation therapy. 3) Describe image guidance techniques using PET/CT in charged particle therapy.

SPSH54C MRI-based Treatment Planning and Therapeutic Assessment - Where Do We Stand?

Participants
Lei Xing, PhD, Stanford, CA (*Presenter*) Research Grant, Varian Medical Systems, Inc

LEARNING OBJECTIVES

1) Present background knowledge of MR and MR simulation for radiation therapy. 2) Describe essential roles of MRI in radiation therapy treatment planning, target definition, treatment planning and verification, and therapeutic assessment. 3) Highlight recent advancements and emerging applications of MR imaging in radiation therapy.

RC701

Thoracic MR: Ready for Prime Time!

Thursday, Dec. 3 4:30PM - 6:00PM Location: E353C

CH MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jeanne B. Ackman, MD, Boston, MA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn what it takes to build a thoracic MR practice. 2) To understand how to create simple mediastinal, pleural, lung, and pulmonary MRA protocols which answer most clinical questions. 3) To become more comfortable interpreting these various types of thoracic MRI.

ABSTRACT

Despite MRI's long-demonstrated advantages in tissue contrast and diagnostic specificity and its absence of radiation, MRI remains an underutilized imaging modality in the thorax. The aim of this course is to cover the basics needed to build a thoracic MR practice and to perform and interpret thoracic MRI, whether of the thymus, the rest of the mediastinum, the pleura, or the lung. Fast and robust examination protocols, applicable and ready to use on currently available MR equipment, will be suggested. Clinical indications for thoracic MRI and commonly encountered lesions will be discussed. Performance and interpretation of pulmonary MRA for pulmonary embolism detection will also be covered.

Sub-Events

RC701A Non-Vascular Thoracic MRI: Building a Clinical Program

Participants
Jeanne B. Ackman, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

To understand the challenges, multifaceted approach, and benefit of building a clinical non-vascular thoracic MR practice.

ABSTRACT

There are many challenges to building a clinical non-vascular thoracic MR practice, many of which can be surmounted by: 1) identifying a knowledgeable and capable radiologist within your practice to take this initiative and build a team of interested colleagues to move forward2) educating technologists, referring physicians, trainees, and colleagues as to its performance, interpretation, and benefits,3) building a few simple MR protocols which can answer most clinical questions,4) regularly sharing MR cases to enhance the knowledge of your group,5) patience and recognition of the fact that those in your group insufficiently trained in thoracic MRI may not at first be comfortable with protocoling, interpreting, and recommending these examinations; these colleagues will need to be convinced of MR's benefits and, if interested, will be open to learning what they need to learn to maximize the benefits that can be achieved for patient care as a result of MR's higher tissue contrast, diagnostic specificity, and lack of ionizing radiation.

RC701B Basic Thymic MRI

Participants
Jeanne B. Ackman, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

The attendee will learn about basic Thymic MR protocoling and interpretation which will help distinguish: 1) Thymic cysts from solid thymic lesions. 2) Normal thymus and thymic hyperplasia from thymic tumors. 3) Low-risk thymomas from high-risk thymomas and lymphoma. 4) Invasive from non-invasive thymic masses.

ABSTRACT

It can be difficult by CT to distinguish between thymic cysts and solid lesions, thymic hyperplasia from thymic tumors, and thymoma from lymphoma. The purpose of this brief lecture is to cover the basics of thymic MR protocoling and interpretation in an effort to achieve these objectives and prevent unnecessary thymectomy.

RC701C Practical Mediastinal and Pleural Imaging

Participants
Constantine A. Raptis, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the key components of an MRI protocol tailored to investigate mediastinal pathology. 2) Review the imaging findings of commonly seen mediastinal pathologies which can be characterized with MRI. 3) Identify sequences which can be helpful in investigating pleural abnormalities. 4) Explore the MRI appearance of pleural fluid collections and soft tissue lesions.

ABSTRACT

RC701D MRI of the Lung: Why...When...How?

Participants
Juergen Biederer, MD, Gross-Gerau, Germany, (biederer@radiologie-darmstadt.de) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) to provide basic protocol suggestions for clinical lung MRI and 2) to make familiar with variations of this protocol for typical questions such as parenchymal, vascular or malignant diseases of the lung.

ABSTRACT

Frequently, customized lung imaging protocols are already available with the MR equipment. If not, setting up a protocol tree for lung imaging with MRI is straightforward using standard sequences for different pathologies: T2-w. fast spin echo (FSE) for infiltrates/soft lesions (1), T2-w. FSE with fat suppression for lymph nodes/bone lesions (2), Steady state free precession (SSFP) for respiratory motion/lung vasculature (3) and T1-w. 3D gradient echo (3D-GRE) for nodules/masses and airways (4). Optional sequences comprise MR angiography, dynamic contrast enhancement (DCE) for lung/tumor perfusion and diffusion weighted imaging (DWI) for lymph nodes/lesion characterization. The examination times range from 15' (standard) to 25' (all options).

RC701E How to Perform and Interpret Pulmonary MRA

Participants
Mark L. Schiebler, MD, Madison, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Protocol a pulmonary MRA exam. 2) Determine what GBCA to use. 3) Problem solve common pulmonary MRA artifacts. 4) Correctly interpret Pulmonary MRA exams.

Active Handout:Mark L. Schiebler

http://abstract.rsna.org/uploads/2015/15001935/RC701E.pdf

RC717

Elastography-Imaging Tissue Stiffness: Approaches and Applications

Thursday, Dec. 3 4:30PM - 6:00PM Location: S505AB

MR US PH

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Juergen K. Willmann, MD, Stanford, CA (*Moderator*) Research Consultant, Bracco Group; Research Consultant, Triple Ring Technologies, Inc; Research Grant, Siemens AG; Research Grant, Bracco Group; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company

LEARNING OBJECTIVES

1) To understand the principle technical aspects of ultrasound and MR elastography. 2) To learn clinical applications of elastography. 3)To learn the advantages and disadvantages of ultrasound and MR elastography for assessing tissue stiffness in various organs.

Sub-Events

RC717A US Elastography of the Liver

Participants
Richard G. Barr, MD, PhD, Campbell, OH (*Presenter*) Consultant, Siemens AG; Consultant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, SuperSonic Imagine; Speakers Bureau, Koninklijke Philips NV; Research Grant, Bracco Group; Speakers Bureau, Siemens AG; Consultant, Toshiba Corporation; Research Grant, Esaote SpA

LEARNING OBJECTIVES

1) To describe the clinical need for liver stiffness evaluation. 2) To describe the principles of ultrasound shear wave liver elastography To review the technique of shear wave liver elastography. 3) To discuss pitfalls in performing and interpreting ultrasound liver elastography To describe the basic approach to interpret ultrasound liver elastography.

ABSTRACT

Diffuse liver disease is one of the major health problems in the world. Hepatitis C (HCV) and Hepatitis B (HBV) viruses are the leading causes of chronic liver disease. It is estimated that 180 million and 350 million people worldwide are chronically infected with HCV and HBV respectively. In western countries, liver disease caused by HCV is the main indication for liver transplantation. Liver biopsy has been considered the reference standard for fibrosis assessment and stage classification. However, biopsy is invasive, with potential complications that can be severe in up to 1% of cases. In addition, a liver biopsy represents roughly 1/50,000 of the liver volume and there is interobserver variability at microscopic evaluation. Elastography is a non-invasive method for liver fibrosis assessment and has been an area of intense research. With ultrasound elastography systems now widely available worldwide this technique is beginning to replace liver biopsy as method for diagnosis and follow-up of liver fibrosis. This technique is easy to perform but requires attention to detail. This course will review the principles of shear wave elastography (SWE) for liver fibrosis assessment. A review of the technique and pitfalls will be presented. The literature will be reviewed as well as published guidelines on the use of SWE for liver fibrosis assessment. A discussion of the clinical applications of this technique and future potential applications will be discussed.

RC717B Non-liver Applications of US Elastography

Participants
Anthony E. Samir, MD, Boston, MA, (ASAMIR@mgh.harvard.edu) (*Presenter*) Consultant, Pfizer Inc; Consultant, General Electric Company; Consultant, PAREXEL International Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, Toshiba Corporation; Research Grant, General Electric Company; Research Grant, Samsung Electronics Co, Ltd; Research Grant, Analogic Corporation; Research support, SuperSonic Imagine; Research support, Hitachi, Ltd

LEARNING OBJECTIVES

1) This refresher course provides a summary of current state-of-the-art Ultrasound (US) elastography methods in non-hepatic conditions including thyroid nodules, prostate cancer, deep vein thrombosis and renal fibrosis and neoplasms.

ABSTRACT

(1) A brief discussion of the evolution of SE over 20 years; physics primer including tissue elasticity, strain, shear wave and Young modulus; classification: quasi-quantitative method (strain elastography, elasticity ratio), quantitative methods by shear wave and comparison of various methods in terms of their advantages and limitations.(2) A discussion of applications of SE techniques in non-hepatic conditions. We compare diagnostic performance and reliability advantages and limitations of various SE techniques.A. Thyroid:SE methods can be used for differentiating benign and malignant thyroid nodules. It may be especially helpful for a group of indeterminate nodules with follicular lesions finding on fine needle aspirationB. Kidney:SE may be useful for detecting renal fibrosis. SE may also has adjunctive role in diagnosis of renal masses.C. Prostate:The main role of SE is prostate cancer detection, and assistance with biopsy targeting.D. Pancreas:SE methods can be used to evaluate the pancreas by upper gastrointestinal endoscopy.E. Deep vein thrombosis:Main clinical application of SE can be measuring time-dependent viscoelastic properties (aging) of blood clots in venous system.SE is a rapidly evolving set of methods that have a promising role as a biomarker in various pathologic conditions through providing information about the physical properties of the tissues that is complementary to that provided by other modalities.

RC717C Participants **MR Elastography**

Richard L. Ehman, MD, Rochester, MN (*Presenter*) CEO, Resoundant, Inc; Stockholder, Resoundant, Inc; Research Grant, Resoundant, Inc

LEARNING OBJECTIVES

1) To describe the rationale for tissue elasticity imaging. 2) To describe the basic physical approach for MRI-based elasticity imaging. 3) To describe the most common indications for MR elastography of the liver. 4) To describe the basic approach to interpretation of hepatic MR elastography exams. 5) To describe pitfalls in interpretation of hepatic MRE. 6) To describe other potential applications of MRE.

ABSTRACT

Many disease processes cause profound changes in the mechanical properties of tissues. This accounts for the efficacy of palpation for detecting abnormalities and provides motivation for developing practical methods to assess tissue elasticity. Magnetic Resonance Elastography (MRE) is a new commercially-available MRI-based technique that can quantitatively image the mechanical properties of tissue. The most advanced current application of MRE is for diagnosing hepatic fibrosis. Chronic liver disease is serious worldwide problem, and hepatic fibrosis is the most important consequence, which if not detected and treated, eventually leads to cirrhosis which is irreversible and associated with high mortality. MRE can be readily implemented on a standard MRI system. A device is used to generate vibrrations in tissue. The waves are imaged with a special MRI pulse sequence. Acquistion time for liver MRE is approximately 15 seconds. Because the incremental imaging time is so small, MRE can readily added to standard abdominal MR imaging protocols. The data are automatically processed generate quantitative images showing the elasticity of the liver and other tissues in the upper abdomen. Clinical studies by multiple investigators have now established that MRE is an accurate method for diagnosing hepatic fibrosis. MRE-measured hepatic stiffness increases systematically with fibrosis stage. Growing clinical experience indicates that MRE is at least as accurate as liver biopsy for this diagnosis, while also being safer, more comfortable, and less expensive. Human studies have demonstrated that it is feasible to apply MRE to quantitatively assess other tissues and organs such as brain, breast, heart, and kidney. MRE may be helpful in differentiating between benign and malignant neoplasms. New research has shown that MRE is helpful in the preoperative assessment of patients with brain tumors such as menigiomas.

RC718

Imaging Tumor Response: Old and New Challenges

Thursday, Dec. 3 4:30PM - 6:00PM Location: S102AB

BQ MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC718A Reporting Cancer Response-Practical Perspective

Participants
Elena K. Korngold, MD, Portland, OR (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define important terms and concepts in tumor response assessment. Describe the current use of imaging for evaluating response of GI cancers. 2) Understand the rationale for the creation of standardized and structured criteria for imaging evaluation of tumor response to therapy in research trials. 3) Understand the basic concept and organization of the RECIST (Response Evaluation Criteria in Solid Tumors) criteria. Understand the limitations of RECIST and other standardized reporting methods. 4) Recognize the reason for use of alternate criteria in specific diseases (i.e., Cheson for lymphoma, EASL/mRECIST for HCC), biomarkers, and the evolving role of imaging in evaluation of tumor response with novel therapeutic interventions.

RC718B Prostate Cancer Treatment Assessment

Participants
Hedvig Hricak, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the clinical challenges of prostate cancer post-treatment follow-up and the role of imaging in detecting local recurrence. 2) Know how MRI protocols for detecting local recurrence should be adjusted depending on the prior treatment and the questions being asked. 3) Understand standard and emerging uses of bone scanning, PET/CT and MRI/PET for detecting metastasis.

ABSTRACT

MRI has emerged as the key modality for assessing local recurrence of prostate cancer after radical prostatectomy (RP) or radiation therapy (RT). Early detection of local recurrence is important to allow potentially curative salvage therapy. The efficacy of MRI in detecting local recurrence is treatment dependent, and MRI protocols need to be adjusted to the questions being asked. After RT, T2-weighted MRI is limited due to post-radiation effects on the prostate such as glandular shrinkage, loss of normal zonal anatomy, and reduced contrast between cancer and normal tissue caused by glandular atrophy and fibrosis. MRI should include both T2-weighted and diffusion-weighted sequences; a recent study suggested that in most patients, dynamic contrast-enhanced (DCE)-MRI could be omitted after RT without lowering diagnostic performance, thereby eliminating the risks and costs associated with the use of contrast. If salvage treatment is an option after RT, MRI offers loco-regional staging. Post-RT MRI can evaluate the length of the urethra and may show urethral shortening (which has been associated with incontinence after primary RP), decreased urethral margin definition and other tissue changes that could conceivably affect treatment selection and planning. After surgery, in addition to DWI, the use of DCE-MRI is essential, as it can show small lesions and differentiate tumor from scarring. MRI may help to determine whether post-RP local recurrence is amenable to salvage RT and may aid RT planning. Assessment of recurrence after emerging focal therapies remains problematic, since methods for reliably differentiating necrosis or scarring from tumor are lacking. In the future, PET/CT with targeted tracers may be able to address this need. PET/CT and bone scanning are valuable in the search for nodal and osseous metastases, respectively. The implementation of clinical MRI/PET and the use of new tracers will likely open new horizons in the assessment of recurrence.

RC718C Evaluating Response in Targeted Therapy of Abdominal Malignancy

Participants
Yves M. Menu, MD, Paris, France (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the main challenges in abdominal tumors treated with targeted chemotherapies in clinical situations like neoadjuvant therapy, tumor down staging or palliative treatment. 2) Know the specific situations of most common abdominal malignancies like liver primary and secondary tumors, pancreatic adenocarcinoma and colorectal cancer. 3) Understand how the Radiologist should manage the imaging techniques (CT, MRI, PET) in order to meet the clinical objectives and if targeted therapies require changes over cytotoxic chemotherapies.

ABSTRACT

Abdominal malignancies are very common. Imaging is pivotal for detection, staging and evaluation of tumor response to treatment. As targeted therapies are increasingly administered, the necessity for an update of tumor response criteria has become obvious. Tumor size and anatomy is still required important information, but evaluation of tissue viability is increasingly needed. Another specificity of abdominal malignancies is the increasing number of patients who are candidates for an integrated approach including systemic therapies, local therapies, radiation therapy and surgery. This underlines the necessity of a team approach and the major role of the radiologist within this group.In Hepatocellular Carcinoma (HCC), targeted therapies are widely used and mainly aimed at palliation, although potential downstaging may lead to reconsider this position. mRECIST criteria have been developed specifically

for HCC and are considered as the international standard nowadays.In secondary liver tumors, targeted therapies are usually administered in association with cytotoxic drugs. As up to 30% of patients with liver metastases from colon cancer might become resectable, the evaluation is not limited to volumetric response. The report should mention in addition relevant information on tumor viability and aggressiveness and also comment on useful elements for guidance of potential surgery or intervention.In other abdominal advanced malignancies, targeted therapies are not yet standard. However, due to the poor prognosis of these diseases, very active research develops in this field and interestingly favors a better selection of patients. Imaging may play a role with this issue, like classifying locally advanced vs metastatic patients as well as highly vs less agressive tumors.In summary, the Radiologist should have knowledge of the main clinical challenges, of ongoing and potential treatments in order to provide relevant information to the Multi Disciplinary Team.

RC718D Evaluation of Lung Cancer Response

Participants
Jeremy J. Erasmus, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the applicability of anatomic imaging using World Health Organization (WHO) criteria and Response Evaluation Criteria in Solid Tumors (RECIST 1.1) in the assessment of tumor response in patients with non-small cell lung cancer (NSCLC). 2) To be aware of the limitations of World Health Organization (WHO) criteria and Response Evaluation Criteria in Solid Tumors (RECIST 1.1) in the assessment of tumor response. 3) To understand the potential role of metabolic tumor response assessment with 18F-FDG PET (PET Response Criteria in Solid Tumors (PERCIST)) in patients with NSCLC.

ABSTRACT

NSCLC commonly presents with advanced disease and chemotherapy is often an integral component in;treatment. However, following initiation of chemotherapy, tumor progression can occur in up to 33% of patients. Early determination of this therapeutic failure can be important in management and can assist clinical decisions concerning discontinuation of ineffective treatment and institution of alternative therapy. Additionally, an essential component of evaluating the results of cancer treatment in patients on clinical trials is the reporting of the response rate. Because small differences in the response rate can affect the outcome clinical trials, it is important that the criteria used to make this determination are meaningful and consistent. While the antitumor effect of a treatment in patients with solid tumors can be determined clinically or by surgical pathologic re-staging, image-based serial measurements based on WHO criteria or Response Evaluation Criteria in Solid Tumors (RECIST) provide uniform criteria for reporting response. However, morphological alterations detected by CT may not correlate with pathological response and tumor viability. Furthermore, the assessment of objective response has also been complicated by the development of treatment protocols that target tumor biology including tumor cell proliferation and invasion, angiogenesis and metastasis. Anti-tumor effect in many of these regimens is cytostatic and, unlike anticancer cytotoxic agents, may not cause regression in tumor size. FDG-PET may allow an early and sensitive assessment of the effectiveness of anticancer chemotherapy as FDG uptake is not only a function of proliferative activity but is also related to viable tumor cell number. This talk will review the status and limitations of anatomic and metabolic tumor response metrics in NSCLC including WHO criteria, RECIST 1.1 and PET Response Criteria in Solid Tumors (PERCIST).

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jeremy J. Erasmus, MD - 2015 Honored Educator

RC723

MR Safety II

Thursday, Dec. 3 4:30PM - 6:00PM Location: E352

MR PH SQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Matthew A. Bernstein, PhD, Rochester, MN (*Director*) Research collaboration, General Electric Company

LEARNING OBJECTIVES

1) Classify MR conditional pacemakers, and describe guidelines for their clinical usage in the MR environment. 2) List several MR Safety incidents and describe their root causes. 3) Describe special MR Safety hazards present in the interventional MR environment, and identify countermeasures to reduce the associated risks. 4) Implement preventive measures for MR Safety in a clinical practice to improve the standard of care.

ABSTRACT

Sub-Events

RC723A MRI Conditional Pacemakers, What to Do?

Participants
Anshuman Panda, PhD, Phoenix, AZ (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC723B Case Review of Real MR Safety Incidents

Participants
Armen Kocharian, PhD, Houston, TX, (akocharian@houstonmethodist.org) (*Presenter*) Research collaboration, General Electric Company

LEARNING OBJECTIVES

View learning objectives under main course title.

Active Handout:Armen Kocharian

http://abstract.rsna.org/uploads/2015/15002852/RC723B Case Review of Real MR Safety Incidents (1).pdf

RC723C MRI Safety in the MR-Guided Interventional Environment

Participants
Krzysztof Gorny, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC729

Updates in Pancreatic Imaging: Spotlight on MRI (An Interactive Session)

Thursday, Dec. 3 4:30PM - 6:00PM Location: E451A

GI MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

LEARNING OBJECTIVES

Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events

RC729A Systematic Approach to Pancreatic Cancer

Participants
Elizabeth M. Hecht, MD, New York, NY, (eh2560@cumc.columbia.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss a systematic approach to diagnosing and staging pancreatic cancer and discuss template reporting for preoperative planning. 2) Discuss potential mimics and pitfalls related to diagnosis and staging of solid pancreatic neoplasms

ABSTRACT

Treatment of pancreas cancer requires a multidisciplinary approach. Imaging interpretation and reports play a critical role in managing patients with pancreatic pathology. Accurate staging of pancreatic neoplasms is paramount to determining management and imaging plays a central role in stratifying patients for treatment. The goal of surgery is to achieve resection margins free of tumor to maximize survival benefit. Unnecessary surgery and accompanying morbidity need be minimized in patients with no added survival benefit from resection. Structured reporting and standardized terminology enhances communication with the clinic team and imparts key elements into a diagnostic report that will help determine appropriate management.

Active Handout:Elizabeth M. Hecht

http://abstract.rsna.org/uploads/2015/15002793/Active RC729A.pdf

RC729B Pancreatic Cyst: A Multidisciplinary Approach to Diagnosis and Management

Participants
Ihab R. Kamel, MD, PhD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the imaging features of pancreatic cysts and the impact of multidisciplinary approach to diagnosis and management.

ABSTRACT

Honored Educators

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Ihab R. Kamel, MD, PhD - 2015 Honored Educator

RC729C The Inflamed Pancreas: Pearls and Perils

Participants
Koenraad J. Mortele, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the imaging features of a vast array of inflammatory conditions that may involve the pancreas.

RC750

MR Imaging-guided Breast Biopsy (Hands-on)

Thursday, Dec. 3 4:30PM - 6:00PM Location: E260

BR MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Peter R. Eby, MD, Seattle, WA, (peter.eby@virginiamason.org) (*Moderator*) Consultant, Devicor Medical Products, Inc
Beatriz E. Adrada, MD, Houston, TX (*Presenter*) Nothing to Disclose
Sandra Brennan, MBBCh, MSc, West Harrison, NY (*Presenter*) Nothing to Disclose
Selin Carkaci, MD, Columbus, OH (*Presenter*) Author with royalties, Reed Elsevier
Chloe M. Chhor, MD, New York, NY (*Presenter*) Nothing to Disclose
Mark J. Dryden, MD, Houston, TX (*Presenter*) Nothing to Disclose
Sujata V. Ghate, MD, Durham, NC (*Presenter*) Nothing to Disclose
Vilert A. Loving, MD, Gilbert, AZ, (vloving@mdanderson.org) (*Presenter*) Nothing to Disclose
Michelle D. McDonough, MD, Jacksonville, FL, (McDonough.michelle@mayo.edu) (*Presenter*) Nothing to Disclose
Virginia M. Molleran, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose
Habib Rahbar, MD, Seattle, WA (*Presenter*) Research grant, GE Healthcare
Jean M. Seely, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Stephen J. Seiler, MD, Dallas, TX, (stephen.seiler@utsouthwestern.edu) (*Presenter*) Nothing to Disclose
Laura B. Shepardson, MD, Cleveland, OH (*Presenter*) Nothing to Disclose
Tanya W. Moseley, MD, Houston, TX (*Presenter*) Nothing to Disclose
Roberta M. Strigel, MD, MS, Madison, WI, (rstrigel@uwhealth.org) (*Presenter*) Research support, General Electric Company
Janice S. Sung, MD, New York, NY (*Presenter*) Nothing to Disclose
Lilian Wang, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Annamaria Wilhelm, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose
Simone Schrading, MD, Aachen, Germany (*Presenter*) Nothing to Disclose
Bethany L. Niell, MD, Boston, MA (*Presenter*) Nothing to Disclose
Jocelyn A. Rapelyea, MD, Washington, DC (*Presenter*) Consultant, General Electric Company

LEARNING OBJECTIVES

1) Explain why MR-guided breast biopsy is needed for patient care. 2) Identify relative and absolute contraindications to MR-guided breast biopsy. 3) Describe criteria for MR-guided breast biopsy patient selection. 4) Debate risks and benefits of pre-biopsy targeted ultrasound for suspicious MRI findings. 5) Understand basic MR-guided biopsy parameters and requirements for appropriate coil, needle and approach selection. 6) Manage patients before, during and after MR-guided breast biopsy. 7) Define benefits and limitations of MR-guided vacuum assisted breast biopsy. 8) Apply positioning techniques to challenging combinations of lesion location and patient anatomy for successful MR-guided biopsy.

ABSTRACT

This course is intended to provide basic didactic instruction and hands-on experience for MR-guided breast biopsy. Because of the established role of breast MRI in the evaluation of breast cancer through screening and staging, there is a proven need for MR-guided biopsy of the abnormalities that can only be identified at MRI. This course will be devoted to the understanding and identification of: 1) appropriate patient selection 2) optimal positioning for biopsy 3) target selection and confirmation 4) various biopsy technologies and techniques 5) potential problems and pitfalls and 6) practice audits. Participants will spend 30 minutes in didactic instruction followed by 60 minutes practicing MR-guided biopsy using provided phantoms. Various combinations of full size state-of-the-art breast MRI coils, biopsy localization equipment and needles from multiple different vendors will be available for hands-on practice. Some stations will have monitors loaded with targeting software. Expert breast imagers from around the world will be at each of 10 stations to provide live coaching, tips, techniques and advice.

Active Handout:Peter R. Eby

http://abstract.rsna.org/uploads/2015/6005779/RC750.pdf

RC803

Quantitative Measures in Cardiac CT and MR Imaging-Do They Matter?

Friday, Dec. 4 8:30AM - 10:00AM Location: E350

CA BQ CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC803A Quantitative Assessment of the Cardiac Chambers and Its Clinical Significance

Participants
Bernd J. Wintersperger, MD, Toronto, ON, (bernd.wintersperger@uhn.ca) (*Presenter*) Speakers Bureau, Siemens AG; Research support, Siemens AG

LEARNING OBJECTIVES

1) Describe the approach of cardiac MR and CT in assessment of cardiac function and size 2) Understand important differences between varies imaging strategies 3) Understand the impact and role of cardiac size and function on treatment decisions

ABSTRACT

Introduction:Cardiac performance is generally assessed by volumetric quantifications such as size and output. Follow-up and changes over time may allow identification of early disease onset, may trigger specific therapies and may allow prediction of patient prognoses and general outcome.While CT & MR imaging provide more accurate results, echocardiography remains the first line modality. CT for functional evaluation should be considered a 3rd line option based on the added radiation exposure.Methods:Most important measures of cardiac function are end-diastolic volume (EDV), stroke volume (SV) and ejection fraction (EF). While the acoustic window may limit echocardiography, CT & MRI can easily cover all aspects of the atria and ventricles. While results of clinical echocardiography may only allow a categorization of ventricular EF (grade 1-4) with large variations related to assumptions, CT and MRI allow highly accurate results in normal & abnormal ventricles. In order to maintain accuracy and precision adequate imaging parameters with respect to coverage, spatial resolution and temporal resolution are required. Today's functional cardiac MR imaging is based on cine SSFP methods with cardiac short axis orientation for the left ventricle and short axis or transverse orientation for the right ventricle. Atrial volumetric assessment is performed rarely but might especially be of interest in patients with AV valve dysfunction or atrial sources of arrhythmia. While quantitative assessment of regional motion was previously limited to echocardiography or specific MR techniques (e.g. MR tagging), recent software developments also allow this information being derived from standard cine MRI. ConclusionBased on its accuracy cardiac MR plays an increasingly important role in assessment of patients with cardiac diseases. Accurate and precise quantification of cardiac function is increasingly important in therapy decisions and therapy monitoring.

Handout:Bernd J. Wintersperger

http://abstract.rsna.org/uploads/2015/14000904/RSNA 2015 RC803A Quantitative Measures in Cardiac CT and MR Imaging_ Quantitative Assessment of the Cardiac Chambers and Clinical Significance.pdf

RC803B Quantitative Assessment Cardiac Valves on MRI

Participants
Jens Bremerich, MD, Basel, Switzerland, (jens.bremeric@usb.ch) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Apply CMR for morphometry and quantification of valvular function. 2) Compare various CMR approaches for assessment of cardiac valves. 3) Analyse flow data in stenotic or incompetent valves.

ABSTRACT

Introduction: Echocardiography remains first line modality for imaging cardiac valves. In specific cases, however, MR provides complementary quantitative data. Methods: Most relevant sequences for valve imaging are: 1) Black blood, 2) CineSSFP, and 3) VENCine. Black blood images are fast spin echo sequences. CineSSFP are used for quantification of valvular morphology and motion. Temporal resolution is typically 50ms for a segmented breath hold sequence but may be further shortened by means of parallel imaging or non-breath hold sequences. VENCine is an excellent tool for flow volume and velocity quantification. Volumes are relevant to calculate regurgitant fraction of incompetent valves, velocities are used to calculate degree of stenosis relying on modified Bernoulli equation. Results: Aortic regurgitation is difficult to evaluate with Echocardiography but easily quantified on VENCine with excellent reproducibility. Regurgitant fraction is defined as $Volume_{antegrade}/Volume_{retrograde}*100$ [%]. Aortic stenosis may also be quantified with MR by measuring the opening area on CineSSFP or by measuring peak velocity in the valve on VENCine and calculation with modified Bernoulli equation ($\Delta P = 4 * Vmax2$). Mitral regurgitation may also be quantified by MRI. Echocardiographic quantification relies predominantely on the extent of the regurgitant jet into the left atrium which is not a reliable sign on MRI, since extent of regurgitant jets depend on various sequence parameters such as field strength and echo time. Pulmonary regurgitation can also be quantified with MRI which is relevant in congenital heart disease such as after surgical repair in tetralogy of Fallot. Pulmonary stenosis, Tricuspid stenosis and regurgitation are no routine indications for MRI but are rather evaluated by echocardiography. Conclusion: Aortic regurgitation is an excellent indication for MRI, it enables accurate and

reproducible quantification.

RC803C How to Quantify Valve Function on Cardiac CT

Participants
Paul Schoenhagen, MD, Cleveland, OH, (schoenp1@ccf.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the limited role of CT for assessment of valvular function. 2) Discuss clinical indications where anatomic and functional valvular with CT is indicated. 3) Describe data acquisition and analysis approach for valvular assessment.

ABSTRACT

CT is a predominantly anatomic imaging modality. Compared to predominantly functional modalities its temporal resolution is limited. In addition, functional/4-D imaging requires retrospective gated data acquisition and is associated with higher radiation exposure. The role of CT for functional valvular analysis is therefore limited to few clinical scenarios, where it can provide complementary information. The strength of CT in these situations is the ability for reconstruction in the acquired 3-D/4-D volume. A prominent example is transcatheter valve replacement/implantation but also assessment of prosthetic valves.

URL

Handout:Paul Schoenhagen

http://abstract.rsna.org/uploads/2015/14000907/schoenhagen_RSNA2015 - valve function 11_30.pdf

RC803D 4D Flow MRI Quantification?

Participants
Christopher J. Francois, MD, Madison, WI (*Presenter*) Research support, General Electric Company

LEARNING OBJECTIVES

1) Describe MRI physics of 4D flow MRI. 2) Illustrate use of 4D flow MRI for basic hemodynamic function. 3) Demonstrate potential futures uses of 4D flow MRI for advanced hemodynamic analyses.

ABSTRACT

MRI flow imaging is based on flow-sensitive, phase contrast sequences. This presentation will introduce the basic MRI physics responsible for imaging flow, extending 1-directional flow imaging to 3-directional flow imaging used in 4D flow MRI.Examples from valvular and congenital heart disease will be used to illustrate the use of 4D flow MRI to quantify flow velocities and volumes. Although 4D flow MRI is still very much in the early developmental phase, published data comparing 4D flow MRI to established techniques for quantifying flow will be reviewed.The future potential for 4D flow MRI to be used to non-invasively quantify more advanced hemodynamic parameters will be demonstrated. Specifically, the use of 4D flow MRI to measure pressure gradients, pulse wave velocity, wall shear stress and kinetic energy will be covered.

Active Handout:Christopher Jean-Pierre Francois

http://abstract.rsna.org/uploads/2015/14000908/RC803D.pdf

RC804

Musculoskeletal Series: Shoulder and Elbow MR Imaging

Friday, Dec. 4 8:30AM - 12:00PM Location: E451A

MK CT MR

ARRT Category A+ Credits: 4.00
AMA PRA Category 1 Credits ™: 3.25

FDA Discussions may include off-label uses.

Participants
Douglas W. Goodwin, MD, Lebanon, NH, (douglas.goodwin@hitchcock.org) (*Moderator*) Nothing to Disclose
Jenny T. Bencardino, MD, New York, NY (*Moderator*) Nothing to Disclose

ABSTRACT

Handout:Jenny T. Bencardino

http://abstract.rsna.org/uploads/2015/15001699/Bencardino Triceps tendon and cubital tunnel.pdf

Sub-Events

RC804-01 Pitfalls in Shoulder MRI Interpretation

Friday, Dec. 4 8:30AM - 8:55AM Location: E451A

Participants
Douglas W. Goodwin, MD, Lebanon, NH, (douglas.goodwin@hitchcock.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize a series of pitfalls encountered in shoulder MRI, including variations in normal anatomy and subtle frequentlyoverlooked injuries and abnormalities. 2) Understand how imaging parameters can be manipulated to account for the inherent challenges of shoulder MR imaging. 3) Improve performance by adjusting patterns of image review.

Active Handout:Douglas W. Goodwin

http://abstract.rsna.org/uploads/2015/15001700/RC804-01handout Avoiding pitfalls in shoulder MR imaging.pdf

RC804-02 3D-CT vs. 3D-MR of the Shoulder in Patients with Glenohumeral Instability

Friday, Dec. 4 8:55AM - 9:05AM Location: E451A

Participants
Laurence D. Stillwater, MD, Winnipeg, MB (*Presenter*) Nothing to Disclose
James K. Koenig, MD, Winnipeg, MB (*Abstract Co-Author*) Nothing to Disclose
Bruce W. Maycher, MD, Winnipeg, MB (*Abstract Co-Author*) Nothing to Disclose
James M. Davidson, MD, Winnipeg, MB (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if 3DMR osseous reformats of the shoulder are equivalent to 3DCT osseous reformats in patients with glenohumeral instability.

METHOD AND MATERIALS

Patients with glenohumeral instability, who were to be imaged with both CT and MRI, were prospectively selected. CT and 3TMR were performed within 24 hours of one another on 10 shoulders. Each MR study included an axial 3D isotropic VIBE sequence (acquisition time 4 minutes 15 seconds). The image data from the isotropic VIBE sequence was post processed using subtraction and 3D software. CT data was post processed using 3D software. The following measurements were obtained for both 3DCT and 3DMR post processed images: height and width of the humeral head and glenoid, Hill-Sachs size and percent humeral head loss (if present), Bankart size and percent glenoid bone loss (if present). Paired T-tests and two one-sided tests for equivalence were used to assess the differences between imaging modalities and equivalence.

RESULTS

The measurement differences from the 3DCT and 3DMR post processed images were not statistically significant: humeral height p=0.06, 95% CI [-0.03, 0.99], humeral width p=0.13, 95% CI [-0.14, 0.90], Hill-Sachs size p=0.42, 95% CI [-0.17, 0.37], percent humeral head loss p=0.93, 95% CI [-0.49, 0.53], glenoid width p=0.13, 95% CI [-0.01, 0.64], Bankart size p=0.43, 95% CI [-0.22, 0.42] and percent glenoid bone loss p=0.22, 95% CI [-0.52, 1.68]. The measurement difference for glenoid height was borderline, p=0.04, 95% CI [0.01, 0.43], however using any adjustment for multiple comparisons this failed to be significant. Using an equivalence margin of 1 mm for measurements and 1.5% for percent bone loss, the 3DMR and 3DCT post processed images were equivalent.

CONCLUSION

3DMR osseous models of the shoulder using a 3D isotropic VIBE sequence were equivalent to 3DCT osseous models and the differences between modalities were not statistically significant. This sequence can be added to MR examinations with only a minimal increase in imaging time and can be used to quantify humeral head and glenoid bone loss. This may eliminate the need for pre-surgical CT examinations pending continued recruitment to obtain a larger sample size.

CLINICAL RELEVANCE/APPLICATION

3DMR osseous reformats are equivalent to and demonstrate no significant statistical difference from 3DCT osseous reformats, which

3D FIR osseous reformats are equivalent to and demonstrate no significant statistical difference from 3D CT osseous reformats, which may eliminate the need for preoperative CT.

RC804-03 Effect of Rotator Cuff Tendon Retraction on Grading of Supraspinatus Muscle Atrophy and Fatty Degeneration

Friday, Dec. 4 9:05AM - 9:15AM Location: E451A

Participants
Vanessa M. Finato, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Eric Y. Chang, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Brady K. Huang, MD, San Diego, CA (*Presenter*) Nothing to Disclose

PURPOSE

Many rotator cuff muscle classifications are in use, making it difficult to compare results and agree on treatment. Muscle atrophy and fatty degeneration are negative prognostic factors for clinical and structural outcome after repair. The 5 point Goutallier classification (Clin Orthop Relat Res 1994) was subsequently simplified by Fuchs (J Shoulder Elbow Surg 1999) into a 3 point system. Thomazeau (Acta Orthop Scand 1996) introduced a system based on the cross-sectional area (CSA) of the supraspinatus (SS) muscle on sagittal oblique (SAG) images with respect to the area of the SS fossa, reported as an occupation ratio (OR). Currently, there are no studies accounting for tendon retraction and its affect on grading.

METHOD AND MATERIALS

This IRB approved, HIPAA compliant retrospective study was performed using radiology reports from a single institution. Search terms of 'retraction' or 'retracted' were applied to non-arthrogram MRI reports from Jan 2014-Jan 2015. Full-thickness SS tendon tears were included. Partial-thickness tears and post-operative cases were excluded. MRI exams were reviewed by an MSK radiologist. Degree of tendon retraction was recorded. Thomazeau CSA and OR was recorded at the standard reference location on SAG images. OR was re-measured correcting for tendon retraction, medial to the reference location, obtaining a new (corrected) CSA. Fuchs grading was applied to both coronal (COR) and SAG planes. Paired Wilcoxon signed-ranks test was used to compare measurements. 25% of the cases were remeasured and independently measured by a second reader and reliability statistics were calculated.

RESULTS

79 patients were in the study group (71/150 excluded). Mean SS CSA at the standard vs corrected location was 4.0±1.6 cm2 (mean±SD) vs 5.6±1.7 cm2 ($p<0.001$). OR was 0.44±0.13 vs 0.62±0.12 ($p<0.001$). Standard Thomazeau and corrected stages revealed a concordance of 17.7% (14/79). Concordance for SAG and COR Fuchs staging was 94% (74/79). Inter- and intra-observer reliability statistics were excellent for OR, corrected OR, Thomazeau Stage, and SAG/COR Fuchs (ICC=0.832-0.997).

CONCLUSION

Accounting for tendon retraction is important in assessing SS atrophy and can significantly alter the grading using standard systems. Caution should be used when reporting these findings, as SS atrophy may be overestimated.

CLINICAL RELEVANCE/APPLICATION

Tendon retraction can result in overestimation of SS muscle atrophy, which may ultimately alter the decision to perform a cuff repair.

RC804-04 Distal Clavicular Osteolysis in Adults: Prevalence, Predisposing Factors, Treatment and Outcome

Friday, Dec. 4 9:15AM - 9:25AM Location: E451A

Participants
Mika T. Nevalainen, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Michael G. Ciccotti, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc
Adam C. Zoga, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Johannes B. Roedl, MD, PhD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the prevalence, imaging findings, treatment and outcome of distal clavicular osteolysis (DCO) in adults as well as the association with bench pressing intensity.

METHOD AND MATERIALS

Patients with atraumatic DCO were selected in a retrospective review of 4217 consecutive magnetic resonance imaging (MRI) shoulder reports of individuals between 20 and 40 years of age. The prevalence of DCO, the DCO grade (mild, moderate, severe), pain scale, bench pressing frequency (times per week and years of bench pressing), bench pressing weight (maximum single repetition and per body weight), conservative and surgical treatment outcome and the long-term sequelae on follow-up MRI were analyzed.

RESULTS

8% (342/4217) of patients between 20 and 40 years of age had atraumatic DCO and 9% of these were females. 82% of DCO patients were bench pressing on a regular basis compared to 41% in the control group ($p<0.001$, chi-square). In male bench pressers who suffered from DCO (n=240), the mean bench pressing weight (maximum single repetition) was 283 lbs (±SD 57) compared to 209 lbs (±SD 60) in male bench pressers not affected by DCO (n=127; $p<0.001$, Mann-Whitney). Intense bench pressing with a bench pressing weight (maximum single repetition) of more than 1.5 times the body weight was a risk factor for DCO (OR=18; 95%CI=11-31, $p<0.001$). High frequency (>1x/week) and duration (>5 years) of bench pressing further increased the risk. 77% of DCO patients responded to conservative therapy, and 23% underwent surgery with resolution of symptoms. On follow-up imaging, acromioclavicular (AC) joint osteoarthritis was significantly more common in DCO patients treated conservatively than in DCO patients treated surgically (74% vs. 47% $p<0.001$, chi-square).

CONCLUSION

Prevalence of DCO in adults undergoing shoulder MRI is 8%, and females are affected in 9% of cases. Bench pressing more than 1.5 times the body weight is a substantial risk factor. AC joint osteoarthritisis a long-term sequela of conservative, but not surgical treatment of DCO.

CLINICAL RELEVANCE/APPLICATION

DCO is associated with AC joint osteoarthritis on follow-up imaging. Maximum bench pressing weight should be kept below 1.5 times the body weight to prevent DCO.

RC804-05 Non-contrast MRI Diagnosis of Adhesive Capsulitis

Friday, Dec. 4 9:25AM - 9:35AM Location: E451A

Participants
Andrew S. Chi, MD, MS, Philadelphia, PA (*Presenter*) Nothing to Disclose
John Kim, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Suzanne S. Long, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
William B. Morrison, MD, Philadelphia, PA (*Abstract Co-Author*) Consultant, General Electric Company Consultant, AprioMed AB Patent agreement, AprioMed AB Consultant, Zimmer Holdings, Inc
Adam C. Zoga, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The MR arthrographic findings of adhesive capsulitis or frozen shoulder are well described. However, adhesive capsulitis most commonly occurs in patients age 45 to 60 years old, a population for whom direct MR arthrography is rarely ordered. We sought to investigate specific noncontrast MRI findings and constellations of MRI findings in patients with clinical adhesive capsulitis.

METHOD AND MATERIALS

A prospective assessment of a retrospective study group was performed. 31 non-contrast, non-arthrographic, shoulder MRI exams were divided into subject and control groups (mean age 55.8 years; 10 men, 20 women). Two blinded MSK radiologists evaluated the MRI exams for coracohumeral ligament thickness >2 mm, fatty infiltration of the rotator interval, and thickening/edema of the inferior joint capsule/axillary recess. Clinical diagnosis of adhesive capsulitis was provided by orthopedic surgery physical exams. One patient with clinical suspicion of adhesive capsulitis was excluded due to concomitant traumatic labral tear, leaving 15 subjects in each group.

RESULTS

A triad of MRI findings is associated with adhesive capsulitis. Adhesive capsulitis can be diagnosed on noncontrast shoulder MRI with high sensitivity/low specificity, intermediate sensitivity and specificity, or high specificity/low sensitivity based on the number of MRI criteria observed. Using a single criterion of coracohumeral ligament thickening, sensitivity is 76.7% and specificity is 53.3% for detection of adhesive capsulitis. Using two criteria of coracohumeral ligament thickening and fatty infiltration of the interval, sensitivity is 66.7% and specificity is 55.2%. Using all three criteria of coracohumeral ligament thickening, interval infiltration, and axillary recess thickening/edema, sensitivity is 23.3% and specificity is 86.7%.

CONCLUSION

Adhesive capsulitis can be accurately diagnosed on routine noncontrast shoulder MRI in conjunction with appropriate clinical criteria. The finding of a thickened coracohumeral ligament shows strong sensitivity for adhesive capsulitis while the constellation of coracohumeral ligament thickening, subcoracoid fatty infiltration of the rotator interval, and axillary recess thickening/edema yields great specificity for adhesive capsulitis.

CLINICAL RELEVANCE/APPLICATION

Routine noncontrast MRI findings in adjunct with clinical findings suspicious for adhesive capsulitis can provide accurate diagnosis without need for direct MR arthrography.

RC804-06 Extraarticular Shoulder MRI

Friday, Dec. 4 9:35AM - 10:00AM Location: E451A

Participants
David A. Rubin, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Modify MR imaging protocols of the shoulder to address suspected abnormalities in the chest wall that may refer symptoms to the shoulder joint. 2) Detect injuries in the shoulder muscles and tendons outside of the rotator cuff, and identify salient features on MR images that guide clinical management. 3) Assess the rib cage using for radiographically-occult injuries.

RC804-07 Postoperative Shoulder MRI

Friday, Dec. 4 10:10AM - 10:30AM Location: E451A

Participants
Lawrence M. White, MD, FRCPC, Toronto, ON (*Presenter*) Advisory Board, Siemens AG

LEARNING OBJECTIVES

1) Understand the general principles of common shoulder surgical procedures and their expected postoperative appearance at MR imaging.2) Review the value of MR imaging techniques in evaluation of the postoperative shoulder3) Identify MR imaging features of complications or recurrent pathology of the postoperative shoulder

ABSTRACT

This presentation will cover the expected spectrum of findings in the postoperative shoulder following common modern surgical

This presentation will cover the expected spectrum of findings in the postoperative shoulder following common modern surgical procedures. The value of MR imaging in the evaluation of recurrent or residual symptoms post shoulder surgery will be reviewed, highlighting the MR imaging features suggestive of complications, or recurrent and residual pathology.

RC804-08 Imaging of the Post Operative Shoulder: Which Imaging Modality is Most Accurate?

Friday, Dec. 4 10:30AM - 10:40AM Location: E451A

Participants
Thomas H. Magee, MD, Indian Harbour Beach, FL (*Presenter*) Nothing to Disclose

PURPOSE

Post operative shoulder patients are often difficult to image due to scar tissue, metallic artifact,and residual irregularity of anatomic structures . We report the accuracy of MR imaging versus MR arthrography versus CT arthrography in assessment of the post operative shoulder in the same patient population.

METHOD AND MATERIALS

One hundred consecutive post operative conventional shoulder MR and MR arthrography exams performed on the same patients were reviewed retrospectively by two musculoskeletal radiologists. Nineteen of these patients also had CT arthrography performed. Exams were assessed for labral tears and supraspinatus tendon tears. All patients went on to arthroscopy.

RESULTS

Of these one hundred patients, thirty-two had SLAP (superior labral anterior to posterior) tears , sixteen had posterior labral tears , nineteen had anterior labral tears and forty-two had full thickness supraspinatus tendon tears on conventional MR exam.On MR arthrogram exam forty six patients had SLAP tears, twenty-two had posterior labral tears, twenty-four had anterior labral tears and fifty-one had full thickness supraspinatus tendon tears .MR arthrogram detected fourteen SLAP tears,six posterior labral tears, five anterior labral tears and nine supraspinatus tendon tears not detected on conventional MR exam. Nineteen patients had additional imaging performed with CT arthrography due to metallic artifacts precluding MR assessment of shoulder pathology. There were two SLAP tears, three posterior labral tears, four anterior labral tears and one supraspinatus tendon tear seen on CT arthrography not seen on MR exam.

CONCLUSION

MR arthrography is more accurate than conventional MR in assessment of post-operative shoulder pathology. CT arthrography can detect additional pathology when there is metallic artifact in post operative patients. It is beneficial to inject a combination of gadolinium and CT contrast at arthrography so CT imaging can be performed post arthrography if metallic artifact precludes imaging shoulder pathology by MR.

CLINICAL RELEVANCE/APPLICATION

MR arthrography is more accurate than conventional MR in assessment of post operative shoulder pathology. It is beneficial to inject a combination of gadolinium and CT contrast at arthrography so CT imaging can be performed post arthrography if metallic artifact precludes imaging shoulder pathology by MR.

RC804-09 Biometry of theGlenoid: How to Choose the Right Prosthesis for the Right Patient in Reverse Shoulder Arthroplasty?

Friday, Dec. 4 10:40AM - 10:50AM Location: E451A

Participants
Sami El Ramadan, MD, Besancon, France (*Presenter*) Nothing to Disclose
Gauthier Menu, Besancon, France (*Abstract Co-Author*) Nothing to Disclose
Christelle Peyron, MD, Besancon, France (*Abstract Co-Author*) Nothing to Disclose
Carlos Torrens Canovas, Besancon, France (*Abstract Co-Author*) Nothing to Disclose
Laurent Obert, MD,PhD, Besancon, France (*Abstract Co-Author*) Nothing to Disclose
Sebastien L. Aubry, MD, PhD, Besancon, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Reverse shoulder arthroplasty has become popular in the treatment of excentrated omarthrosis. However even with up-to-date prosthetic designs and surgical techniques, complications are still frequent. Variations of the glenoid in the general population regarding patient's height, glenoid width and glenoid bone stock, have never been precisely assessed. This could help orthopaedic surgeons to choose the right reverse shoulder implant for one patient. The purpose of the study is 1) to provide a structural analysis of glenoid size and bone stock and 2) to optimize the selection of prosthetic size.

METHOD AND MATERIALS

Sixty-four slice MDCT of 50 normal shoulders were used for this study (Siemens Healthcare, Erlangen Germany). The biometry of the glenoid was assessed on PACS multiplanar and 3D reconstructions : we measured the surface of the largest circle covering the glenoid and being tangent to the inferior rim, the diameter of the circle, the height of the glenoid and the depth of the bone stock at nine representative target points. Glenoid were divided into 3 groups based on the diameter of the circle and correlation with patient's height and bone stock was performed.

RESULTS

Patient's were 62.42+/-12.87 year old and measured 166.96+/-9.63 cm. There was a significant correlation between patient's height, glenoid surface and glenoid diameter. Glenoid can be subdivided into three size groups : small (diameter<26mm), medium (diameter ranging from 26mm to 28mm) and big glenoid (diameter>28mm). There was no correlation between patient's height and glenoid height. Three target points had a bone stock correlated to glenoid size, whereas other target points did not.

CONCLUSION

Patients can be grouped into three distinct categories based on glenoid diameter but not on glenoid height. Glenoid bone stock and the length of the prosthetic screw is constant except antero-inferiorly.

CLINICAL RELEVANCE/APPLICATION

The knowledge of glenoid diameter may be useful to prevent mismatch of prosthetic shoulder implant by choosing between small, medium or big implants.

RC804-10 Imaging of the Unstable Elbow

Friday, Dec. 4 10:50AM - 11:15AM Location: E451A

Participants
Mark W. Anderson, MD, Charlottesville, VA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) List the primary stabilizing ligaments of the elbow. 2) Describe the role of the ulnar collateral ligament in the development of the valgus overload syndrome. 3) Discuss the bone and soft tissue injuries commonly found after posterior dislocation of the elbow.

ABSTRACT

Stability of the elbow depends heavilty upon the medial and lateral collateral ligament complexes. This session will focus on the normal anatomy of these ligaments as well as the most common types of ligament pathology that result in elbow instability and the radiographic and MR imaging findings that are seen in these conditions.

Active Handout:Mark W. Anderson

http://abstract.rsna.org/uploads/2015/15001703/RC804-10.pdf

Handout:Mark W. Anderson

http://abstract.rsna.org/uploads/2015/15001703/FINAL RSNA 2015 IMAGING THE UNSTABLE ELBOW 12.04.15 SYLLABUS ANDERSON.pdf

RC804-11 The Legend of the Luschka's Tubercle and its Association with Snapping Scapulae: Osseous Morphology of Snapping Scapulae on 2D and 3D CT Images

Friday, Dec. 4 11:15AM - 11:25AM Location: E451A

Participants
Tobias J. Dietrich, MD, Zurich, Switzerland (*Presenter*) Nothing to Disclose
Christoph A. Agten, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Philipp Furnstahl, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Lazaros Vlachopoulos, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose
Christian W. Pfirrmann, MD, MBA, Forch, Switzerland (*Abstract Co-Author*) Advisory Board, Siemens AG; Consultant, Medtronic, Inc

PURPOSE

To determine the osseous morphology of snapping scapulae on CT images in comparison with a control group.

METHOD AND MATERIALS

Two and three-dimensional CT images of scapulae of 34 patients with a snapping scapula were compared to a control group of 34 age and gender matched patients without a snapping scapula. Two blinded observers analyzed the following parameters: The presence of the so-called Luschka's tubercle was rated as yes or no. Measurements of the thickness and length of the superior angle of the scapula, the distance from the superior angle to the inferior angle, the depth of the subscapular fossa, the minimal distance between the scapula and rib cage, and the angle between the superior angle of the scapula and the subscapular fossa were obtained. The superior angle of the scapula was rated as concave or convex. Abnormalities of the rib cage and periscapular soft tissues were noted. The Fisher's exact test and Student's t-test served for data analysis.

RESULTS

In snapping scapula patients observer 1 did not find any Luschka's tubercle while observer 2 detected one Luschka's tubercle compared to two Luschka's tubercle in the control group for both observers (p-values>0.48). The superior angle of the scapula was significantly thicker in the snapping scapula group compared to the control group for both observers (observer 1: 4.8±1.3 mm versus 4.1±1.1 mm, observer 2: 5.1±1.6 versus 4.1±1.3 mm, p-values<0.02). The subscapular fossa was significantly deeper in snapping scapula patients compared to control group patients for both observers (observer 1: 21.9±5.0 mm versus 18.8±4.5 mm, observer 2: 28.6±5.9 mm versus 25.1±5.6 mm, p-values<0.035). The comparison of the remaining parameters did not differ significantly between the groups. No abnormalities of the rib cage and periscapular soft tissues were found in snapping scapula patients.

CONCLUSION

The superior angle of the scapula was significantly thicker and the subscapular fossa was significantly deeper in patients with a snapping scapula compared to control group patients. The Luschka's tubercle was rarely seen and not associated with a snapping scapula.

CLINICAL RELEVANCE/APPLICATION

CT images may detect subtle osseous variants in patients with a snapping scapula. Neither published original articles nor the present data suggest an association between the Luschka's tubercle and a snapping scapula.

RC804-12 Ultrasound Elastography Assessment of Changes in Ulnar Nerve Stiffness with Elbow Flexion

Friday, Dec. 4 11:25AM - 11:35AM Location: E451A

Participants
Tony T. Wong, MD, New York, NY (*Presenter*) Nothing to Disclose
Ronny Li, New York, NY (*Abstract Co-Author*) Nothing to Disclose

Dana Lin, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ada Ip, San Ramon, CA (*Abstract Co-Author*) Nothing to Disclose
Elisa E. Konofagou, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The intraneural pressure of the ulnar nerve (UN) within the cubital tunnel increases during elbow flexion. The purpose of this study is to determine whether ultrasound elastography can detect corresponding changes in nerve stiffness at the cubital tunnel and at defined distances away from it.

METHOD AND MATERIALS

Institutional review board and informed consent were obtained. Prospective examination of the UN in twenty elbows for ten consecutive volunteers was performed with ultrasound elastography.Each UN was examined in four positions while the elbow was in full extension: at the cubital tunnel, 4 cm proximal, 4 cm distal, and 8 cm distal. The elbow was then placed in full flexion (145 degrees) for three minutes and the entire examination was repeated.All ultrasounds were performed by a single radiologist on a SonixTouch system (Analogic Corp., Peabody, MA, USA) with a 10 MHz linear array transducer. An acoustic coupler (C) (EZU-TECPL1, Hitachi-Aloka Medical) with a standardized elasticity was attached to the probe. Ultrasound radio-frequency (RF) signals were obtained at each time point with a compression-decompression cycle lasting 4-6 seconds. Inter-frame axial displacements of the UN were estimated offline using a 1D normalized cross-correlation-based motion estimation method (Luo and Konofagou 2010) on the RF signals. Based on these displacements, inter-frame strains were computed using a least-squares strain estimator (Kallel and Ophir 1997) and added together to obtain cumulative strains. UN stiffness at each interrogated position was semi-quantified as a mean cumulative strain ratio (C/UN).

RESULTS

P-values were calculated using a matched pairs t-test. The change in mean C/UN ratios +/- standard deviation from extension to flexion were as follows:At cubital tunnel: 1.31 +/- 0.98 to 2.41 +/- 0.88 (p-value < 0.00015)4 cm proximal: 0.50 +/- 0.37 to 0.41 +/- 0.27 (p-value 0.24)4 cm distal: 1.23 +/- 0.90 to 0.85 +/- 0.91 (p-value 0.14)8 cm distal: 2.61 +/- 1.41 to 2.01 +/-1.45 (p-value 0.10)

CONCLUSION

Increased UN stiffness within the cubital tunnel can be detected by ultrasound elastography shortly after elbow flexion. No significant changes are detected 4 cm proximal, 4 cm distal, and 8 cm distal.

CLINICAL RELEVANCE/APPLICATION

Ultrasound elastography can detect changes in ulnar nerve stiffness during elbow flexion without significant lag time. It has potential for diagnostic use in early nerve compression.

RC804-13 Distal Triceps Tendon and Cubital Tunnel

Friday, Dec. 4 11:35AM - 12:00PM Location: E451A

Participants
Jenny T. Bencardino, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the normal MR anatomy of the distal triceps tendon and cubital tunnel at the elbow. 2) To describe the clinical syndromes that affect the distal triceps tendon and cubital tunnel including insertional triceps tendon tears, snapping triceps syndrome and cubital tunnel syndrome. 3) To review the MR findings associated with distal triceps tendon disease and cubital tunnel syndrome.

ABSTRACT

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Jenny T. Bencardino, MD - 2014 Honored Educator

RC807

GYN and Pelvic Floor 2015: Latest Imaging Guidelines and Angles Simplified!

Friday, Dec. 4 8:30AM - 10:00AM Location: N227

GU CT MR US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Mark E. Lockhart, MD, Birmingham, AL, (mlockhart@uabmc.edu) (*Coordinator*) Nothing to Disclose
Reena C. Jha, MD, Washington, DC (*Presenter*) Nothing to Disclose
Maitray D. Patel, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe current best practice recommendations for management of adnexal asymptomatic, incidental, and/or potentially physiologic findings on pelvic US, CT, and MR based on lesion characteristics and patient clinical factors. 2) Understand the reference lines and angles in pelvic MRI that are used in the evaluation of pelvic floor disorders. 3) Understand the typical imaging characteristics of the endometrium and myometrium according to patient age and stage of the reproductive cycle, and review associated benign pathology.

ABSTRACT

This session will present on topics related to pelvic imaging. At the conclusion of the three presentations, the participants should have an improved understanding of imaging characteristics of the ovaries and uterus, including endometrium. Also, the imaging parameters used in evaluation of pelvic floor abnormalities such as organ prolapse and structural abnormalities related to incontinence will be reviewed. In each lecture, the imaging characteristics of a variety of disease processes will be covered.

Active Handout:Maitray D. Patel

http://abstract.rsna.org/uploads/2015/14000842/RC807.pdf

RC817

Molecular Imaging Beyond PET: MRI and Ultrasound/Photoacoustic Molecular Imaging

Friday, Dec. 4 8:30AM - 10:00AM Location: S504CD

MI MR OI US

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Fabian Kiessling, MD, Aachen, Germany, (fkiessling@ukaachen.de) (*Moderator*) Advisor, invivoContrast GmbH; Co-owner, invivoContrast GmbH; Advisor, Molecular Targeting Technologies, Inc; Cooperation, Bayer AG; Cooperation, Bracco Group; Cooperation, Merck KgaA; Cooperation, AstraZeneca PLC; Cooperation, Koninklijke Philips NV; Cooperation, FUJIFILM Holdings Corporation

LEARNING OBJECTIVES

1) Attendees will learn the principles and applications of molecular imaging using ultrasound and photoacoustic imaging techniques. 2) Principles and applications of ultrasound molecular imaging will be reviewed. 3) Principles and applications of molecular imaging using photoacoustic imaging techniques will be presented. 4) Ultrasound guided drug delivery approaches will be reviewed. 5) At the end of this course, the attendees will understand the principles and potential clinical applications of ultrasound and optoacoustic molecular imaging as well as of ultrasound guided drug delivery.

Sub-Events

RC817A Photoacoustic Imaging

Participants
Stanislav Emelianov, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the fundamental principles of photoacoustic imaging and major components of photoacoustic imaging system. 2) Knowing how photoacoustic images are formed and how to interpret photoacoustic images. 3) Understand how imaging contrast agents or imaging probes affect contrast, penetration depth and specificity in photoacoustic imaging. 4) Understand the ability of photoacoustic imaging system to visualize anatomical, functional and molecular properties of imaged tissue. 5) Identify the role of photoacoustic imaging in pre-clinical and clinical applications.

ABSTRACT

Photoacoustic imaging or tomography - a non-ionizing, non-invasive, real-time imaging technique capable of visualizing optical absorption properties of tissue at reasonable depth and high spatial resolution, is a rapidly emerging biomedical and clinical imaging modality. Photoacoustic imaging is regarded for its ability to provide in-vivo morphological and functional information about the tissue. With the recent advent of targeted contrast agents, photoacoustics is capable of in-vivo molecular imaging, thus facilitating further molecular and cellular characterization of tissue. This presentation is designed to provide both a broad overview and a comprehensive understanding of photoacoustic imaging. With a brief historical introduction, we will examine the foundations of photoacoustics, including relevant governing equations, optical/acoustic properties of the tissues, laser-tissue interaction, system hardware and signal/image processing algorithms. Specifically, penetration depth and spatial/temporal resolution of photoacoustic imaging will be anlyzed. Integration of photoacoustic and ultrasound imaging systems will be discussed. Techniques to increase contrast and to differentiate various tissues in photoacoustic imaging will be presented. Furthermore, design, synthesis and optimization of imaging probes (typically, nanoconstructs or dyes) to enable molecular/cellular photoacoustic imaging will be presented. Special emphasis will be placed on contrast agents capable of multiplexed imaging, multi-modal imaging and image-guided therapy including drug delivery and release. The presentation will continue with an overview of several commercially available and clinically-relevant systems capable of photoacoustic imaging. Regulatory aspects of photoacoustic imaging systems and imaging contrast agents will be presented. Finally, current and potential biomedical and clinical applications of photoacoustics will be discussed.

RC817B Ultrasound Molecular Imaging

Participants
Juergen K. Willmann, MD, Stanford, CA (*Presenter*) Research Consultant, Bracco Group; Research Consultant, Triple Ring Technologies, Inc; Research Grant, Siemens AG; Research Grant, Bracco Group; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company

LEARNING OBJECTIVES

1) To understand the acquisition and quantification principles of ultrasound molecular imaging. 2) To understand the characteristics and biodistribution of molecularly targeted ultrasound contrast agents. 3) To understand the role of ultrasound molecular imaging in preclinical and clinical applications.

ABSTRACT

Ultrasound imaging is a widely available, relatively inexpensive, and real-time imaging modality that does not expose patients to radiation and which is the first-line imaging modality for assessment of many organs. Through the introduction of ultrasound contrast agents, the sensitivity and specificity of ultrasound for detection and characterization of focal lesions has been substantially improved. Recently, targeted contrast-enhanced ultrasound imaging (ultrasound molecular imaging) has gained great momentum in preclinical research by the introduction of ultrasound contrast agents that are targeted at molecular markers over-expressed on the vasculature of certain diseases. By combining the advantages of ultrasound with the ability to image molecular

signatures of diseases, ultrasound molecular imaging has great potential as a highly sensitive and quantitative method that could be used for various clinical applications, including screening for early stage disease (such as cancer); characterization of focal lesions; quantitative monitoring of disease processes at the molecular level; assisting in image-guided procedures; and, confirming target expression for treatment planning and monitoring. In this refresher course the concepts of ultrasound molecular imaging are reviewed along with a discussion on current applications in preclinical and clinical research.

RC817C Sonographically-guided Drug Therapy

Participants
Alexander L. Klibanov, PhD, Charlottesville, VA, (sasha@virginia.edu) (*Presenter*) Co-founder, Targeson, Inc; Stockholder, Targeson, Inc; Institutional research collaboration, AstraZeneca PLC;

LEARNING OBJECTIVES

1) To identify the basic principles of ultrasound energy deposition as applied to molecular imaging and image-guided therapeutic interventions. 2) To combine the general physical principles of ultrasound-microbubble interaction, drug-carrier systems pharmacokinetics and ultrasound contrast imaging, apply this knowledge for the development of triggered delivery approaches in the setting of personalized medicine. 3) To understand advantages and disadvantages of ultrasound application in the potential image-guided intervention designs. 4) To identify and compare potential clinical applications of ultrasound-guided drug delivery.

ABSTRACT

The reason of ultrasound use in drug delivery is to enhance drug action specifically in the area of disease. The design of such therapeutic intervention should assure that drug deposition or action enhancement take place only in the disease site, with the general goal to improve the therapeutic index. There are several approaches to ultrasound-assisted drug delivery. The first approach, closest to clinical practice, takes advantage of existing ultrasound contrast agents (intravenous gas microbubbles approved in US for cardiac imaging). When these bubbles are co-injected intravenously with the drugs, and ultrasound energy applied to the areas of disease, localized energy deposition leads to endothelium activation or transient "softening" of blood brain barrier (BBB). Drugs (including antibodies or liposomes) can thus transit BBB and achieve therapeutic action. Ultrasound imaging can be used for targeted focusing of ultrasound energy in the areas of disease. Second approach suggests attaching microbubbles to the drug or a drug carrier (including nucleic acid drugs). Microbubbles can be complexed with drug or gene carrier nanoparticles, so that local action of ultrasound would result in triggered drug release/deposit or transfection in the ultrasound-treated area. Third approach involves targeted microbubble design, as in ultrasound molecular imaging. Combination of targeted microbubbles with drug carrier makes possible unfocused ultrasound use, to act only in the areas of the target receptor expression, where microbubbles adhere and ultrasound energy is then deposited. Lately, formulation moved from microbubbles to smaller nanodroplet drug carriers, to reach interstitium, where drug release could take place upon ultrasound treatment. Overall, combination of ultrasound imaging, including contrast (molecular) imaging, focused ultrasound, and drug carrier systems will lead to novel image-guided therapies, especially applicable in the era of personalized medicine.

RC817D Magnetic Resonance Molecular Imaging

Participants
Moritz F. Kircher, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To receive a structured overview of the fundamental principles of generating molecular information with MRI. 2) To understand how each of these principles functions and what unique information it can provide. 3) To understand the current role of molecular MRI in preclinical and clinical applications. 4) To understand what the challenges of new molecular MRI approaches towards translation into humans will be.

ABSTRACT

The field of molecular MRI has exploded in the last decade, with hundreds of different concepts and probe designs developed and tested in vitro and in vivo. This talk will attempt at giving a structured overview over this vast arsenal of potentially useful approaches by focusing on those that have the highest potential for clinical translation. The approaches will be grouped into 6 major categories and their principles explained and illustrated with key examples: 1) Multimodal nanoparticles; 2) Activatable MRI probes; 3) Targeted superparamagnetic iron oxide nanoparticles; 4) non-targeted superparamagnetic iron oxide nanoparticles; 5) MRI-based Radiogenomics; and 6) Hyperpolarized magnetic resonance spectroscopic imaging.

RC818

Global Cancer Imaging-Insights from Overseas

Friday, Dec. 4 8:30AM - 10:00AM Location: E261

GU MI MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC818A Functional and Molecular Imaging at Oxford University

Participants
Fergus V. Gleeson, MBBS, Oxford, United Kingdom (*Presenter*) Consultant, Alliance Medical Limited; Consultant, Blue Earth Diagnostics Limited; Consultant, Polarean, Inc;

LEARNING OBJECTIVES

1) To learn about the functional and molecular imaging research being conducted within the Radiology Department of Oxford University Hospitals NHS Trust.

ABSTRACT

There is increasing functional and molecular imaging being performed in medicine. The Radiology department at the Churchill Hospital in Oxford is conducting a number of trials in these areas, and has designed these trials around interventions to measure the effect of these new techniques. It has also taken the opportunity to raise the profile of Radiology within the University, to promote greater collaboration with basic scientists, attracting increased funding, and opportunities for scientists and physicians.

RC818B Lessons Learned from the National Irish Breast Screening Program: The First 12 years-One Million Mammograms On

Participants
Michelle M. McNicholas, MD, Dublin, Ireland (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the results of the Irish National Breast Screening Program following 12 years of screening with over 1,000,000 mammograms performed. 2) To understand the essential components of setting up and maintaining a national breast screening program in Ireland. This includes the rationale for the decisions made at the outset, such as age range, frequency of screens, centralisation of service and responsibility of the screening process to the end of primary surgery. 3) To understand the need for and the mechanism of developing a national registry of eligible women in the absence of a national unique identifier. 4) To understand the need for a client charter which sets out client guarantees, objectives and goals around issues of consent, timeliness of screening results and recall to assessment, biopsy results and admission for surgery and further treatment where indicated. 5) To understand the necessity of national guidelines, annual reports and external accreditation. 6) To demonstrate the essential need for ongoing review of key performance indicators (recall rate, biopsy rate, cancer detection rate, DCIS rate, open biopsy rate, false negative rate, interval cancer rate) as surrogates of program success. 7) To understand the importance of communication and feedback to clients, units, practitioners and media in maintaining uptake. 8) To understand the reporting structure and the composition of various roles within the multidisciplinary medical and surgical teams. 9) To understand the requirements for ongoing training and education of all staff - physicians, technologists, nurses, physicists, administrative staff. 10) To understand the factors affecting radiation dose to the screened population and the over-riding responsibility of the ALARA principle, such as: role of physics team, mammographic technique, equipment choice, technologist expertise and training, quality assessment. 11) To understand the operational issues of different screening units, double reading, discrepancy cases, dealing with interval cancers, dealing with outliers in key performance parameters. 12) To understand the positive spinoff s from the program including increased awareness, improving national standards in the screening and the symptomatic population and the contribution to improved diagnostic and treatment options. 13) To understand how the program achieved, maintained, and monitored performance and how it adapted to changes in practice as issues or controversies arose. 14) To discuss whether this population screening program has been a successful and cost effective health care initiative for Ireland. 15) Ultimately, to understand whether the Irish National Breast Screening Program has led to improved survival in women with breast cancer in Ireland.

RC818C MRI of Pelvic Malignancy-The View from Down Under

Participants
Nicholas J. Ferris, MBBS, Clayton, Australia, (nicholas.ferris@monashhealth.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn about the local availability and funding of MRI in investigating pelvic malignancy that is unique to Australia.2) To understand the current usage of Pelvic MRI in investigating pelvic malignancy in the Australian population.3) To review some typical examples of Pelvic MRI in Oncology that illustrate the advantages of MRI in the assessment of pelvic malignancies and impact MRI has on patient management in the multidisciplinary setting.

ABSTRACT

Most medical imaging tests in Australia are heavily subsidized by the Federal government as part of the 'Medicare' national health

insurance system.Prostate cancer is a common problem in Australian men, and MRI appears to be a very useful tool in its assessment and management, however it remains unfunded in the Medicare system. To remedy this, a group of clinicians has made application to the Medicare Services Advisory Committee (MSAC) for inclusion of the test on the Medicare Benefits Schedule. Steps in the recently revised MSAC procedure will be reviewed, with reference to the current application for prostate MRI.The impact of its current unfunded status on the uptake of prostate MRI will be briefly reviewed.Despite the lack of government support, there has been considerable experience with the technique 'Down Under', leading to some important publications in the international literature about the role of MRI in selection of patients for biopsy, and the choice of biopsy target.

RC818D Imaging of HCC-A Korean Perspective

Participants
Byung Ihn Choi, MD, PhD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn recent imaging techniques for the qualitative and quantitative diagnosis, selection of treatment methods, and evaluation of monitoring after treatment for HCC. 2) To understand the imaging findings of hepatocarcinogenesis from regenerate nodule going through low and high grade dysplastic nodule, early HCC and finally to advanced HCC. 3) To review current clinical practice guidelines including role of imaging for the diagnosis and treatment for HCC with focus on recent change of guidelines by rapid progression of imaging biomarkers.

ABSTRACT

RC829

Body MRI: Clinical Challenges (An Interactive Session)

Friday, Dec. 4 8:30AM - 10:00AM Location: E450A

GI GU MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC829A Imaging Perianal Fistulae

Participants
Damian J. Tolan, MBBCh, FRCR, Leeds, United Kingdom, (damian.tolan@nhs.net) (*Presenter*) Speaker, Bracco Group; Speaker, Merck & Co, Inc

LEARNING OBJECTIVES

1) To understand how to describe the different types of fistula. 2) To learn how to perform, interpret and report MRI for the initial assessment of fistula in ano. 3) To learn the implications of MR findings in planning surgical treatment.

RC829B Pelvic Endometriosis

Participants
Evan S. Siegelman, MD, Philadelphia, PA (*Presenter*) Consultant, BioClinica, Inc; Consultant, ICON plc; Consultant, ACR Image Metrix

LEARNING OBJECTIVES

1) Review the theories concerning the pathogenesis of endometriosis. 2) Discuss the clincial indications that may indicate the use of pelvis imaging to diagnose endometriosis. 3) Assess the current MR techniques used in the detection and characterization of endometriosis. 4) Describe the imaging features of endometriomas and deeply infiltrative endometriosis.

ABSTRACT

Endometriosis is defined as the presence of ectopic endometrial glands and stroma outside the uterus. Endometriosis is a common cause of pelvic pain and infertility, affecting as many as 10% of premenopausal women. Radiologists should be familiar with the various imaging manifestations of endometriosis, especially those that allow its differentiation from other pelvic lesions. The MR 'pearls' offered here apply to the detection and characterization of pelvic endometriosis. The inclusion of T1-weighted fat-suppressed sequences is recommended for all MR examinations of the female pelvis because such sequences facilitate the detection of small endometriomas and aid in their differentiation from mature cystic teratomas. Benign endometriomas can exhibit restricted diffusion and should not be confused with ovarian cancer. Although women with endometriosis are at risk for developing clear cell and endometrioid epithelial ovarian cancers (ie, endometriosis-associated ovarian cancers), imaging findings such as enhancing mural nodules should be confirmed before a diagnosis of ovarian malignancy is suggested. The presence of a dilated fallopian tube, especially one containing hemorrhagic content, is often associated with pelvic endometriosis. Deep (solid infiltrating) endometriosis can involve the pelvic ligaments, anterior rectosigmoid colon, bladder, uterus, and cul-de-sac, as well as surgical scars; the lesions often have poorly defined margins and T2 signal hypointensity as a result of fibrosis. The presence of subcentimeter foci with T2 hyperintensity representing ectopic endometrial glands within these infiltrating fibrotic masses may help establish the diagnosis.

Honored Educators

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Evan S. Siegelman, MD - 2013 Honored Educator

RC829C Cholangiocarcinoma Diagnosis and Staging: What the Surgeon Needs to Know

Participants
Eduard E. De Lange, MD, Charlottesville, VA, (delange@virginia.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn about staging cholangiocarcinoma. 2) To understand how the tumor is classified surgically. 3) To get insight into the various surgical procedures for tumor resection. 4) To understand the importance of vascular involvement for determining tumor resectability.

ABSTRACT

Active Handout:Eduard E. De Lange

http://abstract.rsna.org/uploads/2015/15002799/RC829C.pdf

Handout:Eduard E. De Lange

http://abstract.rsna.org/uploads/2015/15002799/Course RC829C- de Lange EE - Cholangiocarcinoma - What the surgeon needs to

know.xps

RC851

Imaging in Practice: DWI in the Abdomen and Pelvis

Friday, Dec. 4 8:30AM - 10:00AM Location: S406A

GI GU MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants

Sub-Events

RC851A How to Perform DWI - Principles and Protocol

Participants
Shreyas S. Vasanawala, MD, PhD, Palo Alto, CA (*Presenter*) Research collaboration, General Electric Company; Consultant, Arterys; Research Grant, Bayer AG;

LEARNING OBJECTIVES

1) Understand basic principles of contrast formation in diffusion weighted MRI. 2) Understand sources of artifacts in diffusion weighted MRI. 3) Know techniques to reduce artifacts to produce diagnostic quality diffusion weighted images.

ABSTRACT

Diffusion-weighted imaging is being used with increasing frequency in body MRI. The basic mechanism of contrast generation is the use of large motion-sensitizing gradients such that water molecules undergoing random motion are dephased, resulting in signal loss. Tissues and lesions with high cellularity have reduced diffusive motion of water, which results in relatively high signal. However, a number of issues make diffusion-weighted imaging in the body challenging relative to neurological applications. First, the vast majority of clinical DWI is performed with an echo-planar technique, which suffers from image distortions due to field inhomogeneity. These become problematic particularly where there are gas-tissue interfaces, such as at the dome of the liver and near gas-filled bowel. The presentation will discuss methods to minimize these distortions. Second, the T2 relaxation rates of abdominal tissues are less than that of pelvic viscera and much less than that of the brain, whereas normal water diffusivity is higher; as the choice of diffusion sensitivity (b value) heavily influences the echo time, lower b values must be used. Third, motion from cardiac pulsations, respiration, and peristalsis produce artifacts, some of which are easily recognizable, and others which can subtly hide pathology. Techniques to minimize these pitfalls will be presented. Finally, issues of reproducibility that affect the practical clinical use of DWI for lesion characterization in body MRI will be discussed, along with approaches to improve reliability.

RC851B Interpretation of DWI - How to Create and Use ADC Maps in Your Practice

Participants
Thomas A. Hope, MD, San Francisco, CA, (thomas.hope@ucsf.edu) (*Presenter*) Advisory Committee, Guerbet SA; Research Grant, General Electric Company

LEARNING OBJECTIVES

1) Understand the principles of calculating ADC. 2) Understand the effect of b-value selection and weighting on diffusion calculations. 3) Explore the value of IVIM and other parameters.

ABSTRACT

In order to incorporate diffusion weighted imaging into clinical practices, it is important to understand how diffusion data is evaluated. Qualitatively, one can simply say that lesions are "bright" on diffusion, but intensity on high b-value imaging is not always equal to a lesion that has reduced diffusion. The understanding and implementation of quantitative analysis is therefore critical for both research and everyday clinical practice. The first step is the calculation of the apparent diffusion coefficient (ADC) map, which is used to help tease out the differences in intrinsic T2 hyperintensity and diffusivity. The calculation of the ADC map is greatly affected by the methodology used as well as the selection of b-values acquired. The ADC of a tissue describes how quickly signal decreases as the b-value is increased. Those lesions with high diffusivity will have high ADC values, while those lesions with reduced diffusion will have lower ADC values. In addition to ADC, other parameters have been describe that affect the measured diffusivity. The most commonly discussed is intravoxel incoherent motion (IVIM) that is thought to represent the random movement of blood within the capillary system, often called pseudodiffusion. This parameter has its greatest effect on diffusion weighted images at low b-values.

URL

RC851C Applications of DWI in Clinical Practice - When It Does and Doesn't Help

Participants
Frank H. Miller, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate the utility of diffusion weighted imaging in the abdomen. 2) Show advantages and limitations of diffusion weighted imaging in the abdomen.

ABSTRACT

Diffusion weighted imaging (DWI) has been used in neuroimaging for many years. It has only more recently become feasible in the abdomen. The objective of this talk is to emphasize the important role that diffusion-weighted imaging can have in your practice

and that it can be used routinely without difficulty in the abdomen and pelvis. DWI potentially can detect additional lesions and direct the radiologist to lesions that are not as well seen on conventional imaging. DWI helps in characterization of lesions but does have limitations in specificity which will be discussed. Qualitative and quantitative evaluation can be performed and the applications of these techniques clinically will be described. The strengths and limitations of DWI in multiple organs including the liver, pancreas, adrenal gland, kidney, and evaluation for metastases and infections will be discussed. DWI is especially helpful for identify lymph node and peritoneal metastases. Emerging techniques include the use of diffusion weighted imaging to assess response to therapy following liver-directed therapy will also be discussed. In summary, DWI should be used routinely if not being used at your institution. This talk will show benefits and limitations of DWI in a number of organs in the body.

Honored Educators

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Frank H. Miller, MD - 2012 Honored Educator
Frank H. Miller, MD - 2014 Honored Educator

SPNM61

Theranostics: Contributions of Diagnostic Nuclear Medicine and Targeted Radionuclide Therapy in Clinical Oncology (In Conjunction with SNMMI)

Friday, Dec. 4 8:30AM - 12:00PM Location: S504AB

GI HN MK NR CT MR NM OI RO

AMA PRA Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

FDA Discussions may include off-label uses.

Participants

LEARNING OBJECTIVES

1) An important aspect of Nuclear Medicine and Molecular Imaging is that the same core compound of the administered radiopharmaceutical can be labeled with both gamma emitters (for diagnostic) and beta (or alpha) emitters (for therapy), allowing for the targeted treatment of lesions. This is an expression of theranostics, the combination of therapy and diagnostics that is based on the specific tumor biology of each patient's disease. This proposed session will provide several examples of such paired diagnostic studies and treatements using Nuclear Medicine methods.

Sub-Events

SPNM61A Radioactive Iodine and Thyroid Cancer - Current Use and Controversies

Participants
Douglas Van Nostrand, MD, Washington, DC, (douglas.van.nostrand@medstar.net) (*Presenter*) Speakers Bureau, sanofi-aventis Group

LEARNING OBJECTIVES

1) Define remnant ablation, adjuvant treatment, and treatment of locoregional/distant metastases. 2) Discuss the indications and controversies of 131I for each. 3) Discuss the range of prescribed activity of 131I for each.

SPNM61B Bone Scintigraphy and the Use of Radionuclides in the Management of Patients with Metastatic Castrate-Resistant Prostate Cancer

Participants
Hossein Jadvar, MD, PhD, Los Angeles, CA, (jadvar@med.usc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review bone scintigraphy with single photon and PET radiotracers in the imaging evaluation of patients with prostate cancer. 2) To summarize the results of the ALSYMPCA clinical trial for 223Ra dichloride therapy in patients with castrate resistant metastatic prostate cancer.

SPNM61C Updates on the Use of PET/CT (and PET/MRI) and Radioimmunotherapy in NHL

Participants
Erik S. Mittra, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPNM61D Peptide Receptor Radionuclide Imaging and Therapy: Where Are We in Europe and What Shall the US Do to Catch Up?

Participants
Frederik L. Giesel, MD, MBA, Heidelberg, Germany (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the concept of theragnostic. 2) Identify promising candidates for PRRT. 3) Challenges and limitations of PRRT. 4) Future perspective using alpha-emitters.

ABSTRACT

Well-differentiated neuroendocrine tumors (NETs) demonstrate modest responses to conventional chemotherapy due to their slow proliferation rate. However, the expression of somatosatin receptors by NET enables targeting with high affinity peptides. When these octreotide analgue peptides are labelled with beta emitters such as 90Y or 177Lu promising anti-tumor effects have been observed. The presentation will introduce the concept of theragnostic (68Ga-DOTATOC and 90Y/177Lu-DOTATOC) for improved patient stratefication. Today, PRRT is well established for a long time in NET-patients. However challenges and limitations will be discussed in regard to other systemic therapies such as everolimus or sunitinib. Finally, outlook will be given in regard to the novel of targeted alpha therapy in NET-patients and its implication to other tumor entities.

URL

SPNM61E Participant **Selective Internal Radiation Therapy for Hepatic Malignant Lesions**

Ghassan El-Haddad, MD, Tampa, FL, (ghassan.elhaddad@moffitt.org) (*Presenter*) Speaker Bureau, Bayer AG

LEARNING OBJECTIVES

View learning objectives under main course title.

SST01

Breast Imaging (Multi-modality Screening)

Friday, Dec. 4 10:30AM - 12:00PM Location: E450B

BR DM MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Michael N. Linver, MD, Albuquerque, NM (*Moderator*) Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd
Stamatia V. Destounis, MD, Scottsville, NY (*Moderator*) Research Grant, FUJIFILM Holdings Corporation; Research Grant, Hologic, Inc; Research Grant, QT Ultrasound LLC

Sub-Events

SST01-01 Should Screening Breast MRI be Performed in Women with a History of Lobular Neoplasia?

Friday, Dec. 4 10:30AM - 10:40AM Location: E450B

Participants
Claudia R. Seuss, MD, New York, NY (*Presenter*) Nothing to Disclose
Samantha L. Heller, MD, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Jennifer Chun, MPH, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Shira Schwartz, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Freya Schnabel, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Linda Moy, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Women with lobular neoplasia (LN), defined as a history of LCIS and/or ALH, have an elevated breast cancer risk, yet the benefit of screening MRI is unclear. The purpose of our study is to determine the cancer detection rates with mammography alone versus mammography plus MRI in this population.

METHOD AND MATERIALS

This IRB approved retrospective study identified 80 women with LN who underwent a screening MRI and mammogram from 2003 - 2014. Comparison was made to 412 women with LN who underwent mammography alone. Screening MRI was performed at the discretion of the referring physician.

RESULTS

2,168 mammograms were performed in 412 women, median 5 exams. 167 (7.7%) biopsies and 149 (6.9%) follow-up exams were performed. 28/412 (6.8%) cancers were detected by mammography, 9 (32.1%) were DCIS and 19 (67.9%) were invasive carcinomas. Median time from LCIS diagnosis to cancer detection was 57 months (range 18 -128 months). An additional 26 (6.3%) interval cancers were detected, 7 (37%) DCIS and 19 (73%) were invasive cancers, 10 carcinomas were stage 2 or higher.245 MRIs were performed in 80 women, median of 2 exams. 41 (16.7%) biopsies and 25 (10.2%) follow-up exams were performed. 9/80 (11.3%) cancers were detected on MRI of which 5 (55.6%) were DCIS and 4 (44.4%) were IDC. Two (2.5%) women developed interval cancers (both Stage 1 IDC's) that were found on follow-up mammogram. Median time from LCIS diagnosis to cancer detection was 48 months (range 6-120 months).Later stage carcinomas were detected on women with LN who were screened with mammogram alone. Cancer detection rate was higher (11.3%) in women who had screening MRI compared to mammography alone (6.8%), although the rates were not significant (p=0.12). Although the rate of follow up exams did not differ (p=.64), more biopsies were performed in the MRI group (p=.02).

CONCLUSION

Our study cautiously supports screening MRI for women with a history of LN.

CLINICAL RELEVANCE/APPLICATION

Although cancer detection rates were similar between both groups, more interval cancers at an advanced stage were seen in women with LN who underwent mammography alone.

SST01-02 Outcome of Screening Breast MRI in Pre-menopausal Women as a Function of Week of Menstrual Cycle

Friday, Dec. 4 10:40AM - 10:50AM Location: E450B

Participants
Yolanda Bryce, MD, New York, NY (*Presenter*) Nothing to Disclose
Carol H. Lee, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Junting Zheng, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Elizabeth J. Sutton, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Janice S. Sung, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Elizabeth M. Morris, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine if there is an association between the outcome of screening breast MRI and the week of the menstrual cycle in pre-menopausal women.

METHOD AND MATERIALS

The reports of consecutive screening MRI examinations in pre-menopausal women done from January 2011 through December 2012 were reviewed. Cases for which the stage of the menstrual cycle was documented were included. The week of the menstrual cycle, the degree of background parenchymal enhancement (BPE), final BI-RADS assessment, and positive predictive value of any subsequent biopsy (PPV3) were noted. Rao-Scott Chi square test and Fishers exact test were used to determine statistical significance.

RESULTS

A total of 1537 MRI examinations in 1240 women were performed. 334 studies were done in week 1, 620 in week 2, 354 in week 3 and 229 in week 4. There was a significant difference in BPE with fewer cases of marked BPE in weeks 1 and 2 compared to weeks 3 and 4 (p=0.026). However, there was no statistically significant difference in final BI-RADS assessment (p=0.412) or PPV3 by either week of menstrual cycle (p=.180) or by amount of BPE (0.195). Detailed results are presented in Table 1.

CONCLUSION

There is no significant difference in outcome of screening MRI examinations by week of menstrual cycle in which the study is performed. Therefore, aiming to perform screening MRI in week 2 is not necessary.

CLINICAL RELEVANCE/APPLICATION

Timing screening breast MRI for the second week of the menstrual cycle does not make a difference in outcome and is not necessary.

SST01-03 Breast Cancers not Detected by MRI in a High and Intermediate Risk Screening Program

Friday, Dec. 4 10:50AM - 11:00AM Location: E450B

Participants
Suzan Vreemann, MSc, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Albert Gubern-Merida, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Susanne Lardenoije, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Bram Platel, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Nico Karssemeijer, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Shareholder, Matakina Technology Limited; Consultant, QView Medical, Inc; Shareholder, QView Medical, Inc; Director, ScreenPoint Medical BV; Shareholder, ScreenPoint Medical BV;
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG

PURPOSE

The purpose of this study was to evaluate the visibility of MR screen detected cancers on prior MR examinations in a population with an elevated risk for breast cancer.

METHOD AND MATERIALS

An IRB approved, retrospective review of patient files from women screened with breast MRI between 2003 and 2013 was conducted at our academic center. We selected all cases detected in MRI with a prior negative MR examination performed between 6 and 24 months before a cancer was revealed (mean: 12.8 ± 3.7 months). This yielded 43 cancers (3 invasive lobular-, 33 invasive ductal carcinomas, 5 ductal carcinoma in situ and 2 others) in 41 patients (age: 49 ± 9.8 years, 21 BRCA patients). The MR scans where the cancers were detected (diagnostic MR scan) and the prior MR scans were evaluated side-by-side in consensus by two dedicated breast radiologists. The visibility of the cancers on prior scans was rated as: visible (BIRADS 4/5), minimal sign (BIRADS 2/3), or invisible (BIRADS 1). Chi-square tests were used to test the correlation between patient and cancer characteristics, image quality (IQ), background parenchymal enhancement (BPE), and visibility of the tumor in the prior MR scan.

RESULTS

All lesions were retrospectively evident on the diagnostic MR scan. Review of the prior examinations of the 43 cancers detected in follow-up rounds revealed that 11 lesions (26%) were visible in the prior MRI and should have been recalled at the time of this scan. 15 lesions (35%) showed a minimal sign in the prior MRI. Only 17 lesions (40%) were completely invisible. High grade, ER negative, and PR negative tumors were more often invisible in the prior scan (p=0.016, p=0.005, and p=0.002). Moreover, tumors in BRCA patients were more likely to be invisible in the prior scan, than in non-BRCA carriers (p=0.025). IQ and BPE were not significantly related to the visibility of tumors in the prior scan.

CONCLUSION

About 26% of the breast cancers could have been recalled earlier and only 40% of the breast cancers were invisible in retrospect.

CLINICAL RELEVANCE/APPLICATION

To prevent screening errors regular auditing of clinical practice is indicated. Moreover, like in mammography, structural double reading of MRI screening examinations may be recommended.

SST01-04 Consistency of Density Categories over Multiple Screening Rounds Using Volumetric Breast Density

Friday, Dec. 4 11:00AM - 11:10AM Location: E450B

Participants
Katharina Holland, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Carla H. van Gils, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Software support, Matakina Technology Limited
Johanna O. Wanders, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG
Nico Karssemeijer, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Shareholder, Matakina Technology Limited; Consultant, QView Medical, Inc; Shareholder, QView Medical, Inc; Director, ScreenPoint Medical BV; Shareholder, ScreenPoint Medical BV;

PURPOSE

As a result of the breast density laws, clinicians in many states are obliged to inform women about their breast density and the increased risk that is associated with dense breasts. An increasing number of women with dense breasts decides to have

supplemental screening. Using an automated software system, we investigated the consistency of the classification of serial screening mammograms in non-dense and dense classes over time.

METHOD AND MATERIALS

Full field digital mammograms from a breast cancer screening program were used in which women are invited every two years, starting at the age of 50. The initial screening exam and three subsequent screening exams were available for 2504 women. The average screening interval was 24.4 months. All images were processed by Volpara 1.5.0 (Matakina, Wellington, New Zealand); volumetric percent breast density (PDV) was calculated and averaged over both MLO images. Using the thresholds of the Volpara Density Grade (VDG), all exams were classified as non-dense (PDV<7.5, VDG1+2) or dense (PDV>7.5, VDG3+4). Additionally, to avoid class switches due to small fluctuations of PDV, we defined a gated threshold as follows: For a change to the dense category a PDV greater than 8.3 was required, for a decrease a threshold of 6.7 was used. The gate width was based on noise measures.

RESULTS

The majority of women stayed in the same category for the whole period, 38.9% non-dense and 34.5% dense, using the fixed threshold. In 18.1% of the women density decreased and the class changed from dense to non-dense; The deviating patterns were as follows: For 2.4% of the women one intermediate exam was classified as non-dense, while all other exams were dense. Three non-dense and one dense exam were observed in 3.8%. In 2.4% two exams were classified as dense and two as non-dense. Use of the gated threshold reduced the number of women with a deviating pattern.

CONCLUSION

Classification into dense and non-dense classes gives stable results over time. Only in a small fraction of the population do we need to assume that an exam was not assigned to the proper class. Use of a gated threshold to separate the non-dense from the dense class reduces the percentage of misclassified exams.

CLINICAL RELEVANCE/APPLICATION

A consistent classification in non-dense and dense classes is important, as women and clinicians might lose confidence in the stratification process when supplemental screening is offered in deviating pattern.

SST01-05 The Relation between Diabetes, Hypertension, Obesity and the Risk of Breast Cancer Development- Results from a Population-based Breast Cancer Screening Program

Friday, Dec. 4 11:10AM - 11:20AM Location: E450B

Participants
Dorria S. Salem, MD, Cairo, Egypt (*Presenter*) Nothing to Disclose
Rasha M. Kamal, MD, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Sarah A. Maksoud, MBBCh, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Rehab M. El Sheikh, MD, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Asmaa Abdel Magied, MD, PhD, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose
Iman Adel, MA, Cairo, Egypt (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of this study is to evaluate the relation between diabetes, hypertension, obesity and the development of breast cancer in a population- based screening program.

METHOD AND MATERIALS

The studied population includes104,893 female patients who were enrolled in a population-based Breast Cancer Screening Program in the period from November 2007 to November 2013. All patients performed a mammography examination and were classified according to mammography examination into: Group 1 (BI-RADS 1, 2 and 3 categories) and Group 2 (BI-RADS 4 and 5 categories according to the Mammography Bi-RADS lexicon. Blood pressure (BP), random blood sugar (RBS) and body mass index were measured and compared between females in both groups. Descriptive statistics (frequencies and percentages for categorical variables) were calculated in both groups. Comparison between both groups was performed using Chi square test. P values less than 0.05 were considered statistically significant.

RESULTS

The studied population included 104,893 females screened for breast cancer ; 2125/104,893 (2%) of which were scored as BIRADS4 and BIRADS5 categories. Group 2 showed statistically higher elevated random blood sugar levels (652/2125, 30 %), higher blood pressure levels (873/2125, 2125, 41%) and higher BMI (1768/2125, 83.2%) than group 1. The calculated p-values were 0.064, <0.001 and 0.005 respectively.

CONCLUSION

The findings of the current study provide evidence in support of a statistically significant association between elevated blood sugar levels, hypertension, body mass index and breast cancer risk among screened population.

CLINICAL RELEVANCE/APPLICATION

The incidence of breast cancer, diabetes, hypertension and obesity on the rise. They all carry high burden of morbidity and mortality. Breast cancer preventive strategies should be applied with higher concern for those with hypertension, elevated blood sugar levels and overweight population.

SST01-06 The Impact of Making 3D Mammography Available to a Rural Population

Friday, Dec. 4 11:20AM - 11:30AM Location: E450B

Participants
Christin S. Reisenauer, MD, Moscow, ID (*Presenter*) Nothing to Disclose
Mark D. Hiatt, MD, MBA, Salt Lake City, UT (*Abstract Co-Author*) Medical Director, Regence BlueCross BlueShield; Board Member, RadSite ; Former Officer, HealthHelp, LLC

PURPOSE

To assess the impact of making digital breast tomosynthesis, or 3D mammography, available to a rural population (previously with access to only conventional 2D digital mammography).

METHOD AND MATERIALS

The impact of adding 3D mammography on May 5, 2014, as interpreted by 3 board-certified (but not fellowship-trained) radiologists at a 25-bed community hospital serving a rural area in the U.S. encompassing a population of 24,500 (but affecting an extended area encompassing more than1 million), was ascertained by analyzing data (compiled via MRS tracking software) from 5,387 screening and diagnostic mammographic exams (comprised of 2,426 2D studies performed between 5/5/13 and 3/31/14 and 2,961 3D studies performed between 5/5/14 and 3/31/15) regarding (a) compliance with annual screening mammography, (b) the rate of breast-cancer detection per 1,000 screened, (c) the call-back rate for screening exams, and (d) community embracement of 3D technology (as evidenced by its acquisition by nearby facilities).

RESULTS

After 3D installation, (a) screening exams increased by 26% (from 2,128 to 2,685), despite no significant rise in population, (b) the rate of breast-cancer detection increased by 98% (from 4.70 to 9.31 per 1,000), (c) the call-back rate declined by 18% (from 8.18 to 6.67%), and (d) of the 9 major hospitals in the area, all but 2 are slated to acquire 3D mammography within one year of the initial installation.

CONCLUSION

Following the addition of 3D mammography in a small community, the compliance with screening mammography, rate of breast-cancer detection, and rate of community embracement of 3D technology increased, while the call-back rate decreased.

CLINICAL RELEVANCE/APPLICATION

Making 3D mammography available to a rural population may improve key metrics of breast-cancer imaging and entice yet more providers in the region to offer this technology.

SST01-07 How Can We Identify Women at Risk for a Masked Cancer, Who May Benefit from Supplemental Screening?

Friday, Dec. 4 11:30AM - 11:40AM Location: E450B

Participants
Katharina Holland, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Carla H. van Gils, PhD, Utrecht, Netherlands (*Abstract Co-Author*) Software support, Matakina Technology Limited
Johanna O. Wanders, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Speakers Bureau, Bayer AG
Nico Karssemeijer, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Shareholder, Matakina Technology Limited; Consultant, QView Medical, Inc; Shareholder, QView Medical, Inc; Director, ScreenPoint Medical BV; Shareholder, ScreenPoint Medical BV;

PURPOSE

The sensitivity of mammograms is low for women with dense breasts, since cancers may be masked by dense tissue. In this study, we investigate methods to identify women with density patterns associated with a high masking risk. Three methods based on quantitative volumetric breast density analysis are compared to an area based density measure.

METHOD AND MATERIALS

We used the last negative screening mammograms of 87 women who subsequently presented an interval cancer (IC) and, as controls, 870 randomly selected normal screening exams from women without cancer. Volumetric breast density maps (VBDMs) were computed using software provided by Matakina (Wellington, New Zealand). These maps provide dense tissue thickness for each pixel location. We used the VBDMs to compute three masking measures: 1) Volume of glandular tissue (VGT), 2) Percent dense volume (PDV), and 3) Percent area where dense tissue thickness exceeds 1cm (PA1). In addition, we determined percentage dense area (PDA) after classifying pixels automatically in dense and nondense classes (random forest classifier). Methods were applied to MLO views and averaged per exam. For each method, we selected cases with the highest masking measure (by thresholding) and computed the fraction of ICs as a function of the fraction of controls selected. We used the Volpara Density Grade (VDG, threshold on PDV) to distinguish women with nondense breasts from dense breasts (VDG3+4). In practice women with dense breasts are offered supplemental screening. We determined the fraction of controls corresponding to this categorization, and determined sensitivity of our masking measures to select women with masked cancers.

RESULTS

Using VDG, 38% of the controls have dense breasts. When offering 38% of the women supplemental screening, 55%, 66%, 71% and 60% of the women with IC would be included using VGT, PDV, PA1 and PDA respectively. The sensitivity of PA1 was significantly higher compared to VGT and PDA (p-value <0.05).

CONCLUSION

Measures based on volumetric density maps are a promising tool to identify women with a high risk for a masked cancer. Novel masking risk measures have a higher sensitivity than often used measures such as percent dense volume and area.

CLINICAL RELEVANCE/APPLICATION

When offering supplemental screening to women with a high risk for masked cancer, the response of this group should be as high as possible to make supplemental screening feasible and cost efficient.

SST01-08 Comparison of Visibility of Screen Detected Cancers on One-View versus Two-View Digital Breast Tomosynthesis and Full Field Digital Mammography

Friday, Dec. 4 11:40AM - 11:50AM Location: E450B

Participants

Asif Iqbal, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose
Rema Wasan, MBBCh, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Juliet C. Morel, MBChB, MRCP, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
David Evans, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
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Clare Peacock, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Jane E. Goligher, FRCR, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Michael J. Michell, MBBCh, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Keshthra Satchithananda, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Published data from large randomized trial (Wald NJ et al, 1995) indicates significantly increased sensitivity for cancer detection with two-view versus one-view mammography in routine screening. This resulted in implementation of bilateral two-view, medio-lateral-oblique (MLO) and cranio-caudal (CC) rather than one-view mammographic screening. With the advent of digital breast tomosynthesis (DBT) which allows better tissue visualization, we wanted to assess the difference between two-view versus one-view DBT on cancer detection.

METHOD AND MATERIALS

Study group included women who were diagnosed with cancers following recall after routine screening. Cases were identified by their initial film-screen mammography for a suspected lesion. At assessment all subjects underwent bilateral DBT and full field digital mammography (FFDM) examinations as combo in two views (MLO and CC projections), ensuring that DBT and FFDM reconstructed images were co-registered. The process involved first reviewing FFDM followed by DBT mammograms. In each session all readers initially read and rated MLO view of both breasts then read and scored bilateral CC view. Each of the projections (MLO and CC) was interpreted separately. Readers were not allowed to revert to the previous view. This prevented changing of scores of already marked lesions.

RESULTS

Of 358 cancers (in 345 women) imaged on DBT, 19 (5.3%) lesions were visible only on the MLO examination and 2 (0.5%) were only seen on the CC examination; compared to FFDM, 27 (7.5%) were visible only on the MLO view and 15 (4.2%) were seen only on the CC view. Five (1.4%) cancers were only detected on DBT. The projection view of the imaging modality influenced the predictive value for malignancy. The difference in the distribution of cancers detected on MLO-alone and CC-alone was statistically significant (p-value < 0.035 on Fisher's exact test). This suggested that detection of malignant lesions on DBT was more likely than on FFDM.

CONCLUSION

The study results demonstrated that obtaining both views is necessary to ensure that a malignancy will be optimally visualized and derive the potential benefit from DBT.

CLINICAL RELEVANCE/APPLICATION

Two-view DBT detects more cancers than two-view FFDM and more than one-view DBT. Therefore DBT imaging in both CC and MLO positions should be performed.

SST01-09 The Influence of Environment on Optimal Image Acquisition during Mammography

Friday, Dec. 4 11:50AM - 12:00PM Location: E450B

Participants
Shakira Sarquis, Boca Raton, FL (*Presenter*) Nothing to Disclose
Kathy J. Schilling Colletta, MD, Delray Beach, FL (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of mammography is early detection of breast cancer, therefore image quality is essential. Proper breast positioning is a key factor affecting mammographic quality. Proper positioning maximizes the amount of breast tissue imaged thus potentially increasing the sensitivity of the mammogram. We sought to investigate the effect of a multi-modal sensory stimulating environment on the quantity of breast tissue imaged and the compression force used during mammography when compared to a typical setting.

RESULTS

The quantity of additional breast tissue obtained in the SR was significantly improved when compared to the TR in all four standard projections (p<=.04). Mean percentage of additional tissue obtained in the SR versus TR was 5.0%. There were no significant differences present in the compression force utilized to obtain the additional tissue (p>=.14).

CONCLUSION

In summary, a multi-modal sensory stimulating environment positively impacts optimal mammographic image acquisition by maximizing tissue visualized radiographically with no significant change in compression force when compared to typical mammography room. Incorporating a sensory stimulating environment during mammography may serve to increase the sensitivity of the mammogram by reducing false negatives attibuted to inadequate tissue acquisition. Optimal positioning maximizes of amount of breast tissue imaged. The rationale behind these findings may be understood by previous research that reported decreased anxiety and decreased discomfort during mammography when completed in this same sensory-stimulating environment.

METHODS

A retrospective analysis was conducted of women who underwent mammography (n=303) for two consecutive years with their last mammogram being completed in a sensory-stimulating mammography room (SR) and the prior mammogram being completed in a typical mammography room (TR). Specifically, the SR attempted to induce relaxation through simultaneous stimulation of the olfactory, sight, and auditory senses by infusing the air with a light aroma while wall monitors displayed soothing videos of varying environmental themes, and projected relaxing sounds. The amount of tissue imaged was calculated measuring the posterior nipple line on the two MLO and two CC images for both years. Additionally, the compression force was measured for each projection.

SST02

Cardiac (Molecular Imaging/Other)

Friday, Dec. 4 10:30AM - 12:00PM Location: S501ABC

CA MI MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Balazs Ruzsics, MD, PhD, Charleston, SC (*Moderator*) Nothing to Disclose
Pal Maurovich-Horvat, MD,PhD, Budapest, Hungary (*Moderator*) Nothing to Disclose

Sub-Events

SST02-01 Age Dependency of Myocardial Triglyceride Content: A 3T 1H-Magnetic Resonance Spectroscopy Study

Friday, Dec. 4 10:30AM - 10:40AM Location: S501ABC

Participants
Bernhard Petritsch, Wurzburg, Germany (*Presenter*) Nothing to Disclose
Tobias Gassenmaier, MD, Wurzburg, Germany (*Abstract Co-Author*) Speaker, Siemens AG
Julian Donhauser, MD, Wurzburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Andreas Kunz, Wurzburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Thorsten A. Bley, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Horn, PhD, Wurzburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The role of myocardial triglyceride (mTG) content in the aging human heart is not entirely understood. The aim of this study was to measure concentrations of mTG content from healthy volunteers using 1H-magnetic resonance spectroscopy (1H-MRS) and to determine the association between age, mTG content and systolic heart function (expressed as ejection fraction). Furthermore, the technical reliability of 1H-MRS at 3 T was evaluated.

METHOD AND MATERIALS

The total study population of 47 healthy volunteers was divided into 4 age classes, according to the age of the subjects (1st cohort 20 - 29 years (yrs.), n=20; 2nd cohort 30 - 39 yrs., n=10; 3rd cohort 40 - 49 yrs., n=9; 4th cohort 50 - 60 yrs., n=8). Cardiac MRI and dual triggered 1H-MRS of the myocardium were consecutively performed using a 3 T scanner (MAGNETOM Trio, Siemens). The mTG content was calculated as quotient of the mTG resonance areas (at 0.9 ppm [CH3 groups] and 1.3 ppm [CH2 groups]) and the tissue water resonance area (at 4.7 ppm), expressed as triglyceride / water resonance ratio in %. Each participant underwent spectroscopic measurements twice.

RESULTS

mTG content significantly correlates with age (r=0.48; p<0.001). Following age-averaged values for mTG content were determined: 1st cohort 0.25% (± 0.17); 2nd cohort 0.48% (± 0.30); 3rd cohort 0.48% (± 0.18); 4th cohort 0.77% (± 0.70). While we found a slight correlation between BMI and mTG content (r=0.27; p=0.008), age proved to be the dominant variable accounting for higher mTG content in healthy humans. There was no significant correlation (r=0.04; p=n.s.) between LV mass and mTG content in healthy volunteers. No effects of mTG content was seen on systolic heart function (r=-0.01; p=n.s.). Intraclass correlation coefficient of repeated spectroscopic measurements was high (r=0.965; p<0.001).

CONCLUSION

1H-MRS proved to be a highly reproducible, sensitive tool for myocardial lipid determination. Myocardial TG content is age dependent and increases with age. Myocardial TG content was independent from LV mass and systolic heart function. Furthermore a higher scattering of mTG levels was observed with rising age.

CLINICAL RELEVANCE/APPLICATION

Myocardial TG content rises with advancing age. The age-dependent concentration ranges of myocardial lipid metabolites reported in this study may be helpful for the correction of acquired 1H-MRS data in patients when evaluating metabolic and cardiovascular diseases infuture studies.

SST02-02 Transplantation of Mesenchymal Stem Cells Overexpressing Integrin-linked Kinase Improves the Myocardial Repairing Following Acute Myocardial Infarction

Friday, Dec. 4 10:40AM - 10:50AM Location: S501ABC

Participants
Dan Mu, Nanjing, China (*Presenter*) Nothing to Disclose
Hongming Yu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Chuan Shuai Tian, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Weibo Chen, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Biao Xu, Nanjing, China (*Abstract Co-Author*) Research Grant, General Electric Company
Bin Zhu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigated the effects of transplanted autologous mesenchymal stem cells overexpressing integrin- linked kinase (ILK) on myocardial perfusion, myocardial fibrosis and cardiac function in the swine AMI model by MR imaging in vivo.

METHOD AND MATERIALS

MSCs or ILK-MSCs (5×107 cells) were randomly transplanted into the ischemic myocardium via coronary artery 1 week after establishing the swine acute myocardial infarction model (6 swine per group) by ballon occlusion. The myocardial blood perfusion, the infarction area and the cardiac function were assessed by MR first pass perfusion, delayed enhanced examination and cine MR respectively before and 2 weeks after transplantation using MR imaging.The cardiac fibrosis and capillary density were assessed using immunohistochemistry two weeks later. The data was statistically analyzed with Independent Sample t test using SPSS17.0 software.

RESULTS

Myocardial perfusion was significantly greater in the ILK-MSCs group than in the MSCs group (area under the perfusion curve:44840±4807mm2 vs. 35681±5548mm2, p<0.05) and was associated with greater neovessel formation (CD31 positive cells:273.0±28.3cells/field vs. 194.2±30.7cells/field, p<0.05). The variation of infarction areas were larger in the ILK-MSCs group than in the MSCs group(the infarct size ratio:0.96±0.11 vs. 0.76±0.09, p<0.05) and was associated with less myocardial fibrosis in Masson staining(the fibrosis area: 46.7±9.0% vs. 62.0±4.9%, p<0.05). Transplantation of ILK-MSCs improved reginal cardiac function compared with transplantation of MSCs(wall thickness ratio:60.70±6.8% vs. 52.08±5.6% , p<0.05).

CONCLUSION

Transplantation of mesenchymal stem cells modified with ILK enhance the myocardial repairing after AMI.

CLINICAL RELEVANCE/APPLICATION

MR imaging is a reliable method to evaluate the effect of transplantation of MSCs overexpressing ILK on cardiac repairing.

SST02-03 MR Molecular Imaging of Homing of Mesenchymal Stem Cells Overexpressing Intergrin-linked Kinase after Transplantation via Coronary in Swine Acute Myocardial Infarction

Friday, Dec. 4 10:50AM - 11:00AM Location: S501ABC

Participants
Dan Mu, Nanjing, China (*Presenter*) Nothing to Disclose
Hongming Yu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Chuan Shuai Tian, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Weibo Chen, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Biao Xu, Nanjing, China (*Abstract Co-Author*) Research Grant, General Electric Company
Bin Zhu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To in vivo detect the homing ability of MSCs overexpressing integrin- linked kinase (ILK) after transplantation via coronary in swine model of AMI using MR molecular imaging technique.

METHOD AND MATERIALS

MSCs or ILK-MSCs(5×107 cells)genetically modified with adenovirus containing GFP or GFP/ILK and labeled with ultrasmall superparamagnetic iron oxide(USPIO) were transplanted into the ischemic myocardium via coronary artery 1 week after establishing the swine myocardial infarction model by ballon occlusion.The cell cardiac homing and migration were tracked in vivo at 24h, 1w and 2w after transplantation using MR molecular imaging on clinical 1.5T MR scanner.The GFP expression was calculated from frozen section and the iron particles in transplanted cells was detected by prussian blue staining 2 weeks later. The data was statistically analyzed with Independent Sample t test for two group comparison using SPSS17.0 software.

RESULTS

In vivo MR molecular imaging manifested in both Groups that the hypointense area (MSCs:97.60±4.05mm2;ILK-MSCs:109.8±6.96mm2) at 1 week was larger (p<0.05) than those at 24 hours(MSCs:80.06±5.47mm2;ILK-MSCs:89.98±6.15mm2) and the signal intensity variation (MSCs:359.8±44.94; ILK-MSCs:473.6±44.85) was smaller(p<0.05) than those at 24 hours (MSCs: 457.2±43.80; ILK-MSCs:662.4±40.98). The hypointense area (MSCs:32.52±7.65mm2; ILK-MSCs:19.00±3.10mm2) and intensity variation (MSCs:218.6±71.86; ILK-MSCs:108.6±77.87) were all decreased 2 weeks later compared to those at 1week (p<0.05). The area and intensity variation of ILK-MSCs group was larger/higher in former 2 time points compared with those of MSCs group(p<0.05), but smaller/lower in 2 weeks(p<0.05) because of dilution of iron particles in each cells attribute to the promoted cell proliferation caused by ILK modification, which was explained by more GFP positive(420.0±8.8/field vs.106.5±8.3/field,p<0.001) and prussian blue staining positive cells (275±54/field vs. 144±54/field, p<0.001) in ILK-MSCs group in two weeks.

CONCLUSION

USPIO labeled MSCs can be reliably detected and tracked in vivo using serial MR molecular imaging. Transplantation of ILK-MSCs after myocardial infarction can increase the homing rate of MSCs.

CLINICAL RELEVANCE/APPLICATION

MR molecular imaging can identify and dynamically monitor transplanted cells in vivo for verification of effect of ILK on MSCs homing.

SST02-04 Ferumoxytol-poly-l-lysine Labeling and Non-invasive MR Imaging of Mesenchynal Stem Cells

Friday, Dec. 4 11:00AM - 11:10AM Location: S501ABC

Participants
Dan Mu, Nanjing, China (*Presenter*) Nothing to Disclose
Hongming Yu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Chuan Shuai Tian, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Weibo Chen, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Biao Xu, Nanjing, China (*Abstract Co-Author*) Research Grant, General Electric Company
Bin Zhu, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the efficiency and the safety of labeling mesenchymal stem cells(MSCs) in vitro with ferumoxytol- poly-l-lysine (PLL) , a new negative agent for cell lebeling and to detect the imaging characteristics.

METHOD AND MATERIALS

MSCs were incubated with ferumoxytol-PLL. Labeling efficiency was examined by Prussian blue staining, transmission electron microscopy and Colorimetric ferrozine assay. MTT growth curves were obtained at a range of iron concentrations from 5 to 200 ug/ml to assess the effects of the labeling on cell viability and to confirm the safe iron concentration for cell labeling. The effect of ferumoxytol- PLL at iron concentration of 50ug/ml on cell migration,proliferation and cell cycle were determined by transwell migration assay, EdU staining assay and flow cytometry anlaysis after Propidium iodide staining respectively. Different number MSCs labeled with ferumoxytol-PLL at different iron concentrations were imaged using a 3.0T MR system with T2WI and T2*WI sequences. The signal intensity was measured and statistically compared.

RESULTS

The labeling efficiency was 100%. Transmission electron microscopy showed the iron particles in the cytoplasm. The iron content of each cells was liner correlated with the iron concentration of the labeling media. Higher labeling concentration (more than 100 µg/ml) can affect cell viability detected by MTT assay. There were not significant impairments were documented in cell proliferation, migration and cell cycles at 50 µg/ml dose when comparing iron-labeled MSCs to unlabeled controls.The ferumoxytol-PLL labeling caused a stronger low signal attenuation effect on T2WI and T2*WI. The signal intensity was negatively correlated with cell numbers and iron concentration of the labeling media.

CONCLUSION

MSCs can be easily and efficiently labeled by ferumoxytol-PLL without interference on the cell viability, migration, proliferation and cell cycle. MRI visualization of SPIO- labeled MSCs is feasible in bothT2WI and T2*WI.

CLINICAL RELEVANCE/APPLICATION

Ferumoxytol- poly-l-lysine (PLL) can efficiently label MSCs for MR molecular imaging.

SST02-05 Free-Breathing 3D T1-weighted Fat-saturated Contrast-enhanced Gradient-echo Sequence with Radial Data Sampling in Thoracic and Cardiovascular MRI

Friday, Dec. 4 11:10AM - 11:20AM Location: S501ABC

Participants
Christer Ruff, MD, Tuebingen, Germany (*Presenter*) Nothing to Disclose
Robert Grimm, Erlangen, Germany (*Abstract Co-Author*) Employee, Siemens AG
Fabian Bamberg, MD, MPH, Munich, Germany (*Abstract Co-Author*) Speakers Bureau, Bayer AG; Speakers Bureau, Siemens AG; Research Grant, Bayer AG; Research Grant, Siemens AG;
Ulrich Kramer, MD, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG
Mike Notohamiprodjo, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate free-breathing radially sampled fat-saturated T1-weighted gradient-echo acquisitions (radial volumetric interpolated breath-hold examination (VIBE)) with self-gated radially sampled, breath-hold (BH) and free-breathing (FB) cartesian sampled VIBE acquisitions for post-contrast imaging of the thorax and cardiovascular system.

METHOD AND MATERIALS

This IRB approved prospective study was performed according to the declaration of Helsinki. 20 patients referred for myocardial infarction, myocarditis and cardiomyopathy were imaged at 1,5T (Aera, Siemens Healthcare). Gadobutrol (Bayer Healthcare)-enhanced cartesian sampled isotropic (voxel-size 1.4x1.4x1.4mm3) VIBE sequences acquired during BH (18s) were compared to FB radially sampled sequences (approx. 4min) featuring respiratory self-gating. Multiplanar reformations were performed with SyngoVia (Siemens). All image data sets (Cartesian, Radial and Radial VIBE with self-gating) were evaluated by two independent readers (5-poinz-Likert-scale): overall image quality, large vessel depiction, small vessel depiction, heart depiction, thoracic wall/diaphragm sharpness and streaking artifacts. Statistical analysis was performed with paired t-tests.

RESULTS

Respiratory self-gating of the radially sampled VIBE led to significantly improved depiction of large (4.4 +/- 0.5 vs 3.9 +/- 0.7, $p<0.05$) and small vessels (4.7 +/- 0.5 vs 3.4 +/-0.8, $p<0.05$) as well as thoracic wall/diaphragm sharpness (4.9 +/- 0.4 vs 3.6 +/- 0.5, $p<0.05$), whereas overall image quality was not impaired by the significantly increasing streaking artifacts (3.6 +/- 0.5 vs 4.7 +/- 0.5, $p<0.05$).Compared to standard BH cartesian VIBE, radially sampled VIBE with self-gating showed improved large and small vessels (4.4 +/- 0.5 vs 3.3 +/-0.6, $p=0.05$; 4.7 +/- 0.5 vs 3.3 +/- 0,6, $p<0.05$), thoracic wall/diaphragm (4.9 +/- 0.4 vs 3.3 +/- 0.6, $p<0.05$) and overall image quality (4 +/- 0.6 vs. 3.3 +/- 0.6, $p=0.17$).

CONCLUSION

Respiratory self-gated radially sampled VIBE acquired during free-breathing is feasible for thoracic and vascular imaging, particularly of the thoracic wall and large and small vessels compared to radially sampled VIBE without self-gating and breath-hold Cartesian sampled VIBE.

CLINICAL RELEVANCE/APPLICATION

Respiratory self-gated radially sampled VIBE acquired during free-breathing is feasible for thoracic and vascular imaging, particularly of the thoracic wall and large and small vessels.

SST02-06 Could Cardiac Magnetic Resonance Imaging be an Effective Alternative to Transthoracic Echocardiography for Routine Evaluation of the Heart?

Friday, Dec. 4 11:20AM - 11:30AM Location: S501ABC

Participants
Erkan Yilmaz, MD, Izmir, Turkey (*Abstract Co-Author*) Nothing to Disclose
Uygar Teomete, MD, Miami Beach, FL (*Presenter*) Nothing to Disclose
Bahri Akdeniz, Izmir, Turkey (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study is designed to investigate the effectiveness of cardiac magnetic resonance imaging (CMR) in routine evaluation of heart as an alternative method to transthoracic echocardiography.

METHOD AND MATERIALS

The study included 48 randomised patients underwent both echocardiography and CMR. On CMR examination, cine steady-state free precession (SSFP) sequence was used to calculate ejection fraction (EF), ventricular and atrial measurements and wall thickness of left ventricle (LV). Velocity and flow information in the aortic, mitral and tricuspid valves were obtained by using velocity-encoded sequence. CMR and echocardiography outcomes were compared using by paired samples t-, Pearson's correlation, McNemar's and Kappa statistical tests.

RESULTS

Measurements of LV inner diameter in end-diastole, septal wall and posterior wall thickness in end-systole showed a good correlation with CMR and echo (r=0,795, r= 0,798, r=0,536). EF estimated with CMR showed perfect correlation with EF estimated by using echo (r= 0,80, p<0,01). Our results had a good correlation between two methods in terms of diastolic disfunction. When compared with echocardiography, CMR revealed good (κ=0,660), poor (κ=0,370), moderate (κ=0,504), very good (κ=1,0) and poor (κ=0,270) correlations for mitral regurgitation, mitral stenosis, aortic regurgitation, aortic stenosis and tricuspid regurgitation, respectively. Peak E and peak A velocities in the mitral inflow measured by both two methods showed moderate correlation with κ values of 0,435 and 0,493. A highly good accordance between the two methods in terms of the measurements of peak velocity in aortic valve (κ=0,778).

CONCLUSION

We found that volume, flow and thickness measurements of the heart on transthoracic echocardiography examination have a statistically good correlation with CMR measurements. Also, there is a satisfying diagnostic concordance between two modalities in evaluating the heart.

CLINICAL RELEVANCE/APPLICATION

CMR can be used an alternative method to transthoracic echocardiography, especially for acoustically poor patients.

SST02-07 Improved Ex-vivo Human Cardiac DTI using Optimal b-values on a Clinical 3T MRI System

Friday, Dec. 4 11:30AM - 11:40AM Location: S501ABC

Participants
Jian Cao, MD, Peking, China (*Presenter*) Nothing to Disclose
Feng Yang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yining Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Chao Ma, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Lingyan Kong, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Lu Lin, MD, Peking, China (*Abstract Co-Author*) Nothing to Disclose
Yan Yi, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jing An, Beijing, China (*Abstract Co-Author*) Research collaboration, Siemens AG
Tianjing Zhang, Beijing, China (*Abstract Co-Author*) Employee, Siemens AG

PURPOSE

This study aims to investigate the effect of b-value of cardiac DTI in revealing myocardial microstructural remodeling on a 3T MRI system.

METHOD AND MATERIALS

Seven formalin-fixed healthy human heart samples were acquired at room temperature on a Siemens 3.0T MAGNETOM Skyra MR scanner for fiber structural analysis using a 20-channel head coil with a DW sequence with multi-shot EPI readout. Each heart sample was suspended in plastic cylinder filled with liquid paraffin to avoid tissue-air susceptibility artifacts during the acquirement. DTI acquisitions were the following parameters: TE=67 ms, TR=6500 ms, FOV=200× 200 mm, slice thickness= 2.0 mm, number of slices=40~45, 100× 100 pixels for each slice, diffusion sensitivity b=600/800/1000 s/mm2, accel factor=2, gradient directions=20, slice gap=0 mm. Total image acquisition time was about 20 min per sample. Data was post-processed by Matlab based programs. Diffusion tensor indices, such as FA (Fractional Anisotropy), ADC (Apparent Diffusion Coefficient), fiber length and fiber numbers with each b-value in the left ventricle were calculated and compared.

RESULTS

In Table 1 is shown variations of DTI indices with different b-values. Gradual decrease on FA value and gradual increase on ADC value are observed when b value rises from 600 to 1000 s/mm2. Variations of fiber numbers and fiber lengths at different b values are neither regular nor significant.

CONCLUSION

A b value of 600 s/mm2 would be suggested acquire human cardiac diffusion tensor imaging in order to avoid confusion when using FA values as an absolute reference for assessing the difference between normal and abnormal zones.

CLINICAL RELEVANCE/APPLICATION

An appropriate b-value would benefit DTI to better reveal the myocardium structural of human hearts. Since no significant

differences occurs in fiber numbers and fiber lengths, a b value of 600 s/mm2 would be suggested acquire human cardiac diffusion tensor imaging in order to avoid confusion when using FA values as an absolute reference for assessing the difference between normal and abnormal zones.

SST02-08 CT Coronary Angiography: Effect of Iodine CONcentration on Vascular Attenuation: The CT-CON Multicentric Study FINAL RESULTS

Friday, Dec. 4 11:40AM - 11:50AM Location: S501ABC

Participants
Marco Rengo, MD, Rome, Italy (*Presenter*) Nothing to Disclose
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Damiano Caruso, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Marco Das, MD, Maastricht, Netherlands (*Abstract Co-Author*) Research Consultant, Bayer AG; Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Research Grant, Koninklijke Philips NV
Marc C. Kock, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Andre Niezen, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Fiek Van Tilborg, Bron, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Koen Nieman, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Speakers Bureau, Siemens AG Speakers Bureau, Toshiba Corporation Research Grant, Bayer AG Research Grant, General Electric Company
Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, Siemens AG; Speakers Bureau, Siemens AG

PURPOSE

To explore the relative impacts of iodine concentration versus iodine delivery rate on intra-coronary attenuation. To describe the effect of iodine concentration on contrast bolus characteristics

METHOD AND MATERIALS

971 patients were prospectively randomized in 4 groups and underwent CT Coronary Angiography (CTCA). Four CM with different iodine concentrations (300, 350, 370, 400 mgI/ml) were delivered at a fix iodine delivery rate (2.0 mgI/s). Intracoronary attenuation values were measured and grouped on a per-vessel and per-segment bases. Time-to-peak, and pressure curves during CM injection were evaluated and compared

RESULTS

Injection fluxes were 6.7 ml/sec, 5.7 ml/sec, 5.4 ml/sec and 5 ml/sec for group A, B, C and D respectively. No significant differences were observed among four groups in terms of intravascular density on a per-segment and per-vessels analysis. Time-to-peak was significantly earlier in group A (15.3 sec) than in the other three groups. The injection peak pressure was significantly lower in group A (185.16 psi) and C (189.05 psi) than in group B (215.89 psi) and D (243.33 psi). No extravasations were noted in all groups

CONCLUSION

Contrast media with different iodine concentrations, if injected at the same IDR, provide similar intravascular attenuation values. The lower concentration contrast medium provided significantly lower injection pressure values and a significantly shorter time to peak enhancement

CLINICAL RELEVANCE/APPLICATION

Intravascular attenuation in CT coronary angiography is mainly influenced by iodine delivery rate and is independent by iodine concentration

SST02-09 Study of the CT Anatomical Configuration of the Aortic Valve: An Automatic 3D-Shape-based Comprehensive Analysis

Friday, Dec. 4 11:50AM - 12:00PM Location: S501ABC

Participants
Julien Ognard, MD, MSc, Brest, France (*Presenter*) Nothing to Disclose
Thomas Hebert, Brest, France (*Abstract Co-Author*) Nothing to Disclose
Nan Kang, MSc, Brest, France (*Abstract Co-Author*) Nothing to Disclose
Martine Gilard, MD,PhD, Brest, France (*Abstract Co-Author*) Nothing to Disclose
Michel Nonent, MD, Brest, France (*Abstract Co-Author*) Nothing to Disclose
Valerie Burdin, PhD, Plouzane, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

In Transcatheter aortic valve implantation (TAVI) procedures, the determination of AVA (Aortic Valve Annulus) geometric features is crucial to deciding the size and type of the prosthesis valve to be used. The purpose of this study is to asses quantitatively the variation of aortic valve shape along its principle axis in order to find the center and diameter of AVA, and to determine at each levels the measurement that could be done during preoperative plannings, according to the shape.

METHOD AND MATERIALS

A number of 25 ECG-gated cardiac CT (64 channels multidetector CT scanner) were analysed. 2 Experts radiologists manually defined the centerline and the limits of the aortic valve. Threshold techniques and growing regions were used to mask the left ventricle and the aorta. Principle Component Analysis were used to extract an approximate aortic centerline, with an iterative procedure. Then we cut through data to get slices which are perpendicular to the centerline. Each cross section is then unfolded into polar coordinates. The function of distance which describes the contour of tri-leaflet has three pairs of extrema (minima and maxima) and smallest min distance. for each cross section, we find 3 points on the contour of the aorta with minimum distance to the barycenter and calculate ellipse fitting.

RESULTS

The method is based on a quantitative study of shape to find an optimal fit to mimic AVA in the aortic root. Analyses of such models have shown the aortic root to have variable distensibility along its length. Our contribution includes extracting a robust centerline of aortic valve automatically, analyzing the shape changes of cross section along the centerline by the help of polar representation, providing a flexible circle and ellipse fitting for aortic valve part with the coordinates for the center and corresponding change intervals for radius.

CONCLUSION

We introduced measurements for aortic valve by a quantitative study compared with previous qualitative research.

CLINICAL RELEVANCE/APPLICATION

Understanding the 3D shape characteristics of the aortic valve will help radiologist and cardiologist in the preoperative plannings of TAVIs. And could even assist engineer-physicians to design and manufacture customized valve that works in the optimum condition

SST04

Gastrointestinal (New MRI Techniques)

Friday, Dec. 4 10:30AM - 12:00PM Location: E353A

GI MR BQ

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Vamsi R. Narra, MD, FRCR, Saint Louis, MO (*Moderator*) Consultant, Biomedical Systems;
Bobby T. Kalb, MD, Tucson, AZ (*Moderator*) Nothing to Disclose

Sub-Events

SST04-01 Improving the Quality of 2D GRE MR Elastography of Chronic Liver Diseases Using a Shorter, In-Phase Echo Time

Friday, Dec. 4 10:30AM - 10:40AM Location: E353A

Participants
Jin Wang, Rochester, MT (*Presenter*) Nothing to Disclose
Nan Zhang, MS,MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Jun Chen, PhD, Rochester, MN (*Abstract Co-Author*) The Mayo Clinic and Jun Chen have intellectual property rights and a financial interest in MRE technology.
Kevin J. Glaser, Rochester, MN (*Abstract Co-Author*) Intellectual property, Magnetic Resonance Innovations, Inc; Stockholder, Resoundant, Inc
Bogdan Dzyubak, PhD, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Roger C. Grimm, MS, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
Meng Yin, Rochester, MN (*Abstract Co-Author*) The Mayo Clinic and MY have intellectual property rights and a financial interest in MRE technology.
Richard L. Ehman, MD, Rochester, MN (*Abstract Co-Author*) CEO, Resoundant, Inc; Stockholder, Resoundant, Inc; Research Grant, Resoundant, Inc

PURPOSE

The purpose of this study was to validate the improvement in image quality of 2D GRE MR elastography (MRE) using a shorter, in-phase echo time (TE) for patients with chronic liver diseases, steatosis, and iron deposition.

METHOD AND MATERIALS

With IRB approval and patient authorization, 308 consecutive patients with clinically indicated chronic liver diseases underwent MRE exams using a 2D GRE MRE sequence on 1.5T . They were randomly separated into 2 groups based on the TE used. Group 1 used an in-phase TE of 18 ms (160/308, 52%) and Group 2 used the current standard TE of 21 ms (148/308, 48%). Hepatic relative fat fraction (RFF) was measured by using a two-point Dixon method. The iron concentration in blood samples analyzed in standard laboratory tests was used to assess the iron deposition in liver. Clinical information collected at the same time as the MRE exam included blood pressures, and pulse rate. The fraction of the acquired liver volume with an MRE inversion-derived confidence level of over 95%, as well as the average SNR within the liver were computed for each patients and compared between the short TE and long TE groups with analysis of variance (ANOVA). The effect of age, gender, BMI, Total.Iron.Bind.Capacity, iron, systolic pressure, diastolic pressure, FOV, TE, fat concentration (%), and pulse rate on SNR and ROI volume were evaluated by a mixed-effect model.

RESULTS

No significant differences were found in epidemiological and etiological parameters between the two groups ($P>0.05$). The SNR of MRE images in Group 1 was significantly higher than that in Group 2 (23.73 ± 0.61 vs. 18.01 ± 0.63, $p<.0001$). ROI volume for reporting hepatic tissue stiffness was significantly larger in Group 1 (323.70 ± 9.36 cm3 vs. 255.53 ± 9.73 cm3, $p<.0001$). Only TE had a statistically significant effect on SNR ($p < .0001$); only fat ($p<.0001$) and iron ($p=0.0379$) were statistically significant effects on volume.

CONCLUSION

The SNR and reliable ROI volume of 2D GRE MRE can be significantly improved by using a shorter, in-phase TE of 18 ms compared to the current standard of 21 ms.

CLINICAL RELEVANCE/APPLICATION

The quality of 2D GRE MRE can be significantly improved by using a shorter, in-phase TE. A direct measurement of fat and iron disposition in the liver might provide better statistical significance.

SST04-02 Intravoxel Incoherent Motion MR Imaging of the Abdomen: The Effect of Data Fitting Altorithms on the Measurement Repeatability

Friday, Dec. 4 10:40AM - 10:50AM Location: E353A

Participants
Hyojung Park, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Seung Soo Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yu Sub Sung, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyun Hee Cheong, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yedaun Lee, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Cheol Mog Hwang, MD, Daejeon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
So Yeon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Moon-Gyu Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the effect of fitting algorithms and number of b-values on the measurement repeatability of intravoxel incoherent motion(IVIM) parameters of the abdominal organs.

METHOD AND MATERIALS

The institutional review board approved the study protocol, and informed consent was obtained. Twelve healthy volunteers(M:F = 6:6; mean age, 30 years) underwent navigator-triggered DWI twice on an 1.5T system using nine different b values (0,30,60,100,150,200,400,600,900). DWI data were processed using full-biexponential fitting algorithm which estimates slow diffusion(Ds), fast diffusion(Df), and perfusion fraction(f) simultaneously and using segmented fitting algorithm which estimates Ds with higher b-value(≥ 200) data and subsequently estimates f and Df. IVIM parameters were measured on the right lobe of the liver, spleen, pancreas, right renal cortex, and right renal medulla on each set of IVIM parametric maps generated by full-biexponential and segmented fitting algorithms. Measurement repeatability of IVIM parameters over two repeated scans were evaluated using the within-subject coefficient of variation(wCV).

RESULTS

For all abdominal organs and two fitting algorithms, Df showed the poorest repeatability(the range of wCV, 29.5%-144.1%) among IVIM parameters(wCV for Ds, 4.1%-16.9%; wCV for f, 8.5% -46.2%). For spleen, pancreas, renal medulla, segmented fitting resulted in better repeatability of Ds(wCV, 4.9%-11.9% vs. 8.0%-16.9%) and f(wCV, 8.5%-37.9% vs. 17.3% - 46.2%) than full-biexponential fitting. For liver, full-biexponential fitting resulted in better repeatability of all IVIM parameters(wCV, 4.1%, 29.5%, and 9.7% for Ds, Df, and f, respectively) than segmented fitting(wCV, 4.8%, 43.0%, 12.8% for Ds, Df, and f, respectively). For renal cortex, the measurement repeatability of Ds was better with full-biexponential fitting, but that of f was better with segmented fitting.

CONCLUSION

Df is not a reliable parameter for the evaluation of abdominal organs. Despite some inconsistent results across different organs, segmented fitting algorithm generally results in better repeatability of Ds and f than full-biexponential fitting algorithm.

CLINICAL RELEVANCE/APPLICATION

Segmented fitting is a preferred fitting algorithm for IVIM analysis of abdominal organs.

SST04-03 Fast Advanced Spin Echo Diffusion-Weighted Imaging in the Abdomen

Friday, Dec. 4 10:50AM - 11:00AM Location: E353A

Participants
Takeshi Yoshikawa, MD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation
Yoshiharu Ohno, MD, PhD, Kobe, Japan (*Presenter*) Research Grant, Toshiba Corporation; Research Grant, Koninklijke Philips NV; Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Terumo Corporation; Research Grant, Fuji Yakuhin Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Guerbet SA;
Katsusuke Kyotani, RT, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
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Hisanobu Koyama, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Keitaro Sofue, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kouya Nishiyama, Kobe, Japan (*Abstract Co-Author*) Nothing to Disclose
Kazuro Sugimura, MD, PhD, Kobe, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

PURPOSE

To assess values of Fast Advanced Spin Echo (FASE)-diffusion-weighted imaging in evaluation of abdominal diseases

METHOD AND MATERIALS

Fifty-two patients (32 men and 20 women, mean: 69.4 years), who were suspected to have hepato-biliary-pancreatic malignancy and underwent 3T-MRI, were enrolled. FSE-T2WI, SE-EPI-DWI (b=1000), and FASE-DWI (600) were obtained in all patients. Amount of abdominal gas and ascites on images was recorded for each patient using a 5-point scale. Anteroposterior (AP) and right-to-left (RL) abdominal diameters were measured on the slice with most severe image distortion and diameters of the right upper liver near the diaphragm were measured for each sequence and each patient, and correlation analyses were performed. Overall image quality and severity of image distortion were visually assessed using a 5-point scale on EPI-DWI and FASE-DWI, and compared. Regression analyses were done to estimate factors for low image quality and severe distortion. Malignant lesion (n=39) conspicuity was visually assessed separately on EPI-DWI and FASE-DWI, and compared. Diagnostic confidence levels were compared between EPI-DWI alone and EPI-DWI+FASE-DWI sets.

RESULTS

Correlation coefficient was the highest between T2WI and FASE-DWI for all the diameters, indicating less image distortion on FASE-DWI. Lower correlation coefficients, indicating more severe distortion, were observed in abdominal AP direction and right liver RL direction on EPI-DWI. Image distortion was significantly more severe on EPI-DWI ($p<0.0001$). There was no significant difference between overall image quality and malignant lesion conspicuity. Age, sex, and gas were found to be significant factors for image quality on EPI-DWI (0.047, 0.004, 0.018), and sex and AP diameter were significant factors for image quality on FASE-DWI (0.005, 0.043). Diagnostic confidence level for malignant lesion was significantly higher on EPI-DWI+FASE-DWI set (0.022).

CONCLUSION

FASE-DWI can provide additional diagnostic information in evaluation of various abdominal diseases and be used as an alternative to EPI-DWI.

CLINICAL RELEVANCE/APPLICATION

FASE-DWI can provide additional diagnostic information in evaluation of various abdominal diseases and be used as an alternative to

EPI-DWI.

SST04-04 Techniques to Generate High-accuracy Computed Diffusion-weighted Images (cDWIs) of the Liver

Friday, Dec. 4 11:00AM - 11:10AM Location: E353A

Participants
Toru Higaki, PhD, Hiroshima, Japan (*Presenter*) Nothing to Disclose
Yuko Nakamura, MD, Bethesda, MD (*Abstract Co-Author*) Nothing to Disclose
Yuji Akiyama, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Ohkubo, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Yoshimori Kassai, MS, Otawara, Japan (*Abstract Co-Author*) Employee, Toshiba Corporation
Kazuo Awai, MD, Hiroshima, Japan (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Research Grant, Hitachi, Ltd; Research Grant, Bayer AG; Reseach Grant, DAIICHI SANKYO Group; Medical Advisor, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, Nemoto-Kyourindo; ; ; ; ;
Yoshiko Iwakado, Hiroshima, Japan (*Abstract Co-Author*) Nothing to Disclose

Background

Computed diffusion-weighted images (cDWIs) are virtual DWIs calculated from actual DWIs using two arbitrarily selected low b-values. cDWI is advantageous because images can be generated on MR scanners that do not allow the acquisition of high b-value DWIs. cDWI can also reduce the scan time and lower the image noise when DWIs are acquired with routinely-used b-values. However, the image quality of cDWIs may be degraded without adequate image processing. We propose techniques to generate high-accuracy cDWIs.

Evaluation

Six healthy volunteers (4 males, 2 females, age 31-52 years) underwent hepatic MRI on a 3T MR scanner (Vantage Titan 3T, Toshiba Medical Systems, Tokyo, Japan). We obtained 21 DWIs at b-values raised at 50 s/mm2 (from 0 to 1000 s/mm2). We developed software to generate cDWIs via plug-in into NIH ImageJ (http://www.nih.gov/ij/). cDWIs at b=1000 were generated from various combinations of input b-values and the optimal combination was determined quantitatively. We applied some preprocessing as this can reduce artifacts or image noise. One method was non-rigid image registration of DWIs with two input b-values. The other used an image filter to remove abnormal values from the ADC map. Images generated with/without preprocessing were evaluated qualitatively.

Discussion

For the input image of low b-value, we employed image with b=150 because effect of micro-perfusion which strongly arises at b=0 is disappeared at b=150. Quantitative comparisons between cDWIs and actual DWIs obtained at b=1000 showed that the fewest errors in signal intensity were recorded when the combination of input b-values was 150 and 600. Qualitative comparisons revealed that the image quality of the proposed cDWIs obtained with non-rigid image registration and image filtering was superior to that of conventional cDWIs (see attached figures).

Conclusion

When generating cDWIs at b=1000 sec/mm2, the optimal combination of b-values for the cDWI input was b=150 and 600. The proposed preprocessing techniques, non-rigid image registration, and image filtering contributed to the improved image quality of cDWIs.

SST04-05 Accuracy of MR-determined Hepatic Proton Density Fat Fraction (PDFF) and Histology-determined Fat Fraction for Estimation of Triglyceride Concentration in Twenty-one Ex-vivo Human Livers

Friday, Dec. 4 11:10AM - 11:20AM Location: E353A

Participants
Kevin A. Zand, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Elhamy R. Heba, MBBCh, MD, San Diego, CA (*Presenter*) Nothing to Disclose
Tanya Wolfson, MS, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
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Michael Peterson, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Lisa Clark, MPH, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Anthony Gamst, PhD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
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Jeffrey B. Schwimmer, MD, San Diego, CA (*Abstract Co-Author*) Nothing to Disclose
Claude B. Sirlin, MD, San Diego, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Speakers Bureau, Bayer AG; Consultant, Bayer AG ; ;

PURPOSE

To assess the accuracy of magnetic resonance (MR)-determined hepatic proton density fat fraction (PDFF) and histology-determined fat fraction (histology-FF) for estimation of triglyceride concentration ([TG]) in ex-vivo human liver using biochemically-determined liver [TG] as a reference standard.

METHOD AND MATERIALS

Twenty-one postmortem whole livers were obtained from the National Disease Research Interchange and scanned at 3T using a cardiac coil within 48 hours of death. Donors (31 - 67 [mean 55 ± 11] yrs; 11 female) had or were at risk for hepatic steatosis based on medical history. Five 1.5-cm radius circular locations were selected in each specimen. Unenhanced two-dimensional axial spoiled gradient-recalled-echo images of the specimens were obtained. Using published MR techniques, MR spectroscopy (MRS), magnitude-based MRI (M-MRI), and complex-based MRI (C-MRI) hepatic PDFF estimations were computed at each location. Six

biopsies were also obtained at each location (thirty biopsies per liver): three for histologic analysis to determine histology-FF and three for biochemical analysis to determine [TG]. The average of [TG] at each location was used as a reference standard for that location. Regression analyses were performed for [TG] versus MRS-PDFF, M-MRI-PDFF, C-MRI-PDFF, and histology-FF. R^2's with bootstrap-based bias-corrected, accelerated 95% confidence intervals were computed and served as metrics of accuracy. Pairwise comparisons of the R^2's were performed using bootstrap-based tests to adjust for within-liver dependence.

RESULTS

MRS-PDFF, M-MRI-PDFF, C-MRI-PDFF, histology-FF and [TG] of liver specimens ranged from 0.1 - 23.5%, -7.4 - 26.3%, 1.3 - 21.2%, 0 - 70 %, and 1.2 - 31.3 mg/100g respectively. The R^2's from the regression models between [TG] and MRS-PDFF, M-MRI-PDFF, C-MRI-PDFF, and histology-FF were 0.95 (0.86 - 0.98), 0.90 (0.62 - 0.97), 0.92 (0.55 - 0.99), and 0.92 (0.78 - 0.94) respectively. The differences between R^2's were not statistically significant (all $p>0.05$).

CONCLUSION

In this ex-vivo study, using biochemically-determined liver [TG] as a reference standard, MR-determined hepatic PDFF and histology were accurate for estimation of hepatic [TG].

CLINICAL RELEVANCE/APPLICATION

This study helps to validate the MR-determined hepatic PDFF as an accurate biomarker of hepatic steatosis.

SST04-06 Multiecho Single Voxel Spectroscopy and 3-D GRE MR Based Estimation of Liver Fat Correlates Well with Dichotomized Histologic Steatosis Grades

Friday, Dec. 4 11:20AM - 11:30AM Location: E353A

Participants
Sonal Krishan, MD, Gurgaon, India (*Presenter*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic performance of Multiecho Single voxel spectroscopy and 3-D GRE sequences in predicting dichotomised histologic steatosis grades.

METHOD AND MATERIALS

This prospective, IRB approved, HIPAA-compliant single-center study was conducted in 71 consecutive adults who also had simultaneous liver biopsy. MR imaging fat fraction was estimated at 1.5 T by using T1-VIBE low-flip-angle multiecho gradient-recalled-echo imaging with T2* correction and multipeak modeling as well as multiecho single voxel spectroscopy. Steatosis was graded histologically on a semi-quantitative scale as the percentage of hepatocytes with macrovesicular steatosis (grades 0:5%, 1:5-10%, 2:10-20%, and 3:>20%). Sensitivity, specificity, and binomial confidence intervals were calculated for proposed MR imaging fat percentage threshold.

RESULTS

The proposed MR imaging fat fraction threshold of 5% to diagnose grade 1 or higher steatosis had 88% sensitivity (95% confidence interval [CI]: 83, 93) and 89% specificity (95% CI: 78, 100). The diagnostic performance to diagnose grade 2 or higher steatosis had 84% sensitivity (CI: 74, 94) and 92% specificity (95% CI: 85, 99). Accuracy to diagnose grade 3 steatosis had 81% sensitivity (95% CI: 71, 91) and 90% specificity (95% CI: 83, 97).

CONCLUSION

The fat fraction thresholds provided high sensitivity and specificity for diagnosis of grade 1 or higher, grade 2 or higher, and grade 3 steatosis. More clinical and longitudnal studies are now needed to further validate these high-specificity thresholds for inclusion in the clinical practise.

CLINICAL RELEVANCE/APPLICATION

MR based evaluation of liver fat fraction is an accurate technique across all histologic grades of hepatic steatosis.

SST04-07 Feasibility of Magnetic Resonance Elastography for the Pancreas

Friday, Dec. 4 11:30AM - 11:40AM Location: E353A

Participants
Yohei Ito, MD, Hamamatsu, Japan (*Presenter*) Nothing to Disclose
Yasuo Takehara, MD, Hamamatsu, Japan (*Abstract Co-Author*) Nothing to Disclose
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Naoki Ooishi, Hamamatsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Harumi Sakahara, MD, Hamamatsu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purposes are three-folds, 1) to assess the usefulness of elastic belt bracing the upper abdomen for reducing the miscalculated areas (cross-hatches) of the pancreas on the stiffness map of MR elastography (MRE), 2) to establish the stiffness of normal

pancreas in normal subjects and 3) to investigate the feasibility of MRE in differentiating between normal pancreas and the focal pancreatic diseases.

METHOD AND MATERIALS

First, 8 normal volunteers were examined with MRE with or without elastic belt. On the stiffness map, the pancreatic areas with or without cross-hatches were measured by drawing the region of interest and were compared between MRE with and without belt. Second, 14 normal volunteers were examined with MRE with elastic belt for the measurements of normal pancreas stiffness. Third, consecutive 11 adult patients suspected of having pancreatic lesions underwent MR examination at 3.0T including MRE with elastic belt for the assessment of the lesion stiffness. A spin-echo based echo planar MRE utilized MEG of 80Hz, external driver frequency/amplitude of 60Hz/50% and temporal phase of 6.

RESULTS

The median percentages of measurable areas of pancreatic stiffness of 8 normal volunteers were 57.4 % with elastic belt and 35.3 % without the belt ($p = 0.0078$). The mean stiffness of the pancreatic areas of the 14 normal volunteers was 2.37 ± 0.16 kPa for the head, 2.46 ± 0.17 kPa for the body, 2.58 ± 0.26 kPa for the tail and 2.47 ± 0.11 kPa for the overall area. Of 11 patients, 8 patients were diagnosed as having solid pancreatic lesions consisted of 7 pancreatic cancers and 1 inflammatory pseudotumor. The mean stiffness of 7 pancreatic cancers was 6.06 ± 0.49 kPa that was significantly higher than normal pancreatic stiffness. The mean stiffness of inflammatory pseudotumor was 6.2 kPa and it was also higher than normal pancreatic parenchyma.

CONCLUSION

With elastic belt, miscalculation of the pancreatic stiffness was reduced. MRE implicates its potential to differentiate between normal pancreas and pancreatic diseases namely desmoplastic pancreatic lesions.

CLINICAL RELEVANCE/APPLICATION

With improved accuracy with elastic belt, MRE shows a potential to differentiate between normal pancreatic parenchyma and desmoplastic pancreatic lesion based on the stiffness value.

SST04-08 Balanced Steady State Free Precession Sequences for Efficient 3D Whole Organ Liver Iron Content Determination Using MRI: Proof of Principle

Friday, Dec. 4 11:40AM - 11:50AM Location: E353A

Participants
Arthur P. Wunderlich, PhD, Ulm, Germany (*Presenter*) Nothing to Disclose
Stefan A. Schmidt, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Holger Cario, Ulm, Germany (*Abstract Co-Author*) Nothing to Disclose
Meinrad J. Beer, MD, Wuerzburg, Germany (*Abstract Co-Author*) Research Consultant, Shire plc

PURPOSE

Current MRI based methods for determining liver iron content (LIC) suffer from multiple restrictions, one of them incomplete liver coverage. 3D balanced steady state free precession (bSSFP) has the potential to overcome this limitation, but was not yet tested for 3D LIC analysis.

METHOD AND MATERIALS

34 patients (8f, 26m, age 23 ± 12.9 y) suspected for liver iron overload were investigated by 1.5 T MRI (Siemens Avanto, Siemens Healthcare, Iselin, NY). To reduce banding artefacts, shim volume was placed over the liver. A transversal volume was acquired with bSSFP using the whole-body resonator as receiver coil with flip angle (FA) of 7, 10, 17 and 30 and TR/TE 3.5/1.75 ms. Acquisition was performed in free breathing with 3 long-term averages at matrix size 192x192x20 yielding a resolution of 2.2x2.2x4 mm in 35 s acquisition time per FA. Liver-to-muscle signal intensity ratio (SIR) and its uncertainty was calculated by manually placing ROIs in artefact-free liver parenchyma and paraspinal muscles. Results were correlated to LIC determined by Ferriscan® as reference method.

RESULTS

3D whole liver coverage was possible in 27/34 patients. Liver was imaged without visible artefacts in 30/34 patients.SIR uncertainty was below 10% in all FA except 30°, where it remained below 15%. Correlation was best for SIR vs. logarithm of reference LIC at 30° FA with $R^2 = 0.815$.

CONCLUSION

bSSFP is known as MRI sequence with highest efficiency, capable of contiguous 3D acquisition. Short TR/TE allow for whole organ coverage, and high SNR is useful for LIC determination at low uncertainty. Free breathing was chosen because it has the potential of reducing pulsation artefacts by long-term averaging, and is useful in sedated and uncooperative patients. However, bSSFP is prone to susceptibility artefacts, which we handled to a stage of invisibility by shim optimisation in most patients. Probably invisible banding caused only moderate correlation. Results are promising, even with the simple SIR approach. Increasing scan length in head-feet direction will allow for coverage of the entire liver in all patients at the cost of slightly longer measurement times. Quantitative analysis to evaluate tissue T2 is under way, however, challenging due to inhomogeneous liver tissue.

CLINICAL RELEVANCE/APPLICATION

Whole-organ MRI based contiguous 3D LIC determination using the efficient bSSFP sequence is a promising new approach. However, optimization is needed.

SST04-09 Magentic Resonance Performance in Quantifying Activity of Small Bowel Crohn's Disease

Friday, Dec. 4 11:50AM - 12:00PM Location: E353A

Participants
Michal M. Amitai, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Eyal Klang, Ramat Gan, Israel (*Presenter*) Nothing to Disclose

Shomron Ben-Horin, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Doron Yablecovitch, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Adi Lahat, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Sandra Neuman, Ramat Gan, Italy (*Abstract Co-Author*) Nothing to Disclose
Noa Rozendorn, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Nina Levhar, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Uri Kopylov, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Rami Eliakim, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Magnetic Resonance Index of Activity (MaRIA), is a Magnetic Resonance Enterogrpahy (MRE)-based score in the evaluation of distal small bowel and colonic Crohn's disease.The gold standard for quantifying mucosal inflammation is with capsule endoscopy either by Lewis score (LS) or, Capsule Endoscopy Crohn's Disease Activity Index (CECDAI).The aim of this study was to compare the quantification of distal small bowel inflammation using MRE, capsule endoscopy and inflammatory markers.

METHOD AND MATERIALS

Patients with small bowel Crohn's disease in clinical remission or mild symptoms (CDAI<220) were prospectively recruited and underwent MRE and capsule endoscopy, after approval by our institutional review board and signing an informed consent.MaRIA, LS and CECDAI scores were calculated for the distal small bowel. C-reactive protein (CRP) and fecal calprotectin (FCP) levels were evaluated in association with the clinical scores.

RESULTS

Active inflammation was detected in 47/56 patients. A significant correlation was demonstrated between MaRIA and capsule endoscopy scores. The correlation between the MaRIA and either the LS and CECDAI was similar (r=0.51, p=0.0001 and r=0.54, p=0.0001, respectively). The mean MaRIA score was significantly lower in patients with mucosal healing, defined as LS<135 (18.8±10.7 vs 10.7±7.1, p=0.002). CRP did not correlate with either MaRIA or capsule endoscopy indices. FCP demonstrated stronger correlation with the MaRIA (r=0.49, p=0.0001) in comparison to capsule endoscopy scores (r=0.36, p=0.007 and r=0.45, p=0.001 for LS and CECDAI, respectively).

CONCLUSION

Significant correlation was observed between quantitative MRE and capsule endoscopy based indices of inflammation in the distal small bowel. FCP correlated better with MRE than with capsule endoscopy scores.

CLINICAL RELEVANCE/APPLICATION

The MaRIA score can be used to non-invasively quantify distal small bowel Crohn's disease, and thus help guide clinical decisions regarding prognosis and treatment.

SST05

Gastrointestinal (Stomach Cancer and Masses)

Friday, Dec. 4 10:30AM - 12:00PM Location: E353B

GI CT MR OI

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Seong Ho Park, MD, Seoul, Korea, Republic Of (*Moderator*) Nothing to Disclose
Douglas R. Kitchin, MD, Middleton, WI (*Moderator*) Nothing to Disclose

Sub-Events

SST05-01 Chemotherapy Response Evaluation for Late-stage Gastric Cancer by Spectral CT Imaging: Correlation with RECIST Criteria

Friday, Dec. 4 10:30AM - 10:40AM Location: E353B

Participants
Yong Yu, Xianyang City, China (*Presenter*) Nothing to Disclose
Zhong Hui, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Feng Jing I, Xianyang, China (*Abstract Co-Author*) Nothing to Disclose
Yongjun Jia, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Yang Chuangbo, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Zhang Xirong, MMed, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose
Haifeng Duan, Xianyang City, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To study the clinical value of using the iodine content in tumors obtained in Spectral CT imaging for chemotherapy response evaluation of late-stage gastric cancer in correlation with the RECIST criteria.

METHOD AND MATERIALS

A total of 18 patients (11 women, mean age of 60y) with pathologically proved gastric cancer by endoscopy were prospectively enrolled in our study. All patients were certified as having un-resectable gastric cancers and received three months of chemotherapy. Contrast-enhanced spectral CT scans were performed before and after the 3 months chemotherapy. Patients were classified into a good response group or poor response group according to the RECIST criteria (tumor volume reduction exceeds 30% is considered having good response). The iodine concentration (IC) values from the iodine-based material decomposition images of spectral CT for the tumors were measured before and after the chemotherapy. IC reduction ratio was calculated as: (IC(before) - IC(after))/IC(before). The iodine concentration value before the chemotherapy and the IC reduction ratio after the chemotherapy between the good- and poor- response groups were analyzed statistically by independent-samples t test. The correlation between the IC reduction ratio and response was calculated using spearman correlation test.

RESULTS

The iodine concentration values (figure) of the tumors before chemotherapy were significantly different between the good-response group (2.44±0.83mg/ml) and poor-response group (1.65±0.64mg/ml) in the arterial phase ($P<0.05$). The good-response group had a higher IC reduction ratio of 0.42±0.23 in the tumor than that in the poor-response group (0.29±0.17). Significant correlation was seen between IC reduction ratio and responses with correlation coefficient of $r = -0.73$ ($P=0.007$).

CONCLUSION

The iodine content in tumors and its reduction ratio after chemotherapy measured in Spectral CT has significant correlation with the treatment responses defined by RECIST criteria, and may be used as good indications for the chemotherapy prognosis of late-stage gastric cancers.

CLINICAL RELEVANCE/APPLICATION

Spectral CT may provide a new imaging method for evaluating the chemotherapy response for late-stage gastric cancers.

SST05-02 'Gastric Comb Sign' for Prediction of Lymphovascular Invasion in Gastric Cancer on Contrast-Enhanced CT

Friday, Dec. 4 10:40AM - 10:50AM Location: E353B

Participants
Hyun-Jung Baek, Yang-San, Korea, Republic Of (*Presenter*) Nothing to Disclose
Suk Kim, MD, Pusan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Tae Un Kim, MD, Yangsan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Nam Kyung Lee, MD, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Ga Jin Han, Busan, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Gastric cancer is the fourth most common cancer and the second leading cause of cancer-related death worldwide. Although the depth of invasion and lymph node are independent prognostic factors for gastric cancer and associated with patient survival, several studies have reported that lymphovascular invasion (LVI) by cancer cells are associated with poor survival or early recurrence in gastric cancer. The role of CT for predicting LVI remains controversial.The purpose of our study was to evaluate CT findings for predicting LVI in gastric cancer.

METHOD AND MATERIALS

We retrospectively reviewed 194 patients with gastric cancer who underwent contrast-enhanced CT within 6 weeks before the operation between January 2012 to December 2012. The degree of contrast enhancement, location, gastric comb sign (multiple engorged tubular, tortuous opacities radiating from the thickened gastric wall), and ulceration were assessed on CT. Histopathologic analysis was performed for size of the tumor and T stage.The relationship between gastric cancer with LVI and the CT and histopathologic findings was statistically analyzed. Multivariate logistic regression was used to identify independent imaging variables.

RESULTS

Gastric cancer with LVI demonstrated stronger enhancement (80.4%) more often than that without LVI (19.6%) (p= 0.0001). There was a statistically significant difference regarding the presence of gastric comb sign between both groups; gastric cancer with LVI (94.3%) and gastric cancer without LVI (5.7%) (p= 0.0001). There was a statistically significant difference in the presence of ulceration between both groups; 77.6% vs 22.4% (p=0.014). The statistically significant histopathologic feature was T stage (p= 0.0001). In multivariate logistic analysis, the gastric comb sign and T stage were the most significant findings in differentiation between gastric cancer with LVI and those without LVI. The strongest imaging predictor for LVI in the gastric cancer was gastric comb sign (p= 0.026).

CONCLUSION

Our findings suggest that CT can provide valuable information for prediction of LVI in patients with gastric cancer.

CLINICAL RELEVANCE/APPLICATION

Gastric comb sign may be useful in predicting LVI in gastric cancer and used to stratify patients with gastric cancer who will benefit from adjuvant systemic therapy.

SST05-03 Gastrointestinal Stromal Tumours (GIST): A CT Proposal for Predicting the Risk of Malignancy

Friday, Dec. 4 10:50AM - 11:00AM Location: E353B

Participants
Maria A. Mazzei, MD, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Nevada Cioffi Squitieri, MD, Siena, Italy (*Presenter*) Nothing to Disclose
Carla Vindigni, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Giulia Sadotti, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Paola Mercuri, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Lorenzo Righi, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Susanna Guerrini, MD, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco Gentili, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco G. Mazzei, MD, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose
Luca Volterrani, Siena, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to identify the predictors of malignancy on CT for the evaluation of gastrointestinal stromal tumours of the stomach (GIST), correlating CT findings with the mitotic index.

METHOD AND MATERIALS

The medical records at our institution of 42 patients (mean age 68 years, range 26-91 y) with a histologic diagnosis of GIST were reviewed. One radiologist and one resident in radiology with 10 and 4 years experience in oncological field, retrospectively and blindly reviewed the CT findings by consensus with respect to location, lesion size, contour, tumour growth pattern, enhancing pattern, degree of enhancement of tumour, percentage of CT tumour hypodensity, mesenteric fat infiltration, ulceration, calcification, regional lymphadenopathy, direct invasion to adjacent organ, and distant metastasis. All parameters were correlated with the mitotic index evaluated at histopathological analysis following surgery. Normality of variables was evaluated using Shapiro-Wilk test. Pearson's correlation test was used to test the interaction between variables. The diagnostic accuracy of percentage of CT tumour hypodensity in detecting if the number of mitosis per 50 high-power fields was >5 was measured by using receiver operating characteristic (ROC) analysis.

RESULTS

A significant statistical correlation was found between percentage of CT tumour hypodensity and the mitotic index (p<0,005), dimension and location of the tumour. Using a percentage of CT hypodensity major than 20% as the CT feature to compare with the mitotic index in creating a "modified Miettinen CT index" for evaluating the malignancy risk of GISTs we obtained a Cohen's weighted k of 0.80 (95% CI 0.66-0.92) between Miettinen risk assessment and "modified Miettinen CT index".

CONCLUSION

MDCT could be an accurate technique in the prediction of malignancy of GIST in a CT risk assesment system, based on the location of the tumour, its size and the percentage of intralesional CT hypodensity.

CLINICAL RELEVANCE/APPLICATION

The primary aim of this project is to find a modified Miettinen CT index useful to predict the malignancy of GIST, in order to tailor the treatment in elderly or complex patients.

SST05-04 Neuroendocrine Carcinomas of the Stomach: CT, Clinical and Pathologic Findings in 32 Patients

Friday, Dec. 4 11:00AM - 11:10AM Location: E353B

Participants
Kyeong Ah Kim, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Chang Hee Lee, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jae Woong Choi, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Jong Mee Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yang Shin Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Cheol Min Park, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe the computed tomographic (CT) findings and the clinicopathologic features of neuroendocrine carcinomas (NECs) of the stomach.

METHOD AND MATERIALS

The CT examinations of 32 patients with gastric NECs were reviewed retrospectively for the morphology, size, CT attenuation of the tumor, CT attenuation of the lymph node, associated findings such as peritumoral infiltration, liver metastasis and peritoneal carcinomatosis. The ages of patients ranged from 45 to 79 years (mean: 62 years). 27 patients (84%) were men. Pathologic diagnosis was made by gastrectomy (n=28) and endoscopic biopsy (n=4). 19 patients underwent Multidetector CT with water as an oral contrast agent, 12 patients underwent helical CT with water, and one underwent non-helical CT with water-soluble contrast material.

RESULTS

Among the three CT morphologic types (polypoid, ulcerofungating, ulceroinfiltrative), 63% of the gastric NECs were ulcerofungating (n=20), 37% were ulceroinfiltrative and none were polypoid. All were larger than 5 cm in the greatest dimension (mean size: 7.8 centimeter). The characteristic features were focal (n=3) or diffuse (n=15) low attenuation within mass, extensive large necrotic lymphadenopathy (n=13), and liver metastasis (n=6) at presentation. Preoperatively, CT findings were interpreted as gastric adenocarcinoma (n=29) or lymphoma (n=3).

CONCLUSION

Although differential diagnosis between gastric adenocarcinoma and gastric NEC is difficult, gastric NEC should be considered in the differential diagnosis when CT shows a large ulcerofungating tumor with low attenuation areas, especially combined with extensive necrotic lymphadenopathy, and frequent hepatic metastasis.

CLINICAL RELEVANCE/APPLICATION

Gastric NEC should be considered in the differential diagnosis when CT shows a large ulcerofungating tumor with low attenuation areas, especially combined with extensive necrotic lymphadenopathy, and frequent hepatic metastasis.

SST05-05 Preoperative Whole-tumor Texture Analysis by Contrast Enhanced CT in Gastric Cancer: Correlations with Post-operative T Staging

Friday, Dec. 4 11:10AM - 11:20AM Location: E353B

Participants
Francesco Giganti, MD, Milan, Italy (*Presenter*) Nothing to Disclose
Annalaura Salerno, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Paolo Marra, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Sofia Antunes, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco A. De Cobelli, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Del Maschio, MD, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Computed tomography texture analysis (CTTA) is an emerging tool to assess and quantify tumor heterogeneity, that is strictly related to cancer aggressiveness. Many quantitative features can be obtained from CTTA. We investigated the correlation of some of these parameters with postoperative T staging in gastric cancer.

RESULTS

Among all parameters, the following showed significant correlations ($p<0.01$): energy (without and with all filters, r ranging from 0.43 to 0.59), entropy (filtered, r ranging from -0.52 to -0.36) and uniformity (filtered, r ranging from 0.34 to 0.50). Mean values were significantly different ($p<0.05$) between the two groups (pT1-3 vs pT4) for the following: energy (with and without filtered image), entropy and uniformity.

CONCLUSION

CTTA features can help to predict T staging. Uniformity is directly correlated to pT stages: our hypothesis is that the increased vascularity - characteristic of more aggressive tumors - leads to greater parenchymal enhancement and lower contrast resolution, resulting in higher uniformity during CTTA. All the aforementioned parameters could represent promising, non-invasive and easily applicable diagnostic tools to evaluate the aggressiveness of gastric cancer.

CLINICAL RELEVANCE/APPLICATION

CTTA can quantify the heterogeneity of gastric cancer, opening a new window for the evaluation and treatment planning of this type of tumor.

SST05-06 Diffusion-weighted Magnetic Resonance Imaging in Submucosal Tumors of the Stomach: Preliminary Results

Friday, Dec. 4 11:20AM - 11:30AM Location: E353B

Participants
Atsushi Tani, MD, PhD, Kagoshima, Japan (*Presenter*) Nothing to Disclose
Yoriko Kajiya, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Shinohara, MD, Kagoshima City, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Yoshiura, MD, PhD, Kagoshima, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To describe the appearance of submucosal tumors of the stomach on diffusion-weighted magnetic resonance imaging (DWI).

METHOD AND MATERIALS

Ten consecutive patients (5 males and 5 females: age range, 32 to 84 years) with a submucosal tumor of the stomach were included in this retrospective study. Pathological diagnosis was confirmed in all patients either by surgery (8 patients) or biopsy (2 patients). DWI with b values of 0 and 800 s/mm2 was performed using a 1.5T system. Visual evaluation of DWI was independently performed by two radiologists and the signal intensity (SI) of each lesion was evaluated using a five-point scale (1, unrecognizable; 2, recognizable but SI lower than muscle; 3, SI equal to or higher than muscle but lower than kidney; 4, SI equal to or higher than kidney but lower than spleen; 5, SI equal to or higher than spleen). Interobserver agreement of visual scores was evaluated using the weighted kappa statistics. Apparent diffusion coefficient (ADC) values, which were available in 8 patients, were also recorded.

RESULTS

The pathological diagnoses were gastrointestinal stromal tumor (GIST) (n=7), leiomyosarcoma (n=1), malignant lymphoma (n=1) and ectopic pancreas (n=1). All lesions except an ectopic pancreas showed a conspicuous high SI on DWI and the mean of visual scores was 4.5 for both readers. Interobserver agreement in visual analysis was good (weighted kappa=0.78). ADC values for 6 patients with GIST ranged from 1.35x10-3 to 2.11x10-3 mm2/s (mean: 1.52x10-3 mm2/s), which were higher than that of a malignant lymphoma (1.18 x10-3 mm2/s).

CONCLUSION

The majority of gastric submucosal tumors show conspicuous high SI on DWI. DWI may be helpful in the preoperative evaluation of the tumor extent in these patients.

CLINICAL RELEVANCE/APPLICATION

DWI can visualize the majority of submucosal tumors of the stomach and may help us evaluate the extent of these lesions.

SST05-07 Dynamic Contrast-enhanced Computed Tomography (DCE-CT) as a Prognostic Marker for Overall Survival in Gastroesophageal Junctional Cancer and Gastric Cancer after Preoperative Chemotherapy

Friday, Dec. 4 11:30AM - 11:40AM Location: E353B

Participants
Martin Lundsgaard, MD, Kobenhavn, Denmark (*Presenter*) Nothing to Disclose
Eva Fallentin, MD, Kobenhavn, Denmark (*Abstract Co-Author*) Nothing to Disclose
Lene Baeksgaard, PhD,MD, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Birgitte Federspiel, MD, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Lars Bo Svendsen, DSc,MD, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose
Michael B. Nielsen, MD, PhD, Copenhagen, Denmark (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate whether changes in DCE-CT parameters during pre-operative chemotherapy predict overall survival in patients with gastro-esophageal junction (GEJ) cancer and gastric cancer.

METHOD AND MATERIALS

Twenty-eight patients with adenocarcinoma of the gastro-esophageal junction (GEJ) and stomach were followed for a minimum of 2 years after completed surgery. All patient had received three series of chemotherapy before surgery, and were all evaluated with a DCE-CT scan prior to chemotherapy, after the first series of chemotherapy, and after three series of chemotherapy. The DCE-CT scans were performed using a 320-detector row scanner covering 12 - 16 cm in the z-axis. The total scan duration was 55-60 seconds with a variable scan delay determined by a test bolus. Analyses of the DCE-CT scans were done in consensus between two radiologists. Maximum slope model and Patlak analysis were used to calculate the following DCE-CT parameters: tissue perfusion (ml/min/100ml), blood volume (ml/100ml) and permeability (ml/min/100ml). Changes in DCE-CT parameters during pre-operative chemotherapy were calculated. Data on death were collected from the Electronic Patient Record. Patients who were not resected due to tumour invasion (n=1) or died caused by severe complications after surgery (within 30 days) (n=1), were excluded from the survival analysis. Survival analysis was done using Log Rank Test and Kaplan-Meier plot.The protocol was approved by the Committees on Biomedical Research for [BLINDED] with oral and written consent from patients.

RESULTS

Minimum follow-up time was 885 days after inclusion in the study. Surgery was performed at a median of 88 days (range 66-119) after enrolment. Changes in permeability after the first series of chemotherapy ranged from -51% to 86% (median:-19.3%; 25th percentile:-38.1%, 75th percentile:6.6%). Patients with the largest decrease in permeability (using the median as cut-off) had a significant longer overall survival (p=0.03). Changes in tissue perfusion and blood volume were not a significant prognostic factor.

CONCLUSION

Changes in permeability measured with DCE-CT during pre-operative chemotherapy may have a predictive value on overall survival after preoperative chemotherapy and surgery in GEJ cancer and gastric cancer.

CLINICAL RELEVANCE/APPLICATION

DCE-CT may have a role in patient stratification in the management of preoperative chemotherapy for GEJ cancer and gastric cancer.

SST05-08 Hydro-Multidetector CT in the Staging of Gastric Adenocarcinoma. A Comparative Study with Surgical and Histopathological Specimen

Friday, Dec. 4 11:40AM - 11:50AM Location: E353B

Participants
Marco Di Girolamo, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Francesco Carbonetti, MD, Rome-Roma, Italy (*Abstract Co-Author*) Nothing to Disclose

Cristiano Cantone, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Andrea Bucciarelli, Rome-Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
Linda Stefanetti, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Vincenzo David, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the accuracy of hydro-MDCT in the evaluation of gastric adenocarcinoma with subsequent surgical and histo-pathological specimen.

METHOD AND MATERIALS

65 patients with gastric adenocarcinoma diagnosed by endoscopy and biopsy, underwent hydro-MDCT (16 detectors).The distension of the gastric lumen was obtained after the oral administration of 500ml of water and i.v. injection of spasmolytic agent. The dynamic study was performed during arterial and portal phase.

RESULTS

Contrast-enhanced Hydro-MDCT always detected the gastric cancer as a focal or diffuse gastric wall thickening with or without abnormal enhancement. The tumor was pre-operatively classified as T1 stage in 11 cases, T2 in 21, T3 in 25 and T4 stage in 8. In 49/65 patients the assessment of local tumor extension on hydro-MDCT was identical to the histopathological results in defining the T category according TNM classification, with overall accuracy of 75%. We found overstaging in 12 and understaging in 4 cases. The local enlarged lymphnodes were always identified but MDCT results in the N stage were in agreement with histo-pathological samples in 69% of cases. For the evaluation of metastatic disease hydro-MDCT had an accuracy of 99%.

CONCLUSION

Hydro-MDCT is a reliable technique in the preoperative staging of gastric adenocarcinoma.

CLINICAL RELEVANCE/APPLICATION

Hydro-MDCT is a reliable technique in the preoperative staging of gastric adenocarcinoma.

SST05-09 Is CT Surveillance Necessary in Patients who Undergo Curative Endoscopic Submucosal Dissection for Early Gastric Cancers Based on Expanded Indications?

Friday, Dec. 4 11:50AM - 12:00PM Location: E353B

Participants
Kyusung -. Choi, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Se Hyung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Research Grant, Mallinckrodt plc; Research Grant, Samsung Electronics Co Ltd
Cheong-Il Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Sang Gyun Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the role of follow-up abdominopelvic CT in detecting extragastric recurrence in patients who had undergone curative endoscopic submucosal dissection (ESD) for early gastric cancers (EGCs) based on expanded indications.

METHOD AND MATERIALS

This retrospective study was institutional review board approved with waiver of patients' informed consent. Patients who underwent curative ESD for EGCs based on expanded indications between November 2005 and December 2009 as well as post-ESD CT and endoscopy comprised our study population. The primary outcome was post-ESD CT discovery of extragastric recurrence (i.e., lymph nodes or distant metastases) not detected by endoscopy. The incidence of gastric recurrence detected by endoscopy and/or CT was also analyzed. The cumulative incidence of gastric recurrence over the post-ESD follow-up period was analyzed using the Kaplan-Meier method.

RESULTS

The final cohort included 652 patients (297 based on absolute indications [234 men and 63 women; mean age, 64 years] and 390 patients based on expanded indications [311 men and 79 women; mean age, 63 years]). In a total of 611 post-ESD CTs performed over a mean follow-up of 59.1 months (Total 3013 CT scans; range, 4-113 months), extragastric recurrence (lymph node metastasis) was detected in only 2 patients (1 meeting absolute indications and 2 meeting expanded indications). Among the 8 local recurrences and 3 synchronous and 18 metachronous gastric cancers detected by endoscopy, 11 gastric recurrences were also detected on CT. Cumulative incidence of gastric recurrence 1, 3, and 5 years after ESD was 1.6%, 2.8%, and 7.1%, respectively.

CONCLUSION

When EGC meets expanded indications, surveillance CT following curative ESD rarely detects extragastric recurrence during 5-year post-ESD follow-up. However, owing to the high incidence of gastric recurrence, endoscopy surveillance is strongly warranted during this period.

CLINICAL RELEVANCE/APPLICATION

The role of CT surveillance is limited in patients who undergo curative ESD for early gastric cancers based on expanded indications as extragastric recurrence is rare.

SST06

Gastrointestinal (Gallbladder and Biliary Imaging)

Friday, Dec. 4 10:30AM - 12:00PM Location: E353C

GI CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Janio Szklaruk, MD, PhD, Bala Cynwyd, PA (*Moderator*) Nothing to Disclose
Puneet Bhargava, MD, Shoreline, WA (*Moderator*) Editor, Reed Elsevier

Sub-Events

SST06-01 T2-Weighted and Gd-EOB-DTPA Enhanced T1-weighted Magnetic Resonance Cholangiography for Evaluation of Biliary Anatomy in Living Liver Donors

Friday, Dec. 4 10:30AM - 10:40AM Location: E353C

Participants
Larry Cai, BS, San Francisco, CA (*Presenter*) Nothing to Disclose
Benjamin M. Yeh, MD, San Francisco, CA (*Abstract Co-Author*) Research Grant, General Electric Company; Author with royalties, Oxford University Press; Shareholder, Nextrast, Inc;
Antonio C. Westphalen, MD, Mill Valley, CA (*Abstract Co-Author*) Nothing to Disclose
John P. Roberts, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Zhen J. Wang, MD, Hillsborough, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The aim of our study was to determine the utility of T2-weighted and Gd-EOB-DTPA enhanced T1-weighted MR cholangiography (MRC) at 3-Tesla for bile duct visualization and for predicting biliary anatomy.

METHOD AND MATERIALS

This study included 35 consecutive donors who underwent either right or left lobectomy for transplantation. Pre-operative MRC studies were acquired on a 3-Tesla scanner and included 3D T2 MRC and 3D Gd-EOB-DTPA enhanced T1 MRC. Two readers independently rated the quality of second-order bile duct visualization on the T2- and T1- MRC images on a 4 point scale (0, not seen; 3, excellent visualization), and also noted the presence of variant second-order biliary anatomy. MR findings were compared to those at surgery. Wilcoxon test was used to compare the MRC sequences, and Kappa analysis was performed to estimate inter-observer agreement.

RESULTS

There was good inter-observer agreement for bile duct visualization (k=0.72-0.76). The mean second order bile duct visualization scores were significantly higher for Gd-EOB-DTPA enhanced T1 MRC than 3D T2 MRC (2.4±0.7 vs 2.0±0.8, p=0.01). Thirteen of 35 donors underwent right lobectomy; biliary variant was noted at surgery in 11 of 13 right lobe donors. The biliary anatomy on MR was concordant with intraoperative finding in 10 of 13 donors (77%) for reader 1 and in 11/13 donors (85%) for reader 2. Twenty-two of 35 donors underwent left lobectomy; variant biliary anatomy was noted at surgery in 2 left lobe donors, one of which was predicted at MR by both readers. Both readers also noted variant biliary anatomy in 3 additional left lobe donors at MRC. These were not confirmed at surgery, and likely because commonly noted variant second order biliary anatomy predominantly affects right rather than left lobectomy and may not be visualized during left lobectomy.

CONCLUSION

Gd-EOB-DTPA Enhanced MRC provides improved bile duct visualization compared to 3D T2 MRC. Combined 3D T2-weighted and Gd-EOB-DTPA enhanced T1-weighted MRC at 3-Tesla depicts variant biliary anatomy with good accuracy.

CLINICAL RELEVANCE/APPLICATION

Combined 3D T2-weighted and Gd-EOB-DTPA enhanced T1-weighted MRC at 3-Tesla depicts variant biliary anatomy with good accuracy.

SST06-03 Biliary Cast Syndrome in Patients after Liver Transplantation: Which Non-Enhanced T1-weighted Sequence is Able to Show Cast Best?

Friday, Dec. 4 10:50AM - 11:00AM Location: E353C

Participants
Anja Laader, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas C. Lauenstein, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Peter Hunold, MD, Lubeck, Germany (*Abstract Co-Author*) Speaker, Bayer AG; Speaker, Koninklijke Philips NV
Alexander Dechene, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Sonja Kinner, MD, Essen, Germany (*Presenter*) Nothing to Disclose

PURPOSE

It is already known that the addition of T1-weighted (T1w) images to MR cholangiopancreatography (MRCP) facilitates detection of cast in biliary cast syndrome in patients after liver transplantation. Aim of this retrospective study was to compare T1w sequences with regard to the visibility of cast in patients with endoscopically saved biliary cast.

CONCLUSION

Out of the three evaluated T1w non-enhanced sequences, T1w opposed phase was superior regarding image quality and

Out of the three evaluated T1w non-enhanced sequences, T1w opposed phase was superior regarding image quality and conspicuity of cast.

CLINICAL RELEVANCE/APPLICATION

Using T1w opposed-phase as single non-enhanced T1w sequence in addition to MRCP for detection of cast in patients after liver transplantation might shorten the MR protocol and optimize workflow in clinical routine.

SST06-04 Determining the Extent of Cholecystectomy Using Intraoperative Specimen Ultrasonography in Patients with Suspected Early Gallbladder Cancer

Friday, Dec. 4 11:00AM - 11:10AM Location: E353C

Participants
Ji Hoon Park, MD, Seongnam-Si, Korea, Republic Of (*Presenter*) Research Grant, Bracco Group
Young Hoon Kim, MD, PhD, Seongnam-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yoon Jin Lee, MD, Seongnam-si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Accumulating evidence and guidelines recommend extended cholecystectomy for T1b or greater gallbladder cancers. This study aimed to evaluate the feasibility of intraoperative ultrasonography of a resected gallbladder specimen (specimen US) for the determination of the extent of cholecystectomy.

METHOD AND MATERIALS

The study included 37 patients (27 women; median [interquartile range] age, 66 [57-74] years) who underwent specimen US. After simple laparoscopic cholecystectomy, a gallbladder specimen was examined to evaluate the depth of tumor invasion by specimen US and frozen section examination. Then the operating surgeon decided whether to undergo extended cholecystectomy. The technical success rate and the examination time of the specimen US procedure were measured. The sensitivity and specificity in diagnosing T1b or greater cancer were calculated using permanent pathology as the reference standard.

RESULTS

Among 17 patients in whom adenocarcinomas were confirmed, 14 patients had T1b or greater cancers. The technical success rate was 97% (95% confidence interval, 85-100%). The mean examination time was 8.5 minutes (standard deviation, 4.3 minutes). The sensitivity and specificity was 79% (49%-95%) and 91% (71%-99%), respectively.

CONCLUSION

The specimen US is feasible to be incorporated in the clinical practice, and provides useful information to determine the extent of cholecystectomy.

CLINICAL RELEVANCE/APPLICATION

Providing high image resolution which has not been achieved by other diagnostic imaging modalities, intraoperative ultrasonography of a resected gallbladder specimen is feasible to be incorporated in the clinical practice for the determination of the extent of cholecystectomy.

SST06-05 Utility of Diffusion-Weighted MRI for Differentiating Acute from Non-Acute Cholecystitis

Friday, Dec. 4 11:10AM - 11:20AM Location: E353C

Participants
Annie M. Wang, MD, New York, NY (*Presenter*) Nothing to Disclose
Diane M. Dunst, MD, North Bellmore, NY (*Abstract Co-Author*) Nothing to Disclose
Krishna Prasad Shanbhogue, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Cristina H. Hajdu, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Andrew B. Rosenkrantz, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the utility of diffusion-weighted imaging (DWI) for differentiating acute from non-acute cholecystitis, in comparison with conventional MRI features.

METHOD AND MATERIALS

83 patients with abdominal pain who underwent 1.5T liver MRI including DWI (b-values 0, 500, and 1000 s/mm2) within 30 days before cholecystectomy were included. Two radiologists assessed cases for a spectrum of conventional MRI features associated with acute cholecystitis, as well as for visually increased mural signal on high b-value images and visually decreased mural ADC. ADC of the gallbladder wall was also measured. Features were compared between acute and non-acute cholecystitis.

RESULTS

43% (47/83) had acute cholecystitis; 57% (47/83) had non-acute cholecystitis. Conventional MRI features with significantly greater frequency in acute cholecystitis for both readers were: wall thickening, pericholecystic fluid, pericholecystic stranding, gallbladder distension, increased pericholecystic liver enhancement, mural T2 hyperintensity, increased mural enhancement, striated mural appearance, and mural defect (all $p \leq 0.003$). Increased mural signal on high b-value images was significantly more frequent in acute than in non-acute choleystitis for both readers (R1: 92% vs. 32%, R2: 83% vs. 30%; $p<0.001$). For R1 and R2, increased mural signal on high b-value images had a sensitivity of 92% and 83% and a specificity of 68% and 70%, respectively. Visually low ADC was more frequent in acute cholecystitis for R2 ($p<0.001$) but not for R1 ($p=0.406$); ADC values were not different between the two groups for either reader ($p=0.104$-0.139). At multivariable analysis, independent predictors of acute cholecystitis were, for R1: gallbladder distension, increased pericholecystic liver enhancement, and increased mural signal on high b-value images (combined AUC 89%), and for R2: pericholecystic fluid and increased mural signal on high b-value images (combined AUC 89%).

CONCLUSION

Visually increased mural signal on high b-value DWI was highly sensitive and moderately specific in identifying acute cholecystitis,

serving as a significant independent predictor of this diagnosis relative to conventional MRI features for both readers.

CLINICAL RELEVANCE/APPLICATION

Diffusion-weighted imaging (particularly the high b-value images) may have additive value relative to conventional MRI in guiding clinical management in patients with suspected acute cholecystitis.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Krishna Prasad Shanbhogue, MD - 2012 Honored Educator
Krishna Prasad Shanbhogue, MD - 2013 Honored Educator

SST06-06 Intraductal Papillary Mucinous Neoplasms (IPMN) of the Pancreas: Diagnostic Accuracy of Low-dose Abdominal MDCT Scan

Friday, Dec. 4 11:20AM - 11:30AM Location: E353C

Participants
Federica Leone, MD, Monza, Italy (*Presenter*) Nothing to Disclose
Davide Ippolito, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose
Pietro A. Bonaffini, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose
Cammillo R. Talei Franzesi, Milan, Italy (*Abstract Co-Author*) Nothing to Disclose
Pietro Allegranza, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose
Sandro Sironi, MD, Monza, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic accuracy of low-dose MDCT combined with iterative reconstruction algorithm (iDose4) in the assessment of intraductal papillary mucinous neoplasms (IPMN) of the pancreas, to determining the correct surgical approach.

METHOD AND MATERIALS

We retrospectively evaluated nineteen patients (13 men; mean age 70.7±13.1 years) with pancreatic IPMN and who underwent from January 2013 to March 2015 an abdominal MDCT examination on a 256-slice scanner (iCT; Philips), with low-dose scanning protocol (120 kV, mAs determined by x-, y- and z-axis dose modulation) and iDose4 reconstruction modulation. Standard Magnetic Resonance (MR) imaging examination was used as reference standard for diagnosis of IPMN. For every IPMN the following data and morphologic features were reported: location within the gland (head, uncinate process, neck, body, tail), number (multifocality), maximum diameter(measured either on axial images or multiplanar reconstructions), communication with the main pancreatic duct (MPD), maximum MPD diameter, presence of septa, wall thickening, mural enhancing nodules and close adjancency to the portal vein, according to surgical guidelines of International Association of Pancreatology.

RESULTS

Multiplanar CT reconstructions were performed and the imaging data were reviewed as axial and as MPR images: coronal, sagittal and curved in order to evaluate the surgical criteria of malignancies and therefore the surgical approach. A total of 44 IPMN (26 in the tail, 8 in the body, 6 in the head, 2 in the neck) in 19 patients were evaluated (single in 8 cases, multiple in 11). The main lesion diameter was 14.4±6.8 mm; 22/44 (50%) demonstred a distinct communication with MPD and MPD mean diameter was 2.7±0.7 mm. 5/44 (11%) lesions demonstrated inner septa and 10/44 (23%) wall thickening and 2/44 (4%) mural enhancing nodules. 8/44 (18%) of IPMN demonstrated close proximity to the portal vein.

CONCLUSION

Low-dose abdominal MDCT scans with iDose4 reconstruction algorithm are able to properly depict morphologic features of pancreatic IPMNs that may allow their proper characterization according to surgical guidelines.

CLINICAL RELEVANCE/APPLICATION

MDCT scans combined with iDose4 might represents a useful imaging technique, rapid and widely available, for the proper surgical assessment of pancreatic IPMN.

SST06-07 Application of Contrast-enhanced Ultrasound in the Diagnosis of Space-occupying Lesions in Extrahepatic Bile Duct -A Comparison of Conventional Ultrasound and Contrast-enhanced CT

Friday, Dec. 4 11:30AM - 11:40AM Location: E353C

Participants
Wei Wu, MD, Beijing, China (*Presenter*) Nothing to Disclose
Yue Cong, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Zhong-Yi Zhang, PhD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Kun Yan, BS, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the application of contrast-enhanced ultrasound (CEUS), compared with conventional ultrasound (US) and contrast enhanced computed tomography (CECT) in the diagnosis of space-occupying lesions in the extrahepatic bile duct.

METHOD AND MATERIALS

Seventy two patients with pathological diagnosis of space-occupying lesions in the extrahepatic bile duct were retrospectively recruited. All 72 patients underwent US, CEUS and CECT. The Sensitivity, specificity and diagnostic accuracy were obtained and compared.

RESULTS

Among 72 patients,11 cases were benign and 61 cases were malignant. The diagnostic accuracy of US, CEUS and CECT were 66.67% (48/72), 90.28% (65/72) and 88.89% (64/72), respectively. The Youden index showed that CEUS (0.811) is comparable to contrast enhanced CT (0.720) and higher than US (0.159). There was a significant difference between US and CEUS (p=0.001) and US and CECT (p=0.001) in terms of accuracy of diagnosis, however, no significant difference between CEUS and CECT (p=0.785). Sensitivity results showed a significant difference between US and CEUS (p=0.006) and CECT (p=0.006) whilst CEUS was comparable to contrast enhanced CT (p=1.000). There was no significant difference in specificity among the three imaging techniques (p>0.05). There was a significant difference in the number of lesions with clear boundaries displayed, 16 in the US and 56 in CEUS (p=0.006).

CONCLUSION

CEUS can observe dynamic blood supply in the space-occupying pathological regions in the extrahepatic bile duct. The diagnosis accuracy of CEUS in the extrahepatic bile duct was higher than that of conventional US and comparable to that of contrast-enhanced CT. Therefore, CEUS may be a promising imaging technique in the diagnosis of space-occupying disease in the extrahepatic bile duct.

CLINICAL RELEVANCE/APPLICATION

The diagnosis accuracy of CEUS in the extrahepatic bile duct was higher than that of conventional US and comparable to that of contrast-enhanced CT.

SST06-08 Association of Tumor Heterogeneity on CT Image with Genetic Mutation of the Isocitrate Dehydrogenase and Survival in Cholagiocarcinoma

Friday, Dec. 4 11:40AM - 11:50AM Location: E353C

Participants
Koichi Hayano, MD, Boston, MA (*Presenter*) Nothing to Disclose
Lipika Goyal, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Andrew X. Zhu, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rahmi Oklu, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Cinthia Cruz, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Manuel Patino, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Dushyant V. Sahani, MD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Research Consultant, Allena Pharmaceuticals, Inc

PURPOSE

Heterogeneity in the tumor structure or vasculature is a well-recognized feature of malignancy. On the other hand, mutation in the isocitrate dehydrogenase (IDH) is the most common genetic alternations in cholangiocarcinoma, which has been reported its association with progression to metastases. The purpose of this study is to compare computed tomography texture analysis (CTTA) with genetic mutation of IDH and survival in unresectable cholangiocarcinoma.

METHOD AND MATERIALS

46 patients (22 M / 24 W; median age: 61.3 years) with unresectable cholangiocarcinoma were retrospectively evaluated. Median follow-up time was 24.0 months. Contrast enhanced (CE) CT were performed before the therapy. Tumor texture parameters including mean gray intensity (MGI), standard deviation (SD), Entropy, mean of positive pixels (MPP) were measured on portal-phase CECT images by a texture analysis software (TexRAD, Somerset, UK), where the filtration (spatial scale filter, SSF) extracted features of medium texture scale (SSF=3 mm in radius). Correlations of texture parameters with IDH mutations were investigated, and those parameters were also compared with overall survival (OS) using Cox regression and Kaplan-Meier analysis.

RESULTS

Low SD value of tumor significantly associated with IDH mutation (P=0.01). In univariate Cox regression analysis, MGI showed significant correlations with OS (P=0.008). Kaplan-Meier analysis demonstrated that lower MGI (< -4.623) associated with favorable OS (P=0.01).

CONCLUSION

Pre-therapeutic tumor texture parameter may serve as a predictive imaging biomarker for gene mutation and survival in cholangiocarcinoma patients.

CLINICAL RELEVANCE/APPLICATION

CT texture analysis can be a widely applicable noninvasive biomarker for predicting gene mutation and survival in cholangiocarcinoma patients, and it would help select an optimal therapy for those patients.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: https://www.rsna.org/Honored-Educator-Award/

Dushyant V. Sahani, MD - 2012 Honored Educator
Dushyant V. Sahani, MD - 2015 Honored Educator

SST06-09 Common Bile Duct Stone: Value of Adding Single-Shot Balanced Turbo Field-Echo Sequence to Conventional MR Imaging

Friday, Dec. 4 11:50AM - 12:00PM Location: E353C

Participants

Yoshifumi Noda, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Satoshi Goshima, MD, PhD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Toshihisa Kojima, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Shimpei Kawaguchi, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Haruo Watanabe, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Kawada, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Nobuyuki Kawai, MD, Gifu, Japan (*Presenter*) Nothing to Disclose
Hiromi Ono, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Masayuki Kanematsu, MD, Gifu, Japan (*Abstract Co-Author*) Nothing to Disclose
Kyongtae T. Bae, MD, PhD, Pittsburgh, PA (*Abstract Co-Author*) Patent agreement, Medtronic, Inc; Consultant, Otsuka Holdings Co, Ltd

PURPOSE

To evaluate the value of adding single-shot balanced turbo field-echo (b-TFE) sequence to conventional magnetic resonance (MR) imaging for the detection common bile duct (CBD) stone.

METHOD AND MATERIALS

Our institutional review board approved this prospective study and written informed consent was obtained. One-hundred thirty-seven consecutive patients with suspected CBD stone underwent MR imaging, including balanced turbo field-echo sequence. Among 137 patients, 25 patients were confirmed having CBD stone by endoscopic retrograde cholangiopancreatography or ultrasonography. A radiologist reviewed the following two image sets for the detection of CBD stone; image set A, a conventional MR images (unenhanced T1-, T2-, heavily T2-, and MRCP images), and image set B, combined conventional images and b-TFE. The sensitivities, specificities, and area under the receiver-operating-characteristic curve (AUC) for the detection of CBD stone were compared.

RESULTS

AUC for the detection of CBD stone were 0.86 and 0.93 for image sets A and B, respectively. The AUC for image set B was significantly greater than that for image set B ($P = 0.030$). For the detection of CBD stone, sensitivity was comparable between two image sets but image set 2 (99%) yielded better specificity than image set 1 (92%) ($P = 0.0078$).

CONCLUSION

Adding single-shot b-TFE to conventional MR imaging improves the diagnostic performance for CBD stone.

CLINICAL RELEVANCE/APPLICATION

For the evaluation of common bile duct stone, single-shot balanced turbo field-echo sequence significantly improve a confidence rating for the presence.

SST07

Genitourinary (MR and CT of the Urothelium)

Friday, Dec. 4 10:30AM - 12:00PM Location: E351

GU CT MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
David D. Childs, MD, Clemmons, NC (*Moderator*) Research Grant, Endocare, Inc
Paul Nikolaidis, MD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

SST07-01 Quantitative Assessment of Voxel-wise Apparent Diffusion Coefficient using K-means Clustering to Predict and Assess Chemotherapeutic Response in Bladder Cancer

Friday, Dec. 4 10:30AM - 10:40AM Location: E351

Participants
Huyen T. Nguyen, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Amir Mortazavi, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Kamal S. Pohar, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Zarine K. Shah, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Guang Jia, PhD, Baton Rouge, LA (*Abstract Co-Author*) Nothing to Disclose
Michael V. Knopp, MD, PhD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Debra Zynger, MD, Columbus, OH (*Abstract Co-Author*) Nothing to Disclose
Hendrik Von Tengg-Kobligk, MD, Bern, Switzerland (*Presenter*) Research Grant, W. L. Gore & Associates, Inc

PURPOSE

To evaluate the value of k-means clustering of voxel-wise Apparent Diffusion Coefficient (ADC) in the assessment of chemotherapeutic response in bladder cancer.

METHOD AND MATERIALS

10 bladder cancer patients who received neoadjuvant chemotherapy were included in this initial study. Patients were scanned on a 3T multi-transmit system (Achieva, Philips Healthcare) using a 32-channel phased-array surface coil. Each patient had a baseline (before chemotherapy) MRI and a post-chemotherapy MRI, followed by radical cystectomy. High resolution T2W imaging was performed prior to DWI. DWI data were processed on in-house software written in IDL (Exelis, VIS) to acquire voxel-wise ADC for each tumor. The k-means clustering was implemented to segment each tumor in three clusters (labeled as clusters 1, 2, 3 with low, intermediate, high ADC). The volume fractions (VFs) of three clusters in a tumor at baseline and post-chemotherapy were correlated with the tumor response. $P<0.05$ was considered to be statistically significant. Color cluster maps were overlaid on ADC maps to visualize the cluster distribution.

RESULTS

Using pathological findings and radiologic volume estimation of bladder tumors, 6 patients were defined as responders and 4 as non-responders. At baseline, responders showed a significantly higher VF of cluster 1 and lower VF of cluster 2 (all $P<0.04$) than non-responders (Figure 1). In contrast with resistant cases, responsive tumors showed a decrease in VF of cluster 1 and an increase in that of cluster 3 after chemotherapy. These differences in the post-chemotherapy changes of cluster VFs were found to be statistically significant (all $P<0.04$) between responders and non-responders.

CONCLUSION

As ADC characterizes the micro-cellularity in body tissues, the heterogeneity of tumor micro-cellularity can be quantified using k-means clustering of voxel-wise ADC to enable the early assessment and predication of chemotherapeutic response in bladder cancer.

CLINICAL RELEVANCE/APPLICATION

k-means clustering of voxel-wise ADC can be useful in predicting chemotherapeutic response at baseline and assessing chemotherapy-induced changes of micro-cellularity in bladder cancer.

SST07-02 MDCT Urography Using a 320-detector Row Scanner: Comparison of the Wide Volume (W-V) Scan Mode and Conventional Helical Scan Mode in Terms of Radiation Dose and Image Quality

Friday, Dec. 4 10:40AM - 10:50AM Location: E351

Participants
Catherine Roy, MD, Strasbourg, France (*Presenter*) Nothing to Disclose
Raphael Quin, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Mickael Ohana, MD, MSc, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Guillaume Alemann, MD, MS, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Aissam Labani, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Pierre G. Leyendecker, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To prospectively compare the conventional helical scan mode and W-V scan mode in CT Urography examinations using a 320-

detector row scanner in terms of image quality, radiation dose and accuracy of the automatic stitching for alignment of ureteral segments in the W-V scan mode.

METHOD AND MATERIALS

A cohort of 70 patients underwent a multiphasic CT Urography examination using a 320-detector CT scanner (Aquilion ONE, Toshiba Medical Systems) including a medullary phase using the helical scan mode(collimation:80x0.5mm, rotation:0.5s,1mm/0.8mm, acquisition time:4-6s) and an excretory phase using the W-V scan mode (collimation:200x0.5mm, rotation:0.5s,1mm without overlapping and 4 to 5 volumes to cover the entire urinary tract, acquisition time:6-7s). Adaptative blending was used to stitch the wide volumes. Both scans modes were performed at 120kVp with the same FOV, length of coverage and iterative reconstruction (AIDR 3D). The Body Mass Index (BMI) of each patient and the dose-length product (DLP) was also recorded.For the quantitative analysis, the signal to noise ratio (SNR) was calculated in the iliopsoas muscle. For qualitative analysis, two independent experienced readers were asked to subjectively assess the presence of motion artefacts as well as the quality of the volumes matching by analysis the continuity of the ureter on the excretory phase, using a four-point scale.

RESULTS

The mean DLP was significantly lower for the W-V acquisition than for the helical acquisition (136.8+/-28mGy·cm vs 232.8+/-41mGy·cm,respectively) equal to 42.53% ($p<0.05$), regardless of the patient's BMI. The SNR was quite similar with W-V and helical scan mode (15.3+/-1.9 vs 17.3+/-2.5, respectively). No significant difference was noted for the presence of motion artifacts between both modes.In 85% of cases, there was no disruption of the continuity of the ureter with the W-V scan mode after stitching of the volumes. In 12% of cases, there was minimal discontinuity of one segment and in 3% of cases there was an inadequate matching of the volumes.

CONCLUSION

Wide Volume scanning using a 320-MDCT allows a significant radiation dose reduction (42%) while preserving image quality in comparison to helical scanning. The lack of overranging with minimal overbeaming explain those results.

CLINICAL RELEVANCE/APPLICATION

Wide volume scanning allows a significant reduction of radiation dose with a perfect continuity of the ureter and an excellent image quality .

SST07-03 Comparison between Conventional Cystourethrography and MRI with Voiding MR-cystourethrography in the Evaluation of Male Urethral Strictures

Friday, Dec. 4 10:50AM - 11:00AM Location: E351

Participants
Marco Di Girolamo, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Ines Casazza, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Simone Mariani, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco Carbonetti, MD, Rome-Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
Giulia Francione, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Vincenzo David, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the accuracy of conventional retrograde and voiding cystourethrography and MRI together with voiding MR-cystourethrography in the evaluation of male urethral strictures.

METHOD AND MATERIALS

We evaluated 39 male patients with urethral strictures diagnosed with urine flow velocity recording and conventional retrograde and voiding cystourethrography. All these patients underwent MRI and voiding MR-cystourethrography using a 1.5T superconductive magnet. The patients had urine-filled bladders and high-resolution sagittal TSE T2-weighted scans were performed (TR:6250ms; TE:90ms;sl.thick.:3mm; acq.time:3'38"). Voiding MR-cystourethrography was performed with T1-weighted spoiled 3D gradient-echo acquisitions on sagittal plane (TR:12ms; TE:2,7ms; flip-angle:40°; sl.thickness: 2mm; acq.time:12s) after the filling of bladder lumen with contrast-material-enhanced urine obtainded by the i.v administration 20 mg of furosemide followed by ¾ of the normal dose of a paramagnetic contrast agent (Magnevist, Bayer Pharma, Germany). After micturition high-resolution coronal TSE T2-weighted scans were performed at the level of the stenosis. Two radiologists in consensus evaluated the morphology and length of the urethral stenosis with the two modalities and with MRI the entity and the site of spongio-fibrosis was assessed.

RESULTS

3 patients were not able to perform voiding MR-cystourethrography. In 36 patients evaluated with two imaging modalities 32 single and 4 double urethral strictures were detected. The measurement of the stenosis length was equal or superior with voiding MR cystourethrography and the analysis of 3D sagittal scans allowed a better evaluation of the morphology of the urethral strictures in comparison with conventional cystourethrography. Spongio-fibrosis was found in 30 patients (83%). The site of spongio-fibrosis was always assessed with MRI (dorsal, ventral, dorsal and ventral and circular fibrosis).

CONCLUSION

MRI with voiding MR-cystourethrography shows the morphology and the length of the urethral strictures better than conventional cystourethrography and allows the detection and site of spongio-fibrosis, avoiding radiation exposure to the gonads and urinary catheterization.

CLINICAL RELEVANCE/APPLICATION

MRI could be proposed as all-in-one technique for the evaluation of urethral stenosis, allowing their detection and length assessment and determining the presence and site of spongiofibrosis.

SST07-04 Efficiency of Diffusion-weighted (DW) MRI to Evaluate the Excreto Urinary Wall Lesions: A Prospective Study of 95 Patients

Friday, Dec. 4 11:00AM - 11:10AM Location: E351

Participants
Catherine Roy, MD, Strasbourg, France (*Presenter*) Nothing to Disclose
Aissam Labani, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Mickael Ohana, MD, MSc, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Guillaume Alemann, MD, MS, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Guillaume Bierry, MD, PhD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose
Herve Lang SR, MD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose was to investigate the reliability of DW-MRI in differentiating malignant from benign thickening or masses of the entire urinary excretory wall.

METHOD AND MATERIALS

We prospectively evaluated 95 patients referred for 52 upper urinary tract (UUT) and 43 bladder (Bl) lesions during a period of 5 years (from january 2010 to january 2015) . MR examinations were performed on a 3T unit (Achieva, Philips Medical System) including to our conventional protocol using T2 and T1 sequence before and after contrast media injection an axial DWI (TR/TE : 7000/55, FOV : 250-300, ETL : 53, slice thickness : 4 mm, acquisition time : 4 min, Sense factor : 2, b =0 and 1000 mm2/sec) under free breathing with a respiratoy compensatory device (navigator echo) for UUT. The final diagnosis and standard of reference was the pathological analysis performed after MR examination, obtained either after surgery (74 cases) or by selective cytology and endoscopic biopsy (21 cases) with a follow up imaging (at least one year) for 11 of them. Mann-Whitney test and Student -t test were used to determine the efficiency of the mean ADC value.

RESULTS

Maximal axial diameter was 34±24mm for malignant (39 UUT; 33 Bl) and 15±5mm for benign lesions (13 UUT; 10 Bl), respectively. For UUT, the mean ADC value in the malignant lesions was significantly lower than that in the benign lesions: 0.99+0.27 x10-3mm2/s against 1.54+0.43 x10-3mm2/s, respectively (p=0.0005). Thirty-three malignant lesions had an ADC value inferior to 1 x10-3mm2/s and only one benign lesion. There was a significant difference among the mean ADC values of different grades of malignant tumors, corresponding to 0.84 ± 0.12 x10-3mm2/s-1 and 1.0 ± 0.20 x10-3mm2s-1 (p<0.01) in high-grade and low-grade excretory epithelioma, respectively For bladder, the mean ADC value in the malignant lesions was not significantly inferior to that of benign lesions (1.22 ± 0.3 x10-3mm2/s against 1.32± 0.2x10-3mm2/s, p=0.41)

CONCLUSION

DW-MRI is efficient in the differentiation between benign from malignant lesion located on the upper urinary tract. It does not seem according those data reliable for bladder tumors. DW sequence must be included in MR protocols for exploration of upper urinary tract.

CLINICAL RELEVANCE/APPLICATION

DW must be included in MR protocols for exploration of upper urinary tract. DW-MRI is efficient in the differentiation between benign from malignant lesion only in the upper urinary tract.

SST07-05 ADC as a Novel Biomarker to Predict the Local Stage and Tumor Grade of Bladder Cancer

Friday, Dec. 4 11:10AM - 11:20AM Location: E351

Participants
Chandan J. Das, MD, MBBS, New Delhi, India (*Presenter*) Nothing to Disclose
T. Razik, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Sanjay Sharma, MD, FRCR, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Deepnarayan Srivastava, Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Amlesh Seth, MBBS, MCHIR, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
Arun K. Gupta, MBBS, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the role of ADC as a novel biomarker to predict the local stage and tumor grade of bladder cancer using histopathology (of post TURBT/cystectomy specimen) as the gold standard.

METHOD AND MATERIALS

The study was approved by the local institutional ethics committee. MRI of 25 patients were performed in a 3 Tesla imaging system (Achieva, Philips). Routine T1W and T2W images were obtained, followed by Diffusion Weighted Imaging in four b values (b0, 500, 1000, and 1500). All the patients had their surgery done within 1 month of performing MRI. Tumour staging was assessed with the criteria used byTakeuchi et al,(2009). For the tumour grade, freehand ROI values were obtained from the ADC map and their mean calculated. Images were reviewed by two experienced radiologists in consensus, both blinded to the histopathology report. Subsequently, the sensitivity, specificity, positive and negative predictive values were assessed using standard statistical tests. Results were compared with the histopathology.

RESULTS

DWI had a sensitivity of 76.9% in detecting muscle invasion with a high specificity of 91.7%. The positive and negative predictive values were 90.9 and 78.6% respectively. The ADC values were (0.786 + 0.045) x 10-3 for high grade lesions and (1.049 + 0.113) x 10-3 for low grade lesions, with a significant difference between the two (p< 0.05). We could not found any additive value of T2 weighted imaging when combined with DWI. DWI images acquired in coronal and sagiital plane were better for evaluation of bladder dome lesion whereas axial plane DWI were best for rest of the lesions.

CONCLUSION

DWI showed a high specificity and positive predictive value in identifying muscle invasion. ADC values showed significant correlation with the tumor grade and can be used as novel imaging biomarker for predicting redict the local stage and tumor grade of bladder

cancer..

CLINICAL RELEVANCE/APPLICATION

ADC can be used as a noninvasive tool to evaluate bladder tumor and may avoid repeated cystoscopy or biopsy during follow up of low grade lesions following TURBT. DWI at 3T is superior to T2WI for evaluating the T stage of bladder cancer, particularly in differentiating T1 tumors from those T2 or higher, and in detecting stalks of papillary bladder tumors.

SST07-06 Detection of Urothelial Carcinomas: Comparison of Reduced-dose Based Iterative Reconstruction with Standard-Dose Filtered Back Projection

Friday, Dec. 4 11:20AM - 11:30AM Location: E351

Participants
See Hyung Kim, Daegu, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung Hee Hong, Daegu, Korea, Republic Of (*Presenter*) Nothing to Disclose

PURPOSE

To retrospectively assess radiation dose, image quality and diagnostic performance of CT urography detecting urothelial carcinomas for performing reduced-dose with iterative reconstruction (IR) in comparison to standard-dose with filtered back projection (FBP).

METHOD AND MATERIALS

Institutional review board approved this study. 2163 patients (age range, 28-81years; 1452 male) at high-risk for urothelial carcinomas randomly underwent standard-dose scanning with FBP (120kVp for >80kg, 100kVp for 50-80kg) or reduced-dose scanning with IR (100kVp for >80kg, 80kVp for 50-80kg) according to the body weight. Objective and subjective image quality between the two groups with same weight scope was compared, using two-way analysis. The predictive accuracy detecting urothelial carcinomas were also calculated by using as standard reference.

RESULTS

Mean effective dose was 26% (15.5mSv vs. 11.1mSv) and 30% (7.91mSv vs. 5.01mSv) lower with the reduced-dose scanning. Objective image noise had no significant difference, except for 120kVp with FBP and 80kVp with IR (ranging from 7.2 to 7.9 vs. 9.4 to 9.9, P <.0102). SNR and CNR had no significant difference. Subjective image quality had no significant difference in visual image noise, artifacts, ureter depiction and overall image quality, except for artifacts in 100kVp with FBP and 80kVp with IR (5 [4-5] vs. 4 [3-4]) (P >.05). Diagnostic accuracies on lesion level were 89.6% (89/98, 120kVp with FBP), 91.3% (105/115, 100kVp with FBP), 92.9% (79/85, 100kVp with IR) and 88.8% (111/125, 80kVp with IR), respectively.

CONCLUSION

Reduced-dose images with IR showed radiation dose reduction and equivalent image quality with ensuring diagnosis detecting urothelial carcinomas as compared with standard-dose images with FBP, thus these robust capabilities may use in clinical practice.

CLINICAL RELEVANCE/APPLICATION

Reduced-dose images with IR could be of help to reduce radiation dose with equivalent image quality for detecting urothelial carcinomas as compared with standard-dose images with FBP.

SST07-07 Recurrence Patterns in Transitional Cell Carcinoma of the Upper Urinary Tract

Friday, Dec. 4 11:30AM - 11:40AM Location: E351

Participants
Betsa Parsa, Boston, MA (*Presenter*) Nothing to Disclose
Vishala Mishra, MBBS, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Sandeep S. Hedgire, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Yun Mao, MD, Chongqing, China (*Abstract Co-Author*) Nothing to Disclose
Duangkamon Prapruttam, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study included patients diagnosed with UT-TCC who underwent nephroureterectomy between 2003-2008. Tumor location, morphology, TNM staging and histologic grade were recorded based on radiological examinations . The pattern and timing of recurrence was evaluated at 3, 6, 12, 24, 36 and 60 months in a five-year imaging and clinical follow up period (2008-2013).

METHOD AND MATERIALS

This included patients diagnosed with UT-TCC who underwent nephroureterectomy between 2003-2008. Tumor location, morphology, TNM staging and histologic grade were recorded based on radiological examinations and clinical notes. The pattern and timing of recurrence was evaluated at 3, 6, 12, 24, 36 and 60 months in a five year follow up period (2008-2013).

RESULTS

68 patients with an average age of 77.5 yrs were included in this study. At initial work-up, renal, ureteric and renal plus ureteric lesions were present in 34, 25 and 9 patients respectively. Of 59 patients for whom tumor morphology was available, 34 had mass-forming lesions and 25 were seen as filling defects. The majority of patients had a T-stage of Ta (n=28) or T3 (n=23), while nodal involvement was mostly absent. Tumors were grade 3 in 44.1% and grade 2 in 33.8%.Most recurrences were noted at 3 and 24 months. Patients with bilateral tumors had a higher recurrence rate at 3, 12, and 24-month follow-ups while for unilateral tumors the chance was higher at 36-month follow-up. Recurrence rate was also higher in patients with T2, N1 and pathologic grade 3 and in patients with T2, N1 and N2 at 3- and 12-month follow-ups, respectively. Pathological grade 1 tumors showed late recurrence at 5-yr follow up. Overall, recurrence occurred in 20 cases during the 5-yr follow-up, which was commonly located in lymph nodes, bladder. Multivariate analysis showed T-stage and location of primary tumor were independent predictors of tumor-free survival (p=0.021, 0.038 respectively). Average tumor-free survival time was 56.5 months.

CONCLUSION

Nodal, bladder, hepatic and bone metastasis are common in UT-TCC with most of them occurring at 3 and 24 months. T-stage and location are independent predictors of tumor-free survival. Tumors confined to either kidney or ureter, lower T, N stage and histologic grade were associated with longer survivals.

CLINICAL RELEVANCE/APPLICATION

Information on the pattern of recurrence in UT-TCC patients can lead to more effective planning of imaging surveillance strategy.

SST07-08 The Incremental Value of Diffusion-Weighted MR Images in the Tumor Detection and the Staging of Preoperative T Categorization in Renal Pelvic Carcinoma: Effect of Reader Experience

Friday, Dec. 4 11:40AM - 11:50AM Location: E351

Participants
Rika Yoshida, MD, Izumo, Japan (*Presenter*) Nothing to Disclose
Takeshi Yoshizako, MD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
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Minako Maruyama, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Takashi Katsube, Izumo City, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinji Andou, MD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Tomonori Nakamura, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Nobuko Yamamoto, MD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Megumi Nakamura, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Hajime Kitagaki, MD, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to retrospectively assess the incremental value of diffusion-weighted MRI (DWI) to T2-weighted image (T2WI) in the tumor detection and the staging of preoperative T categorization in renal pelvic carcinoma by readers of different experience levels.

METHOD AND MATERIALS

Thirty-two urothelial carcinoma in 32 patients underwent preoperative MRI examination, including T2WI and DWI (b=0, 800 s/mm) and contrast-enhanced imaging (CEI). All patients had total nephrectomy within 1 month of MRI. Two radiologists (reader 1 had 5 years and reader 2 had 18 years of experience) independently reviewed three image sets (T2WI alone, T2WI plus DWI, and T2WI plus CEI) regarding tumor detection and the discrimination of locally advanced tumors.

RESULTS

The pathologic T category was T1 in 5 (15.6%), T2 in 6 (18.8%), T3a in 9 (28.1%), T3b in 11 (34.4%), and T4 in 1 (3.1%).T2WI plus DWI enabled a high detection rate (97%, 31/32) without significant differences.In reader 1, for the diagnosis of T3 or higher categories, the accuracies were relatively low in all three image sets (75.0% each for T2WI alone and T2WI plus CEI and 71.9% for T2WI plus DWI). For discriminating tumors with macroscopic renal invasion from those with microscopic renal invasion or less, T2WI plus DWI (90.6%) was significantly more accurate than T2WI alone (68.8%) ($p < 0.05$), with with areas under receiver operating characteristic curves (AUC) of 0.82 and 0.73, respectively.In reader 2, for the diagnosis of T3 or higher categories, the accuracies were relatively low in all three image sets (each sets were 71.9%). For discriminating tumors with macroscopic renal invasion from those with microscopic renal invasion or less, the accuracies were relatively high in all three image sets (84.3% for T2WI alone, 94.8% for T2WI plus CEI and 90.6% for T2WI plus DWI), with AUC of 0.88, 0.95, and 0.93, respectively.For the diagnosis of T categorization, T2WI added DWI improved interobserver agreement from fair ($\kappa = 0.21, 0.32$) to substantial ($\kappa = 0.60, 0.73$).

CONCLUSION

DWI improved the tumor detection rate and the diagnostic performance for T categorization of renal pelvic cancer without contrast material, especially for the relatively inexperienced reader.

CLINICAL RELEVANCE/APPLICATION

DWI improved the tumor detection rate and the diagnostic performance for T categorization of renal pelvic cancer without contrast material.

SST07-09 Organ Confined Urinary Bladder Carcinoma: A Comparative Analysis for "Submucosa Linear Enhancement" Sign on Early Phase of DCE-MRI and the "Inchworm" Sign on DWI

Friday, Dec. 4 11:50AM - 12:00PM Location: E351

Participants
Huanjun Wang, MD, GuangZhou, China (*Presenter*) Nothing to Disclose
Jian Guan, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yan Guo, MD, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the pathogenetic mechanism of "submucosa linear enhancement" and to further evaluate its application value in preoperative staging of organ confined bladder carcinoma.

METHOD AND MATERIALS

The examination protocol was approved by the institutional medical ethics committee and informed consent was obtained from all patients. 59 patients with suspected or confirmed urothelial bladder cancer and no renal function impairment were enrolled in the study. All patients underwent MRI within 2-weeks before surgery. Two image sets of T2WIandDW-MRI and T2WIandDCE-MRI were independently interpreted by two readers at 2-week intervals by analyzing whether there were "inchworm" sign on DWI and "submucosa linear enhancement" sign on early phase of DCE-MRI, which were further comparatively analyzed with pathology. Tumor size was also compared.

RESULTS

92 carcinomas (79 T1, 13 T2) were analyzed. 58 presented "submucosa linear enhancement" on early phase of DCE-MRI which manifested three types as follow: continuous linear enhanced submucosa gathering toward into the center of tumor (39), continuous straight and no gathering linear enhanced submucosa(14) and interrupted linear enhanced submucosa(5) respectively, and the remaining 34 lesions presented no significant linear enhanced submucosa. 42 carcinomas (38 T1, 4 T2) presented "inchworm" sign on DWI, with the remaining 50 lesions (41 T1, 9 T2) shown not. Statistical significance were found for tumor size between carcinomas presented "inchworm" sign and those without, which had a median of 21.5mm for the former, and 13.0mm for the latter.

CONCLUSION

Presentation of "submucosa linear enhancement" under the tumor base on DCE-MRI is a significant imaging sign which can be applied in preoperative staging of organ confined bladder carcinoma. Presentation of either straight or gathered continuous "enhanced submucosa line" often suggests bladder muscle wall have not been involved.

CLINICAL RELEVANCE/APPLICATION

DCE-MRI and DWI can supply us an optimal imaging tool for preoperative staging of organ confined bladder carcionoma and is highly recommended.

SST08

Nuclear Medicine (Comparative Technologies)

Friday, Dec. 4 10:30AM - 12:00PM Location: S505AB

CT MR NM

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
William G. Spies, MD, Chicago, IL (*Moderator*) Nothing to Disclose
Don C. Yoo, MD, E Greenwich, RI (*Moderator*) Nothing to Disclose

Sub-Events

SST08-01 Does the Trinary Interpretation and Reporting Strategy for Lung Scintigraphy Work in a Nuclear Medicine Residency Program?

Friday, Dec. 4 10:30AM - 10:40AM Location: S505AB

Participants
Charles M. Intenzo, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Sung M. Kim, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose
Andrew Newberg, MD, Philadelphia, PA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Effective 7/01/2012, we implemented the trinary interpretation system for reporting results of lung ventilation/perfusion (V/Q) scintigraphy, i.e. 'PE present', 'PE absent', or 'nondiagnostic'. Our goal was to determine the discrepancy rate between on-call preliminary V/Q scan interpretations made by the residents, vs the final interpretation made by the attending MD, using this new reporting system.

METHOD AND MATERIALS

Over a 2 year interval from 7/1/2012 to 7/1/2014, we tabulated (1) the total number of V/Q scans preliminary read by our nuclear medicine residents on call, and (2) the number of V/Q scans in which the final interpretation later made by the supervising attending was discordant with the residents' preliminary reading.

RESULTS

A total of 458 V/Q scans during the on-call hours were initially reviewed and interpreted by nuclear medicine residents in our academic 600-bed hospital over this 2 year period. Of these, 17 (3.71%) initial interpretations were changed in the final scan reports signed by the attending MD. This discrepancy rate is sigificantly lower compared to the scan interpretation based on probabilities of pulmonary embolism used previously. For example, the discrepancy rate during the academic year 7/2/2011 to 7/1/2012 was 7.66%.

CONCLUSION

Implementation of the trinary interpretation strategy for V/Q scintigraphy works very well in the academic setting of a nuclear medicine residency program.

CLINICAL RELEVANCE/APPLICATION

Adaptation of the trinary interpretation strategy for V/Q scintigraphy is feasible in the academic environment.

SST08-02 Is there a Correlation between Glycolytic on [18F]-FDG-PET and Cell Density on Diffusion-weighted MRI in Lymphoma? Results of an [18F]-FDG-PET/MR Study

Friday, Dec. 4 10:40AM - 10:50AM Location: S505AB

Participants
Chiara Giraudo, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Michael Weber, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Georgios Karanikas, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Matthias Pones, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Barbara Kiesewetter, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Markus Raderer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Marius E. Mayerhoefer, MD, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine, using [18F]-FDG-PET/MR, whether glycolytic activity, as expressed by SUV (standardized uptake values) on [18F]-FDG-PET, and cell density, as expressed by ADC (apparent diffusion coefficients) on diffusion-weighted MRI, are correlated in newly-diagnosed, untreated Hodgkin (HL) and Non-Hodgkin lymphoma (NHL).

METHOD AND MATERIALS

Patients with histologically proven lymphoma were enrolled in this prospective, IRB-approved study and underwent [18]F-FDG-PET/MR on a fully-integrated system, for staging. Fourteen nodal and 12 extranodal regions were evaluated separately. For each involved region, the lymphoma manifestation with the largest diameter was defined as target lesion, provided that it showed a focal tracer uptake and a restricted diffusion. Maximum and mean SUVs (SUVmax, SUVmean), and minimum and mean ADCs (ADCmin, ADCmean) were recorded. Spearman correlation coefficients (r), using a significance level of $P<0.05$, were used to assess the relationship between SUVs and ADCs. Patients with HL were the most numerous (n=9) and were also analyzed separately.

RESULTS

Nine HL, 5 follicular NHL, 4 diffuse large B-cell NHL, 4 mantle cell NHL, and one post-transplant NHL were included. A total of 90 lesions were available for quantitative analysis (32 lesions in HL group, which was also analyzed separately). For HL and NHL combined, the correlations between SUVmax and ADCmin, and between SUVmean and ADCmean, were, respectively, r=0.19 (P=0.073) and r=-0.15 (P=0.89). For HL, the correlation between SUVmax and ADCmin was r=0.094 (P=0.61), and between SUVmean and ADCmean r=-0.23 (P=0.18).

CONCLUSION

Our results demonstrated no statistically significant correlation between SUVs and ADCs for all lymphomas combined. While in the HL subgroup a significant, negative correlation was observed, the degree of correlation was rather low. Thus, there appears to be no relevant relationship between the degree of glycolytic activity and cell density in untreated lymphoma.

CLINICAL RELEVANCE/APPLICATION

SUV and ADC values obtained by [18]-FDG-PET/MR do not show a clinically relevant correlation in Hodgkin or Non-Hodgkin lymphoma.

SST08-03 A Comparison Trial of 18F-FDG PET/CT vs Integrated 18F-FDG PET/MRI vs MRI Alone for Detection of Adenocystoid Carcinoma

Friday, Dec. 4 10:50AM - 11:00AM Location: S505AB

Participants
Lale Umutlu, MD, Essen, Germany (*Presenter*) Consultant, Bayer AG
Markus Ruhlmann, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Thomas C. Lauenstein, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Forsting, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Marc U. Schlamann, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Verena Ruhlmann, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Adenoid cystic carcinomas (ACC) are known to most commonly arise within secretory glands of the head and neck, revealing the lung and liver as sites of most common distant metastasis. The aim of our trial was to compare the diagnostic potential of 18F-FDG PET/CT with integrated 18F-FDG PET/MRI to MRI alone for detection of ACC and potential metastases.

METHOD AND MATERIALS

A total of 35 patients suspect for ACC underwent an 18F-FDG PET/CT (Biograph mCT 128, Siemens) and a simultaneous 18F-FDG PET/MRI examination (Biograph mMR, Siemens). The PETMR scan protocol comprised: 1) HASTE, 2) DWI and a) T1 fs post-contrast FLASH sequence after the application of 0.05 mmol kg/bw Gadoteric acid (Dotarem, Guerbet). The corresponding datasets (PET/CT, PET/MRI and MRI alone) were read separately by two radiologists for identification of malignant lesions (2 point ordinal scale), localization, conspicuity (4 point ordinal scale) as well as diagnostic confidence (3 point ordinal scale). All available data (histology, prior examinations, PET/MRI, follow-up examinations) served as standard of reference. Mean values were compared using Wilcoxon rank sum test.

RESULTS

Malignant disease was present in 22 of 35 patients. 18F-FDG PET/CT and PET/MRI enabled correct identification of all 22 patients (100%), while MRI alone only allowed for correct identification of 18 patients (81,2%). PET/MRI showed significantly higher lesion conspicuity assessment of the primary ACC lesions and liver metastases over PET/CT (PET/MRI: 3.7±0.28; PET/CT: 3.3±0.35). Both hybrid imaging techniques showed superior overall ratings for detection of malignant lesions, lesion conspicuity and diagnostic confidence, when compared to MRI alone (diagnostic confidence: PET/MRI:2.7±0.3; PET/CT 2.5±0.5; MRI alone: 1.9±0.3).

CONCLUSION

Both hybrid imaging techniques provide comparably high-quality assessment of malignant disease in patients suspect for ACC, offering a significant improvement in diagnostic competence when compared to MRI alone.

CLINICAL RELEVANCE/APPLICATION

Based on the significant reduction of ionizing radiation (compared to PET/CT) and improved diagnostic competence (compared to MRI alone), integrated PET/MRI can be considered a highly valuable diagnostic tool for assessment of patients with ACC.

SST08-04 Higher Sensitivity of SPECT-CT in Sentinel Lymphnode Detection

Friday, Dec. 4 11:00AM - 11:10AM Location: S505AB

Participants
Khushboo Gupta, MD, Mumbai, India (*Presenter*) Nothing to Disclose

PURPOSE

With newer trend of minimally invasive onco-surgeries to minimise functional impairment, it is important to stage the disease in presurgery as well as intrasurgery setting. Sentinel node biopsy is one of the intrasurgical method in which the most probable draining node of the primary site is excised and studied for metastatic tumor dissemination. Identification of sentinel node is hence crucial. Various methods like methylene blue dye and sentinel node lymphoscintigraphy (planar and SPECT-CT imaging) are available. We compared these modalities at our institution.

METHOD AND MATERIALS

32 biopsy proven pre-treatment cases of breast carcinoma (24/32) and head and neck cancer (8/32: 4 patients with tongue cancer and 4 patients with buccal cancer) underwent sentinel node lymphoscintigraphy. 5 to 10 Mbq of 99mTc- sulphur colloid was injected intradermally in peritumoral region (if the primary lesion was more than a centimeter) or subcutaneously above the lesion (if

the lesion was subcentimeter in size). Both planar and SPECT-CT imaging with GE Hawkeye Gamma camera were performed, along with node identification with gamma probe pre and intraoperatively. Methylene blue dye was also used preoperatively in all the cases. The patients underwent primary excision surgery with nodal dissection. The histopathology was evaluated and results were compared with sentinel node identification data.

RESULTS

Multiple nodes were identified (54 sentinel nodes), with more than one node identified in 18 cases.Total number of nodes biopsied were 48, out which methylene blue dye could identify 31/48 nodes; Planar lymphoscintigraphy could identify 38/48 nodes whereas SPECT-CT could identify 44/48 nodes. Post operative histopathology results revealed metastatic nodes in 14 cases (11 breast carcinoma and 3 head and neck carcinoma). Results were compared with positive (for metastases) sentinel node identified by either of the above method. Methylene blue dye identified 6/14 cases (42.8%), planar imaging identified 9/14 cases (64.5%) and SPECT-CT identified 13/14 cases (92.8%).

CONCLUSION

SPECT-CT lymphoscintigraphy thus proves to have higher sensitivity in identifying the sentinel node and hence contributes in patient management.

CLINICAL RELEVANCE/APPLICATION

Sentinel node identification method with SPECT-CT lymphoscintigraphy valuably contributes to perform minimal invasive surgeries and decrease the post surgery morbidity in Stage I cancer patients.

SST08-05 18-F Fluoride PET/CT Bone Scans: Its Additional Utility Over Planar Bone Scintigraphy in the Detection of Bone Metastases from Breast Cancer Patients and Its Impact on Patient Management

Friday, Dec. 4 11:10AM - 11:20AM Location: S505AB

Participants
Randeep K. Kulshrestha, MBBS, Manchester, United Kingdom (*Presenter*) Nothing to Disclose
Sobhan Vinjamuri, MBBS,FRCPC, Liverpool, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Peter Hogg, Manchester, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Andrew England, PhD, Salford, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Background: 18-F fluoride PET was first proposed as a bone scanning agent in 1962 by Blau et al (Blau M, Nageler W, Bender MA. Fluorine-18: a new isotope for bone scanning. J Nucl Med 1962; 3:332-4). Today it is undergoing a resurgence of interest by utilizing it in more readily available PET/CT scanners. It has been shown to more accurate in detecting bone metastases in breast and prostate cancer patients.Aims: To compare the sensitivity, specificity, accuracy and equivocal rates of planar bone scintigraphy with 18-F Fluoride PET/CT in detecting bone metastases in breast cancer patients. To assess reasons for any extra imaging performed.

METHOD AND MATERIALS

Retrospective review of 96 patients with breast cancer who underwent initially bone scintigraphy and then later on, an 18-F fluoride bone PET/CT scan. Gold standard was follow-up and other imaging modalities. Proportions of true positives, false positives, true negatives and false negatives were tabulated. The specific reasons for extra imaging was assessed.

RESULTS

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy for planar bone scintigraphy was 85%, 75%, 57.5%, 93% and 78% and for 18-F fluoride bone PET/CT it was 93.5%, 92%, 85%, 97% and 93% respectively.Proportion of equivocal studies for bone scinitgraphy was 21/96 patients (22%), and the majority of these, 17/21 (81%) required further radiographic imaging which showed benign pathology.Proportion of equivocal studies for 18F-Fluoride PET/CT was 8/96 patients (8%), and all of these had further imaging (e.g. MR scan) which showed more serious clinical pathology (e.g. cauda equina).

CONCLUSION

18-F Fluoride PET/CT bone scans are more sensitive, specific , and accurate compared with planar bone scintigraphy, with reduced proportion of equivocal studies performed. Further imaging rates to confirm benign disease are significantly lower for 18-F Fluoride PET/CT, and this impacts on patient management with fewer anxious waits for tests. Further imaging tended to show more serious associated pathology picked up by the low dose CT component, more definitively impacting on patient management.

CLINICAL RELEVANCE/APPLICATION

18-F fluoride bone PET/CT scans are more accurate at delineating bone metastases from breast cancer compared with planar bone scintigraphy and therefore should be considered, where resources are available, in the work-up of staging of breast cancer patients.

SST08-06 Diagnostic Accuracy of [18]F-FDG PET/MR Compared to [18]F-FDG PET/CT and MRI in Squamous Cell Carcinoma of the Head and Neck Area

Friday, Dec. 4 11:20AM - 11:30AM Location: S505AB

Participants
Benedikt M. Schaarschmidt, MD, Dusseldorf, Germany (*Presenter*) Nothing to Disclose
Philipp Heusch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Marcus Ruhlmann, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Christian Buchbender, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD, Duesseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Axel Wetter, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the the diagnostic accuracy of integrated [18]F-fluordeoxyglucose positron emission tomography/magnetic resonance

To compare the the diagnostic accuracy of integrated [18]F-fluorodeoxyglucose positron emission tomography/magnetic resonance ([18]F-FDG PET/MR) imaging to MR and [18]F-FDG positron emission tomography/computed tomography (PET/CT) imaging in histopathologically confirmed head and neck squamous cell carcinoma (HNSCC).

METHOD AND MATERIALS

In 25 HNSCC patients, [18]F-FDG PET/CT and subsequent integrated [18]F-FDG PET/MR was performed for initial tumor spread and recurrence diagnostics. Fused [18]F-FDG PET/CT, fused [18]F-FDG PET/MR and MR images alone were examined by two individual readers in random order under knowledge of the clinical indication. T- and N-Stage was determined in examinations performed for initial tumor diagnostics. In examinations performed for recurrence diagnostics, lesion were analyzed individually. Diagnostic accuracy of each modality was determined by using the histopathological results in initial tumor staging after tumor resection. In patients with undergoing imaging for cancer recurrence, follow-up and results obtained by histopathological sampling were used. Using McNemar's test, results were compared separately for T-stage, N-stage and recurrent lesions. $p<0.017$ was considered statistically significant after Bonferroni correction.

RESULTS

In twelve patients undergoing [18]F-FDG PET/CT and [18]F-FDG PET/MR for initial tumor staging, T-staging was accurate in 50% in MRI alone, 59% in [18]F-FDG PET/CT and 75% in [18]F-FDG PET/MR while N-staging was accurate in MRI alone in 75%, in 77% in [18]F-FDG PET/CT and in 71% in [18]F-FDG PET/MR. No significant differences were observed using in T- and N-staging between all three modalities ($p>0.017$, respectively). In thirteen patients undergoing hybrid imaging for cancer recurrence diagnostics, the diagnostic accuracy was 57% with MRI alone and 72% with [18]F-FDG PET/CT and [18]F-FDG PET/MR, respectively. Differences between all three modalities were insignificant ($p>0.017$, respectively).

CONCLUSION

No significant differences were observed between [18]F-FDG PET/MR, [18]F-FDG PET/CT and MRI in local tumor staging and cancer recurrence diagnostics.

CLINICAL RELEVANCE/APPLICATION

[18]F-FDG PET/MR is considered a highly accurate method in head and neck squamous cell carcinoma. Our data indicate that the advantage over MRI and [18]F-FDG PET/CT is not as obvious as expected in this initial study.

SST08-07 Correlation of the Maximum Standardized Uptake Values and Apparent Diffusion Coefficient Values with Pathologic Prognostic Factors in Breast Carcinoma

Friday, Dec. 4 11:30AM - 11:40AM Location: S505AB

Participants
Kazuhiro Kitajima, MD, Nishinomiya, Japan (*Presenter*) Nothing to Disclose
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Yasuo Miyoshi, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Arisa Nishimukai, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Seiichi Hirota, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose
Shozo Hirota, MD, Nishinomiya, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

to evaluate the combination of maximum standardized uptake values (SUVmax) of 18F-FDG PET/CT, and apparent diffusion coefficient (ADC) values of DWI with pathologic prognostic factors in breast carcinoma patients.

METHOD AND MATERIALS

The institutional review board of our hospital approved this retrospective study; the requirement for informed consent was waived. 181 patients with 183 mass-type invasive breast carcinomas (mean size 2.47 cm, range 1.0-13.0 cm) who underwent whole-body 18F-FDG PET/CT, 3-Tesla breast MRI including DWI, and immunohistochemical staining of the primary lesions before therapy. The primary tumor's SUVmax and ADC were retrospectively measured using FDG-PET/CT and DWI by two experienced nuclear medicine physicians and two experienced radiologists, respectively. Histologic analysis was done on tumor size, axillary lymph node (LN) metastasis, nuclear grade, expression of estrogen receptors (ER), progesterone receptors (PR), human epidermal growth factor receptor 2 (HER2), and Ki-67. The relationship among SUVmax, ADC values, and pathologic prognostic factors were evaluated.

RESULTS

The mean value of SUVmax and ADCmean values was 5.58±3.88 (range, 1.2-24.17) and 892±218×10-6 mm2/s (range, 452-1574×10-6), respectively. There was mild correlation between the SUVmax and ADCmean values (correlation coefficient $r=-0.37$, $p<0.0001$). SUVmax was associated with numerous prognostic factors such as tumor size ($p<0.0001$), axillary LN metastasis ($p<0.0001$), TNM staging ($p<0.0001$), histology ($p=0.00049$), nuclear grade ($p<0.0001$), and expression levels of ER ($p=0.0041$), PR ($p=0.00045$), HER2 ($p=0.00059$), and Ki-67 ($p<0.0001$). Meanwhile, ADCmean values were associated with tumor size ($p=0.013$), axillary LN metastasis ($p=0.0038$), TNM staging ($p=0.0016$), histology ($p=0.013$), and expression of Ki-67 ($p=0.0014$).

CONCLUSION

SUVmax is more useful for predicting the prognosis of breast carcinoma than ADC values.

CLINICAL RELEVANCE/APPLICATION

Primary tumor's SUVmax of pretreatment 18F-FDG PET/CT can be considered as a promising prognostic parameter that may identify highly aggressive breast carcinoma and a very important tool for determining the treatment plan.

SST08-08 Added Value of SPECT-CT over SPECT and Planar Imaging in 111-Indium Octreotide Evaluation of Neuroendocrine Tumors

Friday, Dec. 4 11:40AM - 11:50AM Location: S505AB

Participants
Elham Safaie, MD, Stony Brook, NY (*Presenter*) Nothing to Disclose
Anuj K. Rajput, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose
Kavitha Yaddanapudi, Cleveland, OH (*Abstract Co-Author*) Nothing to Disclose
Robert Matthews, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Body neuroendocrine tumors (NET) constitute a heterogeneous group of neoplasms with a high somatostatin receptor expression. Indium-111 Octreotide provides functional information and combination with CT provides accurate localization. The purpose of this study was to evaluate additional value of SPECT-CT imaging over planar and SPECT imaging foridentifying additional foci of neuroendocrine tumors.

METHOD AND MATERIALS

This is a retrospective study reviewing 51 patients that had undergone 111-Indium for tumor localization and restaging at our institution from October 2013 to the present. Patients were imaged using initial planar imaging, SPECT, and SPECT-CT. Two experienced Nuclear Medicine physicians read each study by consensus and rated as low, moderate, or high diagnostic confidence. Number of lesions identified on SPECT-CT was compared to SPECT and planar imaging. In addition we evaluated the number of false positive lesions on planar and SPECT that could be excluded on subsequent SPECT-CT. Clinical history and pathology was reviewed.

RESULTS

There were 51 patients, 29 female and 22 males with mean age 61yrs. 109 lesions identified on SPECT-CT compared to 63 lesions identified on SPECT and 47 lesions were seen on planar images. SPECT-CT identified additional lesions, improved characterization of lesions and increased the diagnostic confidence in 20 patients (39%). On SPEC- CT the distribution of additional true positive lesions identified was as follows liver (7), pancreas (7), small bowel (2), lymph nodes(9), peritoneal carcinomatosis (3), breast uptake (1), lungs(3), bone (1). In addition benignlesions (false positive) as gynecomastia, post surgical uptake, renal cysts, thyroid uptake, adnexal uptake and skin uptake accounted for the rest and were reliably excluded.

CONCLUSION

Conclusions: SPECT combined with high quality diagnostic CT is superior to conventional planar and SPECT alone imaging in the diagnosis of neuroendocrine tumors. It increases the diagnostic confidence, improves lesion detection, localization and characterization.

CLINICAL RELEVANCE/APPLICATION

The added value of SPECT-CT over planar and SPECT imaging provides a more accurate diagnosis for the clinician and therefore better treatment for the patient.

SST08-09 Multi-modality Assessment of Bone Marrow Involvement in Lymphoma Patients: Contributions of [18F]-FDG-PET, Contrast-enhanced CT, Morphological and Diffusion-weighted MRI

Friday, Dec. 4 11:50AM - 12:00PM Location: S505AB

Participants
Ulrika Asenbaum, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Georgios Karanikas, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Edith Porpaczy, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Michael Weber, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Barbara Kiesewetter, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Markus Raderer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Marius E. Mayerhoefer, MD, PhD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Unilateral bone marrow biopsy is still considered the standard for assessment of bone marrow involvement in lymphoma. It was therefore the goal of this study to determine the value of [18F]-FDG-PET, morphological as well as diffusion-weighted MRI (DWI), independently and in combination, for bone marrow evaluation in lymphoma patients.

METHOD AND MATERIALS

Our prospective IRB-approved study included patients with histologically-proven, untreated lymphomas that underwent whole-body [18F]-FDG-PET/CT and MRI (including T1-weighted MRI and DWI, obtained on a 3T-system, for staging. Two rater teams, each consisting of a radiologist and a nuclear medicine physician, rated all images independently. Sensitivities and specificities, using unilateral bone marrow biopsy as basis for the reference standard, were separately assessed for contrast-enhanced (CE-)CT, [18F]-FDG-PET(/CT), DWI, T1w MRI, DWI+T1w MRI, and [18F]FDG-PET+DWI. Kappa coefficients were used to assess the agreement between the two rater teams.

RESULTS

Sixty patients met our criteria for participation. Based on the results of rater team 1, sensitivities for (CE-)CT, [18F]-FDG-PET(/CT), DWI, T1w MRI, DWI+T1w MRI, and [18F]FDG-PET+DWI were 25%, 81.3%, 81.3%, 62.5%, 75%, and 81.3%; whereas specificities were 100%, 95.5%, 84.1%, 95.5%, 95.5%, and 95.5%, respectively. The corresponding kappa coefficients (interrater agreement) were 1.0, 0.64, 0.82, 0.69, 0.78, and 0.87.

CONCLUSION

The combination of [18F]-FDG-PET and DWI does not improve the detection of bone marrow involvement in lymphoma patients to a relevant degree, compared to stand-alone [18F]-FDG-PET and DWI; the combination does, however, reduce interrater variability.

CLINICAL RELEVANCE/APPLICATION

The combination of [18F]-FDG-PET and DWI may produce results that are less rater dependent, with regard to the detection of bone marrow involvement in lymphoma; thus, PET/MR may be preferrable to the stand-alone techniques.

SST09

Neuroradiology (Cerebrovascular Imaging)

Friday, Dec. 4 10:30AM - 12:00PM Location: N226

NR VA MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Jalal B. Andre, MD, Seattle, WA (*Moderator*) Research Grant, Koninklijke Philips NV; Consultant, Hobbitview, Inc; Research Grant, Toshiba Corporation;

Sub-Events

SST09-01 Subclinical Cardiac Dysfunction Relates to Imaging Markers of Subclinical Brain Disease in the General Population

Friday, Dec. 4 10:30AM - 10:40AM Location: N226

Participants
Hazel I. Zonneveld, MD,MSc, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose
Wiro Niessen, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Co-founder, Quantib BV; Scientific Director, Quantib BV; Shareholder, Quantib BV
Aad Van Der Lugt, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Gabriel P. Krestin, MD, PhD, Rotterdam, Netherlands (*Abstract Co-Author*) Consultant, General Electric Company; Research Grant, General Electric Company; Research Grant, Bayer AG; Research Grant, Siemens AG; Speakers Bureau, Siemens AG
Mohammad A. Ikram, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Meike W. Vernooij, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the association between NT-proBNP, a marker of heart disease, and imaging markers of subclinical brain disease on magnetic resonance imaging (MRI) in community-dwelling persons who are free of stroke, dementia, and a clinical diagnosis of cardiovascular disease.

METHOD AND MATERIALS

In 2,475 persons (mean age 56.6 years; 57.3% women) from a prospective population-based study we measured NT-proBNP in serum. All persons underwent brain MRI on a 1.5-tesla MRI system, yielding imaging markers for global brain structure, focal abnormalities (lacunes, white matter lesions, cerebral microbleeds), and microstructural white matter integrity. We used multivariable linear and logistic regression models to investigate the association between NT-proBNP (continuous levels and per tertile) and markers of subclinical brain disease.

RESULTS

Higher NT-proBNP was associated with smaller total brain volume (mean difference per SD increase in NT-proBNP: -0.023, 95% confidence interval [CI] -0.036;-0.009, p=0.001), predominantly driven by grey matter volume (mean difference per SD increase in NT-proBNP: -0.037, 95%CI -0.057;-0.017, p<0.001), and less by white matter volume. Higher NT-proBNP was associated with larger white matter lesion volume (mean difference per SD increase in NT-proBNP: 0.099, 95%CI 0.060; 0.137, p<0.0001), and with lower fractional anisotropy and higher mean diffusivity in white matter.

CONCLUSION

In community-dwelling persons, subclinical cardiac dysfunction as reflected by serum NT-proBNP levels, is associated with global and microstructural imaging markers of subclinical brain disease.

CLINICAL RELEVANCE/APPLICATION

Our data provide more insight into the heart-brain connection, which is essential since both cardiac dysfunction and subclinical brain disease are growing problems in an aging population.

SST09-02 Endovascular Management of Post-irradiated Carotid Blowout Syndrome

Friday, Dec. 4 10:40AM - 10:50AM Location: N226

Participants
Feng-Chi Chang, MD, Taipei, Taiwan (*Presenter*) Nothing to Disclose
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Ting-Yi Chen, MS, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Chung-Jung Lin, MD, PhD, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Wan-Yuo Guo, MD, PhD, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose
Jiing-Feng Lirng, MD, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Purpose: To retrospectively evaluate the clinical and technical factors related to the outcomes of endovascular management in patients with head-and-neck cancers associated with post-irradiated carotid blowout syndrome (PCBS)

METHOD AND MATERIALS

Between 2000 and 2013, 96 patients with PCBS underwent endovascular management. The 40 patients with the pathological lesions located in the external carotid artery were classified as group 1 and were treated with embolization. The other 56 patients

with the pathological lesions located in the trunk of the carotid artery were divided into 2 groups as follows: group 2A comprised the 38 patients treated with embolization, and group 2B comprised the 18 patients treated with stent-graft placement. Fisher's exact test was used to examine endovascular methods, clinical severities, and postprocedural clinical diseases as predictors of outcomes.

RESULTS

Technical success and immediate hemostasis were achieved in all patients. The results according to endovascular methods (group 1 vs 2A vs 2B) were as follows: technical complication (1/40[2.5%] vs 9/38[23.7%] vs 9/18[50.0%], P=0.0001); rebleeding (14/40[35.0%] vs 5/38[13.2%] vs 7/18[38.9%]), P=0.0435). The results according to clinical severity (acute vs ongoing PCBS) were as follows: technical complication (15/47[31.9%] vs 4/49[8.2%], P=0.0035); rebleeding (18/47[38.3%] vs 8/49[16.3%], P=0.0155). The results according to post-procedural clinical disease (regressive vs progressive change) were as follows: alive (14/21[66.7%] vs 8/75[10.7%], P<0.0001); survival time (34.1±30.6[0.3-110] vs 3.6±4.0[0.07-22] months, P<0.0001).

CONCLUSION

We suggest that taking embolization whenever this is possible, performing endovascular intervention in slight clinical severity and aggressive management of the post-procedural clinical disease can improve the outcomes of endovascular management.

CLINICAL RELEVANCE/APPLICATION

As embolization is the best option of PCBS, application of pre-procedural and post-procedural CT/CTA for disease predication and follow-up can be a central role of its management. Aggressive management of the post-procedural clinical disease is also mandatory.

SST09-03 3D Black-Blood T1-mVISTA for the Diagnosis of Temporal and Ophthalmic Involvement in Patients with Giant Cell Arteritis

Friday, Dec. 4 10:50AM - 11:00AM Location: N226

Participants
Nora N. Kammer, MD, Munich, Germany (*Presenter*) Nothing to Disclose
Karla Maria Treitl, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Eva M. Coppenrath, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Hendrik Kooijman, Hamburg, Germany (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Maximilian F. Reiser, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose
Tobias Saam, MD, Munich, Germany (*Abstract Co-Author*) Research Grant, Diamed Medizintechnik GmbH; Research Grant, Pfizer Inc

PURPOSE

To assess the diagnostic accuracy of a modified, sub-millimeter isotropic whole-brain 3D black-blood T1w-TSE sequence (T1-mVISTA) for the diagnosis of temporal and ophthalmic involvement in patients with giant cell arteritis.

METHOD AND MATERIALS

28 patients were included in this study: 9 patients with clinically diagnosis of temporal arteritis (age: mean: 70.4; median 73; 5 male) and 19 controls (age: mean: 62.3 median 63; 7 male). Among patients with temporal arteritis, 5 were also positive for non-atherosclerotic anterior ischemic optic neuropathy (AION) as defined by fundoscopy. A contrast-enhanced T1-mVISTA sequence (resolution=0.8mm isotropic, scan time 4:43 minutes) was acquired at 3T, additionally to the standard MRI sequences. Two radiologists assessed the images in consensus blinded to the clinical diagnosis. Left/right temporal and short posterior ciliary arteries were evaluated for the presence of mural thickening and contrast enhancement of the vessel wall, indicating arteritis (overall 112 arterial segments). Regional fat suppression (3-point Likert scale), over all image quality (4-point Likert scale) and diagnostic confidence for the presence or absence of arteritis (5-point Likert scale) were also assessed.

RESULTS

Contrast-enhanced T1-mVISTA sequence had a high sensitivity and specificity (100% and 94.7%, respectively) for the diagnosis of temporal arteritis. Positive and negative predictive values (PPV and NPV) were 90.0% and 100%, resepectively. Sensitivity and specificity for vasculitis of the short posterior ciliary arteries in patients with clinical confirmed AION was 83.3% and 75.0%, respectively resulting in PPV of 83.3% and NPV of 75.0%. Over all image quality (mean: 3.8±0.6; median: 4) and regional fat suppression were good (temporal: mean: 2.8±0.4; median: 3; ophthalmic: mean: 2.5±1.2; median: 3) and diagnostic confidence was high (mean: 4.8±0.5; median: 5).

CONCLUSION

3D black-blood T1-mVISTA allows an accurate diagnosis of involvement both for the temporal arteries, as well as the short ciliary arteries in patients with giant cell arteritis.

CLINICAL RELEVANCE/APPLICATION

Whereas sonography, biopsy and fundoscopy were the methods of choice for diagnosing affection of the extracranial arteries, new MRI sequences with black-blood technique can accurately diagnose this on cross-sectional imaging.

SST09-04 Diffusion Tensor Measurement of the Corpus Callsom Correlate with Cognitive Dysfunction in Patients of Subcortical Ischemic Vascular Disease

Friday, Dec. 4 11:00AM - 11:10AM Location: N226

Participants
Lin Lin, Fuzhou, China (*Presenter*) Nothing to Disclose
Yunjing Xue, MD, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
Hailong Lin, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose
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ShaoFan Jiang, FuZhou, China (*Abstract Co-Author*) Nothing to Disclose
Chengsheng Wang, Fuzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate correlation between microstructure changes of the corpus callosum and cognitive dysfunction in subcortical ischemic vascular disease(SIVD) patients using atlas-based diffusion tensor analyses.

METHOD AND MATERIALS

50 right-handed SIVD patients were recruited and divided into vascular cognitive impairment no dementia(VCIND) group and normal cognition(NC) group. 22 VCIND patients and 28 NC patients were underwent in DTI scanning and neuropsychological assessment. Atlas-based analysis(ABA) were performed on each subject for extracting fractional anisotropy(FA) and mean diffusivity(MD) measures from all subregions of the corpus callosum . The correlation between DTI measures and MoCA scores were evaluated. Receiver operating characteristic curves were used to test for the parameter with the best sensitivity and specificity for cognitive function discrimination.

RESULTS

Among VCIND, as compared to NC patients, FA were significantly lower and MD were higher in the genu, body, splenium, left and right tapetum of the corpus callosum (all P<0.001). Moreover, MoCA scores correlated with DTI values in all subregions of the corpus callosum(all P<0.01). In addition, the highest sensitivity and specificity for discriminating between VCIND and NC patients were found for FA (77.27% and 89.29%, respectively) and MD(95.45% and 64.29%, respectively) in the body of the corpus callosum. Optimal thresholds for FA and MD in the body of the corpus callosum for differentiating VCIND and NC patients were 0.421 and 1.038, respectively.

CONCLUSION

The corpus callsum damage occurs in SIVD patients with cognitive impairment, and the damage correlate with cognitive dysfunction. Using Altas-based DTI analysis can evaluate the severity of this disease.

CLINICAL RELEVANCE/APPLICATION

The DTI measures of the corpus callosum can reflect cognitive impairments in SIVD patients and serve as imaging biomarkers for early diagnosis and disease progression of cognitive impairments.

SST09-05 Accuracy of Carotid In-Stent Stenosis Measurement in a Phantom Model Using Effective Atomic Number Imaging Produced by Dual Layer Dual Energy CT

Friday, Dec. 4 11:10AM - 11:20AM Location: N226

Participants
Eliel Ben-David, MD, Jerusalem, Israel (*Presenter*) Nothing to Disclose
John M. Gomori, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, Medymatch Technology Ltd
Isaac Leichter, PhD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose
Zimam Romman, Haifa, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jacob Sosna, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, ActiViews Ltd Research Grant, Koninklijke Philips NV

PURPOSE

In-stent plaque stenosis is difficult to assess in CT angiography of the neck. Effective Atomic Number (EAN) is a projection-space reconstruction of the spectral raw data that calculates the effective atomic number of the voxels. Our purpose was to examine accuracy of in-stent plaque measurment using EAN imaging produced by dual layer dual energy CT in a phantom model.

METHOD AND MATERIALS

A Conichrome stent containing an enhanced radiopaque tantalum core (WALLSTENT, Boston Scientific) and a Nitinol stent (PRESCISE PRO RX, Cordis), both of 0.2mm thickness and 8 mm diameter, were deployed around water-equivalent tubes of 1.5mm wall thickness and 5.0mm lumen. Each tube was filled with iodine solution (16mg/ml), immersed in a water-filled cylinder, and placed in a 10cm diameter water-equivalent phantom (model of in-stent stenosis). The phantom was scanned using a dual layer dual energy CT (Philips Healthcare, Cleveland, OH, USA) at 120kVp and 250mAs and generated simultaneous conventional 120 kV and EAN datasets. Full Width at Half Maximum (FWHM) technique was used to measure accuracy and reproducibility of tube lumen and wall thickness in both datasets.

RESULTS

In the conventional dataset, the average wall thickness and lumen diameter of the Conichrome and Nitinol stents were 0.8 and 4.8mm, and 1.1 and 4.7mm, respectively, reflecting a deviation of -40.7%, -10.0% and -26.7.0%, -6.0% from actual dimensions. In the EAN dataset, the measurements were 1.3, 4.3 mm and 1.2, and 4.6mm, respectively, reflecting a deviation of -13.3%, -14.0% and -20.0%, -8.0% from actual dimensions. For the Conichrome stent the blooming artifact in the conventional dataset was reduced in EAN imaging, and the visualization of the tube wall mimicking the stenosis was improved. For the Nitinol stent, both datasets showed comparable visualization.

CONCLUSION

In our model, EAN imaging, produced by dual layer dual energy CT, improves visualization and increases accuracy of in-stent stenosis assessment in a tantalum-core Conichrome stent.

CLINICAL RELEVANCE/APPLICATION

Carotid in-stent stenosis in high-attenuation metallic metal stents may be more accurately evaluated using effective atomic number (EAN) imaging produced by dual layer dual energy CT.

Honored Educators

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SST09-06 Changes of Cerebral Blood Flow in Patients with Maintaining Hemodialysis: An Aterial Spin Labeling Study

Friday, Dec. 4 11:20AM - 11:30AM Location: N226

Participants
Mengjie Zhang, Tianjin, China (*Presenter*) Nothing to Disclose
Chao Chai, MD, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
E. Mark Haacke, PhD, Detroit, MI (*Abstract Co-Author*) Research Grant, Biogen Idec Inc President, Magnetic Resonance Innovations, Inc
Lei Liu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Wen Shen, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Shuang Xia, MD, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the patterns of cerebral blood flow (CBF) changes using arterial-spin labeling (ASL) MRI in maintaining hemodialysis patients and correlate them with laboratory and neuropsychological tests.

METHOD AND MATERIALS

35 patients with maintaining hemodialysis and 35 age- and sex-matched normal subjects were recruited in this study. Mini-mental state examination (MMSE) was obtained to evaluate their neuropsychological conditions. Pulsed arterial spin labeling was performed on 3.0T MRI scanning in both patients and normal controls. CBF was measured using an SPM8 -based ASL Data Processing Toolbox. Independent sample t test analysis was used to compare CBF difference between the patients and normal controls. Correlation between the neuropsychological tests and CBF changes was calculated by Pearson correlation analysis. Multiple linear regression analysis was used to investigate the effect of laboratory tests on the CBF changes in patients with maintaining hemodialysis.

RESULTS

Compared with normal controls, patients show significantly increased CBF in the left orbital superior frontal lobe, the right insula, bilateral hippocampus and parahippocampal gyrus, the right amygdala, the left calcarine gyrus, bilateral lingual gyrus, the left superior and inferior occipital lobe, bilateral fusiform gyrus, the left pallidum, bilateral thalamus and whole brain white matter (all $P< 0.05$, Bonferroni corrected). The MMSE score of patients is significantly lower than normal controls ($P<0.001$); Increased CBF of the left fusiform gyrus is negatively correlated with MMSE score ($P<0.05$). Multiple linear regression results show that most increased CBF are negatively correlated with the pre-dialysis systolic blood pressure (SBP). Hemoglobin, creatinine, albumin and serum iron are negatively associated with changes of CBF in many regions, while glycerin trilaurate and cholesterol are positively associated with some CBF changes ($P<0.05$).

CONCLUSION

The patients with hemodialysis show increased CBF which is associated with neurocognitive dysfunction. The pre-dialysis SBP, hemoglobin, creatinine, albumin, serum iron, glycerin trilaurate and cholesterol may be the important risk factors for increased CBF in patients with hemodialysis.

CLINICAL RELEVANCE/APPLICATION

Arterial-spin labeling (ASL) MRI can provide cerebral blood flow (CBF) changes which are associated with neurocognitive dysfunction in patients with maintaining hemodialysis.

SST09-07 An Assessment on the Incremental Value of High-resolution Magnetic Resonance Imaging to Identify Culprit Plaques in Atherosclerotic Disease of the Middle Cerebral Artery

Friday, Dec. 4 11:30AM - 11:40AM Location: N226

Participants
Wenjia Peng, MD,PhD, Shanghai, China (*Presenter*) Nothing to Disclose
Qian Zhan, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Yuanliang Jiang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Xuefeng Zhang, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Qi Liu, MD, PhD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Jianping Lu, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

This study was designed to quantify the incremental value of high-resolution, multi-contrast magnetic resonance imaging (hrMRI) to define culprit atherosclerotic lesions in the middle cerebral artery (MCA) over luminal stenosis, suggesting an optimal combination of anatomic parameters to identify lesions responsible for clinical symptoms.

METHOD AND MATERIALS

Patients suspected with atherosclerotic stenosis of MCA underwent hrMRI. Luminal stenosis was measured from TOF images. Lumen and outer wall boundary were manually segmented, allowing calculation of plaque burden (PB), volume (PV), length (PL) and minimum luminal area (MLA).A culprit plaque was defined as a lesion arising on the ipsilateral side to an ischemic stroke on neuro-imaging with accompanying clinical symptoms, whilst a non-culprit plaque was defined as either a plaque occurring in a contralateral artery of a symptomatic patient or one in asymptomatic controls.

RESULTS

MR data from 165 lesions (112 culprit and 53 non-culprit) in 139 individuals were included. Culprit lesions were larger and longer with a narrower lumen and increased PB compared with non-culprit lesions. More culprit lesions showed contrast enhancement. Both PB and MLA were better indicators than stenosis in differentiating lesion types with AUC being 0.649, 0.732 and 0.737 for stenosis, PB and MLA, respectively. Further analysis demonstrated that combinations of PB, MLA and stenosis could improve positive predictive value (PPV) and specificity significantly. An optimal combination of stenosis≥50%, PB≥77% and MLA≤2.0mm2 produced a

PPV=85.7%, negative predictive value=54.1%, sensitivity=69.6%, specificity=75.5%, and accuracy=71.5%.

CONCLUSION

hrMRI plaque imaging provides incremental information to luminal stenosis in differentiating patient clinical presentations. Both luminal and plaque-based measures should be considered in an integrative way for the accurate identification of MCA culprit plaques.

CLINICAL RELEVANCE/APPLICATION

For evaluating culprit plaque of MCA, both luminal and plaque-based measures should be considered in an integrative way,and the optimal combination of morphological characters were stenosis≥50%, PB≥77% and MLA≤2.0mm2.

SST09-09 Evaluation of Cervical Carotid Plaque Using 3D T1-weighted Black-blood MR Imaging at 3T: Comparison of Turbo Field-echo and Turbo Spin-echo Sequences

Friday, Dec. 4 11:50AM - 12:00PM Location: N226

Participants
Katsuhiro Inoue, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Masayuki Maeda, MD, Tsu, Japan (*Presenter*) Nothing to Disclose
Maki Umino, MD, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Tsunehiro Yamahata, Tsu, Japan (*Abstract Co-Author*) Nothing to Disclose
Hajime Sakuma, MD, Tsu, Japan (*Abstract Co-Author*) Departmental Research Grant, Siemens AG; Departmental Research Grant, Koninklijke Philips NV; Departmental Research Grant, Bayer AG; Departmental Research Grant, Guerbet SA; Departmental Research Grant, DAIICHI SANKYO Group; Departmental Research Grant, FUJIFILM Holdings Corporation; Departmental Research Grant, Nihon Medi-Physics Co, Ltd

PURPOSE

3D black-blood (BB) MRI can provide high-resolution images and improved anatomic coverage with retrospective visualization of the vessel wall using multiplanar reconstruction. However, no report has described the comparison between the two 3D T1-weighted (T1-W) sequences including 3D turbo spin-echo (TSE) and 3D turbo field-echo (TFE) T1-W BB MRI. The aim of our study is to compare the capability in the delineation of cervical carotid plaque and the difference of signal-intensity ratio of the plaque to adjacent muscle between 3D T1-W TFE and T1-W TSE BB MRI in patients with cervical carotid stenosis.

METHOD AND MATERIALS

43 patients with moderate or severe cervical carotid stenosis confirmed by 3D rotational angiography were studied with 3D T1-W TSE and 3D T1-W TFE BB MRI at 3T (Achieva, Philips). The border between plaque and the lumen was rated visually (four-point analysis) and quantitatively (contrast-to-noise ratio; CNR). The signal-intensity ratio (SIR) of the plaque to adjacent muscle was also measured. The data were analyzed statistically between 3D T1-W TSE and 3D T1-W TFE using a Wilcoxon signed-rank test.

RESULTS

Visual analysis and quantitative analysis revealed that the border between plaque and lumen was better delineated on 3D T1-W TSE BB than on 3D T1-W TFE BB MRI ($p<0.01$, respectively). 3D T1-W TFE BB MRI occasionally showed incomplete suppression of blood signal, resulting in poor rating particularly in cases with iso-signal-intensity plaques. The SIR of plaque to adjacent muscle was higher on 3D T1-W TFE BB than on 3D T1-W TSE BB MRI ($p<0.05$). High-signal-intensity plaques with a SIR greater than 1.5 (intraplaque hemorrhage) were underestimated in 20 % of cases using 3D T1-W TSE BB MRI.

CONCLUSION

Our results showed that 3D T1-W TSE BB MRI was superior to 3D T1-W TFE BB MRI for plaque delineation. However, high-signal-intensity plaque suggesting intraplaque hemorrhage was underestimated using 3D T1-W TSE BB MRI. We need to know both advantages and disadvantages of the two 3D T1-W BB MRI sequences.

CLINICAL RELEVANCE/APPLICATION

3D T1-weighted black-blood MRI can demonstrate carotid plaque morphology and intraplaque hemorrhage and is recommended in the evaluation of cervical carotid artery stenosis.

SST10

Neuroradiology/Head and Neck (New Techniques in Head and Neck Imaging)

Friday, Dec. 4 10:30AM - 12:00PM Location: N227

HN NR BQ MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

FDA Discussions may include off-label uses.

Participants
Gaurang V. Shah, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

SST10-01 Using Semi-quantitative Dynamic Contrast-enhanced Magnetic Resonance Imaging Parameters to Evaluate Tumor Hypoxia: A Preclinical Feasibility Study in a Maxillofacial VX2 Rabbit Model

Friday, Dec. 4 10:30AM - 10:40AM Location: N227

Participants
Lin-Feng Zheng, MD, PhD, Shanghai, China (*Presenter*) Nothing to Disclose
Yujie Li, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Zhuoli Zhang, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Gui-Xiang Zhang, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To test the feasibility of semi-quantitative dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) parameters for evaluating tumor hypoxia in a maxillofacial VX2 rabbit model.

METHOD AND MATERIALS

Eight New Zealand rabbits were inoculated with VX2 cell solution to establish a maxillofacial VX2 rabbit model. DCE-MRI were carried out using a 1.5 Tesla scanner. Semi-quantitative DCE-MRI parameters, maximal enhancement ratio (MER) and slope of enhancement (SLE), were calculated and analyzed. The tumor samples from rabbits underwent hematoxylin-eosin (HE), pimonidazole (PIMO) and vascular endothelial growth factor (VEGF) immunohistochemistry (IHC) staining, and the PIMO area fraction and VEGF IHC score were calculated. Spearman's rank correlation analysis was used for statistical analysis.

RESULTS

The MER values of eight VX2 tumors ranged from 1.132 to 1.773 (1.406±0.258) and these values were negatively correlated with the corresponding PIMO area fraction ($p = 0.0000002$), but there was no significant correlation with the matched VEGF IHC score ($p = 0.578$). The SLE values of the eight VX2 tumors ranged from 0.0198 to 0.0532 s-1 (0.030±0.011 s-1). Correlation analysis showed that there was a positive correlation between SLE and the corresponding VEGF IHC score ($p= 0.0149$). However, no correlation was found between SLE and the matched PIMO area fraction ($p = 0.662$). The VEGF positive staining distribution predominantly overlapped with the PIMO adducts area, except for the area adjacent to the tumor blood vessel.

CONCLUSION

The semi-quantitative parameters of DCE-MRI, MER and SLE allowed for reliable measurements of the tumor hypoxia, and could be used to noninvasively evaluate hypoxia during tumor treatment.

CLINICAL RELEVANCE/APPLICATION

This preclinical feasibility study shows that DCE-MRI could serve as a potentially non-invasive and translational tool for tumor pathophysiological feature evaluation in clinical practice.

SST10-02 Improved Image Quality in Head and Neck CT Using a 3D Iterative Approach to Reduce Metal Artifacts

Friday, Dec. 4 10:40AM - 10:50AM Location: N227

Participants
Wolfgang Wust, MD, Erlangen, Germany (*Presenter*) Speakers Bureau, Siemens AG
Michael M. Lell, MD, Erlangen, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Research Grant, Bayer AG ; Speakers Bureau, Bayer AG; Research Consultant, Bracco Group; ;
Michael Uder, MD, Erlangen, Germany (*Abstract Co-Author*) Speakers Bureau, Bracco Group; Speakers Bureau, Siemens AG; Research Grant, Siemens AG;
Matthias S. May, Erlangen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG

PURPOSE

Metal artifact from dental fillings and other devices degrades image quality and may compromise the CT detection and evaluation of lesions in the oral cavity and oropharynx. The aim of this study was to evaluate the effect of iterative metal artifact reduction (IMAR) on CT of the oral cavity and oropharynx.

METHOD AND MATERIALS

Data from 50 consecutive patients with metal artifact from dental hardware were reconstructed with standard filtered backprojection (FBP), linear interpolation metal artifact reduction (MAR) and IMAR. The image quality of slices containing metal was analyzed for the severity of artifacts and diagnostic value.

RESULTS

A total of 455 slices, 9.1±4.1 slices per patient, contained metal and were evaluated with each reconstruction method. Slices without metal were not affected by the algorithms and demonstrated identical image quality. 38% of the slices were considered nondiagnostic with FBP, 31% with MAR, but only 7% with IMAR. 33% of slices had poor image quality with FBP, 46% with MAR, and 10% with IMAR. 13% of slices with FBP, 17% with MAR and 22% with IMAR were of moderate, 16% of slices with FBP, 5% with MAR and 30% with IMAR were of good and 1% of slices with MAR and 31% with IMAR of excellent image quality.

CONCLUSION

IMAR yields the highest image quality in comparison to FBP and MAR in patients with metal hardware in the head and neck area.

CLINICAL RELEVANCE/APPLICATION

The 3D iterative approach to metal artifact reduction can significantly improve the imaging of the head and neck region whenever dental hardware might disturb clinical imaging.

SST10-03 Role of Arterial Spin Labelling in Characterizing Skull-Base Lesions

Friday, Dec. 4 10:50AM - 11:00AM Location: N227

Participants
Nadya Pyatigorskaya, Paris, France (*Presenter*) Nothing to Disclose
Stephanie Trunet, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Sophie Gerber, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Bruno Law-Ye, JD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Melika Sahli Amor, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Samia Belkacem, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Peggy Bienvenot, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Damien P. Galanaud, MD, PhD, Paris, France (*Abstract Co-Author*) Research Consultant, Olea Medical
Didier Dormont, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Delphine Leclercq, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Classical dynamic susceptibility-contrast MRI (DSC-MRI) is a challenging technique in studying the skull base because of the air-interface artefacts. This work was aimed at investigating whether the pseudo-continuous Arterial Spin Labeling (pcASL)-MRI perfusion method can be used to adequately evaluate tumor perfusion of skull base tumors, as well as evaluating the diagnostic value of characterizing tumors by the ASL method.

METHOD AND MATERIALS

Forty-eight patients with skull baselesions were retrospectively enrolled. The lesions found were meningiomas (n=10), schwannomas (n=4), paragangliomas (3), chondrosarcoma (1), plasmocytomas (4), metastatic lesions (4), parotid lesions (4), epidermoid carcinomas (5), pituitary adenomas (5), cholesteatoma (1), hemangioblastoma (1), lymphoma (1), cystic lesions (3), and infections (2). Relative Tumor Blood Flow (rTBF) was calculated based on the pcASL data. Two expert neuroradiologists analyzed all the images. PcASL imaging was correlated to the pathology results for the lesions that underwent surgical resection (33), to other post-contrast enhancement perfusion methods (9), to the lesion morphology, and to follow up results (10). The normalized rTBF values for the lesions in the same anatomical region were compared, at the significant level set to $p<0.05$.

RESULTS

The pcASL method allowed characterizing all the enrolled lesions. Moreover, there was a significant rTBF difference between cerebellopontine angle schwannoma and meningioma and between schwannoma and metastasis. For pituitary lesions, there was a significant difference between pituitary adenoma and meningioma. For jugular foramen region, there was a significant difference between paraganglioma, chondrosarcoma, and cholesteatoma.Interestingly, one case of osteomyelitis, showed a pseudotumoral increased rTBF, and a plasmocytoma under treatment, showed low rTBF, in relation with treatment response.

CONCLUSION

The present preliminary study shows the interest of pcASL-MRI in evaluating tumor perfusion in the tumors that are located in the skull-base region. Moreover, pcASL can be helpful in the differential diagnosis of the tumors in this region without using contrast materials.

CLINICAL RELEVANCE/APPLICATION

This study shows that pcASL-MRI can be a powerful tool for detecting and characterizing skull-base lesions; it can be easily implemented in clinical practice.

SST10-04 Feasibility and Preliminary Experience of Quantitative T2 Star Mapping in the Differentiation of Benign and Malignant Thyroid Nodules in Comparison with Diffusion-weighted Imaging

Friday, Dec. 4 11:00AM - 11:10AM Location: N227

Participants
Lianming Wu, Shanghai, China (*Presenter*) Nothing to Disclose

PURPOSE

To investigate the feasibility of T2 star relaxation time for distinguishing benign from malignant thyroid node in comparison with diffusion-weighted (DW) imaging.

METHOD AND MATERIALS

A total of 56 consecutive patients (43 women and 13 men; age range, 23-76 years; mean [+SD] age, 51+12.3 years) with thyroid nodules, who were referred for fine-needle aspiration biopsy by endocrinology or general surgery clinics, were prospectively underwent 3.0T magnetic resonance imaging by using a multi-echo T2 star and DW imaging (maximum b value, 800 sec/mm2).

Parametric maps were obtained for apparent diffusion coefficient (ADC) and T2 star value. Two radiologists reviewed these maps and measured ADC and T2 star value. Data were analyzed by using mixed-model analysis of variance and receiver operating characteristic curves.

RESULTS

The T2 star values of the cancerous node (mean: 23.21+ 0.87ms) were significantly lower (P <0.001) than those of benign node (mean: 5.08+0.32ms). Adopting a threshold value of 12.35 ms. Quantitative T2 star mapping resulted in 91.2% sensitivity, 79.3% specificity in the identification of thyroid cancer. The ADC values of the cancerous node (mean: 0.83+ 0.37ms) were significantly lower (P <0.001) than those of benign node (mean: 1.53+0.28ms). Adopting a threshold value of 1.03 ms, ADC mapping resulted in 90.3% sensitivity, 73.2% specificity. Quantitative T2 star mapping showed significantly greater specificity for differentiating cancerous node from benign node than ADC mapping 79.3% vs 73.2%, P<.001), with equal sensitivity (91.2% vs 90.3%, P>0.05).

CONCLUSION

Preliminary findings suggest the feasibility of performing T2 star mapping of the thyroid node acquired by using mulit-echo T2 star that may provide increased sensitivity to the diagnostic performance of thyroid cancer compared with DWI. Further larger studies to confirm these preliminary findings are warranted.

CLINICAL RELEVANCE/APPLICATION

Preliminary findings suggest the feasibility of performing T2 star mapping of the thyroid node may provide increased sensitivity to the diagnostic performance of thyroid cancer compared with DWI.

SST10-05 Quantitative Diffusion-weighted Imaging for Evaluating Papillary Thyroid Carcinoma at 3T MRI: Optimal b Value

Friday, Dec. 4 11:10AM - 11:20AM Location: N227

Participants
Ruo Yang Shi, Shanghai, China (*Presenter*) Nothing to Disclose
Lianming Wu, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To assess the quantitative diffusion-weighted imaging (DWI) in distinguish papillary thyroid carcinoma (PTC) from benign thyroid nodules, and to evaluate the efficiency of DWI under different b values in discriminating between PTC and benign thyroid nodules, with pathologic analysis after surgery as reference standard.

METHOD AND MATERIALS

DWI was performed in 32 patients with thyroid nodules followed by surgery. DWI was examined by single-shot echo planar imaging (SE-EPI) under different b values including 0, 250, 500, 750, 1000, 1500, 2000s/mm². The diffusion-weighted image quality of six b value groups was evaluated. Apparent diffusion coefficient (ADC) values were counted in region of interest (ROI) for b values of 0 and for each b value from 250 to 2000 s/mm².Mean ADC values in ROI and the difference between PTC regions and benign thyroid nodules were calculated using two independent sample t-test. Sensitivity, specificity and area under the curve (AUC) were acquired by ROC curve.

RESULTS

The contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) were not satisfied when b value 1500 or 2000s/mm² was adopted. The qualitative image quality was not enough to meet diagnostic requirement. The mean ADC values (± standard deviation) of the PTC regions were 1.33 ± 0.47, 0.92 ± 0.35, 0.69 ± 0.31, 0.57 ± 0.26, 0.43 ± 0.20, and 0.32 ± 0.15 x 10-3 mm²/s and were significantly lower than those of benign thyroid nodules (P< .005). b=500 acquired the highest AUC among all the b values. Applying a threshold ADC value of 1.32 x 10-3 mm²/s at b=500, the sensitivity is 73.7% and the specificity is 92.3%.

CONCLUSION

Quantitative DWI can distinguish PTC from benign thyroid nodules. The optimal b value for DWI at 3T MRI to identify PTC may be 500s/mm².

CLINICAL RELEVANCE/APPLICATION

Quantitative DWI for thyroid can play important role in the diagnose of the thyroid nodules. The optimal b value may be 500s/mm².

SST10-06 Multi-parametric Advanced MR Imaging (IVIM, DCE-MR, 2D and 3D Tumor Metrics) as a Predictive Tool of Treatment Response in HPV Positive Oropharyngeal Squamous Cell Carcinoma Patients

Friday, Dec. 4 11:20AM - 11:30AM Location: N227

Participants
Ahmed Elakkad, MBBCh,MSc, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Nabil A. Elshafeey, MD, Houston, TX (*Presenter*) Nothing to Disclose
Masumeh Hatami, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Aikaterini Kotrotsou, PhD, MEng, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Mohamed G. Elbanan, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Vinodh A. Kumar, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Ashok J. Kumar, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Rivka R. Colen, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Human papilloma virus (HPV) positive tumors carry a better prognosis than HPV negative ones. Although HPV positivity is proven to be independent of other known prognostic factors including age and TNM staging, yet treatment failure has been recorded. In our study we used Intra Voxel Incoherent Motion, dynamic contrast enhanced magnetic resonance perfusion imaging (DCEMRI) and 2D, 3D volumetric parameters to find out which is the best predictor of treatment response in HPV positive oropharyngeal squamous

carcinoma.

METHOD AND MATERIALS

Patients with pathologically proven HPV positive oropharyngeal SCC were included in this study under an IRB approved protocol with signed study specific informed consent forms as a part of prospective ongoing clinical trial. All patients underwent two MRI studies, baseline scan within 1week before treatment and mid-treatment scan. According to response to treatment, patients were then categorized into 2 groups; complete responders (CR) in whom the primary has completely disappeared and partial responders (PR) where there was still a residual tumoral tissue. All morphological image analyses and segmentation were done using 3D Slicer 4.3.1 (slicer.org) and reviewed in consensus by 2 neuroradiologists. Multiple quantitative imaging features were identified including IVIM (D, D*, and f), MR-Perfusion (Ktrans, Vp, Ve, and Kep) as well as 2D and 3D volumes of the primary tumor at the first time point.

RESULTS

Median of the time between the two MRI was 25 days. Based on the second MRI, 75% of patients hadcomplete response to treatment. Mann-Whithny U Exact test was used to compare baseline variables between patient with complete and partial response to therapy. Kep mean and Ktrans mean significantly higher in patients who showed partial response to treatment. Logistic Regression analysis was performed to determine the association between each of the perfusion parameters and response to treatment. Higher Ktrans had a significant association with partial response to treatment.

CONCLUSION

Treatment response in HPV positive oropharyngeal squamous cell carcinoma patients can be reliably predicted through different advanced MRI parameters.

CLINICAL RELEVANCE/APPLICATION

HPV positive OPCC response to treatment are detected using multiple advanced and conventional MRI

SST10-07 Differentiation of the Metastatic Lymph Nodes from Thyroid Carcinoma and Squamous Cell Carcinoma and Lymphoma with Dual-Energy CT Monoenergetic Imaging

Friday, Dec. 4 11:30AM - 11:40AM Location: N227

Participants
Yang Yaying I, MD, Kunming, China (*Presenter*) Nothing to Disclose
Li Qing, MD, Kunming, China (*Abstract Co-Author*) Nothing to Disclose
Zhao Wei, MD, Kunming, China (*Abstract Co-Author*) Nothing to Disclose
Yang Bin, MD, Dali, China (*Abstract Co-Author*) Nothing to Disclose

Background

Objective To explore the value of dual-energy CT monoenergetic imaging in differential diagnosis of the metastatic cervical lymph nodes in thyroid carcinoma, squamous cell carcinoma and lymphoma.

Evaluation

The spectrum curve slope of arterial phase and parenchymal phase can be used to differentiate lymph node metastasis of in thyroid carcinoma, the metastatic lymph nodes from lymphoma in the neck.

Discussion

Results Of 79 enlarged lymph nodes, 23 were metastatic lymph nodes from thyroid carcinoma, 24 from squamous cell carcinoma and 32 were lymphoma. With the increase of keV values (from 60 to 180 keV), the corresponding CT values of the three kinds of malignant lymph nodes were decreased. The higher the keV value, the smaller the CT value decrease, and the spectrum curve appeared as "drop type". The spectrum slope curve of the metastatic lymph nodes of thyroid carcinoma in arterial phase (1.23±0.41) and parenchymal phase (0.85±0.33) are maximal and the slope curve of lymphoma in arterial phase (0.40±0.16) and parenchymal phase (0.47±0.09) are the lowest. The spectrum slope curve of metastatic lymph nodes from the squamous cell carcinoma in arterial phase and parenchymal phase is 0.88±0.10 and 0.62±0.28, respectively. The spectrum curve slope of the three kinds of malignant lymph nodes have statistical significance. Comprehensive analysis showed, if $0.36 > K > 0.24$ in arterial phase, it is most probably lymphoma; If $0.81 \geq K \geq 0.78$, it is most probably the metastatic lymph nodes; and if $1.65 \geq K > 0.98$, it is most probably lymph node metastasis from thyroid carcinoma; in parenchymal phase, if $0.38 > K \geq 0.34$, it is most probably the metastatic lymph nodes, If $0.52 > K \geq 0.38$, it is most probably lymphoma, if $1.18 \geq K \geq 0.56$, it is most probably lymph node metastasis from thyroid carcinoma.

Conclusion

The spectrum curve slope of arterial phase and parenchymal phase can be used to differentiate lymph node metastasis of in thyroid carcinoma, the metastatic lymph nodes from lymphoma in the neck.

SST10-08 High Resolution Diffusion Weighted Imaging of Thyroid Gland Using Reduced FOV Technique: A Preliminary Clinical Application at 3T MRI

Friday, Dec. 4 11:40AM - 11:50AM Location: N227

Participants
Hao Yonghong, MD, Wuhan, China (*Presenter*) Nothing to Disclose
Wenzhen Zhu, MD, PhD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose
Jianpin Qi, PhD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

DWI has been shown to be useful for differentiation between benign and malignant thyroid nodules. However, due to severe susceptibility and distortion artifacts and image blurring, the diagnostic value of clinical thyroid DWI is limited. The purpose of this study was to evaluate the performance of reduced field of view (r-FOV) diffusion weighted imaging and compare the diagnostic value of r-FOV diffusion imaging and conventional diffusion imaging in patients with thyroid nodules.

METHOD AND MATERIALS

79 consecutive patients who were clinically suspected with thyroid malignant lesions by ultrasound or/and scintigraphy and 12 healthy controls were included in this study. All participants underwent r-FOV diffusion imaging and f-FOV diffusion imaging with a 3T MRI scanner. Image quality and lesion identifications were visually evaluated by two independent reviewers and image properties (SNR, CNR, geometric distortion) were quantified. The apparent diffusion coefficient values of thyroid lesions and normal thyroid parenchyma were calculated and compared between two diffusion methods. The ROC analyses for both DWI methods were performed and differences in the area under the curve were assessed.

RESULTS

Agreement between two reviewers was good for image quality and lesion identification.The image quality and lesion identification of r-FOV diffusion imaging was rated higher than that of f-FOV DW imaging($p<0.001$). The geometric distortions for f-FOV DW imaging were significant higher than that for r-FOV imaging, while SNR of r-FOV imaging was slightly lower than that of conventional DW imaging. The mean ADCs of r-FOV diffusion imaging were lower than that of f-FOV diffusion imaging ignore of different tissue types ($1.42\pm 0.44 \times 10\text{-}3$ mm2/s vs $1.54\pm0.45\times10\text{-}3$ mm2, $p<0.001$).There was significant difference among the ADCs of different tissue groups obtained from both r-FOV and f-FOV DWI. The areas under the curve for r-FOV (0.962) and conventional DW imaging (0.951) were not statistically different.

CONCLUSION

r-FOV diffusion imaging provide higher image quality and lesion identification than f-FOV diffusion imaging by reducing susceptibility artifacts, spatial distortion, image blurring, and were of comparable diagnostic values in nodules thyroid.

CLINICAL RELEVANCE/APPLICATION

high resolution DWI of thyroid could improve the identification and interpretation of nodules, especially for microcarcinoma.

SST10-09 The Optimization Weighting Factors of Linear Image Blending in Dual-Energy Computed Tomography for the Diagnosis of Laryngeal Carcinoma

Friday, Dec. 4 11:50AM - 12:00PM Location: N227

Participants
Mengxi Jiang, Beijing, China (*Presenter*) Research Grant, General Electric Company
Jian Jiang, MD, Beijing, China (*Abstract Co-Author*) Research Grant, General Electric Company
Yuan Jiang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaoying Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the linear image-blending of varying weighting factors in dual-energy computed tomography of laryngeal carcinoma regarding subjective and objective image quality.

METHOD AND MATERIALS

Patients with biopsy-proven untreated primary laryngeal carcinoma who underwent DECT scan (100kVp/Sn140 kVp) of neck were retrospectively evaluated.Ten (9 men, 1 woman; age range, 46-76 years old) cases were enrolled. Linearly blended images series with 11 weighting factors (0 to 1.0 in steps of 0.1) were reconstructed. For objective assessment, attenuation of lesion, various anatomic landmarks, image noise,lesion contrast-to-noise ratio and signal-to-noise ratio were compared between different image datasets. For subjective assessment, two independent blinded radiologists rated overall image quality, lesion delineation, image sharpness, and image noise of each image dataset on a 5-point grading scale.

RESULTS

The mean attenuation of lesion, sternocleidomastoid muscle, internal jugular vein, and submandibular gland increased stepwise with decreasing tube voltage from Sn140 kVp through 100 kVp. CNR was the highest in the weighting factors of 0.8 (M_0.8; 12.5±5.7). M_0.8 images showed no significant differences between linearly blended image series M_0.6 (11.7±5.5; P=0.123), M_0.7 (12.3±5.6; P=1.000), M_0.9 (12.5±5.6; P=1.000) and M_1.0 (12.2±5.5; P=1.000), but differed significantly compared to the linearly blended image series M_0, M_0.1, M_0.2, M_0.3, M_0.4 and M_0.5 (P<0.05). SNR was the highest in the weighting factors of 0.7 (35.0±6.1). M_0.7 images showed no significant differences between linearly blended image series M_0.6 (34.7±6.1; P=1.000). Overall image quality was higher in M_0.9 (4.7) and M_1.0 (4.7) images, although differences to the M_0.8 (4.4) images did not reach statistical significance (P=0.083). Delineation of the tumour was rated significantly better in M_0.9 (4.4) and M_1.0 (4.5) images compared to other linearly blended image series. Scoring of the image sharpness revealed equally good results in all image series.

CONCLUSION

The linear-blending images of DECT data at the weighting factors of 0.9 and 1.0 can provide higher image quality for the diagnosis of laryngeal carcinoma.

CLINICAL RELEVANCE/APPLICATION

Linear image blending in DECT could provided more information about laryngeal carcinoma, which improved diagnostic confidence in the assessment of laryngeal carcinoma.

SST11

Neuroradiology (Quantitative Neuroimaging)

Friday, Dec. 4 10:30AM - 12:00PM Location: N230

NR BQ MR

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
Pratik Mukherjee, MD, PhD, San Francisco, CA (*Moderator*) Research Grant, General Electric Company; Medical Adivisory Board, General Electric Company;

Sub-Events

SST11-01 Repeatability of the Volume of Interest Placement Using Edited Magnetic Resonance Spectroscopy

Friday, Dec. 4 10:30AM - 10:40AM Location: N230

Participants
Fei Gao, Jinan, China (*Presenter*) Nothing to Disclose
Guangbin Wang, MD, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Bin Zhao, MD, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Fuxin Ren, Jinan, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Edited magnetic resonance spectroscopy (MRS), using the MEGA-PRESS sequence, is the most widely used technique for detecting gamma-aminobutyric acid (GABA) in the human brain. However, this method required a relatively large volume of interest (VOI), so the accuracy of VOI placement is important to ensure the reliability of GABA quantification. In this study the MRS voxels overlap of intra- and inter-subject were evaluated.

METHOD AND MATERIALS

Fifteen healthy volunteers (8 men and 7 women, 44.87±3.42 years) underwent MRS examinations. All subjects were examined on a 3T scanner using MEGA-PRESS sequence and T1-weighted 3D TFE images were used as a localizer. The unsuppressed water signal was obtained for quantification. The VOI was chosen in the parietal region (3x3x3 cm3). MEGA-PRESS was analyzed using 'Gannet' in Matlab with Gaussian curve fitting to the GABA peaks. GABA levels (institutional units) were calculated for each subject. In one subject, four continuous scans were conducted within a period of 3 weeks. The VOI was chosen in the three areas: frontal region (3x3x3 cm3), parietal region (3x3x3 cm3) and temporal region (4x2x2 cm3). Each pixel in the T1-weighted images was segmented as gray matter, white matter, or cerebrospinal fluid using the FSL software. VOIs were co-registered to the anatomical images using the "Re-creation of VOI" Matlab tool. The VOIs and anatomical images were registered to the baseline images (intra-subject) or standard space (inter-subject) using the SPM software. The Dice overlap coefficient was used to calculate the MRS voxels overlap of intra- and inter-subject.

RESULTS

The MRS voxels overlap of inter-subject was 78.87% ± 8.85% in parietal region. No correlation between GABA levels and gray matter volume within VOI was found in parietal region for all subjects (r=0.13, p=0.64). The MRS voxels overlap of intra-subject was 85.88% ± 5.36% in frontal region, 88.86% ± 2.45% in parietal region and 81.31% ± 3.38% in temporal region.

CONCLUSION

The high degree of MRS voxels overlap of intra- and inter-subject and low correlation between gray matter volume and GABA levels, suggesting that VOI placement using MEGA-PRESS has great repeatability, and the small variations in VOI placement and subject anatomy do not affect the GABA levels.

CLINICAL RELEVANCE/APPLICATION

VOI placement using MEGA-PRESS has great repeatability and MEGA-PRESS is recommended to measure GABA levels in vivo in the human brain.

SST11-02 Does Gadolinium Change the Relaxometry of the Dentate Nuclei? A Quantitative Multi-parametric MRI Study

Friday, Dec. 4 10:40AM - 10:50AM Location: N230

Participants
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PURPOSE

Repeated intravenous administration of Gadolinium-based contrast agents (Gd-CA) has been associated with increased MRI signal intensity in T1-weighted sequences in dentate nuclei (DN). Our aim is to perform, for the first time, a quantitative MRI (qMRI) assessment of DN relaxometry in patients receiving multiple doses of Gd-CA using 0.7x0.7x1.3 mm3 resolved Gradient-Echo (GRE) sequences.

METHOD AND MATERIALS

From a total of 92 Multiple Sclerosis patients with normal renal function, we retrospectively selected 21 patients [Group A, M/F=5/16, age: 41±11 years, disease duration (DD): 15.9±8.1 years] who had performed, during the course of the disease, 9 or more contrast-enhanced (CE) MRI scans, and 28 patients (Group B, M/F=14/14, age: 36±11 years, DD: 7.8±6.8 years) who underwent less than 4 CE-MRI scans. A group of 28 age/sex-matched healthy controls (HC, M/F=11/17, age: 38±13 years), who underwent only unenhanced MRI, was also studied. In patients and HC, GRE sequences (TR=28ms, TE=[7,22]ms, FA=[3,20]°) were acquired at 3T and processed with an in-house software, providing quantitative estimates of R1, R2* and magnetic susceptibility (QSM) of the brain. ROIs were hand-drawn on the axial slice with the best representation of DN. Group differences in qMRI data were tested both in terms of absolute DN values and of ratios between DN and a brainstem (BS) ROI, used as internal reference.

RESULTS

The DN/BS ratio for R1 was significantly higher in Group A (1.17±0.09) when compared to Group B (1.10±0.08) and HC (1.11±0.07), p-values being 0.008 and 0.009, respectively. Instead, the DN/BS ratio for R1 did not differ between Group B and HC (p=0.79). Also, no significant differences were found between the 3 groups in terms of R2* or QSM DN/BS ratios, nor of R1, R2* and QSM absolute DN values.

CONCLUSION

Our in vivo high-resolution quantitative relaxometric MRI analysis showed higher R1 values in patients undergoing repeated CE-MRI scans, supporting the hypothesis that Gd-CA accumulate in DN. Further longitudinal quantitative analysis of the mechanisms of Gd-CA clearance in the brain are warranted.

CLINICAL RELEVANCE/APPLICATION

Repeated administration of Gd-based contrast agents is associated with long-term changes in brain relaxometry, thus indirectly confirming the concerns about the stability of Gd-chelation over time.

SST11-03 Metabolic Changes in the Bilateral Visual Cortex of Monocular Blindness Macaque Monkeys: A Multi-voxel Proton Magnetic Resonance Spectroscopy Study

Friday, Dec. 4 10:50AM - 11:00AM Location: N230

Participants
Lingjie Wu, MD, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose
Zuohua Tang, PhD,MD, Shanghai, China (*Presenter*) Nothing to Disclose

PURPOSE

To study adaptive plasticity and reorganization in the visual cortex of the monocular blind macaque using multi-voxel proton magnetic resonance spectroscopy study (1H-MRS).

METHOD AND MATERIALS

Four healthy neonatal macaques were randomly divided into 2 groups. One group served as control group (group A). Optic nerve transecting was performed in the right eye of the other group (group B), to establish the monocular blind model. Sixteen (group B16M) and thirty-two (group B32M) months after monocular optic nerve transecting, multi-voxel 1H-MRS was performed on the bilateral visual cortex of all monkeys, respectively. We compared NAA/Cr, Ins/Cr, Cho/Cr and Glx/Cr in the visual cortex between group A and group B as well as between the left and right visual cortices of group A and B in each time points, respectively. All of the metabolic changes detecting by multi-voxel 1H-MRS were further compared with the hematoxylin-eosin and immunofluorescent staining findings.

RESULTS

Compared with group A, in bilateral visual cortex, NAA/Cr in both group B16M and group B32M, as well as Glx/Cr in group B32M were all significant decrease ($p<0.05$), whereas the Cho/Cr and Ins/Cr of group B32M were significant increase ($p<0.05$). Meanwhile, significant difference of NAA/Cr in group B32M was found between the left and right visual cortex, whereas no statistical difference of Ins/Cr, Cho/Cr and Glx/Cr between the left and right visual cortex was found in both group B16M and group B32M. All of these findings were further confirmed by the hematoxylin-eosin and immunofluorescent staining using anti-NeuN antibody, anti-Choline Acetyltransferase antibody and anti-EAAT3 antibody.

CONCLUSION

Multi-voxel 1H-MRS was able to detect the different metabolic changes in the visual cortex, which was valuable for investigating its adaptive plasticity and reorganization.

CLINICAL RELEVANCE/APPLICATION

Such alterations in the metabolism of the bilateral visual cortex could provide valuable information for future studies of adaptive plasticity and reorganization in visual loss or other sensory deprivation in animal models and human beings.

SST11-04 Physiology-based MRI Assessment of CSF Flow in Chiari I Malformation (CMI)

Friday, Dec. 4 11:00AM - 11:10AM Location: N230

Participants
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Samuel Patz, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Invasive pressure studies have suggested that in patients with Chiari I malformation (CMI), CSF flow across the foramen magnum transiently decreases after coughing in the presence of a clinically significant obstruction. The purpose of this study was to demonstrate this phenomenon non-invasively by assessing CSF flow response to coughing in CMI patients using MR pencil beam imaging (PBI) and compare it to healthy participants.

METHOD AND MATERIALS

7 CMI patients and 6 healthy participants were studied using PBI with a temporal resolution of ~50ms. Patients and participants were scanned for 90-seconds to continuously record cardiac-cycle related CSF flow waveforms as well as the heart rate and respiratory motion during resting, coughing and post-coughing periods. CSF flow waveform amplitude (ACSF), CSF stroke volume (SVCSF), and CSF flow rate (FRCSF; SVCSF x heart rate)in resting and immediate post-coughing periods were determined. Post-coughing values of all three parameters were calculated as a percentage of resting values, and compared between patients and healthy participants.

RESULTS

There was no significant difference in ACSF, SVCSF and FRCSF between CMI patients and healthy participants during rest. However, after coughing, a significant decrease in ACSF ($p<0.001$), SVCSF ($p =0.001$) and FRCSF ($p =0.001$) was observed in CMI patients compared to healthy participants.

CONCLUSION

Coughing decreases CSF flow across the foramen magnum in CMI patients but not in healthy participants. Real-time MRI measurement of CSF flow response to coughing may provide objective quantitative assessment of foramen magnum obstruction in CMI patients.

CLINICAL RELEVANCE/APPLICATION

Physiology-based MRI measurement of CSF flow may provide objective assessment of foramen magnum obstruction in CMI patients

SST11-05 Cerebral Perfusion Relates to Regional Cortical ThicKness in the General Population

Friday, Dec. 4 11:10AM - 11:20AM Location: N230

Participants
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PURPOSE

To investigate whether cerebral perfusion is associated with regional cortical thickness on magnetic resonance imaging (MRI) in community-dwelling persons free of stroke and a clinical diagnosis of dementia.

METHOD AND MATERIALS

2,961 persons (mean age 59.6 years; 54.5% women) from a prospective population-based study underwent brain MRI on a 1.5-tesla MRI system, yielding cortical thickness of 34 cortical regions using automated segmentation technique (FreeSurfer). Total cerebral blood flow (tCBF) was determined using 2D phase-contrast MRI by adding flow rates for the carotid arteries and the basilar artery and expressed in ml/min. Parenchymal CBF (mL/min/100mL) was calculated by dividing tCBF by each individual's brain volume (mL) multiplied by 100. We used multivariable linear regression models to investigate the association between cerebral perfusion and regional cortical thickness.

RESULTS

Both lower tCBF and pCBF were associated with thinner regions of the cortex predominantly involving the frontal lobe, and the medial posterior regions. Strongest association was found for tCBF with cortical thickness of the superior-frontal and rostral-middle-frontal region.

CONCLUSION

In community-dwelling persons, cerebral perfusion relates to cortical thickness variations in different brain regions.

CLINICAL RELEVANCE/APPLICATION

Our findings provide further insight into the pathophysiological role of cerebral perfusion in neurodegeneration in aging.

SST11-06 A Diffusional Kurtosis Imaging Study of Type-2 Diabetic Brain

Friday, Dec. 4 11:20AM - 11:30AM Location: N230

Participants
Ying Xiong, MD, Chicago, IL (*Presenter*) Nothing to Disclose
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PURPOSE

Diffusional kurtosis imaging (DKI) is an extension of diffusion tensor imaging (DTI) by taking non-Gaussian diffusion behavior into consideration, allowing more comprehensive characterization of diffusion in tissues. This study aims at investigating brain microstructural changes in both white matter (WM) and gray matter (GM) of type-2 diabetes mellitus (T2DM) patients using DKI.

METHOD AND MATERIALS

DKI (b=0, 1250, 2500 s/mm2; 25 directions) was performed at 3T on 30 T2DM patients (60.6±6.3 years old; 13 males) and 28 healthy controls (58.5±5.9 years old; 11 males). FMRIB Software Library (FSL) with tract-based spatial statistics (TBSS) was utilized to analyze the DKI metrics, including mean kurtosis (MK), axial kurtosis (Ka), and radial kurtosis (Kr) of multiple WM regions and specific GM structures in the bilateral thalamus, followed by a Pearson's correlation between MK values of selected WM fiber tracts and disease duration.

RESULTS

In the whole-brain TBSS analysis, the T2DM patients exhibited abnormalities in 35.4%, 10.5%, and 26.0% of WM regions as measured by MK, Ka, and Kr, respectively, when compared to the controls. A reduction in MK of the T2DM patients was caused primarily by the decreased Kr, suggesting compromised myelin sheath in the WM regions. MK and Ka also decreased in the bilateral thalamus, while Kr did not show statistically significant difference. This can be related to the compromised synapse in the thalamus, which is a sensory and movement relay between cerebral cortex and other regions of the brain and spinal cord. Atlas-based MK analyses on individual fiber tracts showed that pronounced MK reduction occurred in the internal capsule, corona radiata, cingulum (hippocampus), superior longitudinal fasciculus, corpus callosum, as well as the thalamus. Decreased MK values in the genu of the corpus callosum and anterior corona radiata were correlated with increased disease duration ($R=-0.473$ and -0.400 respectively, $p<0.05$) of the T2DM patients.

CONCLUSION

DKI can complement conventional DTI by providing new information to characterize and pinpoint brain microstructural changes in both WM and GM of T2DM patients.

CLINICAL RELEVANCE/APPLICATION

DKI can probe microstructural changes in WM and GM in patients with T2DM, and potentially provide valuable information to study diabetic encephalopathy, including cognitive impairment.

SST11-07 Adaptive Tissue Cluster Tracking on Quantitative MRI for Fully Automatic Brain Segmentation on Young Children

Friday, Dec. 4 11:30AM - 11:40AM Location: N230

Participants
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Blaise V. Jones, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Multi-parametric quantitative MRI of longitudinal T1 relaxation, transverse T2 relaxation and proton density (PD) can be achieved within a clinically acceptable scan time. It has been shown that values of T1, T2 and PD rapidly change during the first years of life. The purpose of this study was to create an algorithm that adaptively tracks the grey matter and white matter tissue properties in qMRI data, in order to segment grey matter, white matter and cerebrospinal fluid volumes of the brain, independent of age.

METHOD AND MATERIALS

A group of 23 quantified datasets at 3T of paediatric clinical cases in the range 0-20 years old was used to develop an algorithm to automatically track the mean T1, T2 and PD values of GM, myelinated WM and CSF. The positions of the tissue clusters were then used to define GM, myelinated WM and CSF partial volume. The sum of all partial volumes in the intracranial volume resulted in an estimation of total GM, WM and CSF volumes.

RESULTS

The observed T1/T2 relaxation times for GM changed from 1850/110 ms to 1360/86 ms in the first two years of life, whereas myelinated WM changed from 1080/98 ms to 720/70 ms. After two years the T1 and T2 relaxation were relatively constant. CSF had T1/T2 = 4200/1600 ms for all ages. Application of adaptive tissue cluster tracking on GM and WM showed that myelinated WM volume, an average, increased from 0 to 252 mL, CSF decreased from 241 mL to 40 mL and total brain volume increased from 403 mL to 1225 mL in the first 4 years of life. Without tissue cluster tracking the estimated WM volume was significantly lower and CSF volume was significantly higher.

CONCLUSION

Using adaptive tissue cluster tracking the differences in T1 and T2 relaxation between young children and adults can be corrected for, allowing fully automatic brain segmentation on all ages.

CLINICAL RELEVANCE/APPLICATION

Quantitative MRI provides absolute values and improved means of statistics in clinical MRI. Automatic brain segmentation using qMRI may provide more precise monitoring and follow-up throughout life.

SST11-08 Radiomic Texture Analysis Mapping Predicts Areas of True Functional MRI Activation

Friday, Dec. 4 11:40AM - 11:50AM Location: N230

Participants

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PURPOSE

To develop an automated robust method using MR texture analysis to accurately predict areas of true functional activity

METHOD AND MATERIALS

10 right-handed (5 male, 5 female) healthy individuals underwent a functional MRI study using the sentence completion task. IRB approval and informed consent were obtained in this HIPAA compliant study. fMRI data analysis was performed using statistical parametric mapping approach (SPM8). The resultant functional map was individually thresholded to optimize visualization of language area. A board-certified neuroradiologist classified different clusters into Expected (E) and Non-Expected (NE) based on their anatomical locations. Texture Analysis was performed using the mean EPI volume for each individual, and 20 rotation-invariant texture features were obtained. Logistic regression and treebagging models were used to identify significant discriminatory texture features and build predictive models for the E versus NE ROIs

RESULTS

We identified 65 ROIs (23 E versus 42 NE). Logistic regression model identified specific texture features (sum variance p=0.014, sum average p=0.019, cluster shade p=0.028, cluster prominence p=0.046, correlation p=0.09) related with the homogeneity that allowed discrimination between E and NE ROIs. The AUC of the logistic regression model was 93.59% (86.58% cross-validated), specificity/sensitivity of 97.31%/74.17%. Tree-bagging model resulted in an AUC of 88.19% and specificity/sensitivity of 80.95%/86.96%.

CONCLUSION

Radiomic texture analysis of fMRI can be a useful tool for detecting areas of true functional activity and serve as a tool for eliminating false-positive or non-task related activity

CLINICAL RELEVANCE/APPLICATION

Radiomic texture analysis can discriminate those areas of true functional task-related activity and thus allow for precise pre-surgical detection and mapping of areas of true functional eloquence in order that maximal extent of neurosurgical resection can occur while simultaneously maintaining intact neurological function.

SST11-09 Non-Invasive Determination of Epidermal Growth Factor Receptor Variant III Expression in Glioblastoma through Analysis of Multi-Parametric Magnetic Resonance Imaging

Friday, Dec. 4 11:50AM - 12:00PM Location: N230

Participants
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PURPOSE

Epidermal growth factor receptor variant III (EGFRvIII) is the target of ongoing investigational drug trials for the treatment of glioblastoma (GB). However, tissue-based genetic testing of the EGFRvIII status is costly and not widely available. The goal of this study is to combine multi-parametric magnetic resonance imaging (MRI) data, with the intention of non-invasively determining the mutation status of EGFRvIII in patients with GB. We hypothesize that quantification of subtle, yet important, imaging phenotypes of GB from multiple MRI modalities may lead to non-invasively determining expression of molecular tumor characteristics, and particularly of the EGFRvIII oncogene.

METHOD AND MATERIALS

Preoperative multi-parametric MRI data (i.e. T1, T1-Gad, T2, T2-FLAIR, rCBV, DTI, and DSC) from 41 solitary de novo GB patients were retrospectively analyzed. Appropriate imaging features were extracted to create an integrative predictive model of EGFRvIII mutation, based on Support Vector Machines. The utilized features comprise the age of the patient, the size of the enhancing tumor, non-enhancing tumor, and edema; the tumor location, the mass-effect parameters, and the distribution of intensities of each region across all MRI modalities. Leave-one-out cross validation was used to test how well the predictive model generalizes on new unseen patient data. The results were compared with the EGFRvIII status obtained through tissue-based diagnostics.

RESULTS

The output of the predictive model is a value between -1 and 1. Values closer to 1 indicate higher probability for the subject to harbor the mutation, and values closer to -1 the opposite. A receiver operating characteristic (ROC) curve was calculated by changing the threshold in the range of the model's output values. The accuracy of the model was calculated for the threshold equal to 0. The proposed method successfully identified the EGFRvIII mutation, with 83% accuracy and the area under the ROC curve equal to 0.82.

CONCLUSION

Computational analysis of multi-parametric MRI data can lead to the extraction of informative and comprehensive features

Computational analysis of multi-parametric MRI data can lead to the extraction of informative and comprehensive features, representative of the distinctive imaging phenotypes related to the EGFRvIII mutation status in patients with GB.

CLINICAL RELEVANCE/APPLICATION

Analysis of multi-parametric MRI data reveals EGFRvIII mutation phenotypes in GB, hence assists in personalizing treatment whilst avoiding costly and not widely-available tissue-based genetic testing.

SST12

Pediatrics (Neuroradiology)

Friday, Dec. 4 10:30AM - 12:00PM Location: N229

NR MR PD

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50

Participants
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Jeremy Y. Jones, MD, Bellaire, TX (*Moderator*) Nothing to Disclose

Sub-Events

SST12-01 Comparison of CBF Measured with Velocity-selective Arterial Spin Labeling (ASL) MRI and Pulsed ASL MRI in Pediatric Patients with Prolonged Arterial Transit Times Due to Moymoya Disease

Friday, Dec. 4 10:30AM - 10:40AM Location: N229

Participants
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Ellen Grant, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To show that velocity-selective arterial spin labeling (VS-ASL) MRI is superior to pulsed ASL (PASL) MRI for measuring cerebral blood flow (CBF) in Moyamoya patients, as VS-ASL is theoretically insensitive to arterial transit delays (ATD) that can render PASL approaches inaccurate.

METHOD AND MATERIALS

Five pediatric Moymoya patients (2F, 3M, ages 3-9), two with unilateral and three with bilateral disease, one pre- and four post-synangiosis, were imaged with both VS-ASL and PASL MRI at 3T (Siemens). VS-ASL parameters were VC=2.1 cm/s and TI=1300ms. PASL parameters were TI1=700 ms, TI2=2000-2400ms, tag width=100mm, and gap=21-25mm. Perfusion time-series data for PASL and VS-ASL were generated by performing pairwise subtractions between tag and control images. CBF maps were generated by averaging voxels across the perfusion time series and calibrating via ASL signal equations. CBF maps and values from gray matter (GM) are reported.

RESULTS

For all patients, PASL shows large focal perfusion deficits and macrovascular flow artifacts, consistent with tag accumulating in large vessels and failing to reach target microvasculature. These findings highlight PASL sensitivity to increased regional ATD, resulting in artifact and apparent lack of parenchymal perfusion, a finding that could be misinterpreted as ischemia. VS-ASL, on the other hand, yields symmetric parenchymal perfusion bilaterally, and thus appears largely insensitive to the known ATD's seen in these patients. Angiographic data from one patient correlates the findings; both hemispheres show capillary blush, albeit delayed on the diseased side, as this tissue is primarily supplied by delayed flow through pial-pial collaterals. Quantitatively, VS-ASL GM CBF is similar in both hemispheres and in physiologic range (50.8± 9.8 ml/100g-min). PASL GM CBF, on the other hand, is more heterogeneous due to both perfusion deficit and macrovascular artifact, and measures below the normal physiological range (29.2± 9.0 ml/100g- min).

CONCLUSION

VS-ASL MRI is largely insensitive to arterial transit delays and as such more accurately images CBF and parenchymal perfusion in Moyamoya patients, compared to traditional PASL MRI.

CLINICAL RELEVANCE/APPLICATION

VS-ASL has great potential for assessing perfusion in stroke, carotid stenosis, and Moyamoya patients, who often have delayed arterial transit due to large artery stenosis and secondary collateralization.

SST12-02 Non-invasive Quantification of Cerebral Oxygen Metabolism in Children with Sickle Cell Disease

Friday, Dec. 4 10:40AM - 10:50AM Location: N229

Participants
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Jackie Leung, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose
Andrea Kassner, PhD, Toronto, ON (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Ischemic stroke is a serious complication of sickle cell disease (SCD) that manifests in more than 10% of children SCD by the age of 20. It occurs when oxygen (O2) availability is inadequate to meet cerebral metabolic demands, despite the compensatory increase in cerebral blood flow (CBF) in SCD. The cerebral metabolic rate of O2 (CMRO2) may be a potential disease biomarker for ischemic risk in SCD. However, CMRO2 has not yet been quantified in children with SCD. Here, we combine MRI measurements of oxygen extraction fraction (OEF) and CBF to provide the first non-invasive quantitative measurement of CMRO2 in children with SCD.

METHOD AND MATERIALS

Five SCD patients (11-18 yrs) and 4 healthy controls (12-18 yrs) were imaged on a 3T MRI scanner. Gray matter CBF was obtained using PICORE-Q2TIPS pulsed arterial spin labelling (TR/TE=2500/13ms, TI1/TI2=700/1800ms, voxel=3.4×3.4×4.5mm), quantified with a single-compartment kinetic model. T1 of blood was assumed to be 1660ms for a hematocrit (Hct) of 0.4 and corrected for reduced Hct on an individual basis. Global OEF is calculated from the arteriovenous difference, where arterial O2 saturation (SaO2) is assumed to be 1 in healthy controls and measured using pulse oximetry in patients. Using a 3D-FLASH GRE sequence (TR/TE=28/20ms, voxel=0.8x0.7x1.2mm), venous O2 saturation (SvO2) was measured from the phase difference between blood in the superior sagittal sinus and surrounding tissue. From Fick's principle, CMRO2 can be computed from the product of OEF, CBF, and arterial O2 content, which is a function of SaO2 and Hct. Statistical comparisons were made between groups using an independent samples Student's t-test (SPSSv22).

RESULTS

There was a trend for elevated GM CBF in SCD (87.3±20 ml/min/100g vs. 68.7±21 ml/min/100g), while significant reductions were observed in arterial O2 content (5.1± 0.8 µmol O2/ml vs. 7.4±0.4 µmol O2/ml, p<0.01) and OEF (0.18±0.05 vs. 0.30±0.04, p<0.01). This resulted in a significantly reduced CMRO2 (78.4±23.4 µmol O2/min/100g vs. 149.4±44.9 µmol O2/min/100g, p=0.42) (Figure 1).

CONCLUSION

Global CMRO2 is significantly reduced in children with SCD and may present a novel biomarker for assessing stroke risk in this population.

CLINICAL RELEVANCE/APPLICATION

CMRO2 may provide a novel non-invasive biomarker for assessment of stroke risk in children with sickle cell disease

SST12-03 Quantification of Age and Gender Dependence of Normal Cardiac and Intracranial Blood Flow in Pediatric Volunteers Using 2D Phase Contrast and 4D Flow MR Imaging

Friday, Dec. 4 10:50AM - 11:00AM Location: N229

Participants
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PURPOSE

To analyze the normal age and gender induced variability of cardiac and intracranial blood flow in pediatric volunteers using 2D Phase Contrast (PC) and 4D flow MRI.

METHOD AND MATERIALS

ECG-gated 4D flow MRI with volumetric coverage of the major intracranial vessels (spatial resolution =1.2mmx1.2mmx1.5mm, temporal resolution=44ms. acquisition time˜10 min) was performed on volunteers under 18 years (range 6 months - 17 years) with no history of cardio/cerebrovascular diseases on 1.5 and 3T MRI scanners. In addition, 2D PC-MRI with through-plane velocity encoding at the level of proximal ascending aorta (AAo) and descending aorta (DAo) was performed in the same imaging session for all subjects. Following pre-processing, intracranial blood flow was quantified at manually positioned 2D planes orthogonal to the vessels (Fig. a). Total cerebral blood flow (TCBF) was defined as the sum of flow in bilateral intracranial carotid (ICA) and basilar arteries (BA). Aortic flow was quantified by manual segmentation of the AAo and DAo flow contours. Demographics, body mass index (BMI), and body surface area (BSA) were obtained. Cardiac index (CI) was defined as AAo flow/BSA. Pearson correlation coefficient and polynomial and multiple regression models were used for statistical analyses.

RESULTS

Fifty two volunteers (mean age (yr) ± SD: 7.95 ± 5.04) were recruited. Both females (31) and males (21) had similar distributions of age, BMI, BSA, TCBF, and CI. An excellent correlation was observed between age and AAo/Dao flow (P<0.001, r=0.80/0.85, Fig. b). TCBF and TCBF/AAo ratio vs. age were best fitted with cubic polynomial models (P<0.001, r=0.84, r=0.93, respectively, Figs. c, d). Overall, a moderate but significant inverse correlation was detected between age and TCBF (P=0.013, r=-0.34). TCBF/AAo ratio and CI were inversely correlated with age (p<0.001, r=-0.90 -0.65, respectively) (Figs. d, e). Stepwise multiple regression analysis selected CI as the only independent variable that was a predictor of TCBF (P=0.006).

CONCLUSION

These findings highlight the importance of age matched control data for the characterization of intracranial and aortic hemodynamics in children with anthropometric changes.

CLINICAL RELEVANCE/APPLICATION

Providing a control dataset for age-specific cardiac and cerebral hemodynamics in children is crucial to detect abnormal hemodynamics especially in cerebrovascular diseases' early stages.

SST12-04 Assessment of Cerebral/Intestinal Perfusion Ratio Using Dynamic Color Doppler Sonography Quantification in Neonates with Hypoxic Ischemic Encephalopathy (HIE) Treated with Therapeutic Hypothermia

Friday, Dec. 4 11:00AM - 11:10AM Location: N229

Participants
Ricardo Faingold, MD, Montreal, QC (*Presenter*) Nothing to Disclose
Linda Morneault, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

Guilherme Santanna, MD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The objective of this study was to evaluate the perfusion ratio of the basal ganglia and intestinal wall using dynamic color Doppler sonography (CDS) in HIE neonates treated with hypothermia. We also aimed to investigate the correlation between this ratio and survival.

METHOD AND MATERIALS

Head ultrasound (HUS) and abdominal ultrasound were performed in all HIE neonates receiving hypothermia, as part of their routine care. CDS was performed with an 11LW4 MHz linear transducer to obtain DICOM color Doppler videos of the blood flow in the basal ganglia, in the coronal plane and sampled bowel loops in all quadrants. Videos of 3 seconds each were obtained for the region of interest (ROI) and used to calculate the cerebral perfusion intensity (CPI) of basal ganglia and intestinal perfusion intensity (IPI). Measurements of CPI and IPI were evaluated retrospectively by 2 radiologists using dedicated software. It allows automatic quantification of color Doppler data from a region of interest (ROI) by dynamically assessing color pixels and flow velocity during the heart cycle. Data is expressed in cm/sec and is calculated by multiplying the mean velocity of all pixels by the area divided by the ROI. Clinical and radiological data were evaluated retrospectively. Data are presented as mean ± SEM or median (quartiles). Appropriate statistical analysis was applied.

RESULTS

A total of 28 neonates were included: 16 male, 12 female, mean gestational age 39 ± 2 weeks, birth weight 3469 ± 607 grams, studies performed at 17.1 ± 10.5 hours of life. Seven neonates died. The basal ganglia /intestinal perfusion ratio was significantly higher in the 7 non survivors when compared to the 21 survivors (10.389 +/- 7.9 versus 2.660 +/- 2.5; p=0.001).

CONCLUSION

An increased basal ganglia /intestinal perfusion ratio was observed in non survivor neonates,submitted to hypothermia with severe HIE. Assessment of perfusion quantification with dynamic CDS in HIE might be a potential bedside biomarker of severity of insult in this critical population.

CLINICAL RELEVANCE/APPLICATION

Perfusion quantification with bedside ultrasound, using dynamic CDS, opens a window to better understand reperfusion injury and diving reflex in HIE neonates. This technique has the potential to be used as biomarker of severity of insult in this critical population.

SST12-05 Lesional Hyperperfusion in Leigh Disease Demonstrated by Arterial Spin-labeling

Friday, Dec. 4 11:10AM - 11:20AM Location: N229

Participants
Matt Whitehead, MD, Washington, DC (*Presenter*) Nothing to Disclose
Bonmyong Lee, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea L. Gropman, MD, Washington, DC (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Leigh disease is metabolic disorder of the respiratory chain or related components culminating in symmetric necrotizing lesions in the basal ganglia and/or brainstem among other locations. Apart from the classical gliotic and necrotic lesions found on histopathology, small vessel proliferation is also characteristic. Arterial spin-labeling (ASL) imaging has become a powerful adjunct for the detection of perfusion abnormalities during brain MR imaging. We have observed several cases of lesional hyperperfusion demonstrated by ASL sequences in patients with Leigh disease. The aim of this study is to evaluate lesional ASL perfusion characteristics in patients with Leigh disease and compare them to aged-matched normal exams.

METHOD AND MATERIALS

The brain MR imaging database from a single academic children's hospital was searched for the terms "ASL, arterial spin labeling, perfusion, and Leigh" to build a cohort for analysis. Each patient's electronic medical record was reviewed to confirm a diagnosis of Leigh disease. MR exams with excessive motion artifact, technical limitations, and without ASL images were excluded. ASL perfusion images were evaluated by a board certified neuroradiologist for the degree and extent of cerebral blood flow and relationship to brain lesions. Images were compared to normal exams from an aged-matched cohort.

RESULTS

The search yielded 33 exams; 23 were excluded. 10 exams from 5 separate Leigh patients were analyzed. 10 normal exams from aged-matched patients were also evaluated. In general, Leigh brain lesions ranged from hyperintense (n=8) to hypointense (n=2) on ASL perfusion images. Gliotic and necrotic lesions tended to be hypointense/hypoperfused. More active or recent lesions with associated restricted diffusion demonstrated hyperperfusion. ASL perfusion patterns differed significantly from aged-matched normal studies (p=<.0001).

CONCLUSION

Leigh disease patients have abnormal perfusion to brain lesions. Hyperperfusion is associated with more recent or active brain lesions, possibly corresponding to small vessel proliferation characteristic to the disease.

CLINICAL RELEVANCE/APPLICATION

ASL hyperperfusion could help distinguish Leigh disease from other similar appearing metabolic abnormalities and disease mimickers.

SST12-06 The Effect of Conscious Sedation on SWI Sequence of Brain MRI

Friday, Dec. 4 11:20AM - 11:30AM Location: N229

Awards
Trainee Research Prize - Resident

Participants
Yaser Al-Qasimi, MBBS, Detroit, MI (*Presenter*) Nothing to Disclose
Deniz Altinok, MD, Troy, MI (*Abstract Co-Author*) Nothing to Disclose
Sheena Saleem, MD, MBBS, Grosse Pointe Farms, MI (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Conscious sedation is frequently provided during MRI exams, especially in pediatric population. Medications used for conscious sedation have the inherent risk of affecting the oxygenation status, in part by their CNS inhibitory effect. The sensitivity of SWI sequence to deoxyhemoglobin is utilized in this study to evaluate the effects of various sedation medications on cerebral oxygenation.

METHOD AND MATERIALS

After applying selection criteria, retrospective analysis of SWI sequences from brain MRIs is performed. The degree of visualization of cerebral veins is evaluated and graded on a scale from 1 to 4. Other information recorded for each patient includes: the use of sedation medication, the use of supplemental oxygen, and the lowest recorded oxygen saturation during the exam. The investigators were blinded to patient information. The degree of visualization of cerebral veins is compared between different groups. Correlation is made to the lowest recorded oxygen saturation.

RESULTS

A total of 107 cases were enrolled: 33 non-sedated, 31 received pentobarbital (Nembutal), 31 received dexmedetomidine (Precedex), and 12 received diazepam (Valium). Patients who received Nembutal demonstrated significantly increased visualization of cerebral veins ($p<0.0001$), regardless of the use of supplemental oxygen. Patients who received either Precedex or Valium did not have statistically significant change in cerebral venous visualization compared to non-sedated patients. There was no correlation between the lowest recorded peripheral arterial oxygen saturation (pulse oximetry) readings and the degree of cerebral venous visualization on SWI. There was no statistically significant difference between pulse oximetry readings of different groups.

CONCLUSION

Evaluation of the SWI sequence shows evidence that pentobarbital administration is associated with higher concentrations of deoxyhemoglobin in cerebral venous blood. At the doses used for conscious sedation, this appears to be mediated by pentobarbital's known effect on cerebral blood flow (decreased) rather than arterial hypoxia and central hypoventilation. This raises the concern for temporary cerebral hypoxia associated with pentobarbital use, and needs to be further investigated. SWI sequence appears to be promising in evaluating cerebral hypoxia.

CLINICAL RELEVANCE/APPLICATION

SWI sequence proves an important, non-invasive method to evaluate the oxygenation status of the brain.

SST12-07 Whole-brain T2 qMRI Relaxometry of Extremely Low Gestational Age Newborn (ELGAN) Children at Ten Years of Age: Gender Differences

Friday, Dec. 4 11:30AM - 11:40AM Location: N229

Participants
Adam Aakil, MA, MBA, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Osamu Sakai, MD, PhD, Boston, MA (*Abstract Co-Author*) Speaker, Bracco Group; Speaker, Eisai Co, Ltd; Consultant, Guerbet SA
Alexander M. Norbash, MD, Boston, MA (*Abstract Co-Author*) Co-founder, Boston Imaging Core Laboratories, LLC;
Mufeed Mahd, PhD, Lowell, MA (*Abstract Co-Author*) Nothing to Disclose
Hernan Jara, PhD, Belmont, MA (*Presenter*) Patent holder, qMRI algorithms Research Grant, General Electric Company Royalties, World Scientific Publishing Co

PURPOSE

Extremely low gestational age newborns (ELGANs) are defined as infants born before the 28th week after gestation. The purpose herein was to study the whole-brain qMRI distributions of the transverse relaxation time (T2) in a population of ELGAN infants at nine to ten years of age. A further objective was to detect potential brain tissue T2 gender differences.

METHOD AND MATERIALS

Children were MRI scanned at twelve ELGAN participating sites: all scanners were 3T (GE, Philips and Siemens), except one 1.5T (GE). The dual-echo turbo spin echo (DE-TSE) MR images of ninety-eight subjects (38 males and 60 females) were qMRI processed resulting in three-dimensional T2 maps covering the whole head. All tissues contained in the intracranium (intracranial matter (ICM) = gray matter plus white matter plus meninges and cerebrospinal fluid) were segmented using a dual-clustering algorithm programmed in Mathcad. The ninety-eight ICM T2 histograms were tabulated in Excel as a function of increasing ICM volume and separated by gender; these were further processed in Mathcad to yield individual and population measures: mean and standard deviation brain T2 values.

RESULTS

The mean brain T2 values are graphed in Fig. 1 (top) for males (left) and females (right): the population T2 averages are 90.5±13.5 ms and 89.5±12.6 ms for males and females respectively. The combined population histograms are shown in Fig. 1 (bottom): note the much higher T2 data uniformity for female versus male infants (dotted red lines).

CONCLUSION

Both graphic data displays (Fig. 1 top and bottom) as well as the statistical measures point to a significantly higher T2 heterogeneity for the ELGAN brains of male versus female infants. This initial finding could indicate a higher vulnerability of very early preterm birth in males versus females.

CLINICAL RELEVANCE/APPLICATION

T2 qMRI relaxometry could become a valuable clinical tool for assessing the brain tissue integrity of children in the context of preterm birth.

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Hernan Jara, PhD - 2014 Honored Educator
Osamu Sakai, MD, PhD - 2013 Honored Educator
Osamu Sakai, MD, PhD - 2014 Honored Educator
Osamu Sakai, MD, PhD - 2015 Honored Educator

SST12-08 Neuroimaging Findings in a New Pattern of Neonatal Ischemic Encephalopathy Associated with Excessive Uterine Activity

Friday, Dec. 4 11:40AM - 11:50AM Location: N229

Participants
Jill V. Hunter, MD, Houston, TX (*Presenter*) Author with royalties, UpToDate, Inc
Stewart Ater, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Michelle L. Murray, PhD,RN, Albuquerque, NM (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To test the null hypothesis that a pattern of neonatal, predominantly cortical, ischemic injury would not be associated with a labor and delivery during which there were extended periods of shortened resting interval.

METHOD AND MATERIALS

The neonatal imaging in 10 full term children with established motor and cognitive delays, in whom perinatal infection and metabolic disorders had been ruled out, was retrospectively reviewed and correlated with the electronic fetal monitoring (EFM) strips.

RESULTS

The children had a pattern of cortical laminar necrosis that was not a classic watershed, and with a lesser degree of deep gray nuclear ischemia that did not conform to the established patterns of a typical prolonged partial or acute profound hypoxic-ischemic injury. Most of these infants, (8/10), were delivered with a pH >7.0 and without features of sytemic asphyxia. Retrospective analysis of the EFM in these 10 cases revealeda pattern of more than 2 hours of continuous excessive uterine activity with resting intervals of less than 60 seconds duration. Nine of the 10 mothers were nulliparous.

CONCLUSION

The null hypethesis is not proven and the results suggest an association between shortened resting intervals and a previously unrecognized pattern of neonatal, predominantly cortical, ischemic injury.

CLINICAL RELEVANCE/APPLICATION

Cerebral palsy and the sequelae of a previously unrecognized pattern of ischemic encephalopathy has enormous fiscal implications. These neonates do not meet current criteria for hypothermia therapy which may help improve their outcome. In addition if the underlying causes of a shortened resting interval can be recognized prospectively and terminated by the more judicious use of uterine stimulants then it may be feasible to prevent or minimize this cause of neonatal brain injury.

SST12-09 An Intraoral B0 Field Correction Device for Decreasing Magnetic Susceptibility Artifacts on Brain MRI Induced by Stainless Steel Orthodontic Appliances

Friday, Dec. 4 11:50AM - 12:00PM Location: N229

Participants
Zhiyue J. Wang, PhD, Dallas, TX (*Presenter*) Nothing to Disclose
Yong Jong Park, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose
Youngseob Seo, PhD, Daejeon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Michael C. Morriss, MD, Pinehurst, TX (*Abstract Co-Author*) Nothing to Disclose
Nancy K. Rollins, MD, Dallas, TX (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Susceptibility artifacts from orthodontia are a common problem that can interfere with MRI for acute CNS diseases. The artifacts result from ferromagnetic materials in the orthodontia and alteration in B0 field. Recently available rare earth iron permanent magnets have the potential in cancellation of the unwanted B0 effects. We report the initial experience with a prototype field correction device.

METHOD AND MATERIALS

Commercial NdFeB rectangular prism magnets (grade N38EH, intrinsic coercivity 30 kOe) were embedded in front of the teeth between 2 layers of dental plastic sheets in the shape of a mouth-guard, with the magnetization opposing the B0 field. The first prototype had one upper and one lower piece for maxillary and mandibular arches with a total magnetic moment of 0.124 $A{\cdot}m^2$. Subsequent modifications used multiple upper and lower pieces to cover a range of magnetic moment from 0.010 to 0.200 $A{\cdot}m^2$.Human subject studies were conducted with IRB approval at 1.5T without sedation. We studied 3 volunteers with orthodontia and one patient. Brain MRI scans were acquired without and with the subject wearing the field correction device.

RESULTS

Based on B0 map, the total induced magnetic moment of braces in the subjects ranged from 0.009 to 0.194 $A{\cdot}m^2$, with a median value of 0.134 $A{\cdot}m^2$. For the case of the lowest magnetic moment, the braces were essentially non-magnetic and the artifact arose from a unilateral ferromagnetic implant. The device improved B0 homogeneity. In 3 subjects adequate quality EPI-DWI scans were acquired with the device. However, complete correction of geometric distortions was not achieved. Sufficient correction of

geometric distortion on sequences sensitive to susceptibility, e.g. DWI, requires a fairly close match between the device and braces both in the total value and the spatial distribution of magnetic moment.The device may experience noticeable forces and torques near or inside MRI scanners. The device may break or escape from the mouth. The device should be wrapped inside a thin, soft plastic sheet and tethered down using a string during the MRI study for patient protection.

CONCLUSION

Susceptibility artifacts from orthodontia can be decreased with a novel B0 field correction device. This approach is promising although further improvement is needed.

CLINICAL RELEVANCE/APPLICATION

The study may lead to a device that enables diagnostic quality MR examinations for patients wearing braces.