

Friday

RC802

Modern Methods of Education - Innovation, Social Media, and Active Learning

Friday, Dec. 4 8:30AM - 10:00AM Location: E351

ED

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

Participants

Mahesh M. Thapa, MD, Seattle, WA (*Moderator*) Nothing to Disclose

Sub-Events

RC802A Beyond Slideshows...Innovative Methods to Make Presentation

Participants

Jeffrey P. Otjen, MD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss innovative methods that can improve radiology education initiatives. 2) Review the pros and cons of these various strategies.

RC802B Using Social Media for Radiology Education

Participants

Arnold C. Merrow JR, MD, Cincinnati, OH, (carl.merrow@cchmc.org) (*Presenter*) Author with royalties, Reed Elsevier; Consultant, Reed Elsevier ;

LEARNING OBJECTIVES

1) To discuss possible roles for social media utilization in radiology education. 2) To review advantages and disadvantages of various social media platforms for engaging radiology learners. 3) To enable attendees to leverage social media applications for their teaching goals.

RC802C The Flipped Classroom - Engagement through Active Learning

Participants

Mahesh M. Thapa, MD, Seattle, WA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Reiterate the difference between active and passive learning. 2) Describe the principles of Active Learning. 3) Incorporate the principles of Active Learning into his/her teaching.

RC853

Workflow Tools to Optimize Departmental Operations

Friday, Dec. 4 8:30AM - 10:00AM Location: E352



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

Participants

Bradley J. Erickson, MD, PhD, Rochester, MN (*Moderator*) Stockholder, Evidentia Health, Inc; Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC

LEARNING OBJECTIVES

1) Become familiar with workflow technologies that are available and being used in other industries. 2) See how workflow terminologies can be applied in practice. 3) See how workflow engines have been applied in radiology.

ABSTRACT

Workflow is a critical element of safe and efficient practices. Workflow is usually supported by using relational databases, which tends to force a linear workflow into practice. SQL queries are also not optimal for detecting and handling error conditions. Workflow engines are used in other industries for exactly those reasons--they help enforce an agreed upon optimal pathway of events, and make it easy and clear how to deal with error and exception conditions. While they have been applied in healthcare, those experiments have usually failed because the implementation did not handle error conditions well, and did not completely model the richness and complexity of healthcare. Radiology tends to be more straightforward, and may be a good area to use workflow engines. In this session, we will describe one implementation in a clinical practice, as well as use in research and clinical trials. As we have begun to use workflow engines, it became apparent that agreeing on the names for key steps in the workflow would be helpful. Such a common lexicon would help us to assure that workflow was done in the same way in different locations. It could also allow us to measure the efficiency of workflows. This latter aspect was perceived to be of great value to practices across the world, and led to the creation of the SIIM Workflow Initiative in Medicine (SWIM) lexicon, which is now a part of RadLEX. The basic concepts of SWIM and its connection to IHE and the practice will be described.

Sub-Events

RC853A Managing Your Department with Workflow Engines

Participants

Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Stockholder, Evidentia Health, Inc; Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC

LEARNING OBJECTIVES

1) Become familiar with workflow engine technology. 2) Understand how workflow engines can be used within a radiology department. 3) Understand strengths and weaknesses of workflow engines compared to alternative methods like databases.

ABSTRACT

Workflow engines are used in a variety of industries because they can improve efficiency and quality. The same is true for radiology. Workflow engines can help assure that we routinely apply the optimal algorithms and processing steps for best quality care. They can also assure that things don't 'fall through the cracks'. Finally, they can also automate steps that don't need human intervention, both reducing cost of practice, and increasing the timeliness of care.

RC853B Measuring Your Department with the SWIM Lexicon

Participants

Marc D. Kohli, MD, San Francisco, CA (*Presenter*) Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Describe existing heterogeneity of workflow terminology. 2) Explain benefits arising use of a standard nomenclature for workflow steps. 3) Provide details regarding how the SWIM lexicon could be applied in the learner's environment.

ABSTRACT

In current practice, standard workflow steps such as the arrival of a patient to the imaging department, and completion of the exam are tracked in a very heterogenous manner with imprecise terminology. In order to better understand and compare workflow across radiology departments, a common language must be devised and deployed. The SIIM Workflow Initiative In Medicine (SWIM) lexicon aims to address this challenge. We will illustrate how the SWIM lexicon can be used to measure and compare workflow in a radiology department.

RC853C Monitoring Your Department with Dashboards

Participants

Christopher D. Meenan, Baltimore, MD, (cmeen@umm.edu) (*Presenter*) Principal, Analytical Informatics, Inc; Stockholder, Analytical Informatics, Inc

LEARNING OBJECTIVES

1) Describe what a radiology department dashboard entails. 2) Give three examples of key performance indicators for a radiology

department. 3) Explain how dashboards have created an impact in other practices.

ABSTRACT

Leveraging dashboards and other business intelligence tools to measure and improve operational quality can be an effective way for clinical departments to navigate change. Unfortunately for many organizations, the simple acquisition of new technology or new software does not automatically translate to more efficient and effective operations. There is typically a cultural component that must be addressed, and that is essential to understand if an Imaging Department is to realize the key benefits of any technical solution. Defining clear goals around what to measure, understanding data quality issues, and ensuring organizational buy-in are all part of the journey to becoming a data-driven Department.

Forensic Radiology: Preparing Cases for the Court Room (An Interactive Session)

Friday, Dec. 4 8:30AM - 10:00AM Location: E353A

OTAMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credits: 1.50**Participants**

Angela D. Levy, MD, Washington, DC (*Moderator*) Nothing to Disclose
Howard T. Harcke, MD, Dover AFB, DE, (howard.harcke@gmail.com) (*Presenter*) Nothing to Disclose
Barry D. Daly, MD, Baltimore, MD, (bdaly@umm.edu) (*Presenter*) Research Grant, Koninklijke Philips NV
David Fowler, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Edward L. Mazuchowski, MD, PhD, Dover AFB, DE (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the strengths and limitations of the imaging techniques used in forensic radiology. 2) Explain how the courtroom use of imaging findings assists expert witnesses such as forensic pathologists or radiologists. 3) Compare the role of the radiologist and forensic pathologist in preparing cases for the courtroom. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

ABSTRACT

Radiography, CT, CT angiography, and MRI are routinely used in forensic radiology. These are widely accepted imaging techniques that are becoming important diagnostic tools for forensic pathologists. Increasingly, CT and MRI images are being used to provide evidence in the courtroom and the radiologist and pathologist must appreciate how imaging findings may be complementary to or more sensitive than autopsy findings. Imaging findings provide additional objective evidence that can be easily displayed. In some cases, forensic imaging may support evidence from accident or crime scene investigations or may be the sole finding to support a theory for the mechanism and cause of injury or death. Such studies may influence jury members and contribute in securing either a criminal conviction or acquittal where appropriate. In this course, radiologists are paired with a forensic pathologist to discuss cases that they typically encounter in practice. The cases will be presented to the audience in a systematic manner with imaging and autopsy findings to teach the audience how imaging is used in the court to supplement the testimony of the medical examiner or expert radiologist. Examples include the meaning of hyoid fracture in strangulation; assessment of perforating gunshot wounds; the significance of intravascular air; and, the appearance of stillbirth versus live birth in infant death.

RC812

Acute Abdominal Vascular Diseases (An Interactive Session)

Friday, Dec. 4 8:30AM - 10:00AM Location: E353B



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

FDA Discussions may include off-label uses.

Participants

Sub-Events

RC812A Aortic Branch Dissections

Participants

Dominik Fleischmann, MD, Palo Alto, CA (*Presenter*) Research support, Siemens AG;

LEARNING OBJECTIVES

1) Review the epidemiology of aortic side-branch dissections, which can occur as a complication of aortic dissection, or as isolated spontaneous dissections of the visceral or renal arteries. 2) Explain the pathophysiology of side branch malperfusion syndromes in aortic dissection. 3) Present the spectrum of imaging findings in spontaneous aortic branch dissections, including the differential diagnosis (vasculitis, connective tissue diseases, fibromuscular dysplasia, segmental arterial mediolysis).

ABSTRACT

Dissections of aortic side branches is a common complication of Type A and Type B acute aortic dissection which substantially increases mortality. It is important to understand the pathophysiology and the two principle mechanisms of side branch malperfusion in aortic dissection: flow obstruction can be due to (A) local abnormalities, such as occlusive dissection flaps, blind ending false lumen with true lumen occlusion ('windsock'), or frank thrombosis. Side-branch malperfusion may also occur due to (B) limited inflow: The classic situation is complete true lumen collapse in the upstream aorta, resulting in underperfusion of all downstream branches supplied by the true lumen. While local obstructions are most commonly treated by stent placement into the diseased side branch, inflow-lesions typically require surgical or endovascular repair of the upstream aorta. Spontaneous dissections of the celiac, mesenteric, or renal arteries are relatively rare events, and typically present with acute abdominal or flank pain. Dissections of side branch arteries can lead to ischemic complications or to frank rupture with intra- or retroperitoneal hemorrhage. Patients presenting with mesenteric or renal artery dissection require a thorough workup to identify genetic disorders (notably Ehlers Danlos IV), inflammatory conditions (vasculitis), and other entities such as fibromuscular dysplasia and segmental arterial mediolysis (SAM). Imaging findings range from non-obstructive lesions such as intramural hematoma, double-barrel lumen, to partial or complete obstruction ('windsock'). Complications include rupture or ischemia. Spontaneous dissections may heal, or evolve into aortic branch aneurysms.

RC812B Symptomatic Aneurysms

Participants

Phillip M. Young, MD, Rochester, MN, (young.phillip@mayo.edu) (*Presenter*) Nothing to Disclose

ABSTRACT

Symptomatic aneurysms cover the spectrum of arterial aneurysms presenting with a) localized symptoms secondary to aneurysm expansion and possible rupture b) regional symptoms secondary to dissection and embolism and c) systemic cardiovascular dysfunction related to hypotension and organ dysfunction. Common clinical scenarios include aneurysm rupture - most commonly abdominal aortic, popliteal and abdominal visceral aneurysms as well as thoracoabdominal aortic dissection. Symptomatic aneurysms may also occur in patients with known arterial pathology including connective tissue disorders such as Marfan's and Ehlers-Danlos syndrome and Takayasu aortitis/arteritis. Patients with suspected rupture of abdominal aortic or ileofemoropopliteal artery aneurysms may initially be evaluated by sonography. However, in all circumstances, CT angiography due to its robust implementation and high-resolution imaging of the vasculature and regional anatomy that allows for planning of endovascular and surgical intervention is the preferred technique. CT Angiographic protocols appropriate to the suspected anatomic location of the aneurysm that provide an adequate roadmap for endovascular or surgical intervention are employed. Extended coverage is particularly important in patients with suspected thoracoabdominal aortic dissection or aneurysms associated with peripheral embolism. Cardiac gating should be utilized in any patient with a suspected type A aortic dissection or rupture of an ascending aortic aneurysm. Aortic, cardiac and coronary artery imaging are integral to the evaluation and management of these patients. A particular subset of the "symptomatic aneurysm" is post-trauma aortic disruption, usually thoracic in which diagnosis of traumatic aneurysm is critical and the aneurysm is associated with additional sites of soft tissue and skeletal trauma. Guidelines for endovascular or surgical intervention or non invasive management with serial CT Angiographic imaging will be discussed.

RC812C Mesenteric Ischemia

Participants

Iain D. Kirkpatrick, MD, Winnipeg, MB, (kirkpatrick_iain@hotmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the various categories of mesenteric ischemia (arterial occlusive, embolic, venous thrombotic, and nonocclusive), and the pathophysiologic basis behind the imaging findings in each case. 2) Understand the basis behind modern CT protocols for mesenteric ischemia, particularly the biphasic examination with CT mesenteric angiography. 3) Demonstrate techniques to rapidly analyze a mesenteric CT angiographic dataset. 4) Review the CT signs of mesenteric ischemia and their sensitivity and specificity.

5) Evaluate the current literature on mesenteric ischemia and discuss optimal diagnostic criteria.

ABSTRACT

Acute mesenteric ischemia (AMI) is a life-threatening condition said to affect up to 1% of patients presenting with an acute abdomen, and it carries a mortality rate ranging between 59-93% in the published literature. Time to diagnosis and surgical treatment are the only factors which have been shown to improve mortality, and evidence shows that the clear test of choice for AMI is now biphasic CT. Water is preferably administered as a negative contrast agent, followed by CT mesenteric angiography and then a portal venous phase exam. Diagnostic accuracy is significantly improved by analysis of the CT angiogram for arterial stenoses or occlusions, evidence of emboli, or angiographic criteria of nonocclusive ischemia. It is the use of CT angiography in addition to routine portal phase imaging which has pushed the sensitivity and specificity of the test to >90% in recent published articles. Other nonangiographic CT findings that are relatively specific for AMI in the appropriate clinical setting include pneumatosis intestinalis, portal or mesenteric venous gas or thrombosis, and decreased bowel wall enhancement. Bowel wall thickening, mesenteric stranding, ascites, and mucosal hyperenhancement are more nonspecific findings which may also be seen. Nonocclusive ischemia may be the most difficult form to diagnose, and findings of shock abdomen can aid in identification. Knowledge of the patient's clinical history is critical not only for the selection of an appropriate study protocol but also for interpretation of the imaging findings in context.

RC812D Gastrointestinal Bleeding

Participants

Jorge A. Soto, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the appropriate implementation of CT angiography in the evaluation of patients presenting with acute lower intestinal bleeding. 2) To describe the technical details that are necessary for acquiring good quality CT angiography examinations. 3) Illustrate the characteristic CT angiographic findings of active or recent bleeding with specific examples of multiple etiologies.

ABSTRACT

Acute gastrointestinal bleeding is a 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. 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 the inability to precisely localize the source of bleeding and determine its cause. Properly performed and interpreted CT angiography examinations offer 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.

Honored Educators

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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

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 various 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 prognosis 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. Conclusion: Based 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.bremerich@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 $\text{Volume}_{\text{antegrade}}/\text{Volume}_{\text{retrograde}} * 100 [\%]$. 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 ($\Delta P = 4 * V_{\text{max}}^2$). Mitral regurgitation may also be quantified by MRI. Echocardiographic quantification relies predominantly 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 future 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>

RC829

Body MRI: Clinical Challenges (An Interactive Session)

Friday, Dec. 4 8:30AM - 10:00AM Location: E450A



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 clinical indications that may indicate the use of pelvic 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>

RC806

Head and Neck Emergency!

Friday, Dec. 4 8:30AM - 10:00AM Location: E450B



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

Participants

Sub-Events

RC806A Adult Non-Traumatic Emergencies

Participants

Karen L. Salzman, MD, Salt Lake City, UT, (karen.salzman@hsc.utah.edu) (*Presenter*) Consultant, Reed Elsevier; Stockholder, Reed Elsevier

LEARNING OBJECTIVES

1) Review imaging techniques of nontraumatic adult head and neck emergencies. 2) Recognize non-traumatic adult head and neck emergencies and diagnose the extent of disease and its complications.

RC806B Pediatric Non-Traumatic Head and Neck Emergencies

Participants

Caroline D. Robson, MBChB, Boston, MA (*Presenter*) Editor with royalties, Reed Elsevier; Author with royalties, Reed Elsevier;

LEARNING OBJECTIVES

1) Familiarize the audience with imaging protocols that should be used for assessing pediatric head and neck emergencies. 2) Recognize pediatric head and neck emergencies and effectively diagnose the extent of disease and its complications. 3) Provide reports that enable the referring clinician to effectively treat pediatric head and neck emergencies.

ABSTRACT

The talk will focus on pediatric airway obstruction. Please see attached pdf of the talk including two articles for reference regarding pediatric nasal lesions.

Abstract Handout: Caroline Diana Robson

<http://abstract.rsna.org/uploads/2015/15001963/RC806B Pediatric Non-Traumatic Head and Neck Emergencies.pdf>

RC806C Traumatic Head and Neck Emergencies

Participants

Lindell R. Gentry, MD, Madison, WI, (lgentry@uwhealth.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate the most common traumatic lesions that are encountered in the head and neck. 2) Discuss the important traumatic complications of the face, orbit, skull base, temporal bone, and blood vessels. 3) Discuss imaging strategies to effectively diagnose these traumatic lesions and their complications.

ABSTRACT

Traumatic injury of the head and neck is one of the most important and common diagnostic problems that radiologists will encounter in daily practice. Because of the vulnerability of important bony and soft tissue structures in this region, significant traumatic and potentially life-altering complications may be encountered with blunt and penetrating traumatic forces. Traumatic forces may cause injury of the bony and soft tissue structures of the orbit, including the globe, extraocular muscles, optic nerve, and 3rd-6th cranial nerves. This may result in ocular rupture, extraocular muscle entrapment, retrobulbar hemorrhage, proptosis, traumatic optic neuropathy, and superior orbital fissure syndrome. Diagnosis and management of these orbital injuries will be reviewed. Significant dental malocclusion or malunion may arise from displaced fractures of the mandible. Critical airway compromise may be caused by traumatic injury of the mandible, larynx, and trachea. Skull base and temporal bone trauma may produce a number of important complications that will be addressed in this lecture. These include conductive and sensorineural hearing loss, cerebrospinal fluid leak, traumatic facial palsy, lower cranial nerve injury, as well as cerebrovascular injury. Cerebrovascular injury is one of the most important and potentially life-altering complications that may be encountered with both blunt and penetrating craniocervical trauma. The vulnerable position of the extracranial and intracranial cerebral vasculature makes these vessels highly susceptible to traumatic injury. Fractures of the skull base or cervical spine may cause a variety of critically important traumatic lesions (dissection, pseudoaneurysm, occlusion, rupture, arteriovenous fistula). This lecture will discuss high risk imaging signs that suggest the possibility of cervical or intracranial cerebrovascular trauma. The rationale for effective imaging workup and identification of these injuries will be emphasized.

RC808

Emergency Ultrasound Pitfalls (An Interactive Session)

Friday, Dec. 4 8:30AM - 10:00AM Location: E353C



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

Participants

Sub-Events

RC808A Pitfalls in Right Upper Quadrant Ultrasound

Participants

Mindy M. Horrow, MD, Philadelphia, PA, (horrowm@einstein.edu) (*Presenter*) Spouse, Director, Merck & Co, Inc

LEARNING OBJECTIVES

1) Describe technical factors that may improve visualization of cholelithiasis including appropriate frequency transducer and identification of gallbladder neck. 2) Identify non biliary causes of gallbladder wall thickening. 3) Recognize causes for non-visualization of a fluid filled gallbladder and how to differentiate the gallbladder from other fluid filled structures in the right upper quadrant. 4) Describe situations in which color Doppler is essential to detect renal causes of right upper quadrant pain.

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Mindy M. Horrow, MD - 2013 Honored Educator

RC808B Pediatric Abdominal Ultrasound Pitfalls

Participants

Susan D. John, MD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Use optimal protocols for performing abdominal US in infants and children. 2) Avoid diagnostic errors in pediatric gastrointestinal US caused by common artifacts and variables in exam performance. 3) Recognize variations in pathology and important secondary findings that are helpful for the diagnosis of acute or emergent conditions in the pediatric abdomen.

ABSTRACT

RC808C Non-obstetrical Gynecologic Ultrasound Pitfalls

Participants

Ana P. Lourenco, MD, Providence, RI, (alourenco@lifespan.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize commonly encountered gynecological ultrasound pitfalls. 2) Describe strategies to avoid these pitfalls.

ABSTRACT

This session will review common pitfalls encountered in gynecologic ultrasound and highlight strategies for avoiding such pitfalls. Case-based presentations will illustrate the varied presentations of ovarian torsion, non-gynecologic etiologies for acute pelvic pain including ureteral calculi and acute appendicitis, and a variety of uterine, ovarian and adnexal abnormalities. The benefits and limitations of transabdominal and transvaginal imaging, as well as color Doppler, will be highlighted with examples to demonstrate the utility of each technique.

Active Handout: Ana P. Lourenco

http://abstract.rsna.org/uploads/2015/15003351/Active_RC808C.pdf

RC808D First Trimester Ultrasound Pitfalls

Participants

Mariam Moshiri, MD, Seattle, WA (*Presenter*) Consultant, Reed Elsevier; Author, Reed Elsevier

LEARNING OBJECTIVES

1) To review the relatively recent report of the Society of Radiologists in Ultrasound, on new ultrasound criteria for evaluation of first trimester pregnancy. 2) To demonstrate potential pitfalls of sonographic performance and interpretation in the first trimester of pregnancy, and to discuss how to avoid them. 3) To review other relevant, very recent literature on first trimester pregnancy ultrasound performance and interpretation.

Honored Educators

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Mariam Moshiri, MD - 2013 Honored Educator

Mariam Moshiri, MD - 2015 Honored Educator

RC804

Musculoskeletal Series: Shoulder and Elbow MR Imaging

Friday, Dec. 4 8:30AM - 12:00PM Location: E451A



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](http://abstract.rsna.org/uploads/2015/15001699/Bencardino%20Triceps%20tendon%20and%20cubital%20tunnel.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 frequently overlooked 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](http://abstract.rsna.org/uploads/2015/15001700/RC804-01handout%20Avoiding%20pitfalls%20in%20shoulder%20MR%20imaging.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

SS MRI osseous retracts are equivalent to and demonstrate no significant statistical difference from SDR osseous retracts, 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 $4.0 \pm 1.6 \text{ cm}^2$ (mean \pm SD) vs $5.6 \pm 1.7 \text{ cm}^2$ ($p < 0.001$). 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. Roedel, 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 (\pm SD 57) compared to 209 lbs (\pm 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 osteoarthritis is 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 shoulder. 3) 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 the Glenoid: 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 heavily 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

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Jenny T. Bencardino, MD - 2014 Honored Educator

RC801

Lung Cancer Screening: Structured Reporting, Management and Practice Metrics (LungRADS)

Friday, Dec. 4 8:30AM - 10:00AM Location: E451B

CH CT

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

Participants

Ella A. Kazerooni, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To learn why structured reporting is important in the practice of lung cancer screening with CT. 2) To learn what the LUNGRADS structured reporting categories are and what management is associated with each category. 3) To understand how to evaluate lung nodules for reporting in the LUNGRADS coding scheme. 4) To learn basic practice audit variables to collect and follow to evaluate a lung cancer screening CT program.

ABSTRACT

Lung cancer is the leading cause of cancer death in the US for both men and women, exceeding the number of deaths from cancers of the breast, colon, and prostate combined. For each of these cancers, there are well established screening tests. Screening for current and former smokers with LDCT is the only method ever proven to reduce lung cancer mortality in this high risk population and it has also been shown to be cost effective. In December 2013 the USPSTF gave lung cancer screening with CT a grade B; recommendation for high risk older current and former smokers. To prepare radiologists to practice lung cancer screening with CT, the ACR Committee on Lung Cancer Screening formed a working group to develop LUNGRADS, which made its version 1.0 debut in 2014. Similar to BIRADS which is in use, LUNGRADS provides practicing radiologists with a tool to use for categorizing abnormalities found on lung cancer screening CT exams, with management recommendations for each category. In this course we will review why structured reporting and management is important in lung cancer screening CT. As a public health screening tool, performing the exams with high quality, using standardized reporting and following standard management algorithms is important to minimize overdiagnosis, overutilization of diagnostic testing and interventional procedures ranging from percutaneous biopsy to bronchoscopy and surgery. The LUNGRADS categories try to follow BIRADS approach to coding when possible, recognizing that there are differences in screening for lung cancer and breast cancer. Exams are coded as incomplete (category 0), negative; for clinically active cancer (category 1), benign (category 2), probably benign (category 3) and suspicious (category 4). Additional modifiers such as ;S; can be used for clinically significant or potentially clinically significant findings (non lung cancer). Details of using this coding system and metrics to evaluate a screening practice will be discussed.

Sub-Events

RC801A Development

Participants

Ella A. Kazerooni, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

See course 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/>

Ella A. Kazerooni, MD - 2014 Honored Educator

RC801B Benign and Prob Benign

Participants

Ann N. Leung, MD, Stanford, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the CT findings and types of abnormalities that are classified under the 'Benign' and 'Probably Benign' categories.

RC801C Suspicious/Malignant

Participants

James G. Ravenel, MD, Charleston, SC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

View abstract under main course title.

RC801D Significant Other Findings

Participants

Reginald F. Munden, MD, DMD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

See learning objectives under main course title

ABSTRACT

View abstract under main course title

RC801E Practice Metrics and Audit

Participants

William C. Black, MD, Lebanon, NH, (William.C.Black@Hitchcock.Org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Active Handout:William C. Black

<http://abstract.rsna.org/uploads/2015/14000756/RC801E.pdf>

RC801F Panel Discussion

Participants

RC814

Interventional Series: Complications in Interventional Oncology-Avoidance and Damage Control

Friday, Dec. 4 8:30AM - 12:00PM Location: N228

GI **VA** **IR** **OI** **RO**

AMA PRA Category 1 Credits™: 3.25
ARRT Category A+ Credits: 3.75

FDA Discussions may include off-label uses.

Participants

Charles E. Ray JR, MD, PhD, Chicago, IL, (chary@uic.edu) (*Moderator*) Advisory Board, Novate Medical Ltd; Editor, Thieme Medical Publishers, Inc; ; ; ; ;
Robert J. Lewandowski, MD, Chicago, IL (*Moderator*) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc

LEARNING OBJECTIVES

1) List 2 important recent publications in interventional oncology. 2) Explain the mechanism of one complication related to thermal ablation. 3) Describe 1 pitfall of radioembolization. 4) Outline 3 complications in combination therapy for hepatocellular carcinoma. 5) List three complications of chemo-embolization.

ABSTRACT

Sub-Events

RC814-01 Chemoembolization Complications

Friday, Dec. 4 8:30AM - 8:45AM Location: N228

Participants

Charles E. Ray JR, MD, PhD, Chicago, IL (*Presenter*) Advisory Board, Novate Medical Ltd; Editor, Thieme Medical Publishers, Inc; ; ; ; ;

LEARNING OBJECTIVES

View learning objectives under main course title.

RC814-02 DNA ChemoFilter: Novel Method to Prevent Toxicity from Intra-Arterial Administration of Chemotherapeutic

Friday, Dec. 4 8:45AM - 8:55AM Location: N228

Participants

Mariam S. Aboian, MD, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose
Chia-Hung Sze, MS, San Francisco, CA (*Abstract Co-Author*) Researcher, ChemoFilter Inc
Jay F. Yu, MS, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Ayushi Gautam, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Prasheel Lillaney, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
David M. Wilson, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Anand S. Patel, MD, San Francisco, CA (*Abstract Co-Author*) Stockholder, ChemoFilter, Inc Officer, ChemoFilter, Inc
Mark W. Wilson, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
Steven W. Hetts, MD, San Francisco, CA (*Abstract Co-Author*) Consultant, Silk Road Medical Inc Consultant, Medina Medical Inc
Research Grant, Stryker Corporation Data Safety Monitoring Board, Stryker Corporation

PURPOSE

ChemoFilter is a novel medical device that limits systemic toxicity of chemotherapeutics by filtering non-target drug from blood that could be described as intra-vascular dialysis. This method has a potential to prevent toxicity associated with treatment of head and neck cancer, such as renal failure associated with cisplatin. We report a novel method to bind chemotherapeutics in blood that uses immobilized DNA as a platform for binding chemotherapeutics with intrinsic DNA binding activity.

METHOD AND MATERIALS

DNA binding experiments were carried out in vitro with doxorubicin in PBS solution. Genomic DNA was used to determine the concentration of DNA that shows optimum binding kinetics. Binding kinetics in nylon mesh of different pore size was evaluated.

RESULTS

DNA binding kinetics by doxorubicin is dose dependent and is very rapid with 94% decrease in drug concentration from solution within 1 minute of reaction time. DNA demonstrates faster binding kinetics by doxorubicin as compared to previously published polystyrene resin that uses ion exchange to filter doxorubicin out of the solution. DNA sequestered within the Nylon mesh demonstrates approximately 70% decrease in doxorubicin concentration from solution within 5 minutes.

CONCLUSION

DNA ChemoFilter demonstrates rapid binding of doxorubicin and is a model for filtration of DNA binding chemotherapeutics from the bloodstream.

CLINICAL RELEVANCE/APPLICATION

DNA ChemoFilter is optimized for DNA intercalating chemotherapeutics and minimizes their systemic toxicity after intra-arterial administration for treatment of liver and head and neck malignancies.

RC814-03 Repeated Transarterial Chemoocclusion with Degradable Starch Microspheres (DSMs-TACO) of Unresectable Hepatocellular Carcinoma: A Single Center Experience

Friday, Dec. 4 8:55AM - 9:05AM Location: N228

Participants

Fabrizio Chegai, MD, Rome, Italy (*Presenter*) Nothing to Disclose
Antonio Orlacchio, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefano Merolla, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Laura Greco, Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
Elisa Costanzo, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Giovanni Simonetti, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the efficacy and safety of trans-arterialchemo-occlusion (TACO) using Degradable-Starch-Microspheres (DSMs) for unresectable hepatocellular carcinoma (HCC) treatment.

METHOD AND MATERIALS

We prospectively enrolled 28 HCC cirrhotic patients (23/5 M/F, mean age 66.3±10.5 years), to be treated with three repeated DSMs-TACO procedures (225 mg of DSMs, Embocept®S, PharmaCept and Doxorubicin Cloridrate, 50 mg/m²), performed at 4-6 week intervals. Patients were clinically evaluated before and after each procedure and disease severity scored according to Child Pugh and MELD scores. Treatment response was assessed by CT-scan 4 weeks after each procedure, according to mRECIST criteria.

RESULTS

Complete response (CR) was observed in 6 (20.8%), 11 (37.5%) and 14 (58.3%) patients after the first, second and third procedure, respectively. At the end of the treatment course all patients experienced at least a partial response. Patients with monobar disease (16/28: 57.1%) showed higher CR rates after the first procedure compared to those with bilobar HCC (6 vs 0, p=0.017). No differences between mono or bi-lobar disease were observed in CR (64.2% vs 50%; p=ns). Eight patients (33.3%) did not complete the planned repeated procedures. In most cases treatment discontinuation was due to worsening liver function, mainly in patients with more advanced liver disease.

CONCLUSION

DSMs-TACO offers a valid therapeutic option in patients with unresectable HCC. A careful patients selection is required in order to avoid worsening liver function in patients with border-line liver compensation. Further investigations to establish the best treatment schedule and to define the effect of DSMs-TACO on survival are required.

CLINICAL RELEVANCE/APPLICATION

Temporary embolization of the hepatic artery using DSMs is feasible and safe in patients with HCC and an impaired liver function

RC814-04 Locoregional Treatment of Advanced HCC with Complete Portal Vein Thrombosis: The Impact of Radioembolization Using 90Y

Friday, Dec. 4 9:05AM - 9:15AM Location: N228

Participants

Francesco Somma, MD, Napoli, Italy (*Presenter*) Nothing to Disclose
Roberto D'Angelo, MD, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Gianluca Gatta, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco Fiore, MD, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Giovanni Pecoraro, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Our purpose is to assess effectiveness and safety of Trans-arterial Radioembolization (TARE) using microspheres containing 90Y in case of advanced HCC with thrombosis of both portal branches.

METHOD AND MATERIALS

Between March 2010 and March 2013, 41 TARE were performed in 33 patients with unresectable HCC and bilirubine values up to 2.8 mg/dl. Among these, 23 had one portal branch thrombosis and 11 had thrombosis of both portal branches. Multislice Computed Tomography (MSCT) scans and angiography were used to assess the baseline burden and the follow-up studies according to the modified RECIST guideline. Some patients underwent the embolization of the Gastro-duodenal artery, using micro-coils. In these cases, a previous study was performed with the injection of TC-99MAA through a 3F microcatheter. Proton-Pump Inhibitors (PPI) were administered to prevent gastritis and ulcers.

RESULTS

The average dose administered was 1.8GBq. After the treatment, a post-embolization syndrome was found in 31/41 patients with no statistically significant difference between patients with portal thrombosis and those without. According to the RECIST guideline at least a partial response was found in 33/41 (79%) of cases three months after the procedure and in 35/41 (88%) at nine months. At two-year follow-up, patients with thrombosis of two portal branches presented survival rates similar to patients with one portal branch thrombosis, and only slightly inferior if compared to patients without thrombosis. Moreover, a retraction of portal vein thrombosis was registered in more than 60% of patients with thrombosis (21/34).

CONCLUSION

TARE showed to be a safe and effective locoregional treatment of locally advanced HCC, even in case of patients with portal vein thrombosis. Indeed, it does not worsen the post-embolization symptoms, while helping retracting portal vein thrombosis if present. Therefore, this condition not only has no impact on TARE, but represents an indication, even in case of thrombosis of both portal branches.

CLINICAL RELEVANCE/APPLICATION

If compared to patients without thrombosis, TARE in patients with HCC and portal thrombosis does not reduce the post-treatment quality of life, Thrombosis of both portal branches does not interfere with TARE, and represents one of its major indication in case of locally advanced unresectable HCC, even in case of recurrence after other locoregional treatments.

RC814-05 Irreversible Electroporation (IRE) of Malignant Liver Tumors Close to Major Portal or Hepatic Veins Does not Influence Perfusion of Hepatic or Portal Veins but Can Result in Bile Duct Strictures

Friday, Dec. 4 9:15AM - 9:25AM Location: N228

Participants

Martina Distelmaier, Aachen, Germany (*Presenter*) Nothing to Disclose
Alexandra Barabasch, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Nils A. Kraemer, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose
Philipp Heil, Aachen, Germany (*Abstract Co-Author*) 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

PURPOSE

IRE has been proposed as a non-thermal ablation method that offers specific advantages over thermal ablation, notably absence of heat sink effect and preservation of both, blood vessels and bile ducts. The purpose of our study was to verify the theoretical advantages of IRE by systematically investigating clinical efficacy and complications of percutaneous IRE for hepatic malignancies located immediately adjacent to major portal and bile ducts or hepatic veins. We were specifically interested in the long-term patency of adjacent venous and biliary vessels.

METHOD AND MATERIALS

CT-guided percutaneous IRE of 37 primary or secondary liver malignancies (mean size 17 mm; range 7-44 mm) was performed in 27 patients (mean age 59 y; 13 men). All lesions were located immediately adjacent to major hepatic veins (n=16), portal vein branches or both (n=21) and therefore not suitable for RFA or MWA. Per standard IRE protocol, 3 to 5 probes (active tip length 1.5-2.5 cm) were placed strictly parallel under CT-guidance. All patients underwent systematic follow-up by CT or MRI.

RESULTS

No major procedure-related complications were observed. All adjacent major portal or hepatic veins remained perfused even at long term follow-up. Complete ablation of the target was achieved in 34/37 (92%) cases with a safety margin of 5-10 mm, confirmed by CT and MRI. In 9 cases (24%) local recurrences within or adjacent to the ablation zone were observed between 1-12 months after treatment. 5 patients with tumors located next to portal veins/ bile ducts (5/21=24%) developed mild to moderate segmental/lobar cholestasis, not requiring treatment. In one patient a clinically asymptomatic arterio-portal fistula developed.

CONCLUSION

IRE for primary and secondary liver malignancies located adjacent to large portal or hepatic veins proved to be safe and effective with regards to local control, and will leave venous blood vessels unaffected. Bile duct strictures may, however, occur, in up to 25% of lesions located close to portal structures.

CLINICAL RELEVANCE/APPLICATION

CT-guided IRE is a useful ablation method for primary and secondary liver tumors that are not amenable to thermal ablation (RFA, MWA). While blood vessels are preserved, bile duct strictures do occur.

RC814-06 Y-90 Complications

Friday, Dec. 4 9:25AM - 9:40AM Location: N228

Participants

Robert J. Lewandowski, MD, Chicago, IL (*Presenter*) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

RC814-07 Thermal Ablation Complications

Friday, Dec. 4 9:55AM - 10:10AM Location: N228

Participants

Ron C. Gaba, MD, Chicago, IL, (rgaba@uic.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Not applicable.

RC814-08 Debate: IO: More than Radiologists?

Friday, Dec. 4 10:10AM - 10:25AM Location: N228

Participants

Ron C. Gaba, MD, Chicago, IL, (rgaba@uic.edu) (*Presenter*) Nothing to Disclose
Robert J. Lewandowski, MD, Chicago, IL (*Presenter*) Advisory Board, BTG International Ltd; Advisory Board, Boston Scientific

Corporation; Consultant, Cook Group Incorporated; Consultant, ABK Medical Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Not applicable.

RC814-09 Incidence of Tumor Seeding after Percutaneous Radiofrequency Ablation of Hepatocellular Carcinoma: A Six Year Experience in 581 Nodules in 305 Consecutive Patients

Friday, Dec. 4 10:25AM - 10:35AM Location: N228

Participants

Somrach Thamtorawat, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Steven S. Raman, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose
Justin P. McWilliams, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose
Michael L. Douek, MD, MBA, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Simin Bahrami, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
David Y. Lu, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tumor seeding along the needle tract or peritoneum is dreaded complication of percutaneous liver ablation, especially in potential liver transplant patients with a reported incidence up to 4.4%. Therefore, the objective of our study was to determine the incidence of tumor seeding after percutaneous RF ablation of hepatocellular carcinoma (HCC).

METHOD AND MATERIALS

With IRB approval and HIPAA compliance, our institutional clinical database was queried to access all patients who had development of one or more extrahepatic recurrences in the skin, subcutaneous tissues, or peritoneum from March 2006 to December 2012. The study cohort consisted of 305 consecutive patients (217 men and 88 women) and a total of 498 RFA sessions. All lesions were treated with single, double or cluster internally cooled straight electrodes mated to a 200W generator and switching controller (Covidien, Boulder Co) by one of four experienced interventionalists. Tract ablation was used in almost all cases. Six patients were treated by using combined ethanol injection.

RESULTS

Over a 6 year period, 581 HCC nodules were treated by RF ablation with a mean follow up of 28±16 months (range from 3-66 months). Tumor seeding was evaluated by pathological report of explant liver in 96 patients and by imaging follow up in 209 patients. During this time in two patients, single chest wall nodules were detected in or near the needle tract (0.3% per nodule, 0.6% per patient) in the setting of extrahepatic metastases. One nodule was detected at 5.3 months post ablation concurrent with lymph node metastasis. The other nodule was detected at 18.3 month after liver transplantation in a patient with concurrent lung metastases. In both cases, the ablated nodules were subcapsular, poorly differentiated on concurrent biopsy with direct electrode insertion into the nodule. There was no further lesion treatment due to advanced metastatic disease.

CONCLUSION

In this series, no needle tract seeding was detected in patients without concurrent extrahepatic metastases. However, with two solitary chest wall nodules at or near the needle tract, the possible risk of tumor seeding after RF Ablation of HCC was 0.3% per nodule and 0.6% per patient. Both nodules were poorly differentiated and subcapsular.

CLINICAL RELEVANCE/APPLICATION

Using optimal technique, there is very low risk of possible tumor seeding after percutaneous radiofrequency ablation of hepatocellular carcinoma.

RC814-10 Utility and Safety of Radiofrequency Ablation for Focal Hepatic Lesions Adjacent to Gallbladder in Ablating between GB Fossa and Contralateral Safety Margin

Friday, Dec. 4 10:35AM - 10:45AM Location: N228

Participants

In Young Choi, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Pyo Nyun 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
So Yeon Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong Moon Shin, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate safety and therapeutic efficacy of radiofrequency (RF) ablation for treatment of focal hepatic lesions (FHL) adjacent to gallbladder (GB) with reduction of ablation time and rearrangement of electrode.

METHOD AND MATERIALS

We retrospectively evaluated 36 patients who underwent RF ablation of FHL adjacent to GB (less than 10mm) from January 2011 to March 2014. Follow-up period was ranged from 9 to 50 months (mean, 25 months). The electrode was inserted parallel direction to GB. Patients were divided into two subgroups based on whether the lesion was abutting GB (less than 5mm, n=19) or not (more than 5mm, n=17). In abutting group, the electrode was inserted eccentrically after measuring the diameter between GB fossa and contralateral safety margin and ablation time was decreased for reducing the diameter of ablated zone in horizontal axis to GB. Fourteen of abutting group were performed with artificial ascites (5% dextrose aqueous solution) and 8 of non-abutting group were performed with artificial ascites. A panel of radiologists blinded to the patients' clinical histories reviewed immediate follow up CT for complication and late follow up CT for local tumor progression. Statistical evaluation was performed with Chi-square test and

Fisher's exact test.

RESULTS

There were no major complications in both groups. Enhancing wall thickening of GB adjacent to RFA zone was noted in 19.4% (7/36, abutting group; 5, non-abutting group; 2) and it disappeared on subsequent follow-up imaging. There is no statistically significant difference between abutting group and non-abutting group ($p > 0.05$). The technical success rate based on immediate follow-up and one-month follow-up CT was 94.4% (34/36) and two patients remained enhancing foci on immediate follow up (1 abutting group, 1 non-abutting group) and they were retreated successfully. Local tumor progression of completely ablated tumors during follow-up period less than 6 months was noted in two patients (2/34, 1 abutting group, 1 non-abutting group). Except these two patients, there was no local tumor progression during follow-up periods.

CONCLUSION

RF ablation can be a safe and effective treatment for FHL adjacent to GB with rearrangement of electrode and reduction of ablation time.

CLINICAL RELEVANCE/APPLICATION

The treatment of FHL adjacent to GB is challenging issue. RF ablation may be a safe and effective treatment option even though the lesion is located right beside GB.

RC814-11 Combination Therapy Complications

Friday, Dec. 4 10:45AM - 11:00AM Location: N228

Participants

Thuong G. Van Ha, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC814-12 Complications due to Imaging Errors

Friday, Dec. 4 11:00AM - 11:15AM Location: N228

Participants

Aradhana M. Venkatesan, MD, Houston, TX, (avenkatesan@mdanderson.org) (*Presenter*) Institutional research agreement, Koninklijke Philips NV

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

RC814-13 Tumor Board-Ask the Experts

Friday, Dec. 4 11:15AM - 11:30AM Location: N228

Participants

Charles T. Burke, MD, Chapel Hill, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC814-14 Literature Review: The Most Important IO Papers from the Past 5 Years that Everyone Should Know

Friday, Dec. 4 11:30AM - 11:45AM Location: N228

Participants

Ryan Hickey, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Handout: Ryan Hickey

[http://abstract.rsna.org/uploads/2015/15002217/The Most Important IO Papers from the Past 5 years that Everyone Should Know.docx](http://abstract.rsna.org/uploads/2015/15002217/The%20Most%20Important%20IO%20Papers%20from%20the%20Past%205%20years%20that%20Everyone%20Should%20Know.docx)

RC814-15 Questions and Wrap-up

Friday, Dec. 4 11:45AM - 12:00PM Location: N228

Participants

RC854

Growing Your Business with Social Media, Tips and Tricks for Department and Practice Managers

Friday, Dec. 4 8:30AM - 10:00AM Location: N229



AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 0

Participants

Garry Choy, MD, MS, Boston, MA (*Presenter*) Nothing to Disclose

Geraldine B. McGinty, MD,MBA, New York, NY (*Presenter*) Nothing to Disclose

Alex Towbin, MD, Cincinnati, OH, (alexander.towbin@cchmc.org) (*Presenter*) Author, Reed Elsevier; Consultant, Reed Elsevier; Shareholder, Merge Healthcare Incorporated; Consultant, Guerbet SA; Grant, Guerbet SA

Honored Educators

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Alex Towbin, MD - 2014 Honored Educator

RC805

Multiple Sclerosis: Updates and Controversies

Friday, Dec. 4 8:30AM - 10:00AM Location: N226

NR

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

Participants

Aaron S. Field, MD, PhD, Madison, WI, (afield@uwhealth.org) (*Moderator*) Nothing to Disclose
Timothy M. Shepherd, MD, PhD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

RC805A Multiple Sclerosis: What the Clinician Wants to Know

Participants

Christina Azevedo, MD, MPH, Los Angeles, CA (*Presenter*) Advisory Board, sanofi-aventis Group; Advisory Board, Biogen Idec Inc

RC805B New Multimodal Imaging Approaches for MS

Participants

Matilde Inglese, MD, New York, NY, (matilde.inglese@mssm.edu) (*Presenter*) Consultant, Vaccinex; Research Grant, Novartis AG;

LEARNING OBJECTIVES

1) Describe novel MRI techniques to study MS pathophysiology. 2) Discuss how novel MRI techniques contribute to monitoring of MS progression. 3) List the advantages of a multimodal imaging approach for predicting clinical outcomes.

ABSTRACT

The presentation will review novel MRI techniques applied to the study of MS patients to improve understanding of disease pathophysiology, to identify new and reliable markers of disease progression and effective predictors of short- and long-term clinical outcomes.

RC805C Differential Diagnosis in MS

Participants

Aaron S. Field, MD, PhD, Madison, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe both typical and atypical appearances of MS on conventional MRI. 2) List the most common differential diagnoses for these imaging findings. 3) Recognize the distinguishing features that often allow discrimination of MS from potential mimics.

ABSTRACT

This presentation will review typical and atypical appearances of MS in brain and spinal cord on conventional MRI along with alternative diagnoses that often mimic MS and must be considered when these findings are present.

RC807

GYN and Pelvic Floor 2015: Latest Imaging Guidelines and Angles Simplified!

Friday, Dec. 4 8:30AM - 10:00AM Location: N227



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>

RC809

Abdomen Radiographs and GI Fluoroscopy: Don't Bury 'em Yet!

Friday, Dec. 4 8:30AM - 10:00AM Location: N230



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

Participants

Sub-Events

RC809A Abdomen Radiographs: Just an Annoyance Before the CT, Right?'

Participants

David J. DiSantis, MD, Lexington, KY, (djdisantis@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) List the innate 'contrast materials' present in abdomen radiographs. 2) Use those cues to identify pathology.

ABSTRACT

Millions of abdomen radiographs still are performed yearly in the United States. If viewed in a more than perfunctory manner, they can reveal a spectrum of abnormalities. This presentation offers a fresh approach to ferreting out the clues to pathology hidden in the lowly KUB.

Honored Educators

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David J. DiSantis, MD - 2014 Honored Educator

RC809B Esophagography 2015: What You Need to Know

Participants

Laura R. Carucci, MD, Midlothian, VA, (lcarucci@vcu.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the continuing importance of fluoroscopic evaluation of the esophagus. 2) Describe examination techniques for the esophagus. 3) Review the radiologic diagnosis of pathologic conditions involving the esophagus including functional and structural abnormalities.

ABSTRACT

Despite an overall trend towards a decreasing number of fluoroscopic procedures performed, the number of esophagography studies has proportionally increased in recent years. Fluoroscopic evaluation remains the primary modality for evaluating the esophagus. Radiologists should be able to perform and interpret esophagography studies. A spectrum of functional and structural abnormalities that may affect the esophagus will be discussed.

RC809C Fluoro Eyes Only: Role of Fluoroscopy in the Colon

Participants

Christine O. Menias, MD, Scottsdale, AZ, (menias.christine@mayo.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the role of plain film, fluoroscopy and CT in the evaluation of colonic pathology. 2) Review the radiographic, fluoroscopic imaging features of a spectrum of colonic pathologies, with CT correlation. 3) Review the fluoroscopic appearance of complications in the post-operative colon.

ABSTRACT

Despite the overall trend of the decreasing number of fluoroscopic screening studies of the colon, fluoroscopic evaluation of the colon is often requested in the post-operative or obstructed patient. Understanding the common surgical appearance of the post-operative colon, becomes important for the radiologist who is asked to evaluate for complications. Common surgical procedures as well as their complications will be discussed. In addition, a spectrum of entities that result in distal colonic obstruction will be discussed.

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

RC809D Stomach and Small Bowel

Participants

Dean D. Maglinte, MD, Indianapolis, IN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss essentials in the performance of fluoroscopic examinations of the postoperative gastrointestinal tract to: a. prevent complications, b. insure a diagnostic examination, c. avoid technical and interpretive pitfalls.

ABSTRACT

Despite advances in endoscopy and cross sectional imaging, fluoroscopic examinations of the postoperative GI tract has remained essential. Rationale for its performance are: 1. to detect complications in the early (<4 weeks) or late (>4 weeks) post operative periods, 2. to assess the efficacy of the surgical procedure, and 3. to define anatomy and establish a baseline. A brief review of commonly performed surgical procedures will be given to insure understanding of the altered anatomy to insure complete anatomic coverage and enable performance of a 'tailored' diagnostic examination designed to answer clinical questions to guide management of the post surgical patient. Knowledge of the essentials on what contrast agents to use, how it should be administered and radiographic considerations (views/positioning) are emphasized to avoid procedure related complications and avoid pitfalls.

RC810

Vascular Doppler (An Interactive Session)

Friday, Dec. 4 8:30AM - 10:00AM Location: S402AB



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

Participants

Sub-Events

RC810A Beyond Peak Velocities: Waveform Interpretation in Carotid Doppler

Participants

Mark A. Kliewer, MD, Madison, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be familiar with how carotid waveforms change with systemic, regional and local vascular disease. 2) Be able to recognize common waveform variants and their attendant clinical significance.

Active Handout: Mark A. Kliewer

<http://abstract.rsna.org/uploads/2015/15002014/RC810A.pdf>

RC810B Upper and Lower Extremity Veins

Participants

Leslie M. Scoutt, MD, New Haven, CT, (leslie.scoutt@yale.edu) (*Presenter*) Consultant, Koninklijke Philips NV

LEARNING OBJECTIVES

1) This course will review the US criteria for the diagnosis of acute and chronic DVT, including a discussion of pitfalls in the US diagnosis of DVT. 2) Current controversies in the US evaluation of DVT will be reviewed. 3) The role of US in the diagnosis of alternative causes of leg pain and swelling will be described. 4) US diagnosis of DVT in the upper extremity will also be discussed.

ABSTRACT

This session will discuss the clinical presentation and epidemiology of deep venous thrombosis in the upper and lower extremities. The criteria for and pitfalls in the US the diagnosis of DVT will be discussed with an emphasis on current controversies in the role of US in the work up of patients with clinically suspected DVT. In addition, the role of US in identifying alternative causes of extremity pain and swelling will be presented.

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Leslie M. Scoutt, MD - 2014 Honored Educator

RC810C Upper and Lower Extremity Arteries

Participants

Michelle L. Robbin, MD, Birmingham, AL, (mrobbin@uabmc.edu) (*Presenter*) Consultant, Koninklijke Philips NV;

LEARNING OBJECTIVES

1) Describe normal anatomy and normal anatomic variants. 2) Demonstrate normal and abnormal waveform patterns. 3) Discuss methods to evaluate stenoses and occlusions, noting pitfalls.

ABSTRACT

Upper and lower extremity arterial ultrasounds are becoming more commonly requested because of concerns regarding expense and toxicity of CT/MRI contrast agents, as well as radiation associated with CT. Indications and standard US evaluation of the upper and lower extremity arteries will be detailed, including high brachial artery bifurcation (a normal variant), palmar arch evaluation prior to radial artery harvesting for CABG, and lower extremity arterial waveform analysis.

RC832

Mentoring Future Leaders

Friday, Dec. 4 8:30AM - 10:00AM Location: S403B



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

Participants

Sub-Events

RC832A Considerations and Suggested Approaches to Implementing Formal Mentoring

Participants

Alexander M. Norbash, MD, Boston, MA (*Presenter*) Co-founder, Boston Imaging Core Laboratories, LLC;

LEARNING OBJECTIVES

1) To recognize and describe process and system-based approaches to implementing formal mentoring. 2) To understand the strengths and limitations of system-based mentoring systems.

ABSTRACT

This presentation will include three presenters describing their experiences with mentoring, as distinct from coaching and advising. A mentoring relationship includes an experienced individual possessing generativity and experience, and also a receptive advisee who values the contributions of the mentor in facilitating the advisees success. Many organizations have attempted to create formal mentoring systems with varying degrees of success. The three portions of this presentation will focus on processes and systems that can be implemented in creating a formal mentoring system, along with benefits and limitations of the same. A second portion will focus on the complex balancing interplay between mentors, advisees, and the goals of the mentoring engagement. The third portion will specifically focus on best mentoring practices for success in healthcare.

RC832B Mentoring, Mentors and Goals: A Balancing Act

Participants

James V. Rawson, MD, Augusta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize elements of mentoring relationship that should be defined and agreed to. 2) Understand balancing trade-offs in mentoring relationships.

ABSTRACT

The choice of a mentor and a mentoring relationship can be a critical step in professional development. The relationship is a balance of self-discovery, guided development and occasional intervention/rescue. Expectations and responsibilities of both the mentor and the mentee should be defined and agreed to. The author will describe approaches that are helpful in recognizing and balancing trade-offs in a mentoring relationship.

RC832C Mentoring and Your Career: Best Practices for Success in Health Care

Participants

Frank J. Lexa, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the proper role of mentoring in your career. 2) Analyze best practices of mentoring. 3) Become a better mentor and mentee.

RCA61

National Library of Medicine: Find Articles You Need: Searching PubMed/MEDLINE Efficiently (Hands-on)

Friday, Dec. 4 8:30AM - 10:00AM Location: S401AB

IN

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

Participants

Chris Childs, MS, Iowa City, IA (*Presenter*) Nothing to Disclose

Holly Ann Burt, MLIS, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how PubMed constructs a query and how to develop and refine effective search strategies in radiology. 2) Use PubMed tools including Clinical Queries, Related Articles, Single Citation Matcher and Loansome Doc. 3) Build focused searches using the Medical Subject Headings (MeSH) vocabulary for radiology and limit searches to radiology-oriented journals. 4) Understand how to save and download citations.

ABSTRACT

This hands-on workshop covers key searching techniques, changes to PubMed and how to develop effective search strategies for PubMed and MEDLINE. Topics covered include: why keywords don't always give the results you expect, how to limit to specific journals, quick searches to find evidence-based citations, how to access full-text articles, and downloading citations to reference manager programs. The National Library of Medicine (NLM) provides free web access to nearly 24 million citations for biomedical and clinical medical articles through PubMed (available online at PubMed.gov). MEDLINE is a subset of PubMed which includes links to sites providing full text articles and to other related databases and resources.

URL

Handout: Holly Ann Burt

<http://abstract.rsna.org/uploads/2015/14003441/2015pubmedRSNA.pdf>

RC825

Radiomics Mini-Course: Informatics Tools and Databases

Friday, Dec. 4 8:30AM - 10:00AM Location: S404AB



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

Participants

Sandy Napel, PhD, Stanford, CA (*Director*) Medical Advisory Board, Fovia, Inc; Consultant, Carestream Health, Inc; Scientific Advisor, EchoPixel, Inc

LEARNING OBJECTIVES

ABSTRACT

Sub-Events

RC825A The Role of Challenges and Their Requirements

Participants

Jayashree Kalpathy-Cramer, MS, PhD, Charlestown, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of challenges and benchmarks in image analysis, radiomics and radiogenomics. 2) Learn about challenge infrastructure and requirements to host and participate in challenges. 3) Learn about past and upcoming challenges that focus on topics in radiology, radiomics and radiogenomics.

ABSTRACT

Challenges and benchmarks have been used successfully in a number of scientific domains to make significant advances in the field by providing a common platform for collaboration and competition. By provide a common dataset and common set of evaluation metrics, they also facilitate a fair and rigorous evaluation of algorithms. Challenge organizers often sequester the test data from the training data, further enhancing the rigor of the evaluation. These efforts can introduce problems in medical imaging to experts in other domains such as image processing and machine learning and serve as a means to bring in to medical images a range for expertise from other domains. They also serve to allow computer scientists access to clinical data which they may not otherwise have. Many challenges have also highlighted the need for collaboration as the best results are often obtained by combining a range of complementary techniques. We will discuss recent challenges from a number of domains including imaging and bioinformatics, explore the informatics infrastructure to host and participate in challenges and discuss the needs for future challenges including those in radiomics and radiogenomics.

RC825B Quantitative Image Analysis Tools: Communicating Quantitative Image Analysis Results

Participants

Andriy Fedorov, PhD, Boston, MA, (andrey.fedorov@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the meaning and importance of interoperability for quantitative image analysis tools. 2) Review specific use cases motivating standards-based interoperable communication of the analysis results. 3) Learn about free open source tools that can facilitate interoperable communication of analysis results using DICOM standard.

ABSTRACT

Quantitative imaging holds tremendous but largely unrealized potential for objective characterization of disease and response to therapy. Quantitative imaging and analysis methods are actively researched by the community. Certain quantitation techniques are gradually becoming available both in the commercial products and clinical research platforms. As new quantitation tools are being introduced, tasks such as their integration into the clinical or research enterprise environment, comparison with similar existing tools and reproducible validation are becoming of critical importance. Such tasks require that the analysis tools provide the capability to communicate the analysis results using open and interoperable mechanisms. The use of open standards is also of utmost importance for building aggregate community repositories and data mining of the analysis results. The goal of this course is to build the understanding of the interoperability as applied to quantitative image analysis, with the focus on clinical research applications.

Handout:Andriy Fedorov

<http://abstract.rsna.org/uploads/2015/15003220/rc825fedorov.pdf>

RC825C Public Databases for Radiomics Research: Current Status and Future Directions

Participants

Justin Kirby, Bethesda, MD (*Presenter*) Stockholder, Myriad Genetics, Inc

LEARNING OBJECTIVES

1) Understand the importance of using digital object identifiers and public databases to facilitate reproducible radiomics research. 2) Become familiar with publicly available databases where you can. a) download existing radiomic and radiogenomic data sets. b) request to upload new radiomic/radiogenomic data sets. 3) Learn about new data-centric journals which help enable researchers to receive academic credit for releasing well-annotated data sets to the public.

ABSTRACT

Lack of reproducibility in scientific research, particularly in healthcare, has become an increasing issue in recent years. The National Institutes of Health (NIH) and many major publishers have since called for increased sharing of raw data sets so that new findings can be easily validated in a transparent way. This is especially important in the emerging field of radiomics where large data sets and huge numbers of image features lead to an increased risk of spurious correlations which are not actually driven by biology. A number of public databases have since been created by governments and other organizations to help facilitate the sharing of data sets. Publishers have developed new 'data journals' and services specifically designed to encourage researchers to annotate and share their data sets. It is now up to the imaging research community to begin taking advantage of these resources. Other disciplines such as genomics and proteomics are significantly leading imaging in the adoption of these new open-science workflows. Significant engagement with NIH and other organizations providing open databases and related services is critical to enabling imaging researchers to successfully shift to a culture of data sharing and transparency.

RC816

Radiation Safety Education around the World: An International Forum (Sponsored by the Committee on International Radiology Education)

Friday, Dec. 4 8:30AM - 10:00AM Location: S404CD



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

Participants

Sub-Events

RC816A Introduction and Overview of the Committee on International Radiology Education (CIRE)

Participants

Teresita L. Angtuaco, MD, Little Rock, AR, (angtuacoteresital@uams.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To define the role of the RSNA Committee on International Radiology Education (CIRE) in advancing radiology education through its various programs. 2) To identify opportunities for radiology education in other countries especially those with the most need. 3) To list the different educational programs administered by the CIRE, the specific areas of emphasis of each program and the qualifications of candidates.

ABSTRACT

The RSNA Committee on International Radiology Education (CIRE) administers four educational programs each targeting a different population of radiologists. The International Visiting Professor program sends a team of radiologists with different areas of expertise, based on the needs expressed by the host country. The team lectures at national radiology society annual meetings, local hospitals and teaching institutions during a two week period. The Derek Harwood Nash fellowship selects junior faculty within 10 years after completion of training from all over the world who desire to have focused training on a specific radiologic specialty in an institution chosen by the applicant. They train for 6-12 weeks in the U. S. institution prior to returning to their countries. The Introduction to Research for Young Academics selects international residents or fellows interested in academics. They join selected residents from U.S. programs for one week of research workshops during RSNA week. The Education Materials and Journal award program selects institutions of learning from developing or newly-developed nations to receive gratis online or print subscriptions to Radiology and RadioGraphics in addition to other materials from the RSNA Education Center. Background information and updated data will be provided for each program.

RC816B Africa and the Middle East

Participants

Omolola M. Atalabi, MBBS, Ibadan, Nigeria (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To outline the current practice of radiation safety in Africa and other developing world. 2) To outline challenges of radiation safety in developing world and 3. Suggest ways in which the existing gaps in education on radiation safety and practice can be bridged.

ABSTRACT

Abstract: No doubt imaging equipment that use radiation has contributed immensely to the care of patients and the development of different types these equipment have been so rapid over the past 100 years. The dangers inherent in the use of the equipment which are not only to patients but also to staff involved in the practice of imaging and therapy have been ignored for many decades. Aggressive advocacy for adequate education on radiation safety however began in the last few years in the developed world and rapidly gained ground and acceptance through 'Image gently and Image wisely' campaigns but the developing world have been left behind. This presentation will look at the current state of radiation education and practice vis-à-vis who is authorized to work with equipment that use and patients. What are the required type, level, frequency of training, and credentials or certifications needed. What regulatory bodies are in place both locally and nationally to ensure radiation safety practice. What empahsies are being laid on radation safety in the curriculum of medical students and residents? What is the way forward in order to bridge the gap in radiation safety education and practice between the developing and developed world.

RC816C Latin America

Participants

Renato A. Mendonca, MD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate how legislation in Latin American countries prioritizes and addresses radiation protection. 2) Review how radiological societies and alliances in Latin America are organized to influence the education of other health professionals and the public.

RC816D Asia Oceania

Participants

Chamaree Chuapetcharasopon, MD, Bangkok, Thailand, (chamareec@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss about the current situation of radiation safety practice in Asia Oceania. 2) To discuss about the current radiation safety educational programs in Asia Oceania.

ABSTRACT

Asian Oceania comprises of two continents. There are more than 70 countries in all Asian Oceania regions. The estimated population for Asia in 2014 is 4,426,683,000. The Population in Oceania is approximately 39,000,000. Despite the diversities, many activities and programs for radiation safety education have been established including many networks. This presentation will discuss on the current situation of radiation safety practice in Asia Oceania as well as current radiation safety educational programs.

RC816E Europe

Participants

Ulrich Bick, MD, Berlin, Germany, (Ulrich.Bick@charite.de) (*Presenter*) Equipment support, Hologic, Inc; License agreement, Hologic, Inc; Royalties, Hologic, Inc; Equipment support, Toshiba Corporation; Institutional research collaboration, Siemens AG

LEARNING OBJECTIVES

1) To learn about activities in radiation safety education in Europe.

RC816F Educational Initiatives in the United States

Participants

Mahadevappa Mahesh, MS, PhD, Baltimore, MD (*Presenter*) Author with royalties, Wolters Kluwer nv

LEARNING OBJECTIVES

1) To outline educational initiatives on radiation safety education in the US. 2) To list available resources and how to access radiation safety educational topics. 3) To examine how medical physicists and radiologists could coordinate efforts to improve radiation safety education.

ABSTRACT

Radiation safety can be examined from two different points of view namely, patient safety and staff safety. Radiation safety education is key in addressing the radiation protection principles in any radiology practice. Radiation safety education is part of the radiology residents training programs in the US since residents are examined on various medical physics topics including radiation safety education. Radiation safety training is also becoming part of ongoing training of interventional radiologists. This talk will focus on the various educational initiatives in the United States and the various resources available for radiation safety. This talk will also discuss on how to develop and establish radiation safety education for all those utilizing radiation.

RC816G Global Collaboration in Radiation Safety Education

Participants

Miriam N. Mikhail, MD, Geneva, Switzerland (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To outline a global collaborative development and implementation model of radiation safety education. 2) To describe the roles of and actions from international organizations and agencies in radiation safety education. 3) To list open access radiation safety education resources. 4) To examine how radiologists could improve radiation safety education.

ABSTRACT

Successful application of radiation safety principles in radiology practice is a result of teamwork and collaboration between the stakeholders. Individual experts from professional organisations develop education resources based on scientific evidence and knowledge, organisations and agencies advocate for their adoption by regulatory authorities and radiology practices, and radiologists learn from these principles and use them in practice. Professional organisations such as the International Society of Radiology, the Radiological Society of North America and United Nations agencies such as the World Health Organisation and International Atomic Energy Agency are some of the collaborators. The International Basic Safety Standards provide guidance to improve radiology practice and radiation safety. The Bonn call-for-action identified priorities to improve radiation safety in the next decade. These recommendations include the strengthening of radiation safety education and training. Many open access radiation safety education resources are available to radiologists. Radiologists play leading roles in the improvement of quality care and radiation safety through content development, training delivery and practical use of radiation safety measures and tools.

Active Handout: Miriam Niveen Mikhail

[http://abstract.rsna.org/uploads/2015/15003258/Active RC816G.pdf](http://abstract.rsna.org/uploads/2015/15003258/Active_RC816G.pdf)

RC851

Imaging in Practice: DWI in the Abdomen and Pelvis

Friday, Dec. 4 8:30AM - 10:00AM Location: S406A



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. Vasawala, 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

RC821

Medical Physics 2.0: Fluoroscopy

Friday, Dec. 4 8:30AM - 10:00AM Location: S405AB

PH IR

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.00

Participants

Ehsan Samei, PhD, Durham, NC (*Director*) Nothing to Disclose
Douglas E. Pfeiffer, MS, Boulder, CO (*Director*) Nothing to Disclose

Sub-Events

RC821A Fluoroscopy Perspective

Participants

Ehsan Samei, PhD, Durham, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To become familiar with major trends in fluoroscopy technology. 2) To understand transitions in technology that requires new and advanced evaluations. 3) To appreciate how a medical physicist is to effectively engage with clinical practice.

ABSTRACT

Just like other medical imaging modalities, fluoroscopy has been undergoing a number of technological transitions. Those include transitions from II to flat panel detectors and from 2D to 3D imaging. While these advances offer improvements and new possibilities, they challenge the conventional way a system is to be tested. In addition, given the interventional nature of the modality, there is an increasing need for the medical physicist to be more operationally engaged with the use and optimization of the technology. This lecture aims to offer a historical perspective on these topics and an outline of major priorities for fluoroscopic physics service.

RC821B Fluoroscopy 1.0

Participants

Beth A. Schueler, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review basic fluoroscopy imaging system performance evaluation tests. 2) Compare measurement procedures for fluoroscopic exposure assessment. 3) Become familiar with test procedures designed to assess fluoroscopic image quality. 4) Learn about implementation of patient dose management processes for fluoroscopic procedures.

ABSTRACT

This segment will provide a review of customary medical physics support activities for fluoroscopic imaging systems. Quality control testing procedures for image quality evaluation, radiation dose measurement and other mechanical performance characteristics are essential for optimizing equipment performance and ensuring patient and staff safety. Test equipment, phantoms, measurement methods and recommended performance criteria for these tests will be summarized as they apply to different types of fluoroscopic equipment, from angiographic imaging systems to radiographic-fluoroscopic (RF) tables and mobile C-arms. In addition, the medical physicist's role in clinical implementation of fluoroscopic systems will be discussed, including ensuring appropriate configuration of anatomical program settings, recommendations for patient dose management and methods for patient dose estimation.

Active Handout:Beth A. Schueler

<http://abstract.rsna.org/uploads/2015/13010881/RC821.pdf>

RC821C Fluoroscopy 2.0

Participants

Keith J. Strauss, FAAPM, FACR, Cincinnati, OH (*Presenter*) Research Consultant, Koninklijke Philips NV; Speakers Bureau, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Understand need for and advantages of quantitative (as opposed to qualitative) analysis of image quality. 2) Identify and understand new tools becoming available for evaluating fluoroscopic equipment performance. 3) Identify appropriate configuration of acquisition parameters as a function of patient size. 4) Be able to configure the radiation dose to the detector to ensure diagnostic image quality at properly managed patient dose.

ABSTRACT

AbstractSteps that are required to turn physics support of fluoroscopy from a compliance focused to operationally focused program will be discussed. New metrics and analytics to better quantify high contrast resolution, low contrast resolution, temporal resolution, and 3D imaging will be examined. Changes in testing protocols necessary to address new hardware technologies, new acquisition methods, state-of-the-art image processing and analysis will be reviewed. A recently developed "physics testing mode" that the vendors will provide in the near future will be described. Proper management of patient dose metrics will be reviewed. The presentation concludes with clinical implementation of these new strategies. Proper training and communication is critical. Proper

configuration of acquisition parameters (focal spot size, voltage and added filter, tube current, pulse width, pulse rate, scatter removal) as a function of patient size from the smallest neonate to the largest bariatric patient is key to providing diagnostic image quality at properly managed radiation doses. In addition, one must ensure that the detector dose as a function of filter type and thickness, pulse rate, field of view, and complexity of the examination is properly configured.

Active Handout: Keith Jerel Strauss

http://abstract.rsna.org/uploads/2015/13010882/Active_RC821C.pdf

RC815

The Biology of Breast Cancer

Friday, Dec. 4 8:30AM - 10:00AM Location: S406B



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

Participants

Sub-Events

RC815A Breast Cancer Genomics

Participants

Cherie M. Kuzmiak, DO, Chapel Hill, NC (*Presenter*) Research Grant, FUJIFILM Holdings Corporation;

LEARNING OBJECTIVES

1) Understand the molecular classification of breast cancer and comparison with clinical definitions. 2) Learn some of the main genomic features and clinical and treatment outcomes that stratify with the molecular subtypes.

RC815B Genetic Risk and Cancer Biology with Imaging

Participants

Elizabeth S. Burnside, MD, MPH, Madison, WI (*Presenter*) Stockholder, NeuWave Medical Inc

LEARNING OBJECTIVES

1) Understand the different types of genetic information that are being measured and used for the clinical care of breast cancer. 2) Convey that cancer development and evolution depends on both genetics and environment influences. 3) Demonstrate that imaging has the potential to better understand biology, capturing the complex combined influence of genetics and environment. 4) Illustrate the move toward personalized medicine in breast cancer and the role of imaging.

ABSTRACT

RC815C Imaging Breast Cancer Subtypes

Participants

Sheryl G. Jordan, MD, Chapel Hill, NC, (Sheryl_jordan@med.unc.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Master the move beyond classifying breast cancer as DCIS, IDC, ILC, or Other/Rare. 2) Understand imaging features for four breast cancer molecular subtypes, namely luminal A, luminal B, HER2-enriched, and basal subtypes. 3) Recognize molecular subtypes' clinical patterns and outcomes in case-based presentations, to include sufficient length of patient follow-up as to reinforce prognosis.

ABSTRACT

RC813

Pediatric MSK

Friday, Dec. 4 8:30AM - 10:00AM Location: S502AB



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

Participants

Sub-Events

RC813A Imaging of Pediatric Musculoskeletal Infections

Participants

Robert Orth, MD, PhD, Houston, TX (*Presenter*) Research support, General Electric Company;

LEARNING OBJECTIVES

1) Describe the optimal imaging strategy for evaluating suspected pediatric musculoskeletal infections including specifics of the MRI protocol. 2) List common missed diagnoses and imaging pitfalls. 3) Describe methods for differentiating musculoskeletal infections from alternative diagnoses.

RC813B Imaging of Osteochondritis Dissecans

Participants

Jonathan D. Samet, MD, Chicago, IL, (jsamet@luriechildrens.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To identify imaging features of osteochondritis dissecans (OCD) using multiple modalities. 2) To recognize the spectrum of findings between low and high grade lesions. 3) To identify the varying postoperative appearances after surgical intervention.

ABSTRACT

For 'Imaging of Osteochondritis Dissecans'.1. To identify imaging features of osteochondritis dissecans (OCD) using multiple modalities.2. To recognize the spectrum of findings between low and high grade lesions.3. To identify the varying postoperative appearances after surgical intervention.

RC813C Imaging of Musculoskeletal Soft Tissue Masses

Participants

Michele M. Walters, MD, Boston, MA (*Presenter*) Nothing to Disclose

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



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 treatments 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 somatostatin receptors by NET enables targeting with high affinity peptides. When these octreotide analogue 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 stratification. 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 1** **Basic 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.

RC811

Improving PET Interpretation (An Interactive Session)

Friday, Dec. 4 8:30AM - 10:00AM Location: S505AB

CT NM

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

RC811A Mimics and Interpretive Pitfalls: Advanced Tricks of the Trade

Participants

Eric M. Rohren, MD, PhD, Houston, TX (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss interpretive pitfalls in FDG-PET/CT, including challenging and less-frequently encountered pitfalls. 2) Review strategies to avoid interpretive errors in FDG-PET/CT.

ABSTRACT

One of the challenges in the interpretation of FDG-PET/CT is the discovery of unexpected activity, and the determination whether such activity is related to the primary tumor, and incidental second primary tumor, or a benign process. Avoidance of 'false-positive' interpretations is critical for the development and maintenance of a robust PET/CT practice. In this presentation, a broad range of case examples will be shown and discussed, to illustrate some of the most frequent and most challenging pitfalls encountered in a busy oncologic PET/CT practice.

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/>

Eric M. Rohren, MD, PhD - 2015 Honored Educator

RC811B Impact of Patient Preparation

Participants

Don C. Yoo, MD, Providence, RI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the patient preparation issues with performing PET/CT. 2) Review recommendations on patient preparation prior to performing PET/CT. 3) Review the issues in performing PET/CT scans on diabetic patients and learn ways to optimize the glucose level.

ABSTRACT

F18-FDG PET/CT is a valuable tool for a variety of oncologic applications. The purpose of this educational activity is to discuss the importance of appropriate patient preparation prior to performing oncologic F18-FDG PET/CT scans. The recommendations from the American College of Radiology (ACR), the Society of Nuclear Medicine and Molecular Imaging (SNMMI), and the National Cancer Institute (NCI) for patient preparation will be discussed. Issues that will be discussed include fasting, limiting exercise, hydration, sedation, low carbohydrate meals, and diabetic patients. Patients are typically asked to fast for at least 4 hours before tracer injection for oncologic PET/CT scans. The ACR and SNMMI both recommend checking glucose levels on all patients prior to administration of F18-FDG. SNMMI guidelines recommend that patients with glucose of greater than 150-200 mg/dL should usually be rescheduled. Performing PET/CT scans in poorly controlled diabetic patients can result in a PET/CT scan with an altered biodistribution limiting interpretation of the study. In a poorly controlled diabetic patient with a glucose level of greater than 200 mg/dl, the study should usually be rescheduled if it does not critically affect patient care. Hyperglycemia will dilute the FDG uptake by tumors through competitive inhibition. Subcutaneous insulin should not be administered to a diabetic patient with high glucose within 4 hours of a PET/CT scan as insulin will stimulate FDG uptake by skeletal muscle resulting in an altered biodistribution which can severely limit interpretation.

RC811C Challenging Case Examples

Participants

Esma A. Akin, MD, Washington, DC, (Eakin@mfa.gwu.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) With the aid of challenging case examples, this activity aims improve PET-CT interpretation through recognition of pitfalls and variants. In addition, it aims to review typical as well as unusual examples of commonly encountered oncologic diagnoses.

RC850

Image-guided Biopsy of the Spine (Hands-on)

Friday, Dec. 4 8:30AM - 10:00AM Location: E260



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

Participants

John L. Go, MD, Los Angeles, CA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss and demonstrate spine biopsy techniques including CT and fluoroscopic approaches, anatomic landmarks, needle selection, special technical considerations for dealing with soft tissue masses, and fluid accumulations, lytic and blastic lesions, and hypervascular conditions. 2) Hands on exposure will be provided in order to familiarize participants with the vast number of biopsy devices that are clinically available. 3) Training models will also be used in order to teach technical skills with respect to approach and technique. 4) Advantages and disadvantages of various biopsy devices and techniques, and improve their understanding of how to maximize the reliability and safety of these spine biopsy procedures.

ABSTRACT

Sub-Events

RC850A Pre- and Post Biopsy Assessment

Participants

Richard Silbergleit, MD, Royal Oak, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be familiar with all required aspects of the pre-biopsy work-up, including medications, laboratory values, and review of relevant prior imaging. 2) Be familiar with solutions to address to complications or other unexpected events which may arise during the course of spine biopsy. 3) Be comfortable in performing the post procedure assessment of the patient after spinal biopsy.

RC850B Equipment Used for Image-guided Biopsies of the Spine

Participants

Michele H. Johnson, MD, New Haven, CT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate the types of needles used for spine biopsy. 2) Selecting the proper types of needles used for spine biopsy. 3) Case demonstration of the proper use of single or coaxial needle sets for spine biopsy and the advantages or disadvantages of each.

RC850C Thoracic and Lumbar Biopsies

Participants

John L. Go, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the anatomy of the thoracic and lumbar spine relevant to spine biopsy. 2) Describe the approaches used to approach various anatomical regions within the thoracic and lumbar spine. 3) Provide case examples of various approaches used to biopsy the thoracic and lumbar spine.

ABSTRACT

RC850D Cervical Spine Biopsies

Participants

A. Orlando Ortiz, MD, MBA, Mineola, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate the various approaches used to biopsy lesions of the cervical spine. 2) Determine the selection of the proper needles to use to biopsy the spine. 3) Provide case examples of cervical biopsies and the thought process used to perform these procedures.

ABSTRACT

Cervical spine biopsies can be challenging procedures to perform, hence they tend to be performed by a limited number of proceduralists. C-spine biopsy is often performed to evaluate potential neoplastic or infectious processes of the cervical spine. The key to performing these procedures effectively and safely is in appropriate patient selection, careful image analysis in order to properly position the patient and choose an approach, identification of critical structures (such as the carotid artery) and neck spaces that should be avoided, and use of coaxial biopsy techniques. The procedure can be safely performed with CT and/or CT fluoroscopy. Specimen sampling principles and specimen handling are also discussed they can help to optimize this procedure.

RC850E Disc Biopsy and Aspiration

Participants

Amish H. Doshi, MD, New York, NY, (amish.doshi@mountsinai.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC818

Global Cancer Imaging-Insights from Overseas

Friday, Dec. 4 8:30AM - 10:00AM Location: E261



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 spinoffs 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

US-guided Interventional Breast Procedures (Hands-on)

Friday, Dec. 4 8:30AM - 10:00AM Location: E264



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

Participants

Gary J. Whitman, MD, Houston, TX (*Moderator*) Book contract, Cambridge University Press
 Annamaria Wilhelm, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose
 Michael N. Linver, MD, Albuquerque, NM (*Presenter*) Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd
 Stamatia V. Destounis, MD, Scottsville, NY (*Presenter*) Research Grant, FUJIFILM Holdings Corporation; Research Grant, Hologic, Inc; Research Grant, QT Ultrasound LLC
 Anna I. Holbrook, MD, Atlanta, GA (*Presenter*) Nothing to Disclose
 Alice S. Rim, MD, Cleveland, OH, (rima@ccf.org) (*Presenter*) Nothing to Disclose
 Alda F. Cossi, MD, Boston, MA (*Presenter*) Nothing to Disclose
 Eren D. Yeh, MD, Boston, MA, (eyeh@partners.org) (*Presenter*) Nothing to Disclose
 Gary W. Swenson, MD, Mason City, IA (*Presenter*) Nothing to Disclose
 Catherine W. Piccoli, MD, Voorhees, NJ (*Presenter*) Stockholder, VuCOMP, Inc;
 Michael P. McNamara JR, MD, Cleveland, OH, (mpm9@case.edu) (*Presenter*) Nothing to Disclose
 Selin Carkaci, MD, Columbus, OH (*Presenter*) Author with royalties, Reed Elsevier
 Jean M. Seely, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
 Phan T. Huynh, MD, Houston, TX (*Presenter*) Research Grant, Siemens AG; Consultant, Siemens AG
 Basak E. Dogan, MD, Houston, TX (*Presenter*) Nothing to Disclose
 Jiyon Lee, MD, New York, NY, (jiyon.lee@nyumc.org) (*Presenter*) Nothing to Disclose
 Tanya W. Moseley, MD, Houston, TX (*Presenter*) Nothing to Disclose
 Michelle D. McDonough, MD, Jacksonville, FL, (McDonough.michelle@mayo.edu) (*Presenter*) Nothing to Disclose
 Peter R. Eby, MD, Seattle, WA, (peter.eby@virginiamason.org) (*Presenter*) Consultant, Devicor Medical Products, Inc
 William R. Poller, MD, Pittsburgh, PA (*Presenter*) Consultant, Devicor Medical Products, Inc;
 Alexis V. Nees, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the equipment needed for ultrasound guided interventional breast procedures. 2) Review the basic principles of ultrasound guidance and performance of minimally invasive breast procedures. 3) Practice hands-on technique for ultrasound guided breast interventional procedures.

ABSTRACT

This course is intended to familiarize the participant with equipment and techniques in the application of US guided breast biopsy and needle localization. Participants will have both basic didactic instruction and hands-on opportunity to practice biopsy techniques on tissue models with sonographic guidance. The course will focus on the understanding and identification of: 1) optimal positioning for biopsy 2) imaging of adequate sampling confirmation 3) various biopsy technologies and techniques 4) potential problems and pitfalls

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/>

Eren D. Yeh, MD - 2015 Honored Educator

RC823

ABR Maintenance of Certification for Medical Physicists

Friday, Dec. 4 8:30AM - 10:00AM Location: E263



AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 0

Participants

G. Donald Frey, PhD, Charleston, SC, (dfrey@theabr.org) (*Director*) Nothing to Disclose

Sub-Events

RC823A MOC Requirements

Participants

G. Donald Frey, PhD, Charleston, SC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The learner will be able to prepare for the 2016 lookback. 2) The learner will understand the nature of the cognitive exam. 3) The learner will be able to use the changes in the MOC program.

ABSTRACT

The ABR MOC process has been in place for more than a decade. The process requires four elements. This presentation will review the four elements with an emphasis on some recent enhancements. Several years ago the ABR replaced the time limited certificates with a 'continuous certification' process. Continuous certification is based on an annual 'lookback.' The first complete lookback will be in March of 2016. This presentation will help medical physicists be ready for the 2016 lookback.

RC823B PQI Projects

Participants

Jerry D. Allison, PhD, Augusta, GA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The learner will understand the context of and purpose for Performance Quality Improvement (PQI). 2) The learner will understand the "Plan, Do, Study, Act" PQI cycle. 3) The learner will understand requirements for PQI projects. 4) The learner will understand types of PQI projects.

ABSTRACT

Practice Quality Improvement (PQI) is a key element of the ABR MOC continuous certification process. This presentation will review the framework for PQI including the "Plan, Do, Study, Act" cycle for PQI project cycles, PQI project requirements, types of PQI projects and PQI project documentation.

Active Handout: Jerry D. Allison

[http://abstract.rsna.org/uploads/2015/15002856/RC823 Allison \(1\).pdf](http://abstract.rsna.org/uploads/2015/15002856/RC823>Allison(1).pdf)

RC823C The MOC Cognitive Exam

Participants

J. Anthony Seibert, PhD, Sacramento, CA, (jaseibert@ucdavis.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The learner will identify the content of the MOC cognitive exam for each of the specific Medical Physics disciplines (Therapy Medical Physics, Diagnostic Medical Physics, Nuclear Medical Physics). 2) The learner will understand the percentage of fundamental and current clinical question topics and how the exam is assembled. 3) The learner will know how to prepare for the examination based on reference materials used in developing questions, and when to consider taking the exam within the 10 year MOC cycle.

ABSTRACT

Part 3 of the MOC 'Continuous Certification' policy represents the Cognitive Expertise component for participating diplomates of the American Board of Radiology, and is required to maintain the ongoing validity of the certificate (except for lifetime certificate holders). In order to fulfill this requirement, the Diplomate must pass the MOC cognitive exam within the past 10 years. The content of the exam is 30 percent fundamental core questions and the remainder represents recent advances in the field for each of the Medical Physics disciplines. Exams are offered each year at a testing center and can be taken at any time during the MOC process. The Diplomate must take an exam in each discipline in which certification is being maintained. Details of the exam, its content, any study guides useful for preparing for the exam are discussed.

RC817

Molecular Imaging Beyond PET: MRI and Ultrasound/Photoacoustic Molecular Imaging

Friday, Dec. 4 8:30AM - 10:00AM Location: S504CD



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 photoacoustic 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 analyzed. 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.

Tumor Ablation beyond the Liver: Practical Techniques for Success

Friday, Dec. 4 8:30AM - 10:00AM Location: S403A



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

Participants

Debra A. Gervais, MD, Chestnut Hill, MA (*Moderator*) Nothing to Disclose

Terrance T. Healey, MD, Providence, RI (*Presenter*) Nothing to Disclose

Anil N. Kurup, MD, Rochester, MN, (kurup.anil@mayo.edu) (*Presenter*) Nothing to Disclose

Muneeb Ahmed, MD, Wellesley, MA, (mahmed@bidmc.harvard.edu) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Gain knowledge as to how to approach tumor ablation in extrahepatic sites. 2) How to avoid and manage organ specific complications. 3) Review results of tumor ablation in the lung, kidney, and bone.

ABSTRACT

Pulmonary malignancies, and specifically lung cancer, are a leading cause of death worldwide. Utilization of best current therapies results in an overall five-year relative survival rate for all stages combined to be only 15%, necessitating the use of alternative therapies. Image-guided ablation of lung malignancies is a revolutionary concept whose clinical applications are just beginning to be developed. It has some advantages over traditional radiotherapy and chemotherapy. Its safety profile is similar to percutaneous image guided lung biopsy. Almost all image-guided ablative procedures can be performed in an outpatient setting, mostly with conscious sedation. Multiple applications can be performed without any additional risks. Contraindications are few and include uncontrollable bleeding diathesis and recent use of anticoagulants. Image-guided ablation of lung malignancies is performed with two basic rationales. In the first group it is used with an intention of achieving definitive therapy. These are patients who are not candidates for surgery because of co-morbid medical contraindications to surgery, like poor cardiopulmonary reserve or patients refusing to undergo operation. This cohort could potentially derive significant benefit from a minimally invasive alternative therapy. In the second group it is used as a palliative measure as follows: (a) to achieve tumor reduction before chemotherapy (b) to palliate local symptoms related to aggressive tumor growth, such as chest pain, chest wall pain or dyspnea (c) hematogenous painful bony metastatic disease (d) tumor recurrence in patients who are not suitable for repeat radiation therapy or surgery. Image-guided ablation is expanding treatment options for the local control of non-small cell lung cancer and metastatic disease.

RC827

Comparative Effectiveness: New Research Agendas for New Economic Times

Friday, Dec. 4 8:30AM - 10:00AM Location: S501ABC

HP

AMA PRA Category 1 Credits™: 1.50

ARRT Category A+ Credit: 0

Participants

Ruth C. Carlos, MD, MS, Ann Arbor, MI (*Coordinator*) Nothing to Disclose

Ruth C. Carlos, MD, MS, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Mitchell D. Schnall, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

Jeffrey G. Jarvik, MD, MPH, Seattle, WA (*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

Larry G. Kessler, Seattle, WA (*Presenter*) Consultant, Nucleix, Ltd; Consultant, MagForce AG

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

SST02

Cardiac (Molecular Imaging/Other)

Friday, Dec. 4 10:30AM - 12:00PM Location: S501ABC



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 in future 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 investigate 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 (5×10^7 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 balloon 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: $44840 \pm 4807 \text{mm}^2$ vs. $35681 \pm 5548 \text{mm}^2$, $p < 0.05$) and was associated with greater neovessel formation (CD31 positive cells: 273.0 ± 28.3 cells/field vs. 194.2 ± 30.7 cells/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: $46.7 \pm 9.0\%$ vs. $62.0 \pm 4.9\%$, $p < 0.05$). Transplantation of ILK-MSCs improved regional cardiac function compared with transplantation of MSCs (wall thickness ratio: $60.70 \pm 6.8\%$ vs. $52.08 \pm 5.6\%$, $p < 0.05$).

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 (5×10^7 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 balloon 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: $97.60 \pm 4.05 \text{mm}^2$; ILK-MSCs: $109.8 \pm 6.96 \text{mm}^2$) at 1 week was larger ($p < 0.05$) than those at 24 hours (MSCs: $80.06 \pm 5.47 \text{mm}^2$; ILK-MSCs: $89.98 \pm 6.15 \text{mm}^2$) 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: $32.52 \pm 7.65 \text{mm}^2$; ILK-MSCs: $19.00 \pm 3.10 \text{mm}^2$) and intensity variation (MSCs: 218.6 ± 71.86 ; ILK-MSCs: 108.6 ± 77.87) were all decreased 2 weeks later compared to those at 1 week ($p < 0.05$). 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 Mesenchymal 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 labeling 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 µg/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 50 µg/ml on cell migration, proliferation and cell cycle were determined by transwell migration assay, EdU staining assay and flow cytometry analysis 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 cell was linearly 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 no significant impairments 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 both T2WI 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-point 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 dysfunction. When compared with echocardiography, CMR revealed good ($\kappa=0,660$), poor ($\kappa=0,370$), moderate ($\kappa=0,504$), very good ($\kappa=1,0$) and poor ($\kappa=0,270$) 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 ($\kappa=0,778$).

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
Anoeshka S. Dharampal, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
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

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
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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
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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 multiphase 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). Adaptive blending was used to stitch the wide volumes. Both scan 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
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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 obtained 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 Excretory Urinary Wall Lesions: A Prospective Study of 95 Patients

Participants

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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 (BI) 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 respiratory 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 BI) and 15±5mm for benign lesions (13 UUT; 10 BI), 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 x10⁻³mm²/s-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 to 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

Participants

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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 by Takeuchi 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 find any additive value of T2 weighted imaging when combined with DWI. DWI images acquired in coronal and sagittal 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 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. Hegdare, 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
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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 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 T2WI and DW-MRI and T2WI and DCE-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 carcinoma 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 significantly 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 Girauda, 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

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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 [18F]-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

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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 ^{99m}Tc - 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 of 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

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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 be 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 scintigraphy 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

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PURPOSE

To compare the diagnostic accuracy of integrated [18]F-fluorodeoxyglucose positron emission tomography/magnetic resonance

To compare the diagnostic accuracy of integrated [18]F-FDG PET/MR, magnetic resonance tomography, glucose 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

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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 ADC mean values was 5.58 ± 3.88 (range, 1.2-24.17) and $892 \pm 218 \times 10^{-6}$ mm²/s (range, $452-1574 \times 10^{-6}$), respectively. There was mild correlation between the SUVmax and ADC mean 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, ADC mean 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

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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 for identifying 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 SPECT-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 benign lesions (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

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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 preferable to the stand-alone techniques.

SST13

Physics (Radiation Therapy)

Friday, Dec. 4 10:30AM - 12:00PM Location: S403A

RO PH

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

FDA Discussions may include off-label uses.

Participants

Kamil M. Yenice, PhD, Chicago, IL (*Moderator*) Nothing to Disclose
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Sub-Events

SST13-01 Reproducibility of F18-FDG PET Radiomics Features through Different Cervical Tumors Delineation Methods

Friday, Dec. 4 10:30AM - 10:40AM Location: S403A

Participants

Baderaldeen A. Altazi, MS, Tampa, FL (*Presenter*) Nothing to Disclose
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Geoffery Zhang, PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose
Daniel Fernandez, MD,PhD, Tampa, FL (*Abstract Co-Author*) Nothing to Disclose

Background

Several studies discussed various methods of tumor delineation based on PET FDG uptake. Where delineation based on a %threshold of SUVmax is the method most commonly used. This study recruited radiomics as an investigative tool to first, evaluate the sensitivity of radiomics features to the effect of different image segmentation and second, to evaluate the differences between tumors delineated based on SUVmax, SUVpeak and manually delineated Metabolic Tumor Volume (MTV).

Evaluation

Two radiation oncologists contoured primary tumors in cervix region based on pretreatment F-18 FDG PET/CT for a cohort of 74 patients. The cohort characteristics are: 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). Co-occurrence (COM), Gray Level Size Zone (GLSZM), Run-Length (RLM) and Intensity Based (IBM) matrices were employed to extract the radiomics features. Mean Percentage Differences (Δ) of features were determined for each pair of contoured volumes; MTV was set as the reference contour in comparison with SUVmax then SUVpeak. The reproducibility among each pair of contours was assessed by Bland-Altman analysis. In addition, Interobserver agreement for 1) all three contours and 2) pairs of MTV-SUVpeak and MTV-SUVmax was assessed using Interclass Correlation Coefficients test (ICC) within the context of the test re-test format.

Discussion

Radiomics features, which showed statistical significance of (p-value <0.05) on Bland-Altman test, indicated higher reproducibility between reference contour (MTV) and SUVpeak based contour. We set an acceptable reproducibility range of (± 15). ICC test results were concordant with Bland-Altman results with absolute agreement range (0.75 - 0.95).

Conclusion

In general, 5 COM, 4 GLSZM and 4 IBM features were insensitive to contour delineation techniques. ICC revealed that MTV-SUVpeak contours pair scored higher interobserver agreement and precision than MTV-SUVmax contour pair.

SST13-02 By the Position of the Treatment Interruption: How to Affect the Local Control Rate

Friday, Dec. 4 10:40AM - 10:50AM Location: S403A

Participants

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Koji Munakata, MD, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose
Sayako Iwashita, Tokyo, Japan (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): Over the New Year, Golden Week, and other local holidays, radiation therapy is sometimes stopped for long periods of time. In such cases, declines in the local control rates have been reported. Thus, we next investigated the effects of the length of time without treatment and the timing of this treatment break on the local control rate. Deliberately introducing a break period in a real clinical situation poses ethical problems; therefore, tumor model was created, and the local control rate was estimated after fractionated exposure with a set break period. The compensatory dose required to maintain the control rate was also estimated. Materials/Methods: The radiosensitivity of multifocal malignant tumors appears to be non-homogeneous. 1. We randomly allocated 1-7 tumor different radiosensitive clones. 2. Each clone multiplied exponentially. 3. The survival rate was determined using the novel LQ model. Design: Control arm includes 20 groups. In one group, total of 500 tumor cases were generated as per the above method, and each case was exposed to a standard treatment of 60 Gy/30 Fr, 5Fr/w. Test arm includes 5x20 groups. We assumed treatment interval of 2 weeks after continuous 5Fr, 10Fr, 15Fr, 20Fr, and 25Fr, for respective

groups. Results: When the 2-week break was introduced after the 5Fr, 64 Gy (adding 2x2Gy) was no significant difference in the control rate compared with continuous fractionated exposure of 60 Gy ($p = 0.181$). When the break was introduced after the 10Fr and the dose was increased by 2 Gy, the local control rate was lower than that of continuous fractionated exposure of 60 Gy. However, when the dose was increased by 2 x 2 Gy each, a significant increase in the control rate was observed. When the break period was introduced after the 15Fr or 20Fr and the dose was increased by 2 Gy, resulting in a total exposure of 62 Gy, there was no significant difference in the local control rate compared to continuous fractionated exposure of 60 Gy ($p = 0.75$ and $p = 0.106$, respectively). When the break period was introduced at the 25 Fr, a dose increase of 2 Gy resulted in an increased local control rate compared to that of continuous exposure of 60 Gy. On the other hand, when the break was introduced after the 25 Fr and there was no dose increase, the control rate was significantly reduced; and therefore, increases of at most 2 Gy are deemed appropriate. Conclusion: As the local control rates are further reduced when breaks occur sooner after the initiation of radiation, it is necessary to increase the compensatory dose in these cases.

SST13-04 Novel Approaches for the 192-Ir Source Positional Verification Using the Direct-Conversion Flat-Panel Detector

Friday, Dec. 4 11:00AM - 11:10AM Location: S403A

Participants

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Kanae Itakura, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Shinji Hara, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Yasushi Yamamoto, Izumo, Japan (*Abstract Co-Author*) Nothing to Disclose
Taisuke Inomata, MD, Osaka, Japan (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): The direct-conversion flat-panel detector (d-FPD) has led the possibility of transformation for QA of a 192-Ir source. Our goal is to establish a new quality assurance (QA) for 192-Ir source positional accuracy test using the d-FPD. **Materials/Methods:** Initially, the 192-Ir core position is adjusted to 1500.00 mm by two-point calibration with mechanical engineers using by dummy source and radioactive source as well as the d-FPD image. In subsequent 2-dimensional (2-D) verification using check ruler, six points (1500, 1450, 1400, 1350, 1300, 1250 mm) were measured weekly for six month. As for the 3-D verification, 14 dwell (5.0 mm step) coordinates in a series were compared between planned position and actual 192-Ir core, after planning by semi-orthogonal method with X-ray catheter using two intracavitary applicators (Fletcher Williamson tandem; bending 15° and CT/MR-compatible ovoid; bending 45°). The center of the applicator coordinate system (ACS) was set at the arbitrarily-position using spherical metal marker. Five series are evaluated for each applicator, and also measured sagging shift caused by the d-FPD orthogonal movement. 3-D distances were calculated by following formula: $d = \text{square root of } [(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$ **Results:** 192-Ir core was adjusted 1500.05 mm by image-assisted positional calibration. An average (\pm SD) of all errors was 0.23 ± 0.16 in 2-D verification. The highest accuracy point was 1500 mm where the most frequently used point in our clinical treatment, and it's error was 0.19 ± 0.13 mm. Sagging shift was 0.80 mm in superior direction. The most curved point of each applicator was the largest differences in 3-D verification, and it was 1.74 ± 0.02 mm for CT/MR-applicator and 1.01 ± 0.01 mm for Fletcher applicator. The largest coordinate difference was 1.71 mm in anterior direction for CT/MR-applicator. **Conclusion:** The recommendation of the AAPM (American Association of Physicists in Medicine) for 192-Ir source position accuracy is ± 1.0 mm (± 2.0 mm relative to the applicator system). In this study, all measurement errors for 192-Ir source positional accuracy were within the acceptable range. The source adjustment with the d-FPD may more accurately, and also d-FPD could confirm the movement and position (angle) of the 192-Ir core in the applicator. Our quality assurance process using the d-FPD system may serve to improve aspects of QA, as well as the quality of HDR brachytherapy.

SST13-05 Dynamic PET Imaging of Tumor Hypoxia in Non-small Cell Lung Cancer Patients Undergoing Stereotactic Body Radiotherapy

Friday, Dec. 4 11:10AM - 11:20AM Location: S403A

Participants

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PURPOSE

Tumor hypoxia is correlated with treatment failure. To date, there are no published studies investigating hypoxia in patients with small, localized non-small cell lung cancer (NSCLC) undergoing SBRT. We aim to use 18F-fluoromisonidazole (18F-FMISO) PET imaging to non-invasively quantify the tumor hypoxic fraction (HF), to elucidate the potential roles of reoxygenation and tumor vascular response at high doses, and to identify an optimal time point for imaging with prognostic value.

METHOD AND MATERIALS

Six patients with NSCLC tumors >1 cm and eligible for SBRT were prospectively enrolled in an IRB-approved study. CT and dynamic PET images (0-120 min, 150-180 min, and 210-240 min post-injection of radiotracer) were acquired using a Siemens Biograph mCT PET/CT scanner. This 18F-FMISO PET imaging protocol was performed at 3 different time points around a single SBRT delivery of 18 Gy and comparisons of HFs were made using a tumor-to-blood ratio (TBR) > 1.2 and the rate of influx, kinetic parameter K_i (ml/mg/min). HF regions were normalized to the absolute tumor volume defined by CT. TBR was defined as the ratio of the 18F-

FMISO signal in each tumor voxel in the tumor region of interest (ROI) summed from 210-240 min to the average signal in heart over the same time frame post-injection.

RESULTS

Results of all patients show substantial variation in the HF during SBRT. Using a TBR threshold >1.2, the HFs increased by nearly a factor of 2 after 18 Gy and then decreased almost to baseline 96 hours later in more than half of patients who completed the imaging protocol. In one representative patient, shown in Figure 1, the HFs were 19%, 31% and 13% of total tumor volume on day 0, 2 (48 hours post-SBRT), and 4 (96 hours post-SBRT).

CONCLUSION

For NSCLC patients receiving SBRT, 18F-FMISO PET imaging has the potential to measure temporal changes in tumor hypoxia. With the results of six patients, this novel pilot study highlights the potential benefit of non-invasive molecular imaging as results indicate substantial variation in tumor hypoxic fraction post-SBRT. Ongoing work includes the development of tracer kinetic analysis of respiratory-corrected dynamic data to enable treatment individualization based on patient-specific biological information.

CLINICAL RELEVANCE/APPLICATION

This novel pilot study highlights the potential benefit of non-invasive molecular imaging as results indicate substantial variation in tumor hypoxic fraction post-SBRT.

SST13-08 Dosimetric Impact of the Presence of the Bowel Gas in IMRT / VMAT Planning for Patients with Abdominal Tumors

Friday, Dec. 4 11:40AM - 11:50AM Location: S403A

Participants

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ABSTRACT

Purpose/Objective(s): To investigate dosimetric consequences of IMRT / VMAT planning with presence of the bowel gas for patients receiving SBRT/IMRT for abdominal tumors. **Materials/Methods:** Six patients, 4 with pancreas tumor, 1 with adrenal gland receiving SBRT and 1 with pancreas tumor receiving conventional IMRT (with large PTV extending into bowel), who had extensive bowel gas visible in the planning CT images and treated with CBCT image guidance, were selected for this study. Two coplanar IMRT or VMAT plans were retrospectively created with the prescription dose (Rx) to 95% of PTV (27.5 Gy in 5 fractions for the SBRT plans and 50.4 Gy in 28 fractions for the IMRT plan), with and without overriding the bowel gas density to water in Pinnacle 9.6. Dose was calculated with heterogeneity correction and collapsed cone convolution algorithm. Planning CT and pre-treatment CBCT images were registered by aligning to the tumor. Patient body external and bowel gas was contoured on the planning CT and CBCT (5 random selected for pancreas IMRT case to represent whole treatment). The external and bowel gas contours were transferred from the CBCT to the planning CT. To estimate actual delivered dose, the following density overrides were performed on the planning CT. The CBCT external outside the CT external were assigned density one and the CT external outside the CBCT external were assigned density zero. The bowel gas contour in CT was assigned one and the transferred bowel gas contour from CBCT were assigned zero. The dose was calculated on the planning CT. This process was repeated for all CBCTs. Finally, dose was accumulated from 5 fractions. For pancreas IMRT case, dose was rescaled to original prescription for analysis. The estimated delivered CTV-VRx, PTV-VRx, maximum dose received by 0.5cc (D0.5cc) of bowel (duodenum, small and large bowel) were compared to plans made with and without bowel gas overriding. **Results:** For SBRT patients (PTV range: 25.9 – 144.4 cc), without and with override of bowel gas density, mean delivered PTV-VRx was $93.7 \pm 2.0\%$ (range: 90.8% - 95.6%) and $96.0 \pm 1.6\%$ (range: 95.0 - 99.5%), change in bowel D0.5cc between planning and delivery was 0.1 ± 0.7 Gy (range: -1.0 Gy, 1.5 Gy) and 0.8 ± 0.6 Gy (range: -0.6 Gy, 1.9 Gy), respectively. For the IMRT patient (PTV volume: 2184cc), without and with override of bowel gas density, delivered PTV-VRx was 66.5% and 93.2% and change in bowel D0.5cc was -2.7 Gy and 1.5 Gy, respectively. CTV-VRx was not affected by density overrides (100% for both techniques) for SBRT patients. For the IMRT patient, delivered CTV-VRx was 65.9% and 100% respectively without override and with override. **Conclusion:** Planning with overriding bowel gas density to water was better for target coverage but caused slightly increased toxicity to bowel compared to that without overriding. With the presence of the bowel gas, a lower bowel planning constraint may be applied if bowel gas is overridden.

SST13-09 Are Prostate Target Margins Adequate for Combined Brachytherapy Followed by External Beam Treatments?

Friday, Dec. 4 11:50AM - 12:00PM Location: S403A

Participants

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Patrick W. McLaughlin, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose

ABSTRACT

Purpose/Objective(s): In this study, external beam prostate treatments were delivered as a boost after I-125 permanent prostate implants. Prostate motion during external beam treatments involves a novel combination of the implant dose moving with the prostate leaving the external beam irradiation susceptible to motion. The adequacy of target expansions on the combined external beam and implant dose was examined based on the measured daily motion of the prostate. **Materials/Methods:** Thirty patients received an I-125 prostate implant prescribed to dose of 90 (25 patients) or 120 (5 patients) Gy. This was followed by an external beam boost to deliver a dose of 90 Gy (external beam equivalent) to the prostate over 10 to 30 fractions. An ideal IMRT plan was developed by optimizing the external beam dose based on the delivered implant dose. Targets in addition to the prostate were seminal vesicles (SV) (30 patients) and lymph nodes (LN) (13 patients). Target expansions were 0.5, 0.7 and 0.5 cm for the prostate, SV and LN, respectively. The limiting dose to the rectal volume had a higher priority during optimization over target coverage. The implant dose was converted to an equivalent external beam dose using the linear quadratic model. Patients were set up on the treatment table by daily orthogonal imaging and aligning the marker seeds in the prostate. For treatments 2 to 6,

orthogonal films were obtained at the end of treatment to assess the motion of the prostate. Based on the observed motion of the markers between the initial and final images, 5 individual plans showing the actual dose delivered to the patient were calculated. A final true dose distribution was established based on summing the implant dose and the 5 external beam plans. Dose to the prostate, SV, LN and normal tissues, rectal wall, urethra and lower sphincter were calculated. On 18 patients who were sexually active, dose to the corpus cavernosum and internal pudendal artery was also calculated. Results: The average prostate motion in 3 orthogonal directions was less than 1 mm with a standard deviation of less than ± 2 mm. Dose and volume parameters for the targets and normal tissue are shown in the table below.

	Average Planned (Gy or cc)	Average Delivered (Gy or cc)
Prostate D ₉₉	93.7 \pm 8.09	92.8 \pm 9.21
Seminal Vesicle D ₉₉	50.0 \pm 9.74	9.1 \pm 9.91
Lymph Nodes D ₉₉	45.1 \pm 1.14	4.2 \pm 1.41
D _{1cc} Rectal Wall	84.1 \pm 11.68	3.7 \pm 12.61
Rectal Wall V ₈₀	1.7 \pm 0.41	6 \pm 1.11
Urethra D ₉₀	71.7 \pm 25.37	0.6 \pm 26.81
Lower Sphincter D ₉₀	67.4 \pm 15.46	6.7 \pm 16.21
Corpus Cavernosum D ₉₀	4.3 \pm 2.54	2.2 \pm 2.60
Internal Pudendal Artery D ₉₀	16.6 \pm 7.71	6.7 \pm 8.51

Conclusion: The delivered dose to the targets was within 2 % of the planned dose indicating that the target margins are adequate. Combined brachytherapy and external beam dose delivered to the prostate was not sensitive to prostate motion.

SST14

Physics (CT VIII-Image Quality II)

Friday, Dec. 4 10:30AM - 12:00PM Location: S403B



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

Participants

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Sub-Events

SST14-01 Automated QA Approaches to Monitor Low Contrast Performance for Computed Tomography (CT) and Digital Breast Tomography (DBT)

Friday, Dec. 4 10:30AM - 10:40AM Location: S403B

Participants

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PURPOSE

An important attribute of medical imaging systems is Low Contrast (LC) performance which is known to have many caveats in measurement and interpretation. This study uses a number of commercial QA phantoms to investigate measures that might be useful in a constancy sense in an automatic QA program.

METHOD AND MATERIALS

Different modules of the Catphan® Phantom and Tomophan™ (The Phantom Laboratory, Salem, NY), present cylindrical and spherical targets of differing CT contrast and dimensions. Automated QA monitoring methods have been developed that calculate signal (contrast) to noise ratios and related detectability models. These include Rose models of the ratio of target contrast to target noise, predicted related Contrast-Detail (CD) diagrams, and results from applying matched filter models and other more advanced signal detection models. The same models are applied to cylindrical targets as well as spherical targets in both CT and DBT.

RESULTS

The automated results are presented and discussed for CT and DBT and compared to visual results from human observers. With care to identify non-uniformities and possible artifacts, the results are found to be quite reproducible and useful in a QA constancy sense. Caution is urged, however, in extending such physics and QA techniques applied to well-defined targets in relatively uniform backgrounds to the more complex case of more complicated structured clinical backgrounds with more non-uniformity.

CONCLUSION

Low contrast models can be used with automated approaches to produce reliable data on LC performance, at least in a QA constancy sense. Several caveats involving the need to adjust for non-uniformities and/or artifacts need to be considered and an extension to the clinical domain must be approached with caution.

CLINICAL RELEVANCE/APPLICATION

This study does not predict clinical low-contrast performance, but is useful in helping monitor scanner performance in a QA sense of factors such as statistical noise and edge resolution of targets.

SST14-02 Low-contrast Detection in 80-, 100-, 120- and 140-kVp MDCT Protocols Using Adaptive Statistical Iterative Reconstruction-V technique: Diagnostic Accuracy, Image Quality, and Radiation Dose in a Phantom Study

Friday, Dec. 4 10:40AM - 10:50AM Location: S403B

Participants

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PURPOSE

To compare the low-contrast detection (LCD), image quality, and radiation dose of a new, third-generation Adaptive Statistical Iterative Reconstruction (ASIR-V) methodology with a filtered back projection (FBP) at different tube voltages and radiation doses.

METHOD AND MATERIALS

Images of a proprietary Mercury phantom (v3.0) obtained with five different clinically relevant incremental 12-37 cm phantom sizes

and low contrast-detail were acquired on a prototype 256-detector row CT (Revolution, GE Healthcare) using varying tube potentials (80, 100, 120, 140 kVp) and a constant CTDIvol (3.0 mGy). A second set of scans was performed at 120 kVp with six different dose levels (0.7-24.0 mGy). Images were reconstructed using the FBP and the ASiR-V algorithms (at three strengths) at two different slice thicknesses. Image quality was evaluated using detectability index [d' - a measure of LCD for a 5.0 mm, 200 HU contrast lesion] as well as noise by comparing objective image noise on ASiR-V images to FBP images as a control. Statistical analysis was performed using ANOVA.

RESULTS

At variable kVps and a constant CTDIvol, a significantly higher d' was demonstrated at lower-kVp MDCT protocols using iodine-contrast media with either FBP or ASiR-V. At any given phantom diameter, d' for ASiR-V images was significantly higher than d' for FBP images ($P < .01$). This effect was distinct in smaller pediatric-sized phantom diameters (12 and 16 cm). ASiR-V showed significantly higher d' than across all radiation doses (0.7-24.0 mGy; $P < .01$). At the lower radiation doses (0.7-3.0 mGy), LCD was significantly better with only higher ASiR-V strengths ($\geq 80\%$). Compared to FBP, a statistically significant reduction in objective image noise was demonstrated [ASiR-V 50% (range, 24-38% noise reduction), ASiR-V 80% (37-58%), ASiR-V 100% (44-70%)]. Percent decrease in noise was less with increasing phantom size and increasing CTDIvol.

CONCLUSION

ASiR-V iterative technology performed significantly better on low-contrast detectability and noise decrease rates compared to FBP technique at multiple kVp and radiation doses. This effect was amplified at both pediatric-sized phantom diameters, and at lower tube potential (such as 80 kVp using iodine contrast).

CLINICAL RELEVANCE/APPLICATION

Across phantom diameters, especially with pediatric sizes, ASiR-V technology affords significant quantitative improvements in image quality and lesion detection compared to conventional FBP technique.

SST14-03 Tilt Angle Effects on Quality Control Phantom Measurements in Multi-Center CT Imaging Studies

Friday, Dec. 4 10:50AM - 11:00AM Location: S403B

Participants

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PURPOSE

Several multi-center and longitudinal CT studies are relying on monthly scanning of the COPDGene 1 Phantom to monitor temporal stability of individual scanners. This study investigates the effects of imperfect object positioning and provides guide lines for acceptable tilt angles.

RESULTS

Using model (1) fitted to data with a Tilt Index up to 0.8, the acceptable Tilt Index was found to be smaller with denser material: 0.4, 0.6, 0.7 and 0.7, for acrylic, water, lung-foam equivalent and air, respectively. The airway measurements and the MTF curve remain stable with Tilt Indices between 0 and 1.7.

CONCLUSION

Rotations of the COPDGene phantom with a tilt index above 0.4 will produce more than 1-HU shift in the mean density of at least one material. Because of this, at the time of phantom receipt at a radiology core laboratory, quality control procedures should include an assessment of the Tilt Index. A Tilt Index threshold of 0.4 is recommended.

CLINICAL RELEVANCE/APPLICATION

Quality control procedures in a radiology core laboratory should include an assessment of the Tilt Index. A Tilt Index threshold of 0.4 is recommended.

SST14-04 Characterization of Tube Current Modulation in Terms of Transfer Functions with a Utilization for Performance Evaluation and Noise Prediction

Friday, Dec. 4 11:00AM - 11:10AM Location: S403B

Participants

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PURPOSE

This study aims to develop a methodology to characterize the performance of tube current modulation (TCM) techniques in a vendor-generic way, and to broaden a methodology to predict mA and noise for clinical images acquired by TCM.

METHOD AND MATERIALS

The adult head and body cylindrical CTDI phantoms (16 and 32 cm in diameter respectively) were axially assembled together using a long rod. All inserts were placed in the periphery holes to create a solid uniform phantom. The phantom was imaged on a commercial CT (Siemens SOMATOM Definition Flash) with a tube current modulation setting of 300 reference mA, I31s kernel, and 1 mm thick slices. The output tube current for each slice was normalized by the pitch to obtain effective mA. This effective mA as a function of distance, where the transition from small to large section occur, was used to obtain an edge spread function (ESF). The

ESF was numerically fitted using a smoothing spline method, differentiated, and Fourier transformed to obtain the mA transfer function (mATF). Noise from each slice was also measured, plotted against the distance, and processed into a noise transfer function (NTF). To validate the technique, a continuously varying sized phantom was used. The measured mA and noise from the varying size of the phantom were compared to those predicted from the mATF and NTF method.

RESULTS

For the same pitch, mATF curves from different rotation times (0.5 s and 1 s) remained nearly identical. When pitch increased from 0.5 to 1, the frequency at 50% almost halved from 0.027 to 0.015 1/mm. The average difference between predicted and measured values was $\sim 10\%$ for mA, and $\sim 20\%$ for noise.

CONCLUSION

A mA and noise transfer function was proposed for characterization of tube current modulation. The transfer functions can be used to predict mA and noise properties of TCM scans. The methodology was validated using a varying sized phantom.

CLINICAL RELEVANCE/APPLICATION

A mA and noise transfer function was proposed for characterization of tube current modulation. The transfer functions can be used to predict mA and noise properties of TCM scans.

SST14-05 Multi-slice Reading in a Low-Contrast Detection Task in CT: Correlation between Human and Model Observer Performance

Friday, Dec. 4 11:10AM - 11:20AM Location: S403B

Participants

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PURPOSE

Model observers based on 2D images have been used to assess CT image quality. However, radiologists typically read images by paging through multiple slices. The purpose of this study was to correlate human and model observer performance in a low-contrast detection task that involves multi-slice (MS) reading.

METHOD AND MATERIALS

A low-contrast phantom containing 18 spheres (6 sizes x 3 contrast levels) was scanned on a 192-slice CT scanner at 5 dose levels (CTDIvol = 27, 13.5, 6.8, 3.4, and 1.7 mGy), each repeated 100 times. Images were reconstructed using both FBP and an iterative reconstruction method (ADMIRE, Siemens). A 3D volume of interest (VOI) around each sphere was extracted and placed side-by-side with a signal-absent VOI to yield a 2-alternative forced choice (2AFC) trial. 16 2AFC studies were generated, each with 100 trials, to evaluate the impact of radiation dose, lesion size and contrast, and reconstruction method. In total, 1600 trials were presented to both model and human observers. Three medical physicists served as human observers and were allowed to page through slices of the 3D volumes. A multi-slice channelized Hotelling observer (CHO_MS) was applied to the 16 2AFC studies. CHO_MS combined multi-slice responses through a separate Hotelling model. For comparison, the same 16 2AFC studies were also performed in a static 2D mode by the 3 readers and a previously validated CHO (CHO_2D).

RESULTS

In the multi-slice viewing mode, observer performance was highly correlated between human observers and the CHO_MS (two-tailed Spearman's correlation coefficient $R=0.96$, $p<0.01$). Human observer performance varied between the MS and 2D modes. One reader performed better in the MS mode ($p=0.013$); whereas the other 2 readers' performances showed no significant difference between the 2 modes ($p=0.06$ and $p=0.38$). The CHO_2D had a high correlation with human observers in both 2D ($R=0.95$, $p<0.01$) and MS mode ($R=0.97$, $p<0.01$).

CONCLUSION

A multi-slice CHO was shown to be highly correlated with human observers in a low-contrast detection task using multi-slice reading. For this task, a previously validated 2D CHO similarly predicted human observer performance for multi-slice reading of 3D images.

CLINICAL RELEVANCE/APPLICATION

Human observer performance in multi-slice reading may be predicted by either CHO_MS or CHO_2D. These tools are useful for objectively assessing and optimizing CT dose and system performance.

SST14-06 New Approaches to Determination of 3D Resolution in CT

Friday, Dec. 4 11:20AM - 11:30AM Location: S403B

Participants

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Joshua Levy, Salem, NY (*Abstract Co-Author*) Stockholder, The Phantom Laboratory President, The Phantom Laboratory
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PURPOSE

The growing trend toward 3D imaging involving Volume CT scanners and the use of 3D and Multiplanar Reconstruction (MPR)

techniques leads to the need for phantoms and test methods that reveal to the radiologist and physicist actual 3D resolution. That is, measures involving not only in-plane (x,y) resolution and related MTF's but also slice width and Slice Sensitivity Profiles (SSP). These "combined" effects can be studied with two new types of phantoms, the WAVE phantom and a 45° Resolution Gauge and are amenable to analysis by automated approaches.

METHOD AND MATERIALS

Newly available commercial phantoms, the WAVE phantom and 45° Resolution Gauge (The Phantom Laboratory, Salem NY) are designed to incorporate the combined effects of in-plane (x,y) resolution as well as slice thickness (z) resolution. These test objects can reveal the way in which the actual CT resolution can be limited by the choice of reconstruction filter and/or the slice thickness or SSP (z) used for the acquisition. Likewise, these phantoms can be used in direct 3D volume acquisition models and MPR or 3D reconstruction approaches. In the case of the WAVE phantom, automated analysis of the harmonics of an angled periodic step wave can be used to show the combined resolution limitations of the in-plane point spread function and the SSP (z) of the slice thickness used in the acquisition.

RESULTS

Examples are shown of the use of the WAVE phantom and the 45° Resolution Gauge with Volume and Multislice (MS) CT scanners. Both the third harmonic of the WAVE and the cutoff of the 45° Resolution Gauge are shown for various acquisition protocols involving different spatial resolution filters and different slice thicknesses. The limitations of using in-plane resolution filters when using a typical slice thickness of 1 to 5mm are clearly shown for several different volume and MS scanners.

CONCLUSION

Use of the new test methods and phantoms reveals useful information for 3D imaging on the combined effects of in-plane resolution and the slice thickness used in the acquisition or reconstruction process. These results can influence the appropriate choice of resolution filter and slice thickness in acquisition protocols.

CLINICAL RELEVANCE/APPLICATION

New approaches give the physician a quantitative and qualitative (visual) measure of the combined effects of in-plane resolution and slice thickness used in the acquisition or reconstruction process.

SST14-07 Optimization of CT Scan-mode and Reconstruction Kernel for Bone Fracture Detection Tasks

Friday, Dec. 4 11:30AM - 11:40AM Location: S403B

Participants

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Daniel Gomez-Cardona, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

Ke Li, PhD, Madison, WI (*Abstract Co-Author*) Nothing to Disclose

Timothy P. Szczykutowicz, PhD, Madison, WI (*Abstract Co-Author*) Equipment support, General Electric Company Research Grant, Siemens AG

Guang-Hong Chen, PhD, Madison, WI (*Abstract Co-Author*) Research funded, General Electric Company; Research funded, Siemens AG

PURPOSE

Hi-Res(olution) mode was recently introduced in some state-of-the-art CT systems to reduce view-angle aliasing and increase spatial resolution. Hi-Res mode allows users to reconstruct data using either conventional or High Definition (HD) kernels. Since high spatial resolution is often associated with a tremendous increase in image noise, the introduction of the Hi-Res mode confounds scan mode selection and the associated reconstruction protocols. In this work we investigate the optimization of scan mode and reconstruction kernel selection for bone fracture detection

METHOD AND MATERIALS

A quantitative, task-driven imaging performance assessment framework was used for optimization. Spatial resolution was quantified with modulation transfer function (MTF) measurements using a tungsten bead. Similarly, the noise power spectrum (NPS) was measured under different conditions with repeated scans, and the impact of display window and level was incorporated into the analysis. A model observer was used to quantify the dependence of the overall imaging performance on different system parameters, and to optimize mode and kernel selection. Model observer results were validated with an ex vivo animal experiment

RESULTS

(1) For conventional reconstruction kernels, the use of Hi-Res mode did not result in a major change in the MTF for centered positions, but it improved the MTF at off-centered positions. (2) The combined use of Hi-Res mode and HD kernels improved MTF at both centered and off-centered positions. (3) The use of HD kernels increased noise magnitude and pushed the noise power to higher frequencies. (4) The optimal kernel and scan mode strongly depend on fracture size and NPS. Model observer results were qualitatively verified by the ex vivo experimental results

CONCLUSION

Optimal use of the Hi-Res mode and its associated HD kernels depends on patient positioning and imaging task. Optimal decision making for its use can be achieved based on the framework developed in this work

CLINICAL RELEVANCE/APPLICATION

Despite its great potential in reducing aliasing and improving spatial resolution, Hi-Res mode has been underused clinically, most probably due to questions about how to optimize scan protocols for this technique. This work incorporates spatial resolution and noise properties of Hi-Res mode and HD kernels along with specific diagnostic task functions to optimize reconstruction kernel selection

SST14-08 Quality Assurance in a Multicenter Trial Evaluating Quantitative CT Perfusion Imaging as a Biomarker of Patient Outcome in Ovarian Cancer Chemotherapy: An ECOG-ACRIN and NRG GOG Study

Friday, Dec. 4 11:40AM - 11:50AM Location: S403B

Participants

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Background

ACRIN 6695's primary objective was to determine whether CT perfusion (CTP) parameters are prognostic of progression-free survival at 6 months in a cohort of patients from the GOG-262 trial. The latter is a phase III trial on advanced stage ovarian cancer comparing standard to dose-dense paclitaxel/carboplatin with 91% of cohort also receiving bevacizumab. Multivariate analysis of ACRIN 6695 demonstrated association of CTP parameters with patient outcome. 76 subjects underwent 3 CTP studies comprised of dynamic contrast enhanced using a two-phase scanning protocol: 24 images at 2.8 s intervals followed by 8 images at 15 s intervals acquired using 120 kV and 50 mAs each image. Axial shuttle scanning mode was allowed but not required. To ensure protocol compliance and uniform image quality, a CT scanner certification process was implemented. Scanner accreditation required that images of a water phantom scan acquired using the trial CTP protocol be submitted to a central core lab where they were evaluated for the following variables: image interval, CT noise, spatial uniformity and temporal stability of CT number.

Evaluation

19 CT scanners from 4 vendors were accredited. The image intervals in both CTP phases were correct in all scanners. CT noise normalized to 5 mm slice thickness was 10.1 ± 1.6 HU. Spatial uniformity and temporal stability was 0.94 ± 0.54 and 0.44 ± 0.15 HU respectively. Both CT noise and spatial uniformity were within 15% of vendor specifications for all accredited scanners.

Discussion

Important factors affecting the accuracy and precision of CTP derived functional parameters include image intervals, CT noise, spatial uniformity and temporal stability of CT numbers. The accreditation process for the ACRIN 6695 evaluated specifically these factors using a practical process which can be implemented by scanning a routine quality control water phantom already present at the site with the specified protocol.

Conclusion

The ACRIN 6695 trial has demonstrated that CT scanner quality assurance for abdominopelvic CTP can be successfully accomplished with sufficient uniformity across multiple sites and scanner platforms to yield positive results in a multicenter biomarker trial.

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/>

Susanna I. Lee, MD, PhD - 2013 Honored Educator

SST14-09 Quality Control Phantom Using 3D Printing Technology in Multi-modality System

Friday, Dec. 4 11:50AM - 12:00PM Location: S403B

Participants

Byungdu Jo, Wonju-Si, Korea, Republic Of (*Presenter*) Nothing to Disclose
Dohyeon Kim, Wonju, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Su-Jin Park, Wonju, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyemi Kim, Wonju, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Geun Young Park, Wonju, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Chaeun Jung, Wonju, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eunsoo So, Wonju, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yong J. Kim, Wonju-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hee-Joung Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

3D printing is a rapidly evolving technology that allows the fabrication of complex three dimensional and multi-material objects for anatomic models, medical tools, and even quality control (QC) phantoms. The design and QC performance analysis of 3D phantom for multi-modality system has not been investigated rigorously. The QC phantom can be easily fabricated with complicate shapes by using 3D printing technology. The goal of this work was to design pre-clinical or clinical QC phantom and validate its performance for multi-modality system.

METHOD AND MATERIALS

For design of the phantom, the SOLIDWORKS 2012 Computer Aided Design (CAD) software was considered due to the flexibility of applications. The model was exported in mesh format (.STL) for 3D printing and a multi-material printer (Objet Eden, Stratasys Ltd.) was used. The prototype phantom was composed of 3 main parts to support both X-ray imaging and nuclear imaging. For nuclear imaging, phantom was designed to evaluate the image quality, including spatial resolutions and uniformity, in accordance with the NEMA NU-4 2008 protocols. For X-ray imaging, we developed 8 containers to be filled with dilutions containing 0.1% to 1.0% of contrast agent and high- and low contrast resolution disk and uniformity area.

RESULTS

For the purpose of comparison with the NEMA NU 4-2008 image quality phantom, we considered mainly the uniformity and the spillover ratio. Indeed, the developed phantom resulted in very good qualities. Moreover, for X-ray imaging, preliminary analysis revealed consistent HU linearity with increasing iodine concentration and shows a high spatial resolution of up to 1.5 mm.

CONCLUSION

The results indicated that developing a complicate QC phantom can be designed to evaluate the systems for multi-modality imaging simultaneously. Our phantom has flexibility of changing quality parameters for the multi-modality system by changing the QC disk in a standard manner.

CLINICAL RELEVANCE/APPLICATION

The proposed QC phantom can be used for variety of pre-clinical or clinical applications in multi-modality system, SPECT/CT, PET/CT, Spectral-CT, simultaneously.

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 base lesions 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 [\pm 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%, $P < 0.001$, 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 multi-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 (\pm standard deviation) of the PTC regions were 1.33 \pm 0.47, 0.92 \pm 0.35, 0.69 \pm 0.31, 0.57 \pm 0.26, 0.43 \pm 0.20, and 0.32 \pm 0.15 $\times 10^{-3}$ 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 $\times 10^{-3}$ 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, MBCh, 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 had complete response to treatment. Mann-Whitney 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 significantly 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 ($1.42 \pm 0.44 \times 10^{-3} \text{ mm}^2/\text{s}$ vs $1.54 \pm 0.45 \times 10^{-3} \text{ mm}^2$, $p < 0.001$). 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.

SST12

Pediatrics (Neuroradiology)

Friday, Dec. 4 10:30AM - 12:00PM Location: N229



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

Participants

Manohar M. Shroff, MD, Toronto, ON (*Moderator*) Consultant, Guerbet SA; Consultant, Magellan Health, Inc
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 Moyamoya Disease

Friday, Dec. 4 10:30AM - 10:40AM Location: N229

Participants

Divya S. Bolar, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose
Borjan Gagoski, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Richard L. Robertson, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Elfar Adalsteinsson, PhD, Stanford, CA (*Abstract Co-Author*) Research grant, Siemens AG
Bruce R. Rosen, MD, PhD, Charlestown, MA (*Abstract Co-Author*) Research Consultant, Siemens AG
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 Moyamoya patients (2F, 3M, ages 3-9), two with unilateral and three with bilateral disease, one pre- and four post-synangiomas, 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

Paula L. Croal, PhD, MSc, Toronto, ON (*Presenter*) Nothing to Disclose
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 PICOE-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

Amir R. Honarmand, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Can Wu, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Samantha E. Schoeneman, BA, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Ryan Kuhn, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Susanne Schnell, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Sameer A. Ansari, MD, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Ali Shaibani, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
Michael Markl, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

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 Morneau, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose

Guilherme Santana, 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 \pm 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.

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

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 systemic asphyxia. Retrospective analysis of the EFM in these 10 cases revealed a 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 hypothesis 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·m². Subsequent modifications used multiple upper and lower pieces to cover a range of magnetic moment from 0.010 to 0.200 A·m². 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·m², with a median value of 0.134 A·m². 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.

SST11

Neuroradiology (Quantitative Neuroimaging)

Friday, Dec. 4 10:30AM - 12:00PM Location: N230



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 Advisory 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

Enrico Tedeschi, MD, Napoli, Italy (*Presenter*) Nothing to Disclose
Carmela Russo, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Sirio Cocozza, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Palma, PhD, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Antonietta Canna, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Pasquale Borrelli, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Roberta Lanzillo, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Valentina Angelini, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Emanuela Postiglione, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Vincenzo Brescia Morra, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Arturo Brunetti, MD, Naples, Italy (*Abstract Co-Author*) Nothing to Disclose
Marco Salvatore, MD, Napoli, Italy (*Abstract Co-Author*) Nothing to Disclose

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

Rafeeqe A. Bhadelia, MD, Chestnut Hill, MA (*Presenter*) Nothing to Disclose
Neel Madan, MD, Boston, MA (*Abstract Co-Author*) Consultant, Near Infrared Imaging, LLC; Board Member, Quindec Inc
Carl B. Heilman, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
David B. Khatami, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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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 ThickKness in the General Population

Friday, Dec. 4 11:10AM - 11:20AM Location: N230

Participants

Hazel I. Zonneveld, MD,MSc, Rotterdam, Netherlands (*Presenter*) Nothing to Disclose

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Meike W. Vernooij, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

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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Qiang Zhang, PhD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

Kejia Cai, PhD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose

Wenzhen Zhu, MD, PhD, Wuhan, China (*Abstract Co-Author*) Nothing to Disclose

Xiaohong J. Zhou, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

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

Marcel Warntjes, Linköping, Sweden (*Presenter*) Employee, SyntheticMR AB
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James L. Leach, MD, Cincinnati, OH (*Abstract Co-Author*) Nothing to Disclose
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, on 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

Islam S. Hassan, MBBCh, Houston, TX (*Presenter*) Nothing to Disclose
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Raymond Sawaya, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Markus Luedi, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Pascal O. Zinn, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Rivka R. Colen, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

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

Hamed Akbari, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose
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Christos Davatzikos, Philadelphia, PA (*Abstract Co-Author*) Shareholder, Gliomics LLC

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.

SST03

Chest (Thoracic Malignancy)

Friday, Dec. 4 10:30AM - 12:00PM Location: E451B



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

Participants

Patricia M. de Groot, MD, Houston, TX (*Moderator*) Nothing to Disclose
James G. Ravenel, MD, Charleston, SC (*Moderator*) Nothing to Disclose

Sub-Events

SST03-01 Radiogenomic Evaluation of Lung Cancer-Are There Imaging Characteristics Associated with Lung Adenocarcinomas Harboring BRAF Mutations?

Friday, Dec. 4 10:30AM - 10:40AM Location: E451B

Participants

Darragh Halpenny, MBBCh, MRCPI, New York, NY (*Presenter*) Nothing to Disclose
Gregory J. Riely, New York, NY (*Abstract Co-Author*) Consultant, Boehringer Ingelheim GmbH Consultant, Merck & Co, Inc Consultant, F. Hoffmann-La Roche Ltd
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Junting Zheng, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Ramon E. Sosa, BA, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Chaya Moskowitz, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Michelle S. Ginsberg, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

BRAF mutations are found in 2% of non-small cell lung cancers (NSCLC) and are associated with responsiveness to treatment with targeted medical therapy. The purpose of this study is to identify computed tomography (CT) imaging features associated with BRAF mutation in lung cancer.

METHOD AND MATERIALS

The institutional review board approved this study. Patients presenting from 4/2/2004 - 6/3/2013 with BRAF mutated NSCLC were studied. Stage matched patients with NSCLC without BRAF mutation were used as controls. Thoracic CTs, performed at diagnosis, were retrospectively reviewed by 2 radiologists in consensus. Features assessed included: size, contour, consistency of the primary tumor, adjacent parenchymal changes (peri-lesional halo, obstructive changes, pleural tail); presence of thoracic lymphadenopathy, pleural effusion, pleural metastases and lymphangitic spread.

RESULTS

188 patients with NSCLC were included: 47 (25%) patients had a BRAF mutation. 141(75%) had non-BRAF mutated NSCLC: 47 EGFR mutations, 47 KRAS mutations, and 47 lesions without documented mutation. In each group, 30% patients were stage 1, 6% were stage 2, 26% were stage 3 and 38% were stage 4. BRAF patients were more likely to be older ($p=0.014$), male ($p=0.011$) and have a smoking history ($p<0.001$) when compared to EGFR patients. There were no other demographic differences between the groups. BRAF lesions were most frequently solid: 37(79%), spiculated 22(47%) and peripheral 37(79%), however no imaging feature of the primary tumor was significantly different between BRAF and non-BRAF groups. Some ancillary imaging features were significantly associated with BRAF mutations when the BRAF group was compared to patients with KRAS mutations. BRAF patients were more likely to have a pleural effusion than KRAS patients 11(23%) vs 3(6%) $p=0.033$. In addition, BRAF patients were more likely to have pleural metastases than KRAS patients 5(11%) vs 0(0%), $p=0.045$.

CONCLUSION

On CT evaluation, NSCLC with BRAF mutation is most frequently solid, spiculated and peripheral. No feature of the primary tumor can be used to differentiate BRAF lesions from other genetically distinct forms of NSCLC.

CLINICAL RELEVANCE/APPLICATION

The results provide the first description of the radiologic characteristics of BRAF mutated lung cancer, detection of which is important to identify patients who may benefit from targeted therapy.

SST03-02 Radiogenomic Detection of EGFR and KRAS Mutations in NSCLC Using CT Texture Analysis

Friday, Dec. 4 10:40AM - 10:50AM Location: E451B

Participants

James Sorensen, MBBCh, Houston, TX (*Presenter*) Nothing to Disclose
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Shekhar S. Patil, MD, MPH, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Laurence E. Court, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Arvind Rao, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Myrna C. Godoy, MD, PhD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Brett W. Carter, MD, Houston, TX (*Abstract Co-Author*) Author, Reed Elsevier; Consultant, St. Jude Medical, Inc; ;
J J. Lee, PhD, DDS, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Kathryn A. Gold, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose
Stephen G. Swisher, MD, Houston, TX (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc

PURPOSE

To perform CT texture analysis on contrast enhanced chest CT images to detect EGFR and KRAS mutations in non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

We retrospectively evaluated NSCLC patients from the MD Anderson Cancer Center GEMINI (Genomic Marker-Guided Therapy Initiative) cohort who had contrast-enhanced chest CT imaging within 90 days prior to biopsy, and who also had genetic testing for EGFR or KRAS mutations. Tumor segmentation was done semi-automatically using 3DSlicer (Harvard University, Cambridge MA). Textural features were calculated using IBEX (MDACC, Houston TX). On the basis of existing literature, and prior experience, 30 image features were selected, including GreyLevel Cooccurrence Matrix, Run-Length Matrix, intensity histogram, and geometric properties (ie shape and size) of the tumor. Feature sets were generated from CT images without filtering, as well as following application of either a Laplacian of Gaussian filter or Gaussian smoothing filter. The resulting features were used to train a Random Forest machine learning classifier, which yielded a prediction for the EGFR and/or KRAS mutation status of each patient.

RESULTS

Of 115 patients, 107 were tested for KRAS mutation (81 -ve, 26 +ve) and 113 tested for EGFR mutation (85 -ve, 28 +ve). CTs were from a variety of scanners, but all were contrast-enhanced, with soft-tissue reconstructions, and slice-thickness of 1.25 - 5 mm. Mean tumor diameter was 5.7cm (range 1.2 - 14.9cm) and mean volume was 44.9 cm³ (range 0.4 - 338 cm³). No single feature was found to be strongly predictive for either mutation, but when collected in a Random Forest classifier these features predicted the presence of KRAS mutations with a sensitivity and specificity of 42% and 89%, respectively, with a PPV of 55% and NPV of 83%. For EGFR mutation, sensitivity and specificity were 50% and 76%, with a PPV of 41% and NPV of 82%. In total, KRAS and EGFR mutation status was correctly assessed in 76% and 70% of cases, respectively.

CONCLUSION

Texture analysis was able to correctly identify EGFR and KRAS mutation status in the majority of patients. Given the limitations of obtaining histologic samples in patients with multiple lesions or tumor heterogeneity, texture analysis may improve genotyping accuracy in these patients.

CLINICAL RELEVANCE/APPLICATION

Non-invasive genotyping with texture analysis may be of particular benefit to patients with NSCLC being considered for targeted therapy.

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
Brett W. Carter, MD - 2015 Honored Educator

SST03-03 Decoding Tumor Phenotype for ALK, ROS1, and RET Fusions in Lung Adenocarcinoma Using a Radiomics Approach

Friday, Dec. 4 10:50AM - 11:00AM Location: E451B

Participants

Hyun Jung Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Jae-Hun Kim, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yoon-La Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hyeseung Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Kyung S. Lee, MD, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jhngook Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To identify the clinicoradiologic predictors of tumors for ALK (anaplastic lymphoma kinase), or ROS1 (c-ros oncogene 1), or RET (rearranged during transfection) fusion-positive in patients with lung adenocarcinoma.

METHOD AND MATERIALS

A total of 539 pathologically confirmed lung adenocarcinomas were included this retrospective study. Baseline clinicopathologic characteristics were retrieved from the patients' medical records. ALK/ROS1/RET fusion status was also reviewed. Qualitative and quantitative CT and PET imaging characteristics were evaluated. Of all clinicoradiologic features, significant features for ALK/ROS1/RET fusion-positive prediction model were extracted, and sensitivity, specificity, positive and negative predictive value were calculated for each of two discrimination tasks such as fusion-positive vs. fusion-negative tumor. We further performed comparison task between ALK vs. ROS1/RET fusion-positive tumors in clinicoradiologic features to identify clinicoradiologic similarity between the two groups.

RESULTS

Of 539 patients, 47 were ALK + lung cancers (47/539, 8.7%), 17 were ROS1/RET fusion-positive (17/539, 3.2%), and 475 were fusion-negative for those genes (475/539, 88.1%). ALK/ROS1/RET fusion status was mutually exclusive. ALK ROS1/RET fusion-positive predicting model was combination of age, tumor stage, solidity, SUVmax, mass, kurtosis, inverse variance on 3-voxel distance with a sensitivity, specificity, positive and negative predictive value of 0.73, 0.70, 0.71 and 0.69, respectively. In comparison task between ALK vs. ROS1/RET fusion-positive, all clinicoradiologic features were not significantly different except

tumor stage, central location, SUVmax, homogeneity on 1-, 2- and 3-voxel distance, and sum mean on 2-voxel distance.

CONCLUSION

ALK/ROS1/RET fusion-positive lung adenocarcinomas possess certain clinical and imaging features, enabling good discrimination of fusion-positive from fusion-negative lung adenocarcinomas. ROS1/RET fusion-positive tumors share most clinicoradiologic features with ALK fusion-positive tumors.

CLINICAL RELEVANCE/APPLICATION

ROS1/RET + lung adenocarcinomas share clinicoradiologic characteristics with ALK + tumor and it may help to identify cases for ROS1/RET testing targeted Crizotinib even in case of ALK - condition.

SST03-04 Pseudo-progression in NSCLC with anti-PD-1/PD-L1 Antibodies: An Early Onset Event

Friday, Dec. 4 11:00AM - 11:10AM Location: E451B

Participants

Caroline Caramella, MD, Villejuif, France (*Presenter*) Nothing to Disclose
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Francesco Facchinetti, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Christophe Massard, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Anas Gazzah, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
David Planchard, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Jean-Charles Soria, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose
Benjamin Besse, Villejuif, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Immune-checkpoint inhibitors directed against PD-1 (PD-1i) or PD-L1 (PD-L1i) are emerging as a standard of care for non-small cell lung cancer (NSCLC). Radiological and clinical evaluation of their activity is still challenging. In particular, signs of disease progression can be followed by long-term disease control.

METHOD AND MATERIALS

Data from advanced NSCLC patients included in phase I-II clinical trials were retrospectively collected in a single center. CT-scans were performed every 6 weeks and at 4 weeks if progression was suspected. All CT-scans were centrally reviewed by two senior radiologists. A pseudo-progression (pseudo-PD) was defined as a Disease Progression that was not confirmed at 4 weeks evaluation (i.e. tumoral stabilization or regression).

RESULTS

From 12/2012 to 12/2014, 44 patients were included in 3 phase I (n=13) and 2 phase II (n=31) clinical trials evaluating 2 PD-1i and 2 PD-L1i. 38 patients (86%) had a stage IV NSCLC, 6 (14%) local recurrences. There were 14 Squamous Cell Carcinomas, 27 Adenocarcinomas (ADC) and 3 other histologies. PD-1i and PD-L1i were administered to 18 and 26 patients respectively. At 3 months, 20 patients had a PD confirmed at 4 weeks, 9 a Stable Disease (SD), 9 a Partial Response (PR), 2 a Complete Response (CR) and 4 a pseudo-PD. All pseudo-PD patients received a PD-L1i and had PD-L1 positive ADC. Median time to radiological or clinical PD was 33 days (range 7-81), and subsequent response was 84 days (range 40-125). Signs of PD were: 1) appearance of pre-vascular lymph nodes, 2) increase of subcutaneous lesions, 3) significant increase of lung and pleural lesions and new contralateral carcinomatous lymphangitis 4) new pulmonary lesion. Of note, either PR or CR was later achieved for all lesions but the pre-vascular lymph nodes, which remained stable. For case 3), radiological behavior was accompanied by early-onset (7 days after the first infusion) worsening of dyspnea and asthenia, followed by clinical improvement. All 4 patients are still treated, with a median time of 169 days.

CONCLUSION

Pseudo-progression during immunotherapy is frequent (9%) and has to be individualized since these patients may derive a significant benefit, despite initial radiological and sometimes clinical worsening.

CLINICAL RELEVANCE/APPLICATION

The emergence of immunotherapy leads to a new radiological paradigm in tumoral evaluation, the concept of pseudoprogression being a frequent event.

SST03-05 Benefit of Motion Correction for Blood Flow Estimates in CT Perfusion Imaging of Lung Cancer

Friday, Dec. 4 11:10AM - 11:20AM Location: E451B

Participants

Lisa L. Chu, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
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Aryan Shay, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
Kai-Yin See, MD, Sunnyvale, CA (*Abstract Co-Author*) Nothing to Disclose
Jonathan Santos, BS, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose
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Friedrich D. Knollmann, MD, PhD, Sacramento, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

CT perfusion imaging to assess the treatment response in advanced lung cancer can be compromised by respiratory motion during image acquisition. The purpose of this study was to determine whether the use of an original motion correction method can improve the reproducibility of blood flow measurements in CT perfusion imaging.

METHOD AND MATERIALS

The institutional review board approved this dual-institution prospective study. Twenty random adult patients with non-resectable

pathologically proven non-small cell lung cancer treated with systemic therapy gave written informed consent to undergo CT perfusion of their tumor over a period of 50 seconds after intravenous contrast injection. A motion correction method which consisted of manually outlining the tumor margins and then applying a rigid manual landmark registration algorithm followed by the non-rigid Diffeomorphic Demons algorithm was applied on all CT perfusion images. The non-motion-corrected and motion-corrected images were then analyzed with commercially available perfusion analysis software which accounted for tumor dual blood supply. Two observers each performed the analysis twice, and the intra-observer and inter-observer variability of each method was assessed with Bland-Altman statistics.

RESULTS

The 95% limits of agreement of intra-observer reproducibility for observer 1 improved from -84.4%; 65.3% before motion correction to -33.8%; 30.3% after motion correction ($r = 0.86$ and 0.97 , before and after motion correction, respectively, $p < 0.0001$ for both). The 95% limits of agreement of intra-observer reproducibility for observer 2 improved from -151.1%; 95.7% before motion correction to 48.5%; 36.0% after motion correction ($r = 0.87$ and 0.95 , before and after motion correction, respectively, $p < 0.0001$ for both). The 95% limits of agreement of inter-observer reproducibility improved from -168.2%; 153.8% before motion correction to -17.3; 25.3% after motion correction ($r = 0.65$ and 0.97 , before and after motion correction, respectively, $p < 0.0001$ for both).

CONCLUSION

The use of a motion correction method significantly improves the reproducibility of CTP estimates of tumor blood flow in lung cancer.

CLINICAL RELEVANCE/APPLICATION

Respiratory motion is an important compromising factor in measuring lung tumor blood flow. Use of an original motion correction method significantly improves reproducibility of blood flow measurements in lung cancer at perfusion CT.

SST03-06 The Value of Diffusion-weighted Imaging in differentiating Metastatic from Non-metastatic Lymph Nodes in Patients with Lung Cancer: A Meta-analysis

Friday, Dec. 4 11:20AM - 11:30AM Location: E451B

Participants

Guangxiang Chen, Luzhou, China (*Presenter*) Nothing to Disclose
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PURPOSE

To perform a meta-analysis to evaluate the diagnostic performance of the diffusion-weighted imaging(DWI) in differentiating metastatic from non-metastatic lymph nodes in patients with lung cancer.

METHOD AND MATERIALS

Systematic and comprehensive literature searches of the PubMed, Embase, Web of Science, Cochrane Library, China Biomedicine(CBM), China National Knowledge Infrastructure(CNKI) and Wanfang databases were performed to identify eligible original studies. Methodological quality of included studies was assessed by QUADAS-2(Quality Assessment of Diagnostic Accuracy Studies). Meta-analysis were performed to pool sensitivity and specificity, calculate positive likelihood ratio(PLR),negative likelihood ratio(NLR), diagnostic odds ratios(DORs) and construct summary receiver operating characteristic(SROC) curve. Homogeneity of included studies,potential threshold effect and publication bias were investigated.

RESULTS

A total of 10 studies with 11 datasets met the inclusion criterion, including 796 patients with a total of 2,433 lymph nodes. The pooled diagnostic sensitivity was 0.78(95% CI: 0.74-0.81) and the pooled diagnostic specificity was 0.88 (95% CI: 0.86-0.89). The PLR, NLR, and DOR were 7.11 (95% CI: 4.39-11.52), 0.24 (95% CI: 0.18-0.33), and 31.14 (95% CI: 17.32-55.98), respectively. The overall area under the curve (AUC) was 0.90. The Deeks' funnel plot symmetry tests revealed that no publication bias was found (bias = -0.15, P = 0.887). A notable heterogeneity was observed and patient selection, type of lung cancer, number of enrolled lymph nodes, reference standard, b value and type of scanner were the sources of heterogeneity. There was no significant threshold effect.

CONCLUSION

DWI is a valuable, noninvasive, and non-radiative MRI modality with good diagnostic performance for distinguishing metastatic from non-metastatic lymph nodes in patients with lung cancer.

CLINICAL RELEVANCE/APPLICATION

Our meta-analysis revealed that DWI is a valuable, noninvasive, and non-radiative MRI modality with good diagnostic performance for distinguishing metastatic from non-metastatic lymph nodes in patients with lung cancer. In the future, larger-scale prospective studies with respect to DWI for the diagnosis of lymph node metastasis are still necessary to evaluate and confirm its clinical value. Furthermore, the optimization of DWI acquisition protocol, standard image processing and analysis are crucial to routine clinical application of DWI in detecting lymph node metastasis in patients with lung cancer.

SST03-07 Clinical Outcome of Stereotactic Body Radiotherapy (SBRT) of Lung Metastases - A Single Center Study

Friday, Dec. 4 11:30AM - 11:40AM Location: E451B

Participants

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Michael W. Schmuecking, MD, Hamburg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

It is hypothesized that oligometastatic disease represents a potentially curable disease. Stereotactic body radiation therapy (SBRT) is an option for patients who are not amenable to or do not want resection. We present a single center study to evaluate the outcome of SBRT in oligometastatic patients with lung lesions.

METHOD AND MATERIALS

Patients: between 07/2009 and 08/2014 oligometastatic patients (n = 24) with 34 lung lesions of various histology were treated with SBRT. 16.7% of the patients had a solitary lung metastasis. In 14 patients (pts.) we treated 1 pulmonary lesion, in 9 pts. 2 lesions and in 1 patient 3 lesions. 19 lesions were located peripherally, 15 centrally. Radiation Therapy: After stereotactic positioning using a Bodyfix®, every patient received a 4D-CT followed by 18F-FDG-PET/CT in radiation treatment planning position (except patients with renal cell cancer). Dose calculation was done with the pencil beam (PB) algorithm in iPlan, IGRT by daily pre-treatment and post-treatment CBCT. Standard fractionation for peripheral lesions was 5x10-12Gy, for very central lesions 11x4.5Gy or 10x5-6Gy, if tolerable according to the RTOG constraints. The dose was prescribed to the isodose line covering at least 95% of the PTV (median prescription isodose line 80%, mean 82%, range 76%-86%; median coverage of the PTV D98, range D94-D100).

RESULTS

Median follow-up was 13.9 months (range 0-48 months). Actuarial local control (Kaplan-Meier-Plot) after 1, 2, 3, 4 years was 94%, 91%, 91%, 87%, respectively. Actuarial progression free survival after 1, 2, 3, 4 years was 73%, 62%, 45%, 29%, respectively. Local relapse / tumor persistence as detected by CT or 18F-FDG-PET/CT was found in 4 patients: directly after SBRT in one patient (sarcoma), 5, 8 and 31 months after SBRT in the other patients. Regional and/or distant out of volume progression was found in 9 patients (in 4/8 pts. with NSCLC): 0, 0, 1, 1, 3, 8, 14, 28 und 31 months after SBRT. 2 patients died during follow-up, 1 due to tumor progression (NSCLC), 1 due to pulmonary embolism (head and neck cancer). Clinical asymptomatic pneumonitis 12.5%. Grade 2 toxicity 8%.

CONCLUSION

Our preliminary data show a long term local control of 87% in the treated pulmonary lesions without severe side effects. Systemic progression is a major challenge, especially in patients with NSCLC.

CLINICAL RELEVANCE/APPLICATION

Critical is the correct patient selection for this treatment option.

SST03-08 Diagnostic Accuracy of PET/MR in Comparison to PET/CT in Local Thoracic Staging of Malignant Pleural Mesothelioma

Friday, Dec. 4 11:40AM - 11:50AM Location: E451B

Participants

Katharina Martini, Zurich, Switzerland (*Presenter*) Nothing to Disclose
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Thomas Frauenfelder, MD, Zurich, Switzerland (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the diagnostic accuracy of PET/MR for local staging of malignant pleural mesothelioma (MPM) compared to PET/CT.

METHOD AND MATERIALS

In a prospective clinical trial 22 consecutive patients (median age 66 years; range 40-76 years; 1 female, 21 male) with known MPM, who underwent PET/CT and PET/MR exams for either staging or re-staging/follow-up were evaluated. Imaging was conducted using a tri-modality PET/CT-MR set-up (Discovery PET/CT 690, 3T Discovery MR 750w, both GE Healthcare, Waukesha, WI, USA). Two independent readers evaluated images for T and N stage, confidence level (sure to unsure; 1-3) and subjective overall image quality (very good to non-diagnostic; 1-4). Inter-observer agreement of T and N stages (Cohen's kappa) and interclass correlation coefficient (ICC) between PET/CT vs. PET/MR was calculated.

RESULTS

Inter observer agreement for evaluation of T and N stage in PET/CT images was excellent (k=0.871 and k= 0.869, respectively), whereas PET/MR imaging showed substantial agreement in T and N staging (k=0.744 and k= 0.749, respectively). The ICC of PET/CT vs. PET/MR was excellent for the evaluation of T as well as N stage (ICC=0.974 and ICC= 0.963, respectively). Diagnostic confidence was scored significantly higher in PET/MR compared to PET/CT (mean score = 1.16 and 1.48, respectively; p<0.001). Image quality was diagnostic for all image series.

CONCLUSION

Our findings suggest that diagnostic accuracy of PET/MR is comparable to PET/CT in T and N staging of MPM but has significant higher diagnostic confidence due to better soft tissue contrast of PET/MR compared to PET/CT.

CLINICAL RELEVANCE/APPLICATION

PET/MR can be used in local staging of malign pleural mesothelioma and has the benefit to have a higher diagnostic confidence compared to PET/CT.

SST03-09 Locally Advanced Esophageal Squamous Cell Carcinoma: Multidetector CT for Restaging and Assessment of Treatment Response after Neoadjuvant Therapy

Friday, Dec. 4 11:50AM - 12:00PM Location: E451B

Participants

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Xiaoting Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To assess the diagnostic accuracy of multidetector CT (MDCT) for restaging and determine the feasibility of CT for assessment of treatment response in esophageal squamous cell carcinoma after neoadjuvant therapy.

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board, and a waiver of informed consent was remitted. We studied 135 consecutive patients with esophageal squamous cell carcinoma who had pre-resection CT after neoadjuvant treatment. The CT staging of the patients was either T1-2 with N1-3 or T3-4 with N0-N3 without metastases before therapy according to the 7th edition of the AJCC/TNM classification. Results of CT restaging after therapy were compared with the final pathological staging. Tumor regression grade (TRG) from CT was determined by two radiologists using the Response Evaluation Criteria in Solid Tumors (RECIST) method. According to CT restaging, the patients with T0-2 and N0 (cohort 1) were defined as response, T3-4 and N1-3 (cohort 2) were defined as non-response and the response of patients with T3-4 and N0 or T0-2 and N1-3 (cohort 3) was not determined.

RESULTS

The accuracy of CT for T stage of patients with esophageal cancer after neoadjuvant therapy was 45% (61/135) and 47% (64/135), respectively by two radiologists (kappa value=0.718). Sensitivity and specificity were as follows: Observer 1, T0 21%/100%, T1-2 42%/96%, T3 69%/46%, T4 50%/84%; Observer 2, T0 42%/100%, T1-2 55%/93%, T3 54%/54%, T4 57%/85%. Accurate N stage were noted 59% and 56%, by two radiologists (kappa value=0.753). TRG from CT was predicted correctly in only 27% (37/135). There were no significant trends toward better survival for lower TRG (P=0.286). There was significant difference in survival among cohort 1(19 patients), cohort 2 (46) and cohort 3 (70). The survival of responding patients was better than that of non-responders.

CONCLUSION

Restaging by CT did not accurately predict pathological stage in esophageal squamous cell carcinoma after neoadjuvant treatment. Comparing with TN stage before and after therapy, CT can evaluate the response in about one half of patients, but the treatment response of the remaining half of patients was not determined using CT.

CLINICAL RELEVANCE/APPLICATION

The TNM staging of esophageal carcinoma will directly affect overall treatment options and their prognosis. Currently, chest CT is still routinely applied for restaging and monitoring treatment therapy.

SST09

Neuroradiology (Cerebrovascular Imaging)

Friday, Dec. 4 10:30AM - 12:00PM Location: N226



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

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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

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Wan-Yuo Guo, MD, PhD, Taipei, Taiwan (*Abstract Co-Author*) Nothing to Disclose

Jiing-Feng Limg, 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

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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%, respectively. 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 Callsum 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

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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 measurement 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 Arterial 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 $\geq 50\%$, PB $\geq 77\%$ and MLA $\leq 2.0\text{mm}^2$ 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 \geq 50%, PB \geq 77% and MLA \leq 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.

SST06

Gastrointestinal (Gallbladder and Biliary Imaging)

Friday, Dec. 4 10:30AM - 12:00PM Location: E353C



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<0.003). Increased mural signal on high b-value images was significantly more frequent in acute than in non-acute cholecystitis 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 adjacency to the portal vein, according to surgical guidelines of International Association of Pancreatology.

RESULTS

Multiphase 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%) demonstrated 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 represent 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 Cholangiocarcinoma

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 A ($P = 0.030$). 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.

SST01

Breast Imaging (Multi-modality Screening)

Friday, Dec. 4 10:30AM - 12:00PM Location: E450B



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
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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

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Albert Gubern-Merida, 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

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

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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 includes 104,893 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 than 1 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

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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, MBCh, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
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David Evans, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Rumana Rahim, MBBS, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
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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 ($p \leq .04$). 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 ($p \geq .14$).

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 attributed to inadequate tissue acquisition. Optimal positioning maximizes 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.

SST05

Gastrointestinal (Stomach Cancer and Masses)

Friday, Dec. 4 10:30AM - 12:00PM Location: E353B



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
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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: $(IC(\text{before}) - IC(\text{after}))/IC(\text{before})$. 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 ($2.44 \pm 0.83 \text{mg/ml}$) and poor-response group ($1.65 \pm 0.64 \text{mg/ml}$) 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

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Jong Mee Lee, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
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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
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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
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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 histopathological 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
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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.

SST15

Vascular/Interventional (Innovation in Non-Vascular Interventions)

Friday, Dec. 4 10:30AM - 12:00PM Location: E350



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

Participants

Jonathan M. Lorenz, MD, Chicago, IL (*Moderator*) Nothing to Disclose

Robert G. Dixon, MD, Chapel Hill, NC (*Moderator*) Nothing to Disclose

Sub-Events

SST15-01 Gastroduodenal Stent Placement versus Surgical Gastrojejunostomy for the Palliation of Gastric Outlet Obstructions in Patients with Unresectable Gastric Cancer: A Propensity Score-Matched Analysis

Friday, Dec. 4 10:30AM - 10:40AM Location: E350

Participants

Jung-Hoon Park, MS, RT, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

Ho-Young Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Jiaywei Tsauo, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Wei-Zhong Zhou, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

Jin Hyoung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Young Chul Cho, BS, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare the outcomes between stent placement and surgical GJ for the palliation of gastric outlet obstruction (GOO) in patients with unresectable gastric cancer.

METHOD AND MATERIALS

A retrospective study was performed in a single university hospital in 676 patients with GOO, and who were treated either by stent placement (n = 301) or surgical GJ (n = 375). The outcomes were assessed with reference to the following variables with the use of propensity-score matching: success rates; adverse events; dysphagia scores, albumin, and BMI; survival; symptom free duration; and hospitalization.

RESULTS

224 of 676 patients were enrolled in accordance with inclusion and exclusion criteria. In the 74 matched cohorts, there was no significant difference between the two groups following variables: success rates, adverse events, and survival. The dysphagia score seven days after treatment in the stent group was significantly better than in the surgery group (1.50 vs. 2.07, P < 0.001). Albumin level one month after treatments in stent group was significantly lower than in the surgery group (3.33 vs. 4.12, P < 0.001). Duration of symptom free and hospitalization were significantly longer in the surgery group than in the stent group (P = 0.002, P < 0.001, respectively). The recurrence rate was significantly higher in the stent group than in the surgery group (P = 0.032).

CONCLUSION

In a matched cohort of patients, stent placement can provide faster symptom relief and shorter hospitalization, while surgical GJ can provide longer symptom free duration, less recurrent obstruction symptoms and better nutritional status.

CLINICAL RELEVANCE/APPLICATION

Stent placement provides more immediate symptom relief and shorter hospitalization compared with surgical GJ, but is associated with a shorter symptom free duration, a greater chance of recurrent obstruction symptoms, and poorer nutritional status.

SST15-02 Fluoroscopic Stent Placement versus Endoscopic Stent Placement for the Palliation of Malignant Gastric Outlet Obstruction: A Retrospective Comparison Study

Friday, Dec. 4 10:40AM - 10:50AM Location: E350

Participants

Jiaywei Tsauo, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

Ho-Young Song, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Endoscopic stent placement (ESP) and fluoroscopic stent placement (FSP) are both well-established methods for the palliation of malignant gastric outlet obstruction (GOO). To date, there has been no study comparing these two procedures. The aim of this study was to compare retrospectively the outcomes of ESP with FSP in patients with malignant GOO.

METHOD AND MATERIALS

A retrospective study was performed in a single university hospital in 306 patients with malignant GOO, and who were treated either by ESP (n = 181) or FSP (n = 125). The outcomes were assessed with reference to the following variables: success rates;

procedure time; GOOSS scores; adverse events; re-intervention; stent patency; and survival.

RESULTS

A total of 193 patients met our inclusion/exclusion criteria, including 68 patients who underwent ESP and 125 patients who underwent FSP. The technical and clinical success rates, adverse events, re-intervention rates, stent patency, and patient survival rate were not significantly different between two groups. GOOSS score improved significantly in both groups after the procedure. Stent migration rate and number of re-intervention procedures was significantly higher in the ESP group than in the FSP group ($P = 0.002$ and $P = 0.024$, respectively). Stent collapse rate was lower in the ESP group than in the FSP group ($P = 0.021$). Six-month stent patency rate was statistically higher in the ESP group than in the FSP group ($P = 0.044$).

CONCLUSION

Despite similar outcomes and adverse events, partially covered SEMs for TTS delivery system were associated with a higher migration rate and a more frequent need for re-interventional procedure, while lower stent collapse rate compared with partially covered dual SEMs for the palliation of malignant GOO.

CLINICAL RELEVANCE/APPLICATION

Our study demonstrated that both FSP and ESP using a partially covered SEMs are an effective therapeutic option for the palliation of malignant GOOs.

SST15-03 Efficacy and Safety of a Newly Designed, Fully Covered Self-expandable Metallic Stent for Malignant Esophageal Strictures

Friday, Dec. 4 10:50AM - 11:00AM Location: E350

Participants

Jung-Hoon Park, MS, RT, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Wei-Zhong Zhou, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose
Jiaywei Tsauo, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Chul Cho, BS, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To reduce the stent dysfunction rate, we developed a new self-expandable metallic stent (SEMS) with double step flanges at both ends coated with silicone and a main body externally covered with a polytetrafluoroethylene membrane. The purpose of this study was to investigate the efficacy and safety of the new SEMs for the palliation of malignant esophageal strictures.

METHOD AND MATERIALS

With approval from our institutional review board, the records of 76 patients who underwent the new SEMs placement were retrospectively reviewed. Patients with benign strictures or who underwent temporary stenting for other therapies were excluded. Fifty-one patients (44 men, 86.3%; mean age, 63.7 years) were included in this study. Technical and clinical success, stent dysfunction, survival, and complications were analyzed.

RESULTS

Technical and clinical success was achieved in all patients (100%). The dysphagia score improved from 3.2 ± 0.6 to 1.1 ± 0.7 after treatment ($P < 0.001$). Stent dysfunction occurred in 10 patients (19.6%): migration in four (7.8%), tumor overgrowth in five (9.8%), and food impaction in one (2.0%). The major complication was a tracheoesophageal fistula in one patient (2.0%). Minor complications, including mild pain and gastroesophageal reflux, were observed in 10 patients (19.6%). The median survival was 160 days. Twenty-four patients who underwent tumor treatments after stenting had a longer survival but had more stent dysfunction than those on supportive care ($P < 0.05$).

CONCLUSION

The new stent was safe and effective for the palliation of malignant esophageal strictures, and resulted in relatively low migration and tumor overgrowth rates compared to those reported previously.

CLINICAL RELEVANCE/APPLICATION

This newly designed fully covered self-expandable metallic stent could be used for the management of malignant esophageal strictures. Owing to its new design, patients with malignant esophageal strictures could benefit from its low stent dysfunction and complication rates.

SST15-04 Fluoroscopic Removal of Retrievable Expandable Metallic Stents: Experiences in 129 Patients with Malignant Esophageal Strictures

Friday, Dec. 4 11:00AM - 11:10AM Location: E350

Participants

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Jiaywei Tsauo, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Chul Cho, BS, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Wei-Zhong Zhou, Nanjing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the safety and efficacy of fluoroscopic removal of retrievable expandable metallic stents (REMSs) in patients with malignant esophageal strictures, to compare clinical outcomes regarding removal techniques and removal timing, and to identify predictive factors related to successful removal.

METHOD AND MATERIALS

In this retrospective study, 129 patients with a total of 139 stent placements were reviewed retrospectively. Of the 139 stents, 95 stents were removed electively. Technical success rate and complication rate of the standard removal technique (Primary technical success) and modified removal technique (Secondary technical success) were evaluated. Logistic regression models were constructed to identify predictive factors related to successful removal.

RESULTS

Primary technical success rate was 78.4% (109/139) and secondary technical success rate was 100% (30/30). We observed 6 (4.3%) cases of complications associated with the removal. All complications were caused by the standard removal technique. There was no complication noted when REMSs were removed within 4 weeks of placement. Stent location at the upper esophagus ($P=0.006$), and stricture length ≥ 8 cm ($P=0.026$) were negative predictive factors for technical success of the standard technique.

CONCLUSION

Fluoroscopic removal of retrievable SEMSs for malignant esophageal strictures can be performed in a safe and convenient manner. Caution should be posed when removing stents located at the upper esophagus and stricture length ≥ 8 cm as they show higher tendency to failure of the standard removal technique.

CLINICAL RELEVANCE/APPLICATION

Stent removal within 4 weeks might be ideal in minimizing stent-induced complication, albeit further studies are to be performed for verification.

SST15-05 Airway Stent Placement for Malignant Tracheobronchial Strictures in Patients with an Endotracheal Tube

Friday, Dec. 4 11:10AM - 11:20AM Location: E350

Participants

Min Jung Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose
Ji Hoon Shin, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jung-Hoon Park, MS, RT, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Young Chul Cho, BS, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Jin Hyoung Kim, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the technical feasibility and safety of airway stent placement for malignant tracheobronchial strictures in patients with an endotracheal tube.

METHOD AND MATERIALS

We retrospectively analyzed the data regarding retrievable, expandable, metal, stent placement under fluoroscopic guidance in 21 patients with an endotracheal tube inserted for malignant tracheobronchial strictures. The clinical effectiveness was assessed using the following variables: technical and clinical success; procedure and stent-related complications; and duration of intubation following stent placement.

RESULTS

Stent placement was technically successful in all 21 patients (100%), and with 20 of the 21 patients (95%) showing symptomatic improvement within five days. The endotracheal tube could be removed during ($n=7$) or after ($n=13$) stent placement, and the mean duration of intubation following stent placement was 1.4 days (range 0- 4 days). One patient could not have his endotracheal tube removed and he died nine days following stent placement in an intubation state. Mild bleeding was a procedure-related complication that occurred in one patient and which resolved spontaneously within three days. Stent-related complications in four patients included stent migration ($n=3$) and tumor overgrowth ($n=1$), all of which were managed with a second stent placement ($n=3$) or stent removal and a second stent placement ($n=1$).

CONCLUSION

Airway stent placement under fluoroscopic guidance in patients with an endotracheal tube inserted for malignant tracheobronchial strictures, is both technically feasible and safe.

CLINICAL RELEVANCE/APPLICATION

Airway stent placement through an endotracheal tube is technical feasible and safe.

SST15-06 Intervention Planning using a Laser Navigation System (LNS) for CT-guided Interventions: A Phantom and Patient Study

Friday, Dec. 4 11:20AM - 11:30AM Location: E350

Participants

Tatjana Gruber-Rouh, Frankfurt Am Main, Germany (*Presenter*) Nothing to Disclose
Thomas J. Vogl, MD, PhD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Clara Lee, MD, Frankfurt am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Katrin Eichler, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
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Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Stefan Zangos, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the effects of a novel Laser Navigation System (LNS) on accuracy, efficiency and radiation dose compared to free-handed punctures at CT.

METHOD AND MATERIALS

Using a phantom body 60 punctures were performed comparing the conventional free-handed procedure to the LNS-guided method to investigate accuracy, timely effort and radiation dose. Additional 20 LNS-guided interventions were performed on another phantom in order to confirm the accuracy. Ten subsequent patients then underwent LNS-guided puncture.

RESULTS

Phantom 1-LNS group showed a target point accuracy of 4.01 ± 2.72 mm (freehand 6.30 ± 3.58 mm), entrance point accuracy of 0.76 ± 0.6 mm (freehand 6.11 ± 4.66 mm), needle angulation accuracy of $1.27 \pm 0.93^\circ$ (freehand $3.36 \pm 3.10^\circ$), intervention time of $7:03 \pm 5:18$ minutes (freehand $8:38 \pm 4:09$ minutes) and the number of CT images 4.2 ± 3.6 (freehand 7.9 ± 5.1). Results showed significant improvement compared to freehand in 60 punctures. Phantom 2-LNS group showed a target point accuracy of 3.57 ± 2.50 mm, entrance point accuracy of 1.39 ± 1.99 mm, needle angulation accuracy of $0.95 \pm 1.19^\circ$, intervention time of $1:44 \pm 0.22$ minutes and the number of CT images was 3.4 ± 1.7 . Regarding the first experience with patients, the LNS group achieved target point accuracy of 5.01 ± 1.20 mm, an entrance point accuracy of 2.0 ± 1.54 mm, a needle angulation accuracy of $1.5 \pm 0.3^\circ$, an interventional time of $12:08 \pm 3:07$ minutes and using 5.7 ± 1.6 CT-images.

CONCLUSION

LNS can improve CT-guided interventions with regard to accuracy, duration of intervention and radiation dose.

CLINICAL RELEVANCE/APPLICATION

The LNS may improve the accuracy, speed and safety of CT-guided interventions. With this system, the needle can be placed in a more accurate position at a faster speed while requiring a lower number of images, thereby reducing the patients' and working staff exposure to radiation during the procedure.

SST15-07 Marked Reduction in Operator Radiation Dose by Decreasing kVp During CT-Guided Procedures

Friday, Dec. 4 11:30AM - 11:40AM Location: E350

Participants

Gabriel Howles-Banerji, MD, PhD, Stanford, CA (*Presenter*) Nothing to Disclose

Rajesh P. Shah, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Compared to fluoroscopy, CT-guided procedures typically use higher energy x-rays, exposing operators to higher energy scatter radiation, for which aprons provide less protection. In addition, higher energy x-rays are less attenuated by non-lead aprons than lead aprons. Recent studies have shown lower kVp can reduce patient dose during lung biopsies without compromising the procedure. We sought to measure the effects of reduced kVp and apron material on operator dose.

METHOD AND MATERIALS

A torso phantom was placed in a CT scanner (GE) with procedural settings: axial 3×5 mm slice thickness; 75, 135, or 315 mA; 80, 100, or 120 kVp. An electronic dosimeter (PDM-117, Hitachi-Aloka) was placed adjacent to the gantry 1 cm anterior, 36 cm lateral, and 48 cm inferior to the isocenter. Estimated operator dose measurements in μSv per gantry rotation were made without shielding or with 0.35mm Pb-equivalent aprons made of lead-vinyl or antimony-barium (Sb-Ba) (Burlington).

RESULTS

Aprons were more effective at lower kVp: attenuation by the Sb-Ba apron was 90%, 93%, and 97% at 120, 100, and 80 kVp (95% CI: +/- 0.1%, 1.5%, 0.5%). No statistically significant difference was observed between the lead-vinyl and Sb-Ba materials ($p > 0.35$ at each kVp). Measured operator doses at 120, 100, and 80 kVp were 2.05, 0.87, and 0.20 μSv (95% CI: +/- 0.11, 0.195, 0.0). Thus, decreasing kVp from 120 to 100 reduced dose by 58% ($p < 0.001$) and decreasing kVp from 120 to 80 reduced dose by 90% ($p < 0.001$). When tube current was adjusted to maintain constant image noise and the measured dose was multiplied by the kVp-specific apron attenuation (above), estimated doses were 0.45, 0.35, and 0.20 μSv . Thus, decreasing kVp from 120 to 100 reduced dose by 22% and decreasing kVp from 120 to 80 reduced operator dose by 52%.

CONCLUSION

If anatomical contrast permits decreasing kVp from 120 to 100 or 80 (without changing mA), interventionalists can reduce their radiation dose by 58% or 90%, respectively. Even if mA are increased to maintain constant noise, the operator dose will still decrease by 22% or 52%, because aprons are more effective at lower kVp. The Sb-Ba apron was as effective as the lead-vinyl apron for attenuating the scatter radiation at all three kVp.

CLINICAL RELEVANCE/APPLICATION

By decreasing kVp during CT-guided procedures, interventionalists may decrease their occupational radiation dose by up to 90%.

SST15-08 CT-guided Percutaneous Jejunostomy Catheter Placement: A Retrospective Analysis of Safety and Efficacy in 28 Patients

Friday, Dec. 4 11:40AM - 11:50AM Location: E350

Participants

Stephen R. Lee, MD, Boston, MA (*Presenter*) Nothing to Disclose

Colin J. McCarthy, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Peter R. Mueller, MD, Boston, MA (*Abstract Co-Author*) Consultant, Cook Group Incorporated

Ashraf Thabet, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the safety and efficacy of CT-guided insertion of percutaneous jejunostomy catheters.

METHOD AND MATERIALS

Between January 1995 and February 2015, CT-guided percutaneous jejunostomy catheter placement was attempted on 31 patients. A retrospective chart review was performed to assess the technical success rate, procedural time, and rate of major and

minor complications.

RESULTS

Technical success was achieved in 87% of attempted placements (28 of 32 attempts). Technical failure was due to excessive target bowel mobility. Average procedural time was 88 minutes with a median of 77 minutes. Pericatheter leakage was the most common complication, occurring in 78% of patients (22 of 28). There were no major complications.

CONCLUSION

Use of CT to guide placement of percutaneous jejunostomy catheters is safe and effective, with technical success and complication rates similar to reported rates when using fluoroscopy. CT offers distinct advantages in certain patients over fluoroscopy, including the ability to more easily select a bowel loop with no intervening structure at risk of inadvertent injury.

CLINICAL RELEVANCE/APPLICATION

Transgastric access for enteral feeding may be unavailable in patients with upper abdominal malignancy or prior GI surgery; CT-guided jejunostomy tube placement is a safe and effective method to obtain access in these patients.

Honored Educators

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Peter R. Mueller, MD - 2012 Honored Educator

Peter R. Mueller, MD - 2013 Honored Educator

SST15-09 Central Stentoplasty: Technical Results from the First 40 Vertebral Levels

Friday, Dec. 4 11:50AM - 12:00PM Location: E350

Participants

Ivan Huang, 308433, Singapore (*Presenter*) Nothing to Disclose

Uei Pua, MBBS,FRCR, Singapore, Singapore (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Central stentoplasty is a novel technique where a single stent is implanted in the center of the vertebral body under cone-beam CT guidance. Data on this technique including technical feasibility, safety and outcome however remains limited. The purpose of this study is to describe the technical results of the first 40 cases of central stentoplasty in our institution.

METHOD AND MATERIALS

Consecutive cases of central stentoplasty (CS) from our prospective registry was analysed. Patient demographics, indications and pre-procedural imaging were reviewed. Technical success was defined as successful midline stent implantation, on antero-posterior fluoroscopy and in the coronal view on completion cone-beam CT. Procedure related complications were recorded and pain score were obtained immediately before and within 6 hours after the procedure. In addition, fractured vertebral bodies with > 30% height loss were assessed for deformity correction using vertebral angle and anterior vertebral height ratio.

RESULTS

From September 2013 to March 2015, a total of 35 patients (9 men, 26 women) with mean age of 70.8 years (range 51 - 90 years) underwent central stentoplasty. Among them, 40 vertebral levels were treated, consisting of thoracic (n=17) and lumbar (n=23) vertebrae. Etiologies included osteoporotic (n=25), traumatic (n=5) and malignant (n=5). Technical success was achieved in 100% of the cases. Complications included: asymptomatic cement extravasation (n=4) and self-limiting track hematoma (n=1). No stent malpositioning, neurological deficit or complication resulting in escalation of care or surgical intervention was recorded. Visual analogue score improvement of > 3 was recorded in 39 out of 40 patients. A total of 15 fractured vertebral bodies had > 30% loss of height and were further analysed for deformity correction. These vertebral bodies had a mean pre-procedure sagittal index (SI) of 0.82 and the post procedure SI of 0.92. The pre-procedure wedge angle (WA) was -5.38° compared to post-procedure mean WA of -3.54°. The mean pre-procedure segmental kyphosis was -7.00° and the mean post-procedure segmental kyphosis was -4.43°.

CONCLUSION

CS is technically feasible and a low complication rate is expected. It can be applied across various etiologies and have the potential for deformity correction in vertebral bodies with significant vertebral height loss.

CLINICAL RELEVANCE/APPLICATION

CS is a feasible technique in spinal augmentation.

SST16

Vascular/Interventional (Advances in CT angiography)

Friday, Dec. 4 10:30AM - 12:00PM Location: E352



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

FDA Discussions may include off-label uses.

Participants

James C. Carr, MD, Chicago, IL (*Moderator*) Research Grant, Astellas Group Research support, Siemens AG Speaker, Siemens AG Advisory Board, Guerbet SA
Elizabeth M. Hecht, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

SST16-01 Patient Tailored Contrast Volume for Preoperative CT Angiography of the Aorta: A Prospective Study Based on Patient Heart Rate and Body Surface Area Differences

Friday, Dec. 4 10:30AM - 10:40AM Location: E352

Participants

Adriana Dubbeldam, MD, Leuven, Belgium (*Presenter*) Nothing to Disclose
Federica Zanca, PhD, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Walter Coudyzer, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose
Hilde Bosmans, PhD, Leuven, Belgium (*Abstract Co-Author*) Co-founder, Qaelum NV Research Grant, Siemens AG
Geert Maleux, MD, PhD, Leuven, Belgium (*Abstract Co-Author*) Speakers Bureau, Merit Medical Systems, Inc Speakers Bureau, W. L. Gore & Associates, Inc Speakers Bureau, Medtronic, Inc

PURPOSE

The quality of CT aortography is known to critically depend on contrast agent injection. Therefore, relatively high dose (historical and safe) injection protocols are being used. A recent retrospective analysis showed a large variability in contrast enhancement in the aorta, with Hounsfield units (HU) from 123 to 510, while all images remained of acceptable quality. This suggested that contrast doses could be lowered. Our aim is to test whether patient specific contrast dose calculation would allow to reduce contrast dose.

METHOD AND MATERIALS

We performed a randomized prospective study of 60 patients undergoing CT-angiography for aortic aneurysm/dissection. Patients were scanned on a Siemens Somatom Definition Flash optimized for fast acquisition. An in-house developed injection-calculator (iCalc by Nemoto Kyorindo, Tokyo) proposed an optimal patient contrast dose based on patient weight, length, heart rate and contrast medium concentration. Image quality was determined quantitatively (HU-measurements) and qualitatively (five-point visual scale with intra-observer control). All patients received a non-contrast and arterial phase acquisition. Triggering was performed at 120HU at the suprarenal level. Patients were randomly divided in 3 study groups: 1) a control group with standard dose of 120ml, 2) an injector-calculated contrast dose, 3) an additional dilution of 50% on top of the injector-calculated dose.

RESULTS

The average contrast dose in group 2 was reduced by 15% (mean injected dose 101,8ml) compared to group 1 (p-value 0,0012), with a decrease in mean HU-values of only 1%. The range of HU units reduced from [156,3-569,8HU] to [155,6-421,3HU]. The visual score (4,5/5) was unchanged. For group 3, contrast dose reduction was 60% (mean injected dose 48,1ml) (p-value <<0,00001) with a mean decrease in HU-values of 32% (p-value 0,001) and range [79,1-449,1HU]. Average image quality dropped (3,7/5). In 2/20 patients, both diagnosed with dissection, image quality was suboptimal but still of diagnostic quality.

CONCLUSION

Contrast dose for CT-aortography was reduced by 15% without compromising image quality and interpretation. Images remained diagnostic even with further dose reduction to 60%. We would however recommend not to apply this in dissection patients.

CLINICAL RELEVANCE/APPLICATION

The use of a patient specific contrast dose determination can be safely applied for CT aortography with a significant contrast dose reduction.

SST16-02 Feasibility Study of Spectral CT Imaging Associated with Ultra-low Volume Contrast Medium for Aorta CTA: Compared with Conventional 120kVp

Friday, Dec. 4 10:40AM - 10:50AM Location: E352

Participants

Ping Hou, MD, Zhengzhou, China (*Presenter*) Nothing to Disclose
Xiang-Nan Feng, MS, Hong Kong, Hong Kong (*Abstract Co-Author*) Nothing to Disclose
Jianbo Gao, MD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Jie Liu, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose
Yaojun Jiang, MD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the image quality of Spectral CT associated with ultra-low volume contrast medium for aorta CTA, compared with conventional 120kVp scan with 70ml contrast medium.

METHOD AND MATERIALS

62 patients underwent aorta CTA examination on a spectral CT scanner (Discovery CT, GE Healthcare) were divided into 2 groups. 31 patients were scanned using GSI mode with contrast agent volume of 0.4ml/kg and injection rate calculated as volume/(delay time + exposure time) were the study group. After examination, images using 55keV and 70keV were reconstructed. Those two sets of images were named as set 1 and 2. Another 31 patients scanned using 120kvp with contrast agent volume of 70ml and 5ml/s injection rate were control group. The obtained images were regarded as set 3. CT values and CNR of aorta and its branches were obtained and compared. The overall image quality was evaluated on a five-point scale. Results were analyzed using rank-sum test, t test and Bonferroni test.

RESULTS

No significant differences existed in image quality of the renal arteries between set 1 and 3 ($p=0.468$). However, higher CNR values were obtained in set 1 than in set 2 and 3 (CNR 18.12 ± 5.89 vs 12.11 ± 4.07 vs 13.23 ± 1.89 in ascending aorta; 18.34 ± 5.81 vs 12.19 ± 3.85 vs 12.39 ± 1.80 in descending aorta; 16.82 ± 4.47 vs 11.55 ± 3.71 vs 12.44 ± 2.17 in celiac trunk; 17.27 ± 4.73 vs 11.61 ± 3.21 vs 12.51 ± 1.94 in renal arteries) ($p < 0.05$), while there was no significant difference between set 2 and 3 ($p > 0.05$). CT values for aorta and its branches were (358.47 ± 69.56 vs 213.80 ± 91.03 vs 374.46 ± 34.23), (361.17 ± 64.09 vs 216.22 ± 37.65 vs 353.72 ± 30.68), (336.89 ± 55.70 vs 205.01 ± 34.45 vs 354.28 ± 36.96) and (333.57 ± 54.62 vs 201.22 ± 34.45 vs 356.99 ± 54.62) HU for the set 1, 2 and 3. There were significant differences among the three groups ($p = 0.00$) and between set 1 and 2, and set 2 and 3 ($p = 0.00$). There was no significant difference between set 1 and 3 ($p > 0.05$). The amount of contrast agent for each patient in the study group was 28.87 ± 4.42 ml, while that in the control group was 70ml. There were significant differences of the contrast medium volume among the two groups ($F = 537.09$, $p = 0.00$).

CONCLUSION

Monochromatic images of 55keV in spectral aortic CTA with ultra-low volume contrast medium was feasible and can provide good image quality compared with conventional 120kVp scan.

CLINICAL RELEVANCE/APPLICATION

Monochromatic images of 55keV in spectral aortic CTA can significantly reduce the amount of contrast agent and injection rate with improved image quality.

SST16-03 Feasibility Study of Spectral CT Imaging Associated with Ultra-Low Volume of 20ml Contrast Medium for Pulmonary CTA

Friday, Dec. 4 10:50AM - 11:00AM Location: E352

Participants

Jie Liu, Zhengzhou, China (*Presenter*) Nothing to Disclose

Jianbo Gao, MD, Zhengzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the image quality of Spectral CT associated with ultra-low volume of 20ml contrast medium for pulmonary CTA compared with conventional 120kVp scan with 50ml contrast

METHOD AND MATERIALS

25 patients underwent CTPA examination on a spectral CT scanner (Discovery CT, GE Healthcare) using 20ml contrast agent and 5ml/s injection rate as group A. 15 patients scanned by 120kVp with 50ml contrast agent and 5ml/s injection rate were retrospectively reviewed as control group B. 5ml contrast agent were firstly used in the test bolus scan to get the peak time of the aorta and the pulmonary artery (T1, T2). Peak time of CTA scan was calculated as followed: $T_{peak} = T_2 + 1/2(T_2 - T_1)$. After the examination, images of 60keV with 50%ASiR were reconstructed. CT values of the pulmonary artery, lobar artery, and segmental artery were obtained. The overall image quality was evaluated on a five-point scale by two radiologists. Sample T test were used to compare image quality between A group and group B.

RESULTS

CT value of pulmonary artery, lobar artery and segmental artery in group A and B were 399 ± 15 vs 406 ± 79 , ($t = 0.356$, $P = 0.724$), 386 ± 59 vs 396 ± 77 , ($t = 0.377$, $P = 0.709$) and 428 ± 99 vs 441 ± 81 , ($t = 0.377$, $P = 0.709$), SNR was 13.0 ± 2.3 and 14.7 ± 4.2 for Group A and B. CNR was 22.3 ± 9.5 and 23.6 ± 10.1 (both > 0.05), respectively. There was no significant difference between group A and group B. But The image quality score were 3.4 ± 0.6 vs 4.5 ± 0.6 , ($t = 4.279$, $P = 0.001$), There was significant difference between group A and group B

CONCLUSION

Spectral CT associated with ultra-low volume of 20ml contrast medium for pulmonary CTA can provide good artery enhancement and image quality saving half the contrast medium dose.

CLINICAL RELEVANCE/APPLICATION

There is also potential for further reduction in the contrast volume

SST16-04 Spot the Clot: Improvements in CT Detection of Thrombus Using an in Vitro Dual-Energy Based Phantom Model

Friday, Dec. 4 11:00AM - 11:10AM Location: E352

Participants

Jason DiPoce, MD, Jerusalem, Israel (*Presenter*) Nothing to Disclose

Jacob Sosna, MD, Jerusalem, Israel (*Abstract Co-Author*) Consultant, ActiViews Ltd Research Grant, Koninklijke Philips NV

Dorith Shaham, MD, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

Zimam Romman, Haifa, Israel (*Abstract Co-Author*) Employee, Koninklijke Philips NV

Nahum Goldberg, Jerusalem, Israel (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine the added value of dual energy CT utilizing low iodine concentration for the detection of thrombus in an in-vitro phantom model.

METHOD AND MATERIALS

Phantoms were constructed by collecting fresh swine blood which was allowed to form clots. These clots (n=8) were transferred into 11mL tubes. Heparinized blood containing 2 mg/ml iodine (Iomeron 350 mg/ml) was then added to the tubes. Control tubes (n=8) were filled with blood and the same iodine concentration without clot. A 17cm wide cube water bath phantom held the tubes. Scans were obtained using a 64-slice spectral detector CT (Philips Healthcare, Cleveland, OH) with the following iso-dose imaging parameters: 120kV, 250mAs and 80 kV, 700mAs. For each scan, 120 and 80 kV polyenergetic 1.5mm thick images were reconstructed. Monoenergetic images at 40, 50, 65, 80 and 100keV were generated from the 120kV scan. A 112 image presentation was created to display individual tubes in a random order. Three experienced radiologists blindly ranked the images for the presence of clots according to a 6 point certainty scale and a 4 point graded image quality scale. The clot detection confidence and image quality of monoenergetic compared to polyenergetic images were analyzed using T-test.

RESULTS

The mean HU values of the iodinated blood at 120 and 80 kV, and 40, 50, 65, 80, 100 keV were 87, 118, 207, 142, 91, 66, and 51, respectively. Clot detection and image quality ranks were significantly better in low energy monoenergy images at 40 and 50 keV when compared to 120 and 80 kV polyenergetic images (p<0.05). Greater sensitivity and specificity were seen for 40 keV images (100% and 100%) and 50 keV (77.8% and 85.7%) compared to 120 kV conventional images (20.0% and 14%) and 80 kV conventional images (38.5% and 25.0%). Likewise, 40 and 50 keV monoenergy images significantly increased image quality ranks (3.9 and 3.6, respectively) compared to 120 and 80kV conventional images (2.8 and 3.1) (p<0.05, both comparisons).

CONCLUSION

Visualization of clot is improved when using dual energy monoenergetic images when compared to standard and low kV polyenergetic images. Our phantom model will likely also be useful in further identifying thresholds of low dose contrast for other diagnostic applications.

CLINICAL RELEVANCE/APPLICATION

Our results imply that dual energy scanning can permit reduced contrast dose while increasing reader confidence of clot detection.

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Jason DiPoce, MD - 2013 Honored Educator

Jacob Sosna, MD - 2012 Honored Educator

SST16-05 Preliminary Study of 70 kVp and Tailored Contrast Injection Protocol on Foot CT Perfusion

Friday, Dec. 4 11:10AM - 11:20AM Location: E352

Participants

Li Guo, MD, Beijing, China (*Presenter*) Nothing to Disclose

Xiaoying Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Xin Qi, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Haochen Wang, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

Xiaohui Zhang, Shanghai, China (*Abstract Co-Author*) Employee, Siemens AG

Min Yang, Peking, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to apply 70 kVp and tailored contrast injection protocol in foot CT perfusion, and investigate the clinical use of foot CT perfusion.

METHOD AND MATERIALS

18 patients with lower extremity arterial occlusive disease (including 7 patients with diabetic foot) were examined with foot CT perfusion, aged from 54 to 86 years old, 10 men and 8 women. Contrast enhancement was achieved with intravenous injection of nonionic iodinated contrast medium (320mgI/ml) and 30 mL of saline solution with the same flow rate. The volume (ranged from 29 to 54 mL) and the flow rate of contrast medium (ranged from 2.9 to 5.4 mL/s) was calculated with a tailoring approach according to the patients' body weight, height and age. CT perfusion was carried out on Siemens dual source CT, with the following parameters: 128×0.6mm collimation, tube voltage 70 kV, rotation time 0.28s, acquisition time 57s (31 scans), with a fixed start delay of 20s. The radiation dose was 0.87 mSv (CTDI 70.59 mGy). The images were analyzed with commercial CT software (SyngoMMWP VE40B). A circular region of interest was placed in the distal anterior or posterior tibial artery of the foot to get a time-density curve (TDC). Perfusion parameters (blood volume [BV], blood flow [BF], and mean transit time [MTT]), and the TDC of the foot tissue were automatically calculated by the software for both feet.

RESULTS

1. Three types TDC were obtained: type A, B and C. Most of the TDCs were type B, which has whole arising part, peak value and descending part. Type A curve was observed in a red hot diabetic foot, which genius-quickly peaks in the early parts of the scans. And type C curves were observed in black swallow feet, which peaks very slow or only has the arising part without the peak value and the descending part. 2. Because of motion artifact, perfusion parameters (including BV, BF and MTT) of 27 feet out of 36 (both sides for one patient) were obtained, and only 10 feet could get expected TDCs of the foot soft tissue, which shows a curve with whole arising part, peak value and descending part.

CONCLUSION

70 kVp CT perfusion could be a potential technique to determine the information about foot vascularization, and meanwhile, further study is needed to justify tailored contrast injection protocol.

CLINICAL RELEVANCE/APPLICATION

70 kVp CT perfusion could be a potential technique to determine the information about foot vascularization.

SST16-06 Comparison of 4D Dynamic Computed Tomography Angiography and 4D Dynamic Magnetic Resonance Angiography in Patients with Peripheral Arterial Occlusive Disease

Friday, Dec. 4 11:20AM - 11:30AM Location: E352

Participants

Philipp Riffel, MD, Mannheim, Germany (*Presenter*) Nothing to Disclose
Holger Haubenreisser, Mannheim, Germany (*Abstract Co-Author*) Speaker, Siemens AG; Speaker, Bayer AG
Sonja Sudarski, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Mathias Meyer, Mannheim, Germany (*Abstract Co-Author*) Speaker, Siemens AG; Speaker, Bracco Group
Stefan O. Schoenberg, MD, PhD, Mannheim, Germany (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Thomas Henzler, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study was to compare diagnostic image quality of 4D dynamic computed tomographic angiography (d-CTA) of the lower leg in comparison to 4D dynamic magnetic resonance angiography (MRA) at 3T in patients with peripheral arterial occlusive disease (PAOD).

METHOD AND MATERIALS

22 patients with PAOD (PAOD stage 1: 4 patients; PAOD stage 2: 7 patients; PAOD stage 3: 2 patients; PAOD stage 4: 9 patients) were examined with a combined CTA protocol on a 3rd generation 2 x 192 slice dual-source CT system consisting of a static CTA (s-CTA) of the lower leg runoff and d-CTA of the calves with a z-axis coverage of 80 cm. Additionally the patients underwent a MRA protocol combining continuous table movement (CTM) MRA of the runoff vasculature (s-MRA) as well as time-resolved MRA (d-MRA) of the calves with a z-axis coverage of 45 cm. Diagnostic image quality of s-MRA and s-CTA alone was compared with s-MRA and s-CTA in addition with d-MRA and d-CTA by two independent radiologists with a time interval of 4 weeks between the reading sessions for the static examination and for the combination of static and dynamic examinations. The images were evaluated according to a 4-point Likert-like rating scale assessing image quality on a segmental basis.

RESULTS

For static angiography 637 segments were included in the assessment of image quality. For s-CTA 62% of segments were rated as excellent, 20% as good, 16% as moderate and 2% as poor. No segments were rated as non-diagnostic. For s-MRA 20% of segments were rated as excellent, 20% as good, 20% as moderate and 26% as poor. 14% of segments were rated as non-diagnostic (all p-values < 0.0001). For dynamic angiography 264 segments were included in the assessment of image quality. For d-CTA 89% of segments were rated as excellent or good (78% as excellent, 11% as good). For d-MRA 40% of segments were rated as excellent or good (20% as excellent, 20% as good), while 28% of segments were rated as non-diagnostic.

CONCLUSION

In patients with PAOD the addition of d-CTA leads to an improved depiction of the calf vessels compared to s-CTA alone. The combined static and dynamic CTA yield improved image quality in comparison to a combined 3-T MRA protocol.

CLINICAL RELEVANCE/APPLICATION

A combined static and dynamic CTA yield improved image quality in comparison to a combined 3-T MRA protocol and should be considered as a valuable alternative in patients with all stages of PAOD.

SST16-07 Dual-Energy CT with Advanced Image-Based Virtual Monoenergetic Reconstructions Improves Depiction of Portal Vein Thrombosis

Friday, Dec. 4 11:30AM - 11:40AM Location: E352

Participants

Moritz H. Albrecht, MD, Frankfurt am Main, Germany (*Presenter*) Nothing to Disclose
Jan-Erik Scholtz, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
Martin Beeres, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Boris Bodelle, MD, Frankfurt Am Main, Germany (*Abstract Co-Author*) Nothing to Disclose
Ralf W. Bauer, MD, Frankfurt, Germany (*Abstract Co-Author*) Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Julian L. Wichmann, MD, Charleston, SC (*Abstract Co-Author*) Nothing to Disclose
Andreas Bucher, MD, Frankfurt, Germany (*Abstract Co-Author*) Nothing to Disclose
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 investigate the impact of an advanced monoenergetic reconstruction algorithm on visualization and diagnostic performance in dual-energy computed tomography (DECT) imaging of portal vein thrombosis (PVT).

METHOD AND MATERIALS

Forty patients (22 men; mean age, 67.5 years \pm 17.6 years) who underwent contrast-enhanced portal-venous-phase DECT of the upper abdomen within clinical routine were retrospectively evaluated. Standard linearly blended (M_{0.5}, 50% low-kV spectrum) and virtual monoenergetic images were calculated using a basic (Mono) and an advanced image-based monoenergetic algorithm (Mono+) with energy levels ranging from 40-100 keV (10-keV increments). ROI measurements were performed in the portal vein proximally and, if visible, distal to the thrombus, and the splenic and superior mesenteric vein for objective contrast-to-noise ratio (CNR) calculation. Five-point likert scale ratings regarding image quality, contrast, noise, suitability for PVT assessment and

diagnostic performance of 2 radiologists in the diagnosis of PVT were evaluated.

RESULTS

Twenty patients (50%) showed findings of PVT. Mono+ images at 40 keV showed the best objective image quality (mean CNR, 7.2 ± 5.1 , $P < 0.01$) compared to all other image series and were rated most suitable for PVT assessment (rating, 4.9 ; $P = 0.03$). Intravenous attenuation and contrast between Mono and Mono+ series showed no significant difference (objectively, $P < 0.88$; subjectively, $P < 0.52$), but substantially increased noise was found for Mono 40 and 50 keV compared to Mono+ and all other reconstructions (objectively, $P < 0.01$; subjectively, $P < 0.01$). Mono+ 60 keV images were rated best regarding subjective image quality ($P = 0.67$). Diagnostic performance for diagnosis of PVT was highest for both radiologists at Mono+ 40 keV compared to all other available image series (mean sensitivity, 100 % ; mean specificity, 93,4 %, $P < 0.04$).

CONCLUSION

Mono+ reconstructions at 40 keV in DECT facilitate significantly improved diagnostic performance for detection of PVT compared to both standard linearly blended and basic Mono images.

CLINICAL RELEVANCE/APPLICATION

Additional reconstruction of Mono+ DECT series at 40 keV may improve detection and assessment in cases of suspected PVT.

SST16-08 AngioCTA in the Preoperative Planning of Perforator Flaps in Plastic Reconstructive Surgery

Friday, Dec. 4 11:40AM - 11:50AM Location: E352

Participants

Ruben Guerrero Vara, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose
Claudia Alejandra Nunez Peralta, MD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Gemma Pons Playa, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Jose Sarria, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose
Fernando Gomez, MD, PhD, Barcelona, Spain (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the utility of CTA in planning perforator surgery in different kind of flaps. To demonstrate the radiologic correlation between intraoperative and radiological findings.

METHOD AND MATERIALS

202 CTAs performed from January 2011 to January 2014 and their intraoperative findings were reviewed. We focused on DIEP(96), SIEA (25), ALTF(51), TDAP(18) and SGAP(12) flaps. The images were pre-operatively evaluated by a radiologist and a plastic surgeon. The best perforator vessel was selected and its position was identified by means of an X and Y axis respect to anatomic references. These anatomic references were different depending on the kind of flap. The obtained coordinates (x-y) for each perforator vessel were transferred to patient's skin before the surgical intervention. All the vessels depicted in CTA were found in the surgery. We consider good correlation if doppler ultrasound over the skin located at the exact given reference, could detect the vessel. We consider poor correlation if the vessel was located more than 10 mm distant from the reference or if the vessel was not found during surgery.

RESULTS

We found a very reliable relationship for DIEP (99,5%), SGAP(97%) and ALTF (98%)flaps. In SIEA flap (80%) the correlation was less exact since it has an inconstant anatomy and a learning curve for the radiologist is necessary. However, when we analysed the data of the last year, a 94% success was achieved. In TDAP flap (80%) the different position between the image acquisition and the surgery was the cause of the results. TDAP was the only flap where the images couldn't be acquired in the same position as surgery would be performed. Nevertheless, all perforators were always found in an area of 2 cm² around the point given by CTA.

CONCLUSION

CTA provides important information about vascular anatomy before perforator flap surgery. Choosing the dominant vessel allows faster and safer perforator flap surgical procedures. A proper knowledge of the anatomy and a good understanding of the surgical procedure by the radiologist are of paramount importance to achieve optimal results.

CLINICAL RELEVANCE/APPLICATION

CTA is nowadays a pre-operative examination of choice to perform perforator flap surgery since faster and safer surgical procedures have been demonstrated after its use.

SST16-09 The Gravitational Gradient (GG), Defined as the Dependent Divided by Independent Region of Interest (ROI) Attenuation in Abdominal Aortic Aneurysms (AAA), Strongly Predicts Rapid Aneurysm Growth in Patients with Less Intramural Thrombus

Friday, Dec. 4 11:50AM - 12:00PM Location: E352

Participants

Ayaz Aghayev, MD, Boston, MA (*Presenter*) Grant, Toshiba Corporation
Andreas Giannopoulos, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Tianxi Cai, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Kanakano K. Kumamaru, MD, PhD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael L. Steigner, MD, Boston, MA (*Abstract Co-Author*) Speaker, Toshiba Corporation
Dimitris Mitsouras, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, Toshiba Corporation; Speakers Bureau, Toshiba Corporation
Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Abstract Co-Author*) Research Grant, Toshiba Corporation;

PURPOSE

The GG quantifies 1st pass AAA CTA contrast variation; uniform enhancement (0.90.4 cm³/yr) AAA growth, and (b) the presence of

Near-Circumferential (>270° of sac) Intraluminal Thrombus (NCIT) significantly modifies the ability of GG to predict rapid growth.

METHOD AND MATERIALS

156 consecutive pre-intervention AAA pts who met study criteria (multiple exams >6mo apart to compute growth, ≥ 1 first-pass CTA to compute GG) underwent AAA dimension and volume (sac, lumen, and intramural thrombus) measurements. The GG was computed from the CTA dated closest to intervention. We evaluated (a) the relationship between abnormal GG (defined as <0.9 and >1.1) and rapid growth, and (b) if the presence of NCIT modifies the GG predictive ability.

RESULTS

42/156 (26%) pts were female; age=71±9.6 (22-92yrs). 103 pts had >2 scans. 66/156 (42%) had NCIT. The mean of the largest AAA diameter was 4.2±0.7cm on the first scan and 5.0±0.9 cm on the scan closest in time to the intervention. Mean vol of AAA sac, lumen, and thrombus on initial scan=65.2±34.7cc, 38.6±16cc and 26.6±25.7 cc, respectively. On scan closest to intervention, mean volume of AAA sac, lumen, and thrombus=91.04±38.9cc, 52.6±24.3cc and 38.4±29.3cc, respectively. 53/156 (33%) of patients had rapid growth (>0.4cm/year). 63/156 (40%) of patients had an abnormal GG. GG is significantly associated with rapid growth with unadjusted OR 1.19 (95% CI: [1.03, 1.38], p<0.02). Furthermore, its ability in predicting rapid growth is dependent on the presence of circumferential thrombus. Based on a logistic regression model including an interaction between GG and presence of circumferential thrombus, the OR for GG=6.05 (95% CI: [2.0, 18], p<0.001) for those without NCIT and 1.30 (95% CI: [0.45, 3.72], p=0.63) for those with NCIT. The presence of NCIT significantly modifies the ability of GG to predict rapid growth (test for interaction, p<0.05).

CONCLUSION

Patients with a positive GG within the AAA sac have rapid aneurysm growth, and AAA patients with an abnormal GG and without NCIT have an odds ratio > 6 for rapid growth, a significant modification of the predictive ability of the GG.

CLINICAL RELEVANCE/APPLICATION

Observation of a positive GG in an AAA sac warrants close attention, particularly when there is little intramural thrombus.

SST04

Gastrointestinal (New MRI Techniques)

Friday, Dec. 4 10:30AM - 12:00PM Location: E353A



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 patient 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 Algorithms 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

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 a 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 (D_s), fast diffusion (D_f), and perfusion fraction (f) simultaneously and using segmented fitting algorithm which estimates D_s with higher b-value (≥ 200) data and subsequently estimates f and D_f . 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, D_f showed the poorest repeatability (the range of wCV, 29.5%-144.1%) among IVIM parameters (wCV for D_s , 4.1%-16.9%; wCV for f , 8.5%-46.2%). For spleen, pancreas, renal medulla, segmented fitting resulted in better repeatability of D_s (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 D_s , D_f , and f , respectively) than segmented fitting (wCV, 4.8%, 43.0%, 12.8% for D_s , D_f , and f , respectively). For renal cortex, the measurement repeatability of D_s was better with full-biexponential fitting, but that of f was better with segmented fitting.

CONCLUSION

D_f 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 D_s 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

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
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Research Grant, Bayer AG; Research 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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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
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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

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. R²'s with bootstrap-based bias-corrected, accelerated 95% confidence intervals were computed and served as metrics of accuracy. Pairwise comparisons of the R²'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 R²'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 R²'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 longitudinal 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 Oishi, 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 $192 \times 192 \times 20$ yielding a resolution of $2.2 \times 2.2 \times 4$ 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
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PURPOSE

Magnetic Resonance Index of Activity (MaRIA), is a Magnetic Resonance Enterography (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.

SPFR61

Friday Imaging Symposium: Neuroimaging Emergencies

Friday, Dec. 4 12:30PM - 3:00PM Location: E253CD



AMA PRA Category 1 Credits™: 2.50
ARRT Category A+ Credits: 3.00

Participants

Christopher P. Hess, MD, PhD, Mill Valley, CA, (christopher.hess@ucsf.edu) (*Moderator*) Research Grant, General Electric Company; Research Grant, Quest Diagnostics Incorporated; Research Grant, Cerebrotech Medical Systems, Inc;

Sub-Events

SPFR61A CNS Infection

Participants

Ashley H. Aiken, MD, Atlanta, GA, (ashley.aiken@emoryhealthcare.org) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize basic imaging patterns of CNS infection in the immunocompetent patient 2) Use imaging features of specific pathogens along with clinical characteristics to narrow the imaging differential diagnosis and guide treatment. 3) Recognize imaging features of opportunistic infections in the immunocompromised patient.

ABSTRACT

The radiologist plays a crucial role in identifying and narrowing the differential diagnosis of CNS infection. This case-based review aims to outline a practical imaging approach based on 5 basic imaging patterns: 1) Extra-axial infection 2) Ring-enhancing lesion 3) Temporal lobe lesion 4) Basal ganglia lesion 5) White matter abnormality. For extra-axial patterns of infection, it is key to search the paranasal sinuses, middle ear, and mastoid air cells for a source. It is also very important to look out for complications including brain abscess, dural sinus thrombosis, infarction, and hydrocephalus. The ring-enhancing pattern is the classic mimicker, and there is a long list of differential considerations. Frequently, the primary differential can be narrowed to infection versus neoplasm. However, close attention to the imaging features is critical to recognize non-operative ring-enhancing lesions such as tumefactive demyelination, subacute infarct, and subacute hematoma. The imaging characteristics that favor infection over neoplasm include a thin, smooth, ring-enhancement, "daughter cysts", a thinner ring of enhancement toward the ventricular surface and, of course, the "light bulb bright DWI" of a pyogenic abscess. When the temporal lobe imaging pattern is encountered, the primary diagnostic consideration should always be herpes encephalitis! Primary differential considerations for bilateral basal ganglia and white matter abnormalities include infection, toxic-metabolic etiologies, venous ischemia, hypoxic-ischemic injury and neoplasm. It is critical to know the patient's history and specifically their immune status. Within these broad imaging categories, a thorough understanding of the characteristic imaging features of specific pathogens and clinical history are essential to narrow the differential considerations and propose a more specific diagnosis. Neuroimaging also plays a pivotal role in diagnosing and monitoring the therapeutic response in opportunistic infections in the setting of HIV. This subset of infections will also be discussed within the context of the five basic imaging patterns listed above. References: 1) Aiken AH. Central Nervous System Infection. *Neuroimaging Clin N Am.* 2010 Nov; 20(4): 557-80

URL

Handout: Ashley Hawk Aiken

<http://abstract.rsna.org/uploads/2015/15002667/CNSinfection.handout.RSNA.12.4.15.pptx>

SPFR61B Evaluation and Management of Acute Stroke

Participants

Achala S. Vagal, MD, Cincinnati, OH (*Presenter*) Research Grant, F. Hoffmann-La Roche Ltd;

LEARNING OBJECTIVES

1) To review the classic imaging features of acute ischemic stroke. 2) To review the role of imaging selection in evaluation and management of acute stroke. 3) To review stroke mimics.

ABSTRACT

The landscape of acute ischemic stroke treatment is rapidly changing with multiple positive endovascular trials. In the current scenario, neuroimaging plays a vital role in the diagnosis, triage and treatment of acute ischemic stroke patients. Comprehensive evaluation of brain parenchyma, vessel status and tissue perfusion is critical in patient selection. This case based course will highlight the practical aspects of acute ischemic stroke evaluation in the emergency setting.

URL

SPFR61C Intracranial Hemorrhage: Pearls and Pitfalls

Participants

Jalal B. Andre, MD, Seattle, WA, (drjalal@uw.edu) (*Presenter*) Research Grant, Koninklijke Philips NV; Consultant, Hobbitview, Inc; Research Grant, Toshiba Corporation;

LEARNING OBJECTIVES

1) Gain a deeper understanding of how etiology, location, and timing of intracranial hemorrhage may affect patient disposition and

1) Gain a deeper understanding of how etiology, location, and timing of intracranial hemorrhage may affect patient disposition and outcome, and review pertinent associated radiological findings. 2) Explore recent imaging methods that better characterize intracranial hemorrhage and its components. 3) Discuss current treatment strategies for managing intracranial hemorrhage that are relevant to radiologists.

ABSTRACT

Intracranial hemorrhage has been traditionally classified as intra- versus extra-axial in location, and can arise from a variety of etiologies. We will focus on the above learning objectives through a case-based exploration of intracranial hemorrhage and associated complications as they pertain to the following locations: 1) Intraventricular 2) Intraparenchymal 3) Subarachnoid 4) Subdural 5) Epidural

URL

SPFR61D Spine Emergencies

Participants

Jason F. Talbott, MD, PhD, San Francisco, CA, (jason.talbott@ucsf.edu) (*Presenter*) Data Safety Monitoring Board, StemCells, Inc

LEARNING OBJECTIVES

1) Gain familiarity with the subaxial injury classification system (SLIC) for cervical spine trauma and AOSpine thoracolumbar injury classification system (TLICS) for thoracolumbar spine trauma. 2) Review standardized nomenclature for vertebral fracture morphology descriptions utilized by both SLIC and TLICS. 3) Review a systematic checklist for spinal imaging findings in the setting of suspected non-traumatic spinal emergencies.

ABSTRACT

The radiologist plays a critical role in evaluation of spinal emergencies, both traumatic and nontraumatic. With respect to traumatic spine emergencies, the primary focus of this review is to familiarize the radiologist with the increasingly utilized classification systems employed by many spine surgeons for (1) subaxial cervical spine trauma known as subaxial injury classification (SLIC) and (2) thoracolumbar spine trauma known as thoracolumbar lumbar injury classification system (TLICS) and the more recently updated AOSpine TLICS. These grading schemes were designed by surgeons to aid in surgical decision-making and share in common some descriptive nomenclature related to vertebral body fracture morphology, discoligamentous complex integrity, and frank spine displacement/translation injury. It is important that the radiologist interpreting spinal trauma studies is familiar with these classifications schemes as they are increasingly supplanting older classification systems for surgical decision-making. Finally, a case-based review of non-traumatic spinal emergencies will be undertaken to emphasize a systematic checklist for imaging findings suggesting emergent pathology.

URL

SPFR61E Head and Neck Emergencies

Participants

Jenny K. Hoang, MBBS, Durham, NC, (jennykh@gmail.com) (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe imaging findings of acute head and neck diseases that are emergencies. 2) Apply a systematic checklist to identify key imaging findings that could lead in significant morbidity or mortality.

ABSTRACT

This will be a case-based presentation of imaging findings of head and neck emergencies categorized into 4 clinical scenarios: 1. Fever 2. Trauma 3. Difficulty breathing 4. Epistaxis

URL