Premammary Lesions of the Breast: Differential Diagnosis between Breast Skin Lesions and Superficial Breast Parenchymal Lesions

All Day Room: BR Community, Learning Center

Participants
Jin Hwa Lee, MD, Busan, Korea, Republic Of (Presenter) Nothing to Disclose
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TEACHING POINTS
Premammary lesions of the breast are usually benign, and develop from the composition of the dermis and the subcutaneous fat. Although relatively uncommon, benign and malignant breast parenchymal lesions arising from anterior terminal duct lobular units are encountered within the premammary layer, and differential diagnosis between skin and superficial parenchymal lesions is necessary. The anatomic structures of the nipple-areolar complex are somewhat specialized, and we should understand its anatomy. By reviewing imaging findings of breast parenchymal lesions detected in the premammary layer, differential diagnosis between breast skin lesions and superficial breast parenchymal lesions can be achieved.

TABLE OF CONTENTS/OUTLINE
1. Normal skin anatomy of the breast
2. Nipple-areolar complex and its surroundings
   1) Paget disease vs Benign skin lesions
   2) Malignant calcifications vs Metallic densities after Chinese-herbal treatment
3. Premammary layer other than nipple-areolar complex
   1) Invasive ductal carcinoma vs Fat necrosis
   2) Mucinous carcinoma vs Intraductal papilloma
   3) Recurrent breast cancer vs Epidermal inclusion cyst after breast cancer surgery
   4) Benign parenchymal lesions; sclerosing adenosis, fibroadenoma, granulomatous lobular mastitis
   5) Metastatic breast cancer from extramammary origin
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TEACHING POINTS
After reading this educational exhibit radiologists will know:
- Automated breast ultrasound (ABUS) target population
- How to operate and properly perform ABUS
- How to read an ABUS
- Identify potential pitfalls

TABLE OF CONTENTS/OUTLINE
- Approved indications for ABUS
- Siemens and GE Machine components and proper use
- Reading workstation layout and tips for its proper use
- Pearls of ABUS
- Pitfalls of ABUS
Spectrum of Suspicious Findings in Patients with Breast Implants: A Multimodality Imaging Review

All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS
Review imaging characteristics of suspicious findings in patients with breast implants as seen on mammography, digital breast tomosynthesis, breast ultrasound and contrast enhanced MRI.
Discuss possible differential diagnoses based on imaging findings.
Describe appropriate management of suspicious findings.

TABLE OF CONTENTS/OUTLINE
Discuss normal imaging evaluation of patients with breast augmentation Pitfalls of imaging patients with breast implants Review multimodality imaging of suspicious findings in patients with breast implants Digital mammography, digital breast tomosynthesis, breast ultrasound and breast MRI Discuss appropriate diagnostic evaluation Management based on imaging findings Biopsy techniques Determining histo-pathologic correlation Follow-up and summary
Participants
Takayoshi Uematsu, MD, PhD, Nagaizumi, Japan (Presenter) Nothing to Disclose

TEACHING POINTS

In current breast imaging workflow, breast US examination for screening and extent of disease in a newly diagnosed breast cancer patients is most likely to be performed by trained technologists rather physicians because of the financial disincentives. With the spread of breast density-inform legislation, the need of technologist-performed screening breast US imaging is more and more increasing. We should know the current status and clinical pathway about technologist-performed breast US. The major teaching points of this exhibit are: 1. Standard approaches to training and documentation of technologist-performed breast US imaging are important. 2. A breast US examination performed by trained technologists should be interpreted by physicians together with the corresponding mammograms with one integrated impression and overall BI-RADS assessment.

TABLE OF CONTENTS/OUTLINE

1. Introduction
2. Current status about technologist-performed breast US
3. Training for breast US technologists
4. Technique and documentation for breast US technologists
5. Technologist-performed breast US outcomes and performance benchmarks
6. How to interpret both the mammography and US examination for physicians
7. Illustrative cases with integrated reports
8. How to determine correspondence of mammographic and sonographic findings
9. Summary
TEACHING POINTS

1. Due to its high operator dependence, it is important for the radiologist to recognize poor image quality when interpreting breast ultrasound.  
2. If poor image quality is not recognized, it can lead to misinterpretation of malignancy as benign disease as well as unnecessary biopsies and follow-ups.

TABLE OF CONTENTS/OUTLINE

Take a quiz comparing two ultrasound images: Identify the difference between the good and poor quality image. What ultrasound parameter was altered between the two images? The following ultrasound parameters will be demonstrated and reviewed:

- Transducer frequency
- Field of view
- Trapezoidal acquisition
- Focal zone placement
- Gray scale gain
- Spatial compounding
- Tissue harmonic imaging

References

All Day Room: BR Community, Learning Center

FDA
Discussions may include off-label uses.

Participants
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TEACHING POINTS
1. To present and discuss the technique of strain and shear wave elastography
2. To describe technical challenges, and propose management tips
3. To review the spectrum of applications of elastography for breast imagers

TABLE OF CONTENTS/OUTLINE
1. Overview of the technique
2. Management tips for challenging cases: superficial lesions, deep lesions
3. Radio-pathologic correlation examples with management recommendations
4. False negative and false positive cases: how to identify and prevent them

Elastography became a complimentary tool of the breast imager yet the technique remains challenging and imperfect. Challenges include technical considerations related to scanning adequately. Through various examples using Doppler and other modalities correlation and pathology correlation, this exhibit will offer practical tips to the radiologists as well as propose evidence-based algorithms for the use of elastography in breast imaging according to the review of the literature.
Ultrasound Appearance of Inflammatory Breast Cancer: A Pictorial Essay

All Day Room: BR Community, Learning Center

Participants
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TEACHING POINTS
Inflammatory breast carcinoma (IBC), a rare and aggressive form of breast cancer. Ultrasound (US) plays an important role in the assessment of many IBC. In this exhibit, we will review the US appearance of various manifestations of IBC. Objectives:

- Emphasize the common sonographic features of IBC which can render an accurate diagnosis
- Review available literature of the role of sonography as the unique imaging modality in the diagnosis of IBC
- Review cases

TABLE OF CONTENTS/OUTLINE
1-Introduction
3- US technique for identifying IBC
4- The appearance of IBC at ultrasound
5- Differential Diagnoses
6- Cases
7- Conclusions
Quantitative Analysis of Breast Tumor Vascularity Using Superb Micro-vascular Imaging (SMI) and Contrast-enhanced Ultrasound (CEUS)

All Day Room: BR Community, Learning Center

Participants
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Bo Kyoung Seo, MD, PhD, Ansan, Korea, Republic Of (Abstract Co-Author) Research Grant, Toshiba Corporation
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Ok Hee Woo, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
Angiogenesis plays a crucial role in tumor development, growth, and metastasis in breast cancers. Therefore, quantitative analysis of tumor vascularity with non-invasive radiological examination is essential to differentiate benign from malignant breast lesions, to monitor response to treatment, and to predict prognosis. Superb micro-vascular imaging (SMI) is a new generation of Doppler technique, specialized in demonstrating microvessels. Contrast-enhanced ultrasound (CEUS) has been used as a sensitive imaging tool for evaluation of tumor microcirculation and perfusion. In this exhibit, we will show how to analyze breast tumor vascularity quantitatively using SMI, and CEUS and to demonstrate their clinical implementation.

TABLE OF CONTENTS/OUTLINE
Significance of tumor angiogenesis in breast cancers Short history of radiological evaluation of breast tumor vascularity using ultrasound SMI and CEUS: Two up-to-date ultrasound techniques for assessment of tumor vascularity Imaging principles and application in breast lesions How to analyze breast tumor vascularity quantitatively: SMI - Vascular index: CEUS (Time intensity curve analysis) - peak intensity, time to peak, mean transit time, slope, area under the curve Potentials and limits 4. Discussion: Future work for quantitative analysis of breast tumor vascularity
Axillary Lesions: Are You Managing Them Well?

All Day Room: BR Community, Learning Center

**Participants**
Pramod K. Gupta, MD, Plano, TX *(Presenter)* Nothing to Disclose
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Francisco García-Morales, MD, Plano, TX *(Abstract Co-Author)* Nothing to Disclose

**TEACHING POINTS**
Although lymphadenopathy is the most common disease entity in the axilla, many other disease processes also affect the axilla. The radiologists should be aware of these entities and manage them effectively. The purpose of this exhibit is: 1. To present various commonly encountered axillary lesions in challenging quiz format. 2. To discuss the salient features and enhance general understanding of these axillary processes to help radiologists to develop reasonable differential diagnosis and guide clinical management.

**TABLE OF CONTENTS/OUTLINE**
The cases will be presented in a quiz format. Salient features, differential diagnosis and management will be discussed at the end of each case. Following cases will be presented: Benign reactive lymph nodes Metastatic lymph nodes Lymphoma Silicon axillary lymphadenopathy Accessory breast tissue Lipoma Epidermal inclusion cyst Seroma Abscess Oil cysts Poland syndrome
TEACHING POINTS

Accurate correlation of mammographic and sonographic findings first requires complete diagnostic work-up and combined assessment for mammography and adjunctive sonography to screen for breast cancer to improve the specificity. Lesion detection at sonography is improved by localizing breast lesions based on breast MR images and recognizing the possible differences in presentation of identical lesions at sonography and MR imaging. Mammographic-sonographic-breast MR imaging correlation is also of great value in diagnostic breast imaging. The major teaching points of this exhibit are:

1. Mammographic and sonographic location, size, shape, and margins should be concordant and carefully correlated to avoid errors.
2. Use of targeted sonography for identification of MR imaging detected breast lesions is challenging, but useful.

TABLE OF CONTENTS/OUTLINE

1. Introduction
2. Mammographic-sonographic correlation
   - Location, Size, Masses, FAD, Architectural distortion, Calcifications
3. Breast MR imaging-sonographic correlation
   - Targeted sonography techniques, MR imaging-navigated sonography systems (real-time virtual sonography technique: RVS)
4. Mammographic-sonographic-breast MR imaging correlation
5. Pitfalls
6. Summary
TEACHING POINTS

1. Contrast-enhanced ultrasound (CEUS) background, diagnostic applications in liver imaging.
2. Utility of intravenous CEUS (IV CEUS) in monitoring percutaneous ablations in the liver.

TABLE OF CONTENTS/OUTLINE

OUTLINE:
1. CEUS technique, both IV (analogous to CT/MR), and IA (analogous to DSA).
2. CEUS advantages, including lack of radiation and nephrotoxicity.
3. IV CEUS in monitoring percutaneous liver ablations
   - CEUS appearance hepatocellular carcinoma (HCC) and metastases pre and post treatment
   - CEUS in evaluation post-treatment ablation zone, with CT comparison; option immediate additional ablation based on CEUS
   - Post-ablation CEUS artifacts - periablation hyperemia, gas, and pseudoenhancement
4. IA CEUS in hepatic TACE procedures; localization HCC present on CT or MR, but not seen on digital subtraction angiography (DSA), including
   - HCC with poor DSA enhancement
   - HCC with extra-hepatic arterial supply; IA CEUS in “mapping” tumor supply
   - HCC with portal venous supply

SUMMARY
Participant will:
1. Be familiar with technique, advantages, and limitations of CEUS in liver interventions
2. Understand the role of IV CEUS in monitoring percutaneous liver ablations, and of IA CEUS in localizing liver lesions during TACE
Enhancing Radiofrequency Ablation with Contrast-Enhanced Ultrasound

All Day Room: VI Community, Learning Center

FDA

Discussions may include off-label uses.

Awards
Certificate of Merit

Participants
Emily Pang, MD, Vancouver, BC (Presenter) Nothing to Disclose
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Stephen G. Ho, MD, Vancouver, BC (Abstract Co-Author) Medical Advisory Board, Boston Scientific Corporation

TEACHING POINTS

Review the background, procedural technique and optimal settings for performing contrast-enhanced ultrasound (CEUS), with a particular focus on CEUS in concert with radiofrequency ablation (RFA) in the liver and kidney. Illustrate situations in which CEUS can add utility to ultrasound-guided RFA, with case examples. Describe the general pitfalls and limitations of CEUS in well as in the context of RFA.

TABLE OF CONTENTS/OUTLINE

Introduction (Contrast ultrasound agents, mechanism of action, radiofrequency ablation overview) Technique (CEUS imaging method, ultrasound settings, injection and imaging timing optimization) Utility in ultrasound-guided RFA with focus on liver and kidney Improving lesion visibility Detecting and targeting recurrence Post-procedure assessment of residual disease Imaging in renal failure Other: concurrent biopsy of viable tumor, pre-procedural upstaging Pearls, Pitfalls, and Limitations (expected findings post-treatment on CEUS, CEUS Artifacts, limitations of CEUS technique) CEUS guided RFA in the literature
Carotid Atherosclerotic Plaque Evaluation; Technique, Limitations, and Role of Multiparametric Ultrasound Evaluation

All Day Room: VI Community, Learning Center

FDA
Discussions may include off-label uses.

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TEACHING POINTS
To show efficacy, limitations of multiparametric ultrasound (Color-doppler, CEUS, Ultrasound elastography and 3D arterial analysis software) evaluation of carotid stenosis as compared with CTA or MRA. To describe tips and tricks of the techniques

TABLE OF CONTENTS/OUTLINE
A soft plaque with irregular surface, neoangiogenesis and internal bleeding, is more prone to embolic events, while the percentage of stenosis is not a highly reliable parameter. Color-Doppler US is usually first line study. Lately, ultrasound elastography (UE), contrast enhanced ultrasound (CEUS) have been used to better characterize atherosclerotic plaques of the carotid. UE is an ultrasonographic technique capable of assessing or even measuring the elasticity of tissues (indirectly the composition of plaques), hard versus soft (fibrosis and calcification versus lipid content). CEUS as reported by EFSUMB guidelines has established role for carotid wall motion, with automatic volumetric acquisition, which provides stenosis evaluation, plaque characterization (low and high risk). Our results with typical and atypical cases of carotid stenosis compared with CTA and MRI will be presented, while describing the signs and technique tips and tricks.
ED014-SU

Ultrasound Sunday Case of the Day

Sunday, Nov. 27 7:00AM - 11:59PM Room: Case of Day, Learning Center

US

AMA PRA Category 1 Credit ™: .50

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TEACHING POINTS

1) Participants will learn to list the sonographic appearances of common and uncommon diseases. 2) Participants will learn to describe the differentiating features between similar diseases via a case based format. 3) Participants will learn to discuss the pathophysiology of diseases that are responsible for the sonographic appearance.
**SSA02**

**Breast Imaging (Ultrasound Diagnostics)**

**Sunday, Nov. 27 10:45AM - 12:15PM Room: N228**

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**FDA** Discussions may include off-label uses.

**Participants**

Wendie A. Berg, MD, PhD, Pittsburgh, PA (Moderator) Nothing to Disclose

Catherine S. Giess, MD, Wellesley, MA (Moderator) Nothing to Disclose

**SSA02-01 Comparison of Mammography, Digital Breast Tomosynthesis, Automated Breast Ultrasound, Magnetic Resonance Imaging in Evaluation of Residual Tumor after Neoadjuvant Chemotherapy**

**Sunday, Nov. 27 10:45AM - 10:55AM Room: N228**

Participants

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**PURPOSE**

To compare the accuracy of mammography (MG), digital breast tomosynthesis (DBT), automated breast ultrasound (ABUS) and magnetic resonance imaging (MRI) for the assessment of residual tumor extent in breast cancer patients after neoadjuvant chemotherapy (NAC).

**METHOD AND MATERIALS**

Thirty-four women (age range, 40-68 years; mean age, 49 years) with 35 stage II-III invasive breast cancer undergoing NAC and mastectomy were enrolled from April 2015 to March 2016. Histopathological verification was available for all patients. The longest diameter of residual tumor measured with MG, DBT, ABUS and MRI has been compared with the residual invasive tumor size at pathologic evaluation. Mean differences (MD) in tumor size between measurement by radiologist and pathological size were evaluated. Statistical analysis was performed using intraclass correlation coefficients (ICC) and marginal homogeneity test. Receiver operating characteristics (ROC) analysis was used to evaluate the diagnostic performance of MG, DBT, ABUS, and MRI for predicting pathologic complete response (CR) (pCR).

**RESULTS**

The ICC values between predicted tumor size and pathologic size were 0.69 for MG, 0.78 for DBT, 0.79 for ABUS and 0.85 for MRI. MD between MG, DBT, ABUS, MRI and pathology were 15.2mm, 10.8mm, 14.0mm and 10.1mm, respectively. A discrepancy limited in the interval from -5mm to +5 mm compared with the pathologic size was observed in 31.4%, 48.6%, 28.6% and 54.3% of the patients with MG, DBT, ABUS and MRI, respectively. The discrepancy between MRI and pathologic size was statistical different from that of MG and ABUS (P=0.043 and 0.0091, respectively), but not different from that of DBT. Eight of 35 (22.9%) patients showed pCR and 27 (77.1%) showed nonpathologic CR (npCR). For predicting pCR, area under the ROC curve (AUC) for MG, DBT, ABUS and MRI was 0.90, 0.83, 0.77, and 0.92, respectively (P= not significant).

**CONCLUSION**

Prediction of residual tumor size on MRI and DBT was better correlated with pathology than that on MG and ABUS. Thus, breast MRI and DBT allowed more accurate assessment of residual tumor extent in breast cancer after NAC.

**CLINICAL RELEVANCE/APPLICATION**

Breast MRI and DBT provide more accurate assessment of residual tumor extent in breast cancer after NAC. Thus, MRI and DBT can be a useful tool in planning an effective surgical treatment.

**SSA02-02 Comparison of Automated Volume Breast Ultrasound to Hand Held Ultrasound for Diagnostic Breast Ultrasound Work-Up**

**Sunday, Nov. 27 10:55AM - 11:05AM Room: N228**

Participants

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Carmine Tinelli, MD, MSC, Pavia, Italy (Abstract Co-Author) Nothing to Disclose
PURPOSE
To compare the diagnostic accuracy and inter-observer variability of a hand held US (HH) and a single volume using AVBS centered over the clinical abnormality and to compare if there is a significant difference if the AVBS is performed by a sonographer (UT) or mammography technologist (MT).

METHOD AND MATERIALS
90 patients (age 53.1 years +/- 16.3) receiving a diagnostic US for a palpable mass (60), mammogram abnormality (25), follow-up study (1) or breast discharge (4) were enrolled in this HIPPA compliant, IRB approved study. Patients were randomized to have either a HH or AVBS first. HH was performed using a 14MHz transducer. The AVBS was performed using a L15-9 transducer. The technician performing the second study was blinded to results of the first exam. The AVBS was randomized between a UT and a MT. The studies were blinded, randomized and read by two radiologists each with greater than 10 years experience in breast ultrasound. The lesion with the highest BI-RADS score was used in the analysis. The HH studies were read 6 month before the AVBUS studies. Final diagnoses where made by core biopsy for follow-up for 2 years. Lesions included 9 malignant lesions and 81 benign lesions.

RESULTS
The K for benign/malignant was 0.831 (95% CI 0.744-0.920) while the global agreement using a 7-point BI-RADS score was 0.488 (95% CI 0.372-0.560). The K agreement between AVBS and HH in detecting breast pathology was 0.831 (95% CI 0.717-0.945). The first rater had a K of 0.910 (0.787-1.000) while the second 0.760 (0.578-0.943). The agreement between AVBS and HH was nearly the same when AVBS was performed by a MT (K=0.858 (0.723-0.963)) or UT (k=0.803(0.596-1.000)), p=0.47. The AUC for lesion characterization was AVBS reader 1 0.91 (0.84-0.96), AVBS reader 2 0.91 (0.83-0.96), HH reader 1 0.91 (0.84-0.96) and HH reader 2 0.83 (0.74-0.90) with no statistical difference. The inter-observer agreement based on BI-RADS was 0.568(0.468-0.647), with the HH k of 0.631(0.584-0.665) and for AVBS 0.492(0.457-0.564). The agreement based on pathology was K=0.831(0.718-0.944) with HH k=0.795 (0.623-0.967) and AVBS 0.869 (0.725-1.000).

CONCLUSION
Performing a one view diagnostic AVBS is equivalent to performing a HH (p=0.47) in diagnostic US work-up. There is no difference if the AVBS is performed by a trained UT or MT.

CLINICAL RELEVANCE/APPLICATION
For Diagnostic US workup HH and AVBS performed by a UT or MT are statistically equivalent.

SSA02-03 Utility of Ultrasound Evaluation of Symptomatic Patients with Fatty Replaced Breast Tissue with a Negative Mammogram

Sunday, Nov. 27 11:05AM - 11:15AM Room: N228

Participants
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PURPOSE
This study was conducted to assess the utility of ultrasound evaluating breast pain or a palpable abnormality in patients with fatty replaced breast tissue in the setting of a negative mammogram.

METHOD AND MATERIALS
We retrospectively reviewed 7180 patient charts of patients who underwent ultrasound evaluation between 1/01/2008 to 12/31/2010. Those who underwent both mammographic and concurrent sonographic evaluation for breast pain and/or palpable abnormality with fatty replaced breast tissue in the setting of a negative mammogram were included in the study. Medical records were reviewed to determine presence or absence of sonographic correlate of patient symptoms, need for biopsy, and final pathology. Those cases with reported positive ultrasound findings were reviewed by a fellowship trained board certified breast imager. Patients with a history of breast cancer or with axillary complaints were excluded from the study.

RESULTS
161 patients with fatty replaced breasts underwent mammographic and concurrent sonographic evaluation in the setting of a negative mammogram for the work-up of pain and/or palpable abnormality. No cancer was identified in any of the 161 patients. 78 ultrasounds were performed for pain and 83 for a palpable abnormality. There were 156 negative ultrasounds (96%) and 5 ultrasounds (4%) demonstrating 1 lipoma, 1 normal lymph node, 1 inclusion cyst, 1 heterogeneous area characterized as fat necrosis given history of trauma which resolved on follow up and 1 patient lost to follow-up. None of the patients with ultrasound correlates to symptomatic area of concern warranted biopsy.

CONCLUSION
In patients with fatty replaced breast tissue and a negative mammogram presenting with breast pain and/or a palpable abnormality, ultrasound did not yield any cancer detection.

CLINICAL RELEVANCE/APPLICATION
Ultrasound may not be required in patients with fatty replaced breasts who present with pain or a palpable abnormality within the breast in the setting of a negative mammogram.

SSA02-04 Participants
**Superb Micro-Vascular Imaging (SMI) in Distinguishing Benign from and Malignant Solid Masses at Breast US: Comparison with Contrast-enhanced US**

Andrew Young Park, MD, Ansan, Korea, Republic Of (Presenter) Nothing to Disclose  
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Jaemyung Cha, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose  
Suk Keu Yoom, MD, Ansan, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To prospectively investigate the effect of Superb Micro-Vascular Imaging (SMI) in distinguishing benign from malignant solid breast masses by comparing with contrast-enhanced ultrasound (CEUS).

**METHOD AND MATERIALS**
Forty female patients who underwent US-guided core needle biopsy for 40 suspicious breast masses and gave written informed consent to this investigation were finally included. Before the biopsy, SMI and CEUS examinations were done in all patients using Aplio500 US equipment (Toshiba Medical Systems Corporation, Japan) and SonoVue contrast agent (Bracco, Italy). Both quantitative and qualitative parameters were evaluated in SMI (vascular index=area of vessel signal in the total lesion; qualitative parameters including morphology and distribution of vessels and presence of penetrating vessel) and CEUS (time intensity curve analysis-peak intensity [PI], time to peak [TTP], mean transit time, slope, area under the curve [AUC]; qualitative parameters including degree, margin, and order of enhancement and the presence of internal homogeneity, penetrating vessel, and perfusion defect). Each parameter was compared between benign and malignant masses using student’s T-test and chi-square test. The diagnostic performance of SMI and CEUS was analyzed and compared using logistic regression and the receiver operating characteristic curve (ROC) analysis.

**RESULTS**
Twenty-four masses were benign and 16 were malignant. On SMI, malignant masses showed higher vascular index (P<.001), more frequently branching/shunting vessel (P=.047), central vascularity (P=.027), and penetrating vessels (P=.002). On CEUS, malignant masses demonstrated higher PI (P=.073) and AUC (P=.057), lower TTP (P=.092), more frequent hyperenhancement (P=.061), centripetal enhancement (P=.022), penetrating vessel (P=.053), and perfusion defect (P=.018). The area under the ROC curve of SMI and CEUS was 0.857 and 0.898, which was statistically equivalent (P=.475).

**CONCLUSION**
SMI is a valuable Doppler technique in distinguishing benign from malignant solid breast masses and its diagnostic performance was equivalent to CEUS.

**CLINICAL RELEVANCE/APPLICATION**
SMI is a very useful Doppler technique in distinguishing benign from malignant masses at breast US without the use of contrast agent in clinical setting.

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**SSA02-05 Improving Specificity of Whole Breast Ultrasound using Tomographic Techniques**

**Participants**
Neb Duric, PhD, Detroit, MI (Abstract Co-Author) Officer, Delphinus Medical Technologies, Inc  
Peter J. Littrup, MD, Providence, RI (Presenter) Founder, CryoMedix, LLC; Research Grant, Gall Medical Ltd; Research Grant, Endo International plc; Consultant, Delphinus Medical Technologies, Inc  
Rachel F. Brem, MD, Washington, DC (Abstract Co-Author) Board of Directors, iCAD, Inc; Board of Directors, Dilon Technologies LLC; Stock options, iCAD, Inc; Stockholder, Dilon Technologies LLC; Consultant, U-Systems, Inc; Consultant, Dilon Technologies LLC; Consultant, Dune Medical Devices Ltd  
Mary W. Yamashita, MD, Los Angeles, CA (Abstract Co-Author) Research Grant, Delphinus Medical Technologies, Inc  

**PURPOSE**
Ultrasound is a sensitive modality with a limited specificity for breast cancer. Ultrasound tomography (UST) is an emerging whole breast imaging modality that combines reflection, attenuation and speed of sound imaging, to support “triple acoustic detection” (TriAD). The purpose of this study is to determine UST’s specificity utilizing the TriAD approach.

**METHOD AND MATERIALS**
This HIPAA compliant, IRB approved trial accrued 167 patients with breast masses identified by standard imaging. Sequential reflection images and quantitative sound speed (SS=m/sec) and attenuation (AT=dB/cm/MHz) images were generated from UST scans. Each mass was characterized using the TriAD approach: The masses were outlined by an experienced radiologist using an ROI ellipse (Figure 1A), for which 10 progressive peri-mass and 10 intra-mass ellipses were generated by an algorithm to create radial profiles (Figure 1B) which were used to estimate the relative SS and AT of each mass. A tumor margin assessment was made from visual inspection of the reflection images to yield values of REF = -1, 0 and 1 for sharp, indistinct and irregular margins respectively. The three parameters were then ombined into two parameters via the formula: DS = SS + REF/20; DA = AT + REF/20 and the results plotted on a scatter plot. A cut line was chosen for which no cancers were missed and the resulting false positives evaluated (Figure 1C).

**RESULTS**
55 cancers, 71 fibroadenomas, and 41 cysts were found. Their resulting values of DS and DA are shown in the form of a scatter plot (Figure 1C) with DS plotted horizontally and DA vertically. The cutline shows threshold values running from (DS,DA) = (-0.025, 0.25) to (DS,DA) = (0.075, -0.2) and yielding 3 false positives in the form of cysts and 5 false positives in the form of fibroadenomas for a total of 8 false positives, compared to 55 true positives. This resulted in positive predictive values (PPV) for UST of 87%.

**CONCLUSION**
The addition of TriAD lesion characterization, using UST, demonstrates a PPV of 87%. This is higher than the reported 20-25% PPV for ultrasound guided breast biopsy and has the potential to decrease the number of false positive breast biopsies for breast masses.

**CLINICAL RELEVANCE/APPLICATION**

Whole breast UST demonstrates a significant difference in the quantitative evaluations of cancer and benign masses which may allow for fewer biopsies of benign masses.

**Sasa02-06**  Identification and Biopsy of Sentinel Lymph Nodes using Intradermal Microbubbles and Contrast-enhanced Ultrasound (CEUS) in Pre-operative Breast Cancer Patients: The Experience of a National Collaborative Working Group

Sunday, Nov. 27 11:35AM - 11:45AM Room: N228

**Participants**

Karina Cox, MBBS, Maidstone, United Kingdom (Presenter) Nothing to Disclose

Nisha Sharma, MBChB, Leeds, United Kingdom (Abstract Co-Author) Nothing to Disclose

Alice A. Leaver, MBChB, FRCR, Gateshead, United Kingdom (Abstract Co-Author) Nothing to Disclose

Adrian K. Lim, MD, FRCR, London, United Kingdom (Abstract Co-Author) Luminary, Toshiba Corporation

Jennifer Weeks, Maidstone, United Kingdom (Abstract Co-Author) Nothing to Disclose

Philippa Mills, MD, Maidstone, United Kingdom (Abstract Co-Author) Nothing to Disclose

Ali R. Sever, MD, Maidstone, United Kingdom (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

At Maidstone Hospital Breast Clinic (MHBC), sentinel lymph nodes (SLN) are routinely biopsied in patients with newly diagnosed breast cancer and a normal grey-scale axillary ultrasound. The technique has been adopted by other Breast Units who now work collaboratively (UK Microbubble Working Group) and herein present their early experience.

**METHOD AND MATERIALS**

Data was collated from 4 Breast Units across the UK. Between 2010 and 2015; retrospective data was collected on 376 patients from Unit 1 and 122 patients from Unit 2, prospective data was collected on 64, mainly screen detected, breast cancer patients from Unit 3 and 48 patients from Unit 4. All patients were newly diagnosed with breast cancer, clinically lymph node (LN) negative and had SLN identified and core biopsied +/- fine needle aspiration (FNA) using intradermal microbubbles and CEUS.

**RESULTS**

Sentinel LN were identified and successfully biopsied (LN tissue retrieved) in 78% (Unit 1), 77% (Unit 2), 89% (Unit 3) and 79% (Unit 4) of patients with invasive breast cancer undergoing primary surgery. The sensitivities of the technique as a test to identify SLN metastases were; 53%, 46%, 62% and 45% respectively. The specificities were, 98%, 100%, 100% and 96% respectively. The post-test probabilities that given a benign biopsy the patient had SLN metastases were, 29%, 35%, 21% and 29% respectively. The post-test probabilities that given a malignant biopsy the patient had SLN metastases were; 53%, 46%, 62% and 45% respectively. The specificities were, 98%, 100%, 100% and 96% respectively. The post-test probabilities that given a malignant biopsy the patient had SLN metastases were; 53%, 46%, 62% and 45% respectively. The specificities were, 98%, 100%, 100% and 96% respectively. The post-test probabilities that given a malignant biopsy the patient had SLN metastases were; 53%, 46%, 62% and 45% respectively. The specificities were, 98%, 100%, 100% and 96% respectively. The post-test probabilities that given a malignant biopsy the patient had SLN metastases were; 53%, 46%, 62% and 45% respectively. The specificities were, 98%, 100%, 100% and 96% respectively.

**CONCLUSION**

The results represent 4 Breast Units around the UK serving different patient populations with heterogeneous data collection and some variation in the use of the technique. Nevertheless, the data show that CEUS guided SLN biopsy can be readily incorporated into a diagnostic pathway for breast cancer. The sensitivities of the test were all within the previously published confidence intervals for MHBC. Further work should be undertaken to consolidate a standardised approach for the use of CEUS guided SLN biopsy in the breast clinic to establish the foundations for a clinical trial. There may be patients, with a benign core/ FNA SLN biopsy, in whom it is appropriate to completely omit axillary surgery.

**CLINICAL RELEVANCE/APPLICATION**

This collaborative work establishes the foundation for a clinical trial as some patients may be able to avoid axillary surgery completely.

**Sasa02-07**  Assessment of Shear Wave Elastography in the Ultrasonic Diagnosis of Breast Cancer in Chinese Patients: The BE3 Multicenter Study of 2262 Masses

Sunday, Nov. 27 11:45AM - 11:55AM Room: N228

**Participants**

Xi Lin, Guangzhou, China (Presenter) Nothing to Disclose

Ya-Ling Chen, Shanghai, China (Abstract Co-Author) Nothing to Disclose

Anhua Li, Guangzhou, China (Abstract Co-Author) Nothing to Disclose

Cai Chang, Shanghai, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To gather elastic information of breast masses based on Chinese population, and to determine the added value of SWE in the characterization of breast masses as compared to conventional US alone.

**METHOD AND MATERIALS**

From June 2014 to June 2015, 2262 patients consented to repeat standard breast US supplemented by quantitative SW elastographic examination in this prospective multicenter study. Features and assessments of B-mode BI-RADS and qualitative and quantitative SWE were recorded. The final diagnosis for each lesion in which biopsy was recommended was derived from histopathologic results. There were 2262 masses analyzable:152 BI-RADS category 2 masses were assumed to be benign; reference standard was available for 2110 category 3 or higher lesions. Considering BI-RADS category 4a or higher as test positive for malignancy, effect of SW elastographic features on area under the receiver operating characteristic curve (AUC), sensitivity, and specificity after reclassifying category 3 and 4a masses was determined.
RESULTS

Of these 2262 patients, 1509 lesions were benign and 752 were malignant. If the BI-RADS test was considered to be Test>0 for BI-RADS 4 and Test <0 for BI-RADS 2 and 3, the accuracy, sensitivity, specificity were 69.0%, 97.5% and 54.8% respectively. Among qualitative SWE variables, SWE Homeneguty, SWE Shape and SWE Rim pattern and Emax, Emean, Eratio and ESD were significantly increasing the AUC (no overlap of 95%CI). And the best variable to add BI-RADS classification to improve the AUC for breast US diagnosis was Emax. By using a new reclassification rule, the malignancy rates were higher than 2% in BI-RADS 3 stiffer than 50 kPa, which could advocate for their upgrade to biopsy. Meanwhile, the malignancy rates were lower than 10% in BI-RADS 4a mass softer than or equal to 40 kPa, which could advocate for their downgrade to follow-up.

CONCLUSION

Quantitative and qualitative SWE features of Chinese population had been demonstrated well in this study. The importance of maximum stiffness on SWE was confirmed in the improvement of US performances in breast lesion characterization. By combining SWE to US, we could decrease the number of false positives of US in the sub-group of low-suspicion masses and avoid unnecessary biopsy.

CLINICAL RELEVANCE/APPLICATION

Combining SWE to US could decrease the number of false positives of US in the sub-group of low-suspicion masses and avoid unnecessary biopsy.

SSA02-08 The Comparison of Elastography and Apparent Diffusion Coefficient (ADC) Values of Solid Breast Lesions Benign Versus Malignant

Sunday, Nov. 27 11:55AM - 12:05PM Room: N228

Participants
Turkan Uz Ikizceli, Istanbul, Turkey (Presenter) Nothing to Disclose
Nurcan Gocgun, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Ozkes I. Karahan, MD, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Yildiray Savas, MD, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose
Gokce Gulsen, Istanbul, Turkey (Abstract Co-Author) Nothing to Disclose

PURPOSE

The purpose of this study is to compare elastography and the result of DWI-ADC values in terms of the discrimination of the solid breast lesions as benign versus malignant.

METHOD AND MATERIALS

This study was approved by Human Subjects Institutional Review Board. All patients gave informed consent. US and real-time Strain Ultrasound Elastography were performed in 71 women (mean age, 46.1±13.4 years; age range, 19-80 years), who had breast lesions greater than 1cm in diameter (29 benign, 42 malignant; confirmed by cytology/histology) evaluated prospectively. Elastography (cut off value is used 4.2) and scoring designed by Itoh et al. (Tsukuba elasticity score; 1-3 is considered to be benign, 4-5 is considered to be malignant) is obtained. All patients were assessed by DWI sequence and ADC value of each lesion was calculated from the ADC maps done using five b values 0, 125, 250, 375, and 500 s/mm2. Results of the two techniques were compared the sensitivity and specificity according to the gold standard histopathology results.

RESULTS

As a result of histopathology; 42 of the 71 solid breast lesions were malignant and 29 were benign. Elastography scoring has one false negative and 3 false positives and sensitivity and specificity were 93.1% and 96.2%, respectively. Elastography index has 2 false negatives, 2 false positives; sensitivity and specificity were 95.4% and 95.2%, respectively. As a comparison of ADC values and gold standard histopathology, we find a strong correlation of 100 % between them. DWI-ADC values showed no false positive nor false negative results. The cut off value of ADC is obtained with ROC curve as 0.71x10-3 mm2/s. The 29 benign lesions of histopathology are above the ADC cutoff and 42 of malign lesions of histopathology are below; and both the specificity and sensitivity of ADC were 100%.

CONCLUSION

When we compared the ADC results obtained by maximum b values of 500 s/mm2; the strong correlation is found (p < 0.0001). ADC has a prominent lesion characterization of solid breast lesions and superior to elastography in terms of benign and malignant discrimination. Also elastography provides specific benefits and plays an important role in the diagnosis of solid breast lesions.

CLINICAL RELEVANCE/APPLICATION

ADC has a prominent lesion characterization of solid breast lesions and superior to elastography in terms of benign and malignant discrimination.

SSA02-09 Prediction of Pathological Complete Response (pCR) to Neoadjuvant Chemotherapy (NACT) Comparing Greyscale Ultrasound (US), Shear Wave Elastography (SWE) and MRI

Sunday, Nov. 27 12:05PM - 12:15PM Room: N228

Participants
Andrew Evans, MRCP, FRCR, Dundee, United Kingdom (Presenter) Research Grant, SuperSonic Imagine; Speakers Bureau, SuperSonic Imagine
Patsy Wheelahan, MSc, Dundee, United Kingdom (Abstract Co-Author) Research Grant, Siemens AG
Alastair Thompson, Houston, TX (Abstract Co-Author) Nothing to Disclose
Colin Purdie, MBChB, PhD, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Shelley Waugh, PhD, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Lee Jordan, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Jane Macaskill, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
Sarah J. Vinnicombe, MRCP, FRCR, Dundee, United Kingdom (Abstract Co-Author) Nothing to Disclose
**PURPOSE**

Pathological complete response (pCR) is increasingly common after neoadjuvant chemotherapy (NACT) for invasive breast cancer. Early prediction of pCR may influence planned surgical approaches in the breast and axilla. The aim of this project is to assess the value of interim SWE and US after 3 cycles in predicting pCR after 6 cycles of NACT and to compare performance of these parameters with MRI using RECIST criteria.

**METHOD AND MATERIALS**

51 patients with primary, operable breast cancer receiving NACT were recruited into a study which included baseline and interim US and SWE examinations. 4 shear wave images were performed in 2 orthogonal planes and quantitative data extracted prospectively. Maximum greyscale US diameter was measured. We compared three parameters with the binary outcome of presence or absence of pCR: 1. Mean elasticity at interim scan greater or less than 50 kPa (a threshold previously validated for benign-malignant differentiation); 2. Percentage stiffness reduction; 3. Percentage diameter reduction at interim US scan compared with pre-treatment. Interim MRI response using RECIST criteria was available for 42 (82%) women. The Chi square test was used to ascertain the significance of differences.

**RESULTS**

Mean stiffness at baseline was 148 kPa. pCR occurred in 13 of 51 (25%) women. pCR was seen in 8 of 10 (80%) women where masses had an interim stiffness value of <50 kPa, compared to 5 of 41 (12%) of women whose masses had an interim stiffness value of ≥50 kPa, p < 0.0001. with a sensitivity (sens) 62%, specificity (spec) 95%, PPV 80% and NPV 88% respectively. Percentage reduction in stiffness was the next best performance parameter (sens 53%, spec 94%, p = 0.0002) followed by % reduction in US diameter (sens 47%, spec 88%, p = 0.007). MRI performance using RECIST criteria was sens 55% and spec 74%, p = 0.08).

**CONCLUSION**

SWE stiffness less than 50 kPa after 3 cycles of NACT is strongly associated with pCR after 6 cycles of NACT and this parameter outperforms percentage reduction in stiffness, US diameter and MRI using RECIST criteria.

**CLINICAL RELEVANCE/APPLICATION**

SWE shows promise as a method of interim prediction of response in women with breast cancer treated with NACT and could be used to inform surgical decision making, allowing earlier discussion regarding breast conserving or oncoplastic options.
3D ABUS: Hands-on Workshop: GE Vendor Workshop
Sunday, Nov. 27 1:00PM - 2:00PM Room: Booth 5528

Participants

PARTICIPANTS
Susan Roux, MD

PROGRAM INFORMATION

This one-hour workshop led by a Peer Educator will introduce 3D Automated Breast Ultrasound (ABUS) interpretation, including how to navigate the coronal plane to efficiently highlight potential abnormalities and streamline the screening workflow. Attendees will:

Learn how 3D ABUS screening helps increase cancer detection in women with Dense Breast Tissue
See how quickly whole breast image volumes are acquired on the Invenia™ ABUS Scan Station
Review clinical cases on the Invenia™ABUS Workstation during physician guided hands-on exam interpretation.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Renal Doppler, Contrast and Elastography

Sunday, Nov. 27 2:00PM - 3:30PM Room: S103CD

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

Discussions may include off-label uses.

Participants

Sub-Events

RC110A | Renal Doppler: What You Need to Know

Participants
John S. Pellerito, MD, Manhasset, NY, (jpelleri@northwell.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Apply techniques and protocols for the renal Doppler evaluation. 2) Analyze diagnostic criteria for renal artery stenosis and occlusion. 3) Utilize Doppler for the evaluation of renal artery stents. 4) Compare Doppler to other imaging modalities used to evaluate renal vascular disease.

ABSTRACT
Participants
Dirk-Andre Clevert, MD, Muenchen, Germany, (dirk.clevert@med.uni-meunchen.de) (Presenter) Speaker, Siemens AG; Speaker, Koninklijke Philips NV; Speaker, Bracco Group;

LEARNING OBJECTIVES
1) Ultrasound visualization of renal lesions using B-mode sonography, contrast enhanced ultrasound and image fusion is explained. This includes the characterization of renal cysts. 2) The Bosniak classification is explained with the five different categories of characterization of renal cysts. A common finding are non-complicated solitary lesions Bosniak type I. 3) The main differential diagnoses are explained with an emphasis on the renal cell carcinoma.

ABSTRACT
Ultrasound is the most used interdisciplinary non-ionizing imaging technique in clinical routine. Therefore, ultrasound has a special value in the diagnosis and monitoring of cystic renal lesions, which can be classified as non-complicated or complicated and by means of occurrence as solitary or multifocal lesions. The Bosniak classification (I-IV) classifies renal cysts in 5 different categories with the help of ultrasound and computed tomography image criteria and is used for decisions of further clinical treatment. Additionally to normal native B-mode sonography, several new methods are in clinical use to improve diagnostic accuracy of unclear cases. Contrast enhanced ultrasound and MRI/CT are able to find and characterize difficult pathologies. In contrast to multislice-CT (MS-CT), ultrasound image fusion is a real-time imaging technique that can be used in combination with other cross-sectional imaging techniques. This course explains the most important pathologies of cystic lesions of the kidney and stresses the different imaging methods of native B-mode sonography and the new techniques of contrast enhanced ultrasound.

RC110C | Renal Elastography: Where Are We?

Participants
Nicolas Grenier, MD, Bordeaux CEDEX, France, (nicolas.grenier@chu-bordeaux.fr) (Presenter) Advisory Board, Supersonic Imagine; Travel support, Guerbet SA

LEARNING OBJECTIVES
1) Explain the principles and limitations of elastographic techniques applied to the kidney. 2) Learn about the impact of the renal structure on elasticity values. 3) Identify the significant structural changes responsible for variations of renal elasticity.

ABSTRACT
Ultrasound elastography is a new imaging technique under development that provides information about renal stiffness. Kidney elasticity quantification with ultrasound should be better performed with a quantitative technique, based on shear wave velocity measurements (ARFI or SSI methods). Kidney stiffness changes can be affected by mechanical factors such as external pressure induced by the probe and intrarenal characteristics such as tissue anisotropy, which is high in renal medulla, vascularization, which is high within the cortex, and hydronephrosis. Chronic kidney disease (CKD) incidence and prevalence are increasing in Western countries, due particularly to diabetes mellitus and hypertension-related nephropathies. During progression of such renal parenchymal diseases, cellular density may increase, mainly during acute inflammatory phases, and the interstitial matrix may be invaded by fibrosis. All components of these tissue changes may induce an increase of renal elasticity which is not specifically related to fibrosis. Tubular, glomerular, interstitial and vascular changes may also be responsible for an increase of stiffness. This is why, further studies are now necessary before to understand the real impact of elastography measurement in clinical nephrology. Considering characterization of renal tumors with elastography, clinical experience is still limited. Preliminary results show that benign tumors seem to have lower values of elasticity than malignant ones, but, here too, more experience is also necessary.
LEARNING OBJECTIVES

1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography. 2) Discuss and perform basic skills involved in thermal tumor ablation in a live learning model. 3) Perform specific US-guided procedures to include core biopsy, abscess drainage, vascular access, cyst aspiration, soft tissue foreign body removal, and radiofrequency tumor ablation. 4) Incorporate these component skill sets into further life-long learning for expansion of competency and preparation for more advanced interventional sonographic learning opportunities.

ABSTRACT
ED014-MO

Ultrasound Monday Case of the Day

Monday, Nov. 28 7:00AM - 11:59PM Room: Case of Day, Learning Center

US

AMA PRA Category 1 Credit ™: .50

Participants
Aya Kamaya, MD, Stanford, CA (Presenter) Nothing to Disclose
Nirvikar Dahiya, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Shweta Bhatt, MD, MBBS, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Jade J. Wong-You-Cheong, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Maryellen R. Sun, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Robert A. Kane, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Linda N. Morimoto, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Jennifer A. Steinkeler, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Christopher Czaplicki, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Maitray D. Patel, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Scott W. Young, MD, Scottsdale, AZ (Abstract Co-Author) Nothing to Disclose
Jeffry S. Kriegshauser, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Amelia Wnorowski, MD, Ellicott City, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Participants will learn to list the sonographic appearances of common and uncommon diseases. 2) Participants will learn to describe the differentiating features between similar diseases via a case based format. 3) Participants will learn to discuss the pathophysiology of diseases that are responsible for the sonographic appearance.
**Hot Topic Session: MSK Quantitative Imaging Biomarkers: MRI and Beyond**

Monday, Nov. 28 7:15AM - 8:15AM Room: E450A

**SPSH20A  MR Diffusion in the MSK System**

Participants
Mark R. Robbin, MD, Cleveland Hts, OH, (mark.robbin@uhhospitals.org) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

Apply MRI physics concepts of diffusion-weighted imaging techniques to clinical imaging. Describe the current techniques and applications of diffusion-weighted imaging in evaluating musculoskeletal neoplasms. Examine new techniques and applications of diffusion-weighted imaging.

**ABSTRACT**

**URL**

**SPSH20B  Quantitative Techniques to Characterize MSK Tissue Structure and Function**

Participants
Martin Torriani, MD, Boston, MA, (mtorriani@mgh.harvard.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Introduce concepts of how to perform quantitative musculoskeletal techniques focusing on 1H-MR spectroscopy. 2) Review current applications of MR spectroscopy with focus on muscle (sarcopenia, fatty infiltration, atrophy).

**URL**

**SPSH20C  Quantitative Musculoskeletal Ultrasound Elastography: Shear Wave Speed Measurements**

Participants
Kenneth S. Lee, MD, Madison, WI, (klee2@uwhealth.org) (Presenter) Grant, General Electric Company; Research support, SuperSonic Imagine; Research support, Johnson & Johnson; Consultant, Echometrix, LLC; Royalties, Reed Elsevier

**LEARNING OBJECTIVES**

1) Introduce the basic concepts of quantitative musculoskeletal ultrasound elastography using shear wave speed measurements. 2) Review the current applications of quantitative musculoskeletal elastography using shear wave speed measurements with focus on the tendon and muscle.

**Active Handout:** Kenneth S. Lee

SPSH21

Hot Topic Session: Zika Virus: What the Radiologist Needs to Know

Monday, Nov. 28 7:15AM - 8:15AM Room: E450B

- **GU**
- **HN**
- **NR**
- **OB**
- **CT**
- **MR**
- **US**
- **PD**

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

Participants
Richard L. Robertson, MD, Boston, MA *(Moderator)* Nothing to Disclose

**LEARNING OBJECTIVES**
1) To describe the Zika epidemic spread. 2) To illustrate the appearance of congenital Zika both prenatal and postnatal using ultrasound, MRI, and CT. 3) To discuss developments from the infectious disease perspectives, including vaccine development.

**URL**
http://pubs.rsna.org/doi/full/10.1148/radiol.2016161584

**Sub-Events**

**SPSH21A** Introduction: Why is Zika from an Imaging Perspective So Different from other Congenital Infections

Participants
Richard L. Robertson, MD, Boston, MA *(Presenter)* Nothing to Disclose

**SPSH21B** Facing the Zika Epidemic in Brazil: The Epidemiology and the Role of the Radiologist

Participants
Jacob Szejnfeld, MD, Sao Paulo, Brazil, (jacob.cura@gmail.com) *(Presenter)* Nothing to Disclose

*Handout: Jacob Szejnfeld*


**SPSH21C** Multidomality Prenatal Imaging Findings of Congenital Zika Infection

Participants
Patricia Oliveira-Szejnfeld, MD, Sao Paulo, Brazil, (patricia.fetal@gmail.com) *(Presenter)* Nothing to Disclose

**LEARNING OBJECTIVES**

**ABSTRACT**

**SPSH21D** New Insights on Imaging and Pathological Correlations on Zika Infection

Participants
Fernanda Tovar-Moll, MD, PhD, Rio de Janeiro, Brazil *(Presenter)* Nothing to Disclose

**SPSH21E** Controlling Zika Virus: Update on Prevention Strategies and Vaccination

Participants
Andrew Hale, MD, Boston, MA *(Presenter)* Nothing to Disclose

**SPSH21F** Panel Discussion

Participants
How to Incorporate CEUS into your Imaging Practice: Supported by Samsung

Monday, Nov. 28 8:30AM - 10:00AM Room: S101AB

Participants

PROGRAM INFORMATION
This course does not offer CME.

Sub-Events

3 CEUS as a Problem Solving Tool in Clinical Practice

Participants

PARTICIPANTS
Professor Paul Sidhu

3 Hepatocellular Carcinoma: The Advantages of Imaging with CEUS

Participants

PARTICIPANTS
Stephanie R. Wilson, MD

3 Efficacy and Limitations of Multiparametric Ultrasound (Color-doppler, CEUS and 3D Arterial Analysis) in Evaluation of Carotid Stenosis as Compared with CTA or MRA.

Participants

PARTICIPANTS
Vito Cantisani MD
Molecular Imaging Symposium: Basics of Molecular Imaging

Monday, Nov. 28 8:30AM - 10:00AM Room: S405AB

Participants
Jan Grimm, MD, PhD, New York, NY (Moderator) Nothing to Disclose
Zaver M. Bhujwalla, PhD, Baltimore, MD (Moderator) Nothing to Disclose

Sub-Events

MSMI21A MI Using Radioactive Tracers

Participants
Jan Grimm, MD, PhD, New York, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) In this course, we will discuss the various radio tracers and their applications in Molecular Imaging studies. Participants will understand in which situations to use which radio tracers, what to consider when developing the imaging construct and what controls to obtain for nuclear imaging studies. Examples will contain imaging with small molecules, with antibodies and nanoparticles as well as with cells in order to provide the participants with examples how to correctly perform their imaging studies. Most of the examples will be from the oncology field but their underlying principles are universally applicable to other areas as well.

ABSTRACT
Nuclear Imaging is currently the only true "molecular" imaging method utilized in clinic. It offers quantitative imaging of biological processes in vivo. Therefore, it is not surprising that it is also highly frequented in preclinical imaging applications since it is currently the only true quantitative imaging method. Multiple agents have been developed, predominantly for PET imaging but also for SPECT imaging. In this talk, we will discuss the application of radio tracers to molecular imaging and what to consider. Common pitfalls and mistakes as well as required measures to avoid these will be discussed. We will discuss various examples of imaging constructs, ranging from small molecules to antibodies, nanoparticles and even cells. In addition, the imaging modalities will also briefly discussed, including PET, SPECT and Cherenkov imaging.

MSMI21B Molecular MRI and MRS

Participants
Zaver M. Bhujwalla, PhD, Baltimore, MD (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To define the role of MRI and MRS in molecular and functional imaging and cover specific applications in disease processes. 2) The primary focus will be advances in novel theranostic approaches for precision medicine.

ABSTRACT
With an array of functional imaging capabilities, magnetic resonance imaging (MRI) and spectroscopy (MRS) techniques are valuable in obtaining functional information, but the sensitivity of detection is limited to the 0.1-1 mM range for contrast agents and metabolites, respectively. Nevertheless, MRI and MRS are finding important applications in providing wide-ranging capabilities to tackle key questions in cancer and other diseases with a 'molecular-functional' approach. An overview of these capabilities and examples of MR molecular and functional imaging applications will be presented with a focus on theranostic imaging for precision medicine.

MSMI21C Nanoparticles

Participants
Heike E. Daldrup-Link, MD, Palo Alto, CA, (heiked@stanford.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Understand important safety aspects of USPIO. 2) Recognize the value of immediately clinically applicable iron oxide nanoparticles for tumor MR imaging applications. 3) Learn about intrinsic immune-modulating therapeutic effects of USPIO.

ABSTRACT
NanoparticlesNanoscale materials can be employed to develop novel platforms for understanding, diagnosing, and treating diseases. Integrating nanomedicine with novel multi-modality imaging technologies spurs the development of new personalized diagnostic tests and theranostic (combined diagnostic and therapeutic) procedures. This presentation will provide an overview over the safety, diagnostic applications and therapeutic implications of clinically applicable ultrasmall superparamagnetic iron oxide nanoparticles (USPIO). USPIO which are currently used for clinical applications include ferumoxytrol (Feraheme), an FDA-approved iron supplement, and ferumoxtran-10 (Combidex/Sinerem), which is currently undergoing renewed clinical trials in Europe. Safety considerations for these agents will be discussed. Since USPIO are not associated with any risk of nephrogenic sclerosis, they can be used as alternative contrast agents to gadolinium chelates in patients with renal insufficiency or in patients in whom creatinine lab values are not available. Both ferumoxytrol and ferumoxtran-10 provide long lasting blood pool enhancement, which can be used
for MR angiographies and tissue perfusion studies. Subsequently, USPIO are slowly phagocytosed by macrophages in the reticuloendothelial system (RES), which can be used to improve MRI detection of tumors in liver, spleen, lymph nodes and bone marrow. A slow phagocytosis by tumor associated macrophages (TAM) in the tumor microenvironment can be used to grade tumor-associated inflammation and monitor the efficacy of new cancer immunotherapies. This opens opportunities for new discoveries in the area of cancer immunology and immunotherapy. TAM imaging concepts could represent a significant breakthrough for clinicians as a new means for risk stratification and as a new gold-standard imaging test for tracking treatment response in TAM-directed immunotherapy trials, which are currently entering clinical applications.

**Contrast Ultrasound**

Participants
Steven B. Feinstein, MD, Chicago, IL (Presenter) Research support, General Electric Company; Consultant, General Electric Company;

**LEARNING OBJECTIVES**

1) Inform: Clinical utility and safety of contrast enhanced ultrasound (CEUS) imaging. 2) Educate: Current diagnostic and therapeutic approaches. 3) Introduce: Newer concepts for combined diagnostic and therapeutic applications.

**ABSTRACT**

Contrast-Enhanced Ultrasound (CEUS) provides a novel, multi-faceted approach to diagnostic imaging and localized drug/gene delivery systems. The value-added proposition of CEUS centers on the pillars of safety, effectiveness, and economics. Specifically, in the field of diagnostic imaging, 3D CEUS ultrasound technology challenges the established formats CT, MR, and PET. CEUS provides distinct advantages including real-time volumetric imaging, unparalleled spatial and temporal resolution, economies of scale and all without exposure to unnecessary, ionizing radiation. Our efforts to develop 3D and contrast-enhanced ultrasound imaging continues to provide academic leadership while advancing the clinical field of cardiovascular medicine, urology (prostate imaging), and cancer (monitoring and therapy). In the evolving field of the ultrasound therapeutics, CEUS provides a novel, localized delivery system for ethical drugs and nucleic acids; all effectively delivered without viral-mediated agents. Further, the global installed base of ultrasound along with the safety record and ease of patient access highlights the utility of CEUS as a truly competitive, therapeutic delivery modality. In April 1, 2016, the USA FDA approved CEUS for liver imaging in adults and children. This is likely to have a major, paradigm change in healthcare in the USA.

**Quantitative Imaging Biomarkers**

Participants
Richard L. Wahl, MD, Saint Louis, MO (Presenter) Consultant, Nihon Medi-Physics Co, Ltd;

**LEARNING OBJECTIVES**

1) Identify at least one method of quantitatively assessing anatomic tumor response . 2) Identify at least one method of quantitatively assessing metabolic tumor response using FDG PET . 3) Identify an MRI quantitative metric which is associated with cellularity of biological processes and which can be used in response assessments.

**ABSTRACT**

Radiology initially developed as an analog imaging method in which non quantitative data were interpreted in a “qualitative and subjective” manner. This approach has worked well, but modern imaging also is digital, quantitative and has the opportunity for more quantitative and objective interpretations. This lecture will focus on a few areas in which quantitative imaging is augmenting quantitative image assessments to lead to more precise interpretation of images. Examples of such an approach can include measurement of tumor "metabolic" activity using formalisms such as PERCIST 1.0; methods of assessment of tumor size and volumes using the RECIST 1.1 and emerging formalisms and metrics of tumor heterogeneity, density, receptor density, diffusion, vascular permeability and elasticity using techniques including PET/SPECT, MRI, CT and ultrasound. With quantitative imaging, the opportunity to move from qualitative methods to precise in vivo quantitative phenotyping is a real one, with a quantitative “phenome” complementing other “omics” such as genomics. However, the quality of quantitation may vary and close attention to technical methodologies and process are required to have reliable and accurate quantitation. The RSNA QIBA effort will be briefly reviewed as one approach to achieve precise quantitative phenotyping. Examples of the use of quantitative phenotyping to inform patient management will be discussed.

**Honored Educators**

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Richard L. Wahl, MD - 2013 Honored Educator
Gynecologic Ultrasound (An Interactive Session)

Monday, Nov. 28 8:30AM - 10:00AM Room: E353B

Participants

Sub-Events

RC210A Uterus and Endometrium

Participants
Ruth B. Goldstein, MD, San Francisco, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Be able to state the acceptable standards for endometrial assessment in women with abnormal vaginal bleeding. 2) Be able to recognize a uterine abnormality in a postmenopausal woman that warrants further evaluation including tissue sampling or MRI. 3) Be able to recognize and diagnose adenomyosis.

RC210B Ovarian Masses

Participants
Beryl R. Benacerraf, MD, Brookline, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) To learn how to characterize ovarian cysts and determine whether they are benign or malignant. 2) To learn how to recognize the actual tissue diagnosis of an adnexal mass using ultrasound. 3) To learn to recognize non ovarian masses: hydrosalpinx, peritoneal inclusion cysts, appendiceal mass, dilated ureter, rectal lesions etc. 4) To learn the importance of color Doppler as well as recent scoring systems to determine whether or not a mass is malignant.

ABSTRACT

Endometriosis is a very common gynecological disease affecting millions of women in their reproductive life, often causing pelvic pain and infertility. Clinical history and physical examination may suggest endometriosis, but imaging mapping is necessary to identify the disease and mandatory for clinical counseling and surgical planning. Transvaginal ultrasound after bowel preparation is the best imaging modality as the first-line technique to evaluate patients suspected of endometriosis. The bowel preparation is relatively simple and includes the day before and the day of the examination. This method is highly accurate to identify intestinal endometriosis and to determine which layers of the bowel wall are affected. In addition, it provides better assessment of small peritoneal lesions of the retrocervical space, vagina and bladder. Pelvic adhesions can also be evaluated during the exam.

URL
http://chamie.com.br/download
Participants
Marnix T. van Holsbeeck, MD, Detroit, MI, (marnix@rad.hfh.edu) (Presenter) Consultant, General Electric Company; Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder MedEd3D; Grant, Siemens AG; Grant, General Electric Company; Joseph H. Introcaso, MD, Neenah, WI (Presenter) Nothing to Disclose
Michael A. Dipietro, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Catherine J. Brandon, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Alberto S. Tagliafico, MD, Genova, Italy (Presenter) Nothing to Disclose
Humberto G. Rosas, MD, Madison, WI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Recognize and identify pitfalls of scanning that lead to false positive or false negative musculoskeletal ultrasound results. 2) Perform skills for scanning difficult patients. 3) Follow rigorous protocols for the examination of different anatomic regions. 4) Position patients for more complicated musculoskeletal ultrasound examinations. 5) Recognize and integrate the importance of tissue movement in judging the functionality of the extremities.

ABSTRACT
In this Musculoskeletal Ultrasound Master class, an opportunity will be given to participants to start a written dialogue in advance to RSNA 2016. The electronically submitted questions will be sorted by instructors and organized per topic. A select number of recurrent themes in these questions will be prepared for dialogue on stage. When the questions focus on a particular scanning skill, the authors of the questions will be invited on the examination platform to show problems they encounter in their practice. By using a step-by-step approach in solving the scanning issues, all who are present should benefit from the technical interactions on stage. Cameras will project scanning details on large screens. The seating in the master class will guarantee close proximity for an enriching interaction between audience and stage. If you plan to attend this session and you want your questions answered in November, please contact us soon at marnix@rad.hfh.edu

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Michael A. Dipietro, MD - 2016 Honored Educator
Participants

Gary J. Whitman, MD, Houston, TX (Presenter) Book contract, Cambridge University Press
Annmaria 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; Scientific Advisory Board, Seno Medical Instruments, Inc
Stamta V. Destounis, MD, Scrtottsville, NY (Presenter) Nothing to Disclose
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Michelle D. McDonough, MD, Jacksonville, FL (Presenter) Nothing to Disclose
Peter R. Eby, MD, Seattle, WA (Presenter) Consultant, Devicor Medical Products, Inc
William R. Poller, MD, Pittsburgh, PA (Presenter) Consultant, Devicor Medical Products, Inc; Consultant, General Electric Company; Alexis V. Nees, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
H. Carisa Le-Petross, MD, Houston, TX (Presenter) Nothing to Disclose
Paula B. Gordon, MD, Vancouver, BC (Presenter) Stockholder, OncoGenex Pharmaceuticals, Inc ; Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd
Mohammad Eghtedari, MD, PhD, La Jolla, CA, (meghtedari@ucsd.edu) (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

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https://www.rsna.org/Honored-Educator-Award/

Eren D. Yeh, MD - 2015 Honored Educator
**SSC16**

**Vascular Interventional (Percutaneous Ablation Outside of the Liver)**

**Monday, Nov. 28 10:30AM - 12:00PM Room: E352**

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**SSC16-01 Biopsy Results do not Significantly Alter Management Among Patients Undergoing Thermal Ablation of Suspicious Renal Masses**

**Monday, Nov. 28 10:30AM - 10:40AM Room: E352**

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**Participants**
Ronald S. Arellano, MD, Boston, MA (Moderator) Nothing to Disclose
Naganathan B. Mani, MD, Chesterfield, MO (Moderator) Nothing to Disclose

**Sub-Events**

**Awards**

**Student Travel Stipend Award**

**Participants**
Michelle S. Tsang Mui Chung, MD, Providence, RI (Presenter) Nothing to Disclose
Aaron W. Maxwell, MD, Providence, RI (Abstract Co-Author) Nothing to Disclose
Grayson L. Baird, PhD, Providence, RI (Abstract Co-Author) Nothing to Disclose
Li-Juan Wang, MD, PhD, Providence, RI (Abstract Co-Author) Nothing to Disclose
William W. Mayo-Smith, MD, Boston, MA (Abstract Co-Author) Author with royalties, Reed Elsevier; Author with royalties, Cambridge University Press
Damian E. Dupuy, MD, Providence, RI (Abstract Co-Author) Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposia

**PURPOSE**
To evaluate the diagnostic yield of image-guided percutaneous biopsy of suspicious renal masses in patients referred for thermal ablation, and to determine the role of biopsy in guiding post-ablation patient management.

**METHOD AND MATERIALS**
A single-institution retrospective review was conducted to identify patients referred for thermal ablation of suspicious renal masses. Patients were divided into groups according to whether or not biopsy was performed. Lesions were categorized according to size, malignancy/benignity and pathology, and biopsied lesions were further grouped according to need for post-procedural follow-up. Local recurrence and complication rates were determined, and relevant diagnostic and procedural fees were used to compare overall costs.

**RESULTS**
A total of 406 ablation events in 339 patients were identified from April, 2000 to April, 2015. Ablation was performed without biopsy for 69 (17.0%) lesions. Of the 337 biopsied lesions, 175 (51.9%) were biopsied concomitantly with ablation. There were 22 non-diagnostic biopsies (6.5%) for an overall diagnostic yield of 93.5%. Among diagnostic biopsies, 272 (86.3%) were malignant/suspicious and 43 (13.7%) were benign/likely benign. Post-ablation follow-up was supported by biopsy results in 299 (94.9%) cases when including oncocytic neoplasms. Among lesions with at least 12 months of imaging follow-up (n=271, 66.7%), local recurrence was noted in 25 cases (9.2%); recurrence rate was not significantly different between groups. There were 42 (10.3%) complications and no deaths. No difference in complication rates was found between same- and separate-day biopsy/ablations (X2 = 5.7, p=0.22), nor between patients that did and did not undergo biopsy (X2 = 4.7, p=0.32). Assuming five years of follow-up, foregoing biopsy would have yielded $7,065 in average cost reduction per patient in our cohort.

**CONCLUSION**
Image-guided percutaneous biopsy of suspicious renal masses has a high diagnostic yield and low morbidity. Post-ablation management is seldom altered by biopsy results. Routine pre-ablation biopsy is of limited clinical value while incurring additional health care costs and can safely be avoided in most patients.

**CLINICAL RELEVANCE/APPLICATION**
Routine pre-ablation biopsy seldom alters patient management and can safely be avoided in most patients referred for thermal ablation of suspicious renal masses.

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Damian E. Dupuy, MD - 2012 Honored Educator

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**SSC16-02 Percutaneous CT-Guided Renal Cryoablation: A Long-Term Follow-up and Low Morbidity for Nearly Any Tumor Location**
Participants
Hussein D. Aoun, MD, Dearborn, MI (Abstract Co-Author) Nothing to Disclose
Peter J. Littrup, MD, Providence, RI (Abstract Co-Author) Founder, CryoMedix, LLC; Research Grant, Galil Medical Ltd; Research Grant, Endo International plc; Consultant, Delphinus Medical Technologies, Inc
Barbara A. Adam, MSN, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Mohamed M. Jaber, MD, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Fatima Memon, MD, Detroit, MI (Presenter) Nothing to Disclose
Matthew Prus, BS, Detroit, MI (Abstract Co-Author) Nothing to Disclose
Mark J. Krycia, BS, Detroit, MI (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess technical feasibility, efficacy and complication rates of CT guided percutaneous renal cryoablation in a large series with long term follow up.

METHOD AND MATERIALS
CT and/or CT-US fluoroscopic-guided percutaneous cryoablations were performed in 357 procedures on 382 tumors (347 primary, 17 metastasis and 18 benign) in 302 patients noting tumor size and location. Outcomes were also assessed based on nephrometry score and body mass index (BMI). Multiple tumors were ablated in 59 patients. Follow-up CT or MRI evaluated for local recurrences or new multicentric tumors. Hydrodissection and ureteral stent placement was performed to protect adjacent vital structures. Complications were graded according to the Clavien-Dindo grading system.

RESULTS
All procedures were performed under conscious sedation and were virtually painless. Average tumor and ablation size was 2.9 cm and 5.0 cm, respectively, with the largest 10.3 cm. Hydrodissection was performed in 247 procedures. Major complication (grade >3) rate attributable was 2.8% (10/357) with a slightly greater risk in patients with high nephrometry score (p< 0.025) or obese BMI (p<0.025). Of the major complications, 3 (3/10) were related to hemorrhage requiring transfusion. Prior to protective techniques in our early experience, a ureteral stricture, prior to ureteral stent placement for central tumors, and bowel injury were observed, but not after. Mean follow-up was 2 years with 114 tumors having > 3 year follow-up, 57 tumors having > 5 year follow-up and 23 tumors having > 7 year follow-up. Local recurrence rate was 2.9% (11/382), with 9 technical failures and 2 tract recurrences. Of the local recurrences, 9 were re-ablated (2 tract and 7 technical) without residual disease on follow-up for a secondary efficacy of 99%. There was no statistical significance of recurrences between T1a vs T1b tumors, nephrometry score or patient BMI.

CONCLUSION
Renal cryoablation has established low complication and local recurrence rates which do not appear to be significantly affected by tumor size or central location. CT guided percutaneous cryotherapy is a low cost and low morbidity alternative for patients with complex renal tumors.

CLINICAL RELEVANCE/APPLICATION
The rising cost of health care mandates consideration of renal cryoablation as a cost effective treatment option, justified by comparable low recurrence and complication rates for any renal location.

SSC16-03 New Perspectives in Magnetic Resonance Guided Focused Ultrasound (MRgFUS) for Localized Prostate Cancer

Participants
Vincenzo Noce, MD, Rome, Italy (Presenter) Nothing to Disclose
Fabrizio Andrani, Roma, Italy (Abstract Co-Author) Nothing to Disclose
Michele Anzidel, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Hans Peter Erasmus, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose
Alessandro Napoli, MD, Rome, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess safety and feasibility of non-invasive high intensity 3T MR guided focused Ultrasound (MRgFUS) treatment of localized prostate cancer in a phase I, treat and resection designed exploratory study.

METHOD AND MATERIALS
12 patients, aged 47–78 years, with biopsy proven focal T2 prostate cancer (low-to-intermediate risk: Gleason max 3+4 and PSA max 12), confirmed on a previous multiparametric MR exam (Discovery 750, GE) including dynamic contrast enhanced (DCE) imaging (Gd-BOPTA, Bracco), underwent MRgFUS ablation (ExAblate, InSightec). All patients underwent also to radical laparoscopic prostatectomy; MRgFUS ablation was carried out on the MR identifiable lesion (max 2) using a specific energy (2900-8300 J) for each patient and real time MR thermometry monitor for correct treatment location. Non-perfused volume (VPV) in the post-ablative prostatectomy was than compared with excision pathology for necrosis assessment.

RESULTS
Histological examination demonstrated extensive coagulative necrosis at the site of sonication surrounded by normal prostatic tissue with inflammatory changes; these features positively compared with immediate post-ablative MRI scan and VPV. At histology 11 patients were free of residual viable tumor within the treated area while in only 1 patient, 10% of residual tumor was observed within the NPV. There was a variable amount of isolated cancer tissue (Gleason max 5, 3+2) within the non-treated parenchyma that was neither identifiable at MRI nor at biopsy. No significant complications were observed in all subjects during or immediately after the procedure.

CONCLUSION
MR guided Focused Ultrasound appear as a safe and effective modality to determine >90% necrosis of treated prostate cancer; more prospective studies in larger cohort are needed to extend success rate and to validate the procedure.

**CLINICAL RELEVANCE/APPLICATION**

MRgFUS has potential in focal therapy in localized prostate tumors without significant complications.

**SSC16-04  Therapeutic effect of Focused Ultrasound Combined with Chemo-agent for Pancreatic Cancer Xenograft Model**

**PURPOSE**
As focused ultrasound (FUS) has been widely studied in anti-cancer drug delivery, there is growing interests in the effects of how FUS enhances the results of chemotherapy. To investigate whether non-thermal effect of FUS more effective in enhancing the combined chemotherapy, in vivo studies using human pancreatic cancer xenograft model was designed. In addition, the feasibility of combined treatment of FUS with chemotherapy was studied as a potential treatment protocol for pancreatic cancer.

**METHOD AND MATERIALS**
Immunodeficient mouse inoculated with CFPAC-1 were used as the pancreatic xenograft model. For the first step experiments, animals were treated in six groups: control, gemcitabine (GEM)-only, FUS#1-only, FUS#2-only, GEM+FUS#1, and GEM+FUS#2. Weekly treatments were performed for three weeks and post-treatment monitoring was followed for five weeks. In the second step, animals in GEM-only and GEM+FUS#2 groups were treated for four treatment cycles which consisted of three weekly treatments and one week monitoring.

**RESULTS**
Tumor growth rate of animals treated with FUS-only was lower than the rate of control group while it was higher than GEM-only group. Animals treated with GEM+FUS showed reduction of tumor growth after two treatments. In GEM+FUS#2 group, tumor size reduced until fifth week after the treatment procedure was completed. Additional study, for both treatment groups, tumor size reduced during the weekly treatments in each cycle and increased again during the monitoring period. Tumor in both groups showed similar growth pattern for each treatment cycle. However, the re-growth rate of tumor in GEM+FUS#2 group was lower than GEM-only group. Especially, three out of 10 mouse in GEM+FUS#2 group showed complete response (CR).

**CONCLUSION**
From this study, it has been shown that mechanical effects of FUS are more effectively enhance therapeutic effects of chemotherapy. Additionally, the results of repeated treatment show the potential as a new treatment protocol for pancreatic cancer.

**CLINICAL RELEVANCE/APPLICATION**
For an alternative of cancer treatment, combined therapy of FUS and chemo-agent has promising potential.

**SSC16-05  Vascular Complications on Short-term Follow-up Computed Tomography Associated with Irreversible Electroporation (IRE) of Locally Advanced Pancreatic Cancer**

**PURPOSE**
Irreversible electroporation (IRE) is a relatively recent development in the palliative treatment of locally advanced pancreatic cancer by inducing apoptosis using selective high-voltage electric fields to create nanoscale permanent defects in the cell membrane. Despite IRE's advantages for use in vascular-rich organs (e.g., excellent tissue selectivity and sharp ablation zone margins of only a few cell layers thick), this study presents our institutional multi-year experience with vascular complications following pancreatic IRE ablation on short-term follow-up CT.

**METHOD AND MATERIALS**
An IRB-approved institutional registry identified patients with locally advanced pancreatic cancer treated with technically-complete IRE. Follow-up CT was performed within the first two weeks and at two to three month intervals. Helical CT was performed on either 64- or 128-slice multidetector units with two board-certified attending body imaging radiologists performing independent retrospective interpretations documenting any relevant findings which could be reasonably construed as sequelae of the procedure.

**RESULTS**
Between 3/2011-11/2015, 36 patients were eligible for retrospective review. Vasculature abnormalities were the most common finding (51% of the total occurrences, 23/36 patients) including post-procedural narrowing (50%), pseudoaneurysm formation.
(22%), occlusion of a major peripancreatic vessel (17%), and splenic infarct (11%).

CONCLUSION
Although IRE is regarded for treatment of tumors in highly vascular organs such as the pancreas, vascular sequelae were observed most frequently in our series. Despite the majority of animal and human studies demonstrating effective cell death by IRE without affecting adjacent blood vessels, other studies report direct and indirect vascular damage in the ablation zone. The vascular complications observed in our study are postulated to be secondary to a combination of direct and indirect vascular damage as well as inflammatory changes in the ablation bed and extrinsic changes associated with the evolving tumor (e.g., mass effect, altered neovascularization, and variations in residual tumor necrosis).

CLINICAL RELEVANCE/APPLICATION
Despite regard for IRE’s ability to target tumor cells while sparing adjacent structures, short-term CT follow-up at our institution showed vascular complications to be the most common post-ablative sequelae occurring in over half of all patients treated with IRE for locally advanced pancreatic cancer.

PURPOSE
To describe our 13-year experience and outcome of image-guided percutaneous cryoablation of T1 renal cell carcinomas.

METHOD AND MATERIALS
285 patients, 180 (65%) males, 105 (37%) females, 38-92 yrs, (mean 66.8 yrs) with solitary renal cell carcinomas were treated with percutaneous image-guided cryoablation from August 1, 2000 through December 31, 2013. Lesions (260 T1a, 25 T1b, median size 2.5 cm, range, 0.6 - 6.5 cm), were ablated using one to seven (median three) cryoprobes. CT (n=155) or MRI (n=130) was utilized for imaging-guidance and iceball monitoring. In selected cases, adjacent normal structures were displaced from the treatment site by percutaneous instillation of saline and/or manual displacement of bowel. MRI was obtained at 24 hrs to assess for early complications. In addition to a review of the medical record, MRIs were repeated at 3 to 6 month intervals for the first year, and every 6 to 12 months thereafter (median 26 mos; range 3-143 mos) to assess for treatment efficacy and additional complications.

RESULTS
Primary efficacy was 97.8%; all recurrences were successfully treated. Overall complication rate was 14%, including 9 CTCAE grade 1 (e.g., pain, perinephric hematoma), 17 grade 2 (e.g., myoglobinemia, urinary retention), 11 grade 3 (e.g., UTI, anemia, pneumonia), and 3 grade 4 complications (CVA, aspiration pneumonia, hypertensive emergency).

CONCLUSION
Percutaneous image guided cryoablation of T1 renal cell carcinoma resulted in highly successful intermediate to long term outcomes.

CLINICAL RELEVANCE/APPLICATION
Image-guided cryoablation is clinically efficacious and a viable alternative to partial nephrectomy.

PURPOSE
To assess the technical feasibility and local outcomes of cryoablation for head and neck masses. We hypothesize that head and neck cryoablation responds similarly in terms of recurrence, complication and/or healing rates, regardless of anatomic location and tumor type.

METHOD AND MATERIALS
45 CT and/or US-guided, percutaneous cryotherapy procedures were performed for 61 tumors from primary (27) and metastatic cancers (34), in 22 patients. In general, cases were selected to avoid major cranial nerves, skin, and endoluminal involvement. Tumor number and type, prior treatment regimens, ablation volumes, location, abutting vessels >3mm, recurrences, and procedural complications were noted. Complications were graded according to Common Terminology Criteria for Adverse Events Version 4.0 (CTCAE). Local tumor recurrence and involution was monitored over time with 1, 3, 6, 12 month and annual scans thereafter.

RESULTS
Percutaneous cryoablation was performed under conscious sedation, with only one patient requiring intubation due to anticipated...
Percutaneous cryoablation was performed under conscious sedation, with only one patient requiring intubation due to anticipated pharyngeal swelling post-procedure. The 27 primary tumors consisted solely of squamous cell carcinoma and the metastases were from lung (15), renal (4), sarcoma (7), and other (8) in origin. Of the 45 total procedures, 10 procedures involved multiple tumors ablated in the same session. Average diameters of tumor and ablation zone were 2.4 cm and 4.2 cm, respectively. Major complications (CTCAE Grade >3) occurred after 4 procedures (8.9%). Of the 4 complications, one was a facial skin debridement as a result of thorough cryoablation coverage. One patient whose tumor extended through the skin had a planned resection and flap reconstruction of the ablation zone. Mean follow-up was 1.9 years (range: 0.1-6.2 years). There was a slight statistically significant increase in local recurrence rates for primary and metastatic tumors, 18.5% (5/27) and 2.9% (1/34) (p<0.05), respectively.

CONCLUSION
CT/US guided PCA is a safe, effective local cancer control option for patients with oligo-metastatic soft tissue disease or recurrent primary tumors in the head and neck region. With appropriate precautions, local healing is excellent.

CLINICAL RELEVANCE/APPLICATION
Cryoablation of head and neck tumors contributes to improved local control for many tumor types, particularly for those having "escaped" other treatments.

SSC16-09  Role of MRI Chest in the Assessment of Tumor Response Post Microwave Ablation of Pulmonary Metastases

Monday, Nov. 28 11:50AM - 12:00PM Room: E352

Participants
Nour-Eldin A. Nour-Eldin, MD, PhD, Frankfurt Am Main, Germany (Presenter) Nothing to Disclose
Benjamin Kaltenbach, Frankfurt, Germany (Abstract Co-Author) Nothing to Disclose
Nagy N. Naguib, MD, MSc, Frankfurt Am Main, Germany (Abstract Co-Author) Nothing to Disclose
Mohammed A. Alsubhi, BMBS, 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 determine the value contrast enhanced (CE-MRI) follow-up in the assessment of tumor response of microwave (MW) ablated pulmonary metastases by correlating the results with CE-CT.

METHOD AND MATERIALS
This prospective study included 130 ablation sessions for pulmonary metastases in 80 patients. CE-MRI Chest scanning was performed 1 week before the ablation and at 24 hours, 3, 6, 9 and 12 months post ablation. Thin section CT Volumetric measurement of the lesions was performed at the same time periods as a second parameter for comparison. The lesion MRI enhancement intensity in each study was estimated, and the ratio to the paraspinal muscle enhancement intensity at the same level was measured (Lesion Muscle Signal (LMS ratio). The correlations between post ablation follow-up CT volume of tumors and CE-MRI LMS ratio at the follow-up periods were assessed.

RESULTS
The preablation tumor volumes range: 0.30-6.1 cm (mean: 1.5 cm³, SD: 1.3). LMS ratio < 1 was associated with post ablation reduction of tumor volume (denoting scaring), while LMS ratio > 1 were noted in: preablation due to high contrast enhancement of the tumor, in 24 h post ablation due to the inflammatory response associated with the thermal ablation and due to tumor residue or progress. Weak correlation was detected between the LMS ratios and CT volumetric changes in 24 h post ablation. Strong correlation between the LMS ratios was estimated between the follow-up periods of 3 months (Spearman R: 0.66, p = 0.001), 6 months (Spearman R: 0.66, p = 0.001), 9 months (Spearman R: 0.61, p < 0.001) and 12 months (Spearman R: 0.7, p < 0.0001).

CONCLUSION
CE-MRI follow up of the MW ablated lung tumors can be used effectively to assess the tumor response to ablation using LMS ratio as a parameter of assessment.

CLINICAL RELEVANCE/APPLICATION
CE-MRI may be used for the evaluation of tumor response post pulmonary ablation therapy.
Participants

PARTICIPANTS

Marc Inciardi, MD, Susan Roux, MD

PROGRAM INFORMATION

In this era of cost-conscious medicine, Marc Inciardi, MD and Susan Roux, MD, investigators on the Somo-Insight Clinical Trial will discuss their current experience with ABUS including cancer detection rate in conjunction with 3D mammography and "how to" keep one's call back rate as low as possible.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
The Use of Ultrasound Contrast Imaging in the Characterization of Focal Liver Lesions: Supported by GE Healthcare

Monday, Nov. 28 3:00PM - 4:30PM Room: S101AB

Participants

PROGRAM INFORMATION

Ultrasound Contrast (CEUS) in the Use of Liver Lesion Characterization Symposium. Come and learn about Bubble Basics as well as how to start using CEUS as a departmental problem solving tool. Speakers will also discuss specific CEUS applications including: hepatocellular carcinoma patients, pediatrics, and interventional procedures. This course does not offer CME credit.

RSVP

http://ge.cvent.com/LiverLesion
Gastrointestinal (Gall Bladder and Biliary Imaging)  
Monday, Nov. 28 3:00PM - 4:00PM Room: E353C

SSE08-01  Risk Stratification of Gallbladder Polyp Greater than 10 mm Using High-Resolution Ultrasonography (HRUS) and Texture Analysis

**Participants**
- Jeong Min Lee, MD, Seoul, Korea, Republic Of (Moderator)  
  Grant, Guerbet SA; Support, Siemens AG; Grant, Bayer AG; Grant, General Electric Company; Grant, STAReMed Co, Ltd; Grant, RF Medical Co, Ltd; Grant, Toshiba Corporation; Grant, Samsung Medical Healthcare
- David J. Lomas, MD, Cambridge, United Kingdom (Moderator)  
  Nothing to Disclose

**Sub-Events**

**Purpose**
To assess the important features for differentiating neoplastic from non-neoplastic polyp, and GB carcinoma from adenoma in polyp greater than 10mm using high-resolution ultrasonography (HRUS) findings and texture analysis.

**Method and Materials**
We included 136 patients with GB polyp (>10 mm) who underwent both pre-operative HRUS and cholecystectomy (non-neoplastic polyp=58, adenoma=32, and carcinoma=46). Two radiologists retrospectively accessed HRUS images and we analyzed relationship between image findings and differential diagnosis of GB polyps. Computerized texture analysis was quantified and texture parameters were compared between GB polyps. Multivariate logistic regression analysis was performed to identify significant predictors for neoplastic polyps and GB carcinomas.

**Results**
Statistically common findings for neoplastic polyp included single, larger size, sessile shape, lobular surface, vascular core, heterogenous echo, hypoechoic polyp, and non-hyperechoic foci (P<0.05). Single (OR, 3.680-3.856, P<0.05) and larger size (OR, 1.450-1.477, P<0.001) were independently associated with neoplastic polyp. Using polyp >14mm as a cutoff level, diagnostic accuracy to differentiate neoplastic polyp was 80.9-81.6%. To differentiate GB carcinoma from adenoma, sessile shape (OR, 9.485-41.257, P≤0.001) and larger size (OR, 1.267-1.303, Ps=0.001) in HRUS, and higher skewness (OR, 6.382, P=0.006) and lower grey level co-occurrence matrices (GLCM) contrast (OR, 0.963, P=0.006) in texture parameters were significant predictors for GB carcinoma. Using polyp >21mm as a cutoff level, diagnostic accuracy to differentiate GB carcinoma was 73.1-79.5%. Among four significant predictors for GB carcinoma, if polyp showed at least one texture feature (skewness >0.24 or GLCM contrast <24.7) and one HRUS finding (polyp>21mm or sessile shape), diagnostic accuracy to differentiate carcinoma was increased to 89.7-91.0%.

**Conclusion**
In GB polyp >10mm, single lesion and polyp >14mm were useful for prediction of neoplastic polyps. In neoplastic polyps, sessile shape, polyp >21mm, higher skewness, and lower GLCM contrast were useful for prediction of GB carcinoma.

**Clinical Relevance/Application**
Combined use of HRUS findings and computerized texture analysis would improve the accuracy of sonographic differentiation between GB adenomas and GB carcinomas.

SSE08-02  Varying 18F-FDG Uptake and Glucose Metabolism in Mass Forming Type of Intrahepatic Cholangiocarcinoma

**Participants**
- Kazuto Kozaka, MD, Kanazawa, Japan (Presenter)  
  Nothing to Disclose
- Toshifumi Gabata, MD, PhD, Kanazawa, Japan (Abstract Co-Author)  
  Nothing to Disclose
- Hiroyuki Takamura, Kanazawa city, Japan (Abstract Co-Author)  
  Nothing to Disclose
- Yasunori Sato, Kanazawa city, Japan (Abstract Co-Author)  
  Nothing to Disclose
- Satoshi Kobayashi, MD, Kanazawa, Japan (Abstract Co-Author)  
  Nothing to Disclose
- Hidehiro Tajima, Kanazawa city, Japan (Abstract Co-Author)  
  Nothing to Disclose
- Seigo Kinuya, Kanazawa city, Japan (Abstract Co-Author)  
  Nothing to Disclose
- Kenichi Harada, Kanazawa City, Japan (Abstract Co-Author)  
  Nothing to Disclose
- Tetsuo Ohta, Kanazawa city, Japan (Abstract Co-Author)  
  Nothing to Disclose
- Osamu Matsui, MD, Kanazawa, Japan (Abstract Co-Author)  
  Nothing to Disclose
PURPOSE
Recently, intrahepatic cholangiocellular carcinoma (ICC) can be divided by the origin of biliary tree. Bile ductular carcinoma (BDC) is considered to arise from small bile ducts such as septal, interlobular bile ducts and ductal carcinoma (DC) is considered to arise from large bile ducts. The usefulness of 18F-FDG PET/CT in ICC is well-known but some ICCs don't show uptake of 18F-FDG. The aim of this study was to assess the 18F-FDG accumulation and glucose metabolism in mass forming type of intrahepatic cholangiocarcinoma (M-ICC) with sub-classification into BDC and DC.

METHOD AND MATERIALS
Surgically resected M-ICC (n=15, all adenocarcinoma) was enrolled. M-ICC could be divided into BDC (n=7, tumor size 23±6.7mm) and DC (n=8, tumor size 47±26mm) by the pathologic appearance. The SUV-max value in 18F-FDG PET/CT was calculated and Glut-1, 2, Hexokinase (HK) II and glucose-6-phosphatase (G6P) expression were evaluated by 5 point score using the number of positive cells and staining density.

RESULTS
SUV-max value in BDC was significantly lower than that in DC (3.2±0.8 vs 7.6±3.2, p<0.01). The score of Glut-1 and HK II in DC were significantly higher than those of BDC. The expressions of Glut 2 and G6P were variable and not significant in BDC and DC.

CONCLUSION
18F-FDG accumulation, Glut-1, and HK II expression in DC was higher than those in BDC and thus ICC could be divided into BDC and DC by 18F-FDG PET/CT findings.

CLINICAL RELEVANCE/APPLICATION
Glucose metabolism is different between DC and BDC and 18F-FDG PET/CT is recommended not only for making disease staging but for distinguish them.

SSE08-03 Intrahepatic Mass Forming Type Cholangiocarcinoma: Subtype Differentiation between Small Duct Type and Large Duct Type Using MDCT

Participants
Ju G. Nam, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Jeong Min Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Grant, Guerbet SA; Support, Siemens AG; Grant, Bayer AG; Grant, General Electric Company; Grant, STARmed Co, Ltd; Grant, Toshiba Corporation; Grant, Samsung Medical Healthcare
Jeon Min Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ijin Joo, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Su Joa Ahn, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To identify useful MDCT imaging features for the differential diagnosis between small duct (SD) and large duct (LD) types of intrahepatic mass forming type cholangiocarcinoma (IMCC), which are regarded to have different stem cell origins and prognoses.

METHOD AND MATERIALS
This retrospective study was approved by our institutional review board and the requirement for informed consent was waived. Eighty-two patients with surgically confirmed IMCCs (60 SD type; 22 LD type) and available preoperative four-phase MDCTs were included. Two independent radiologists assessed the dynamic enhancement patterns and morphologic characteristics of IMCCs as well as the presence or absence of ancillary features. All discrepancies were resolved by a third reviewer. Univariate and multivariate logistic regression analyses were performed to identify relevant MDCT features in the differentiation between SD and LD type IMCCs.

RESULTS
On the arterial phase, peripheral hyper-enhancement and diffuse or heterogeneous enhancement were significantly frequent in SD type IMCCs (56.7%, 34/60 and 17.1%, 12/60, respectively) while absence of arterial hyper-enhancement was frequent in the LD type (63.6%, 14/22) (P=0.003). Frequencies of the presence of centripetal enhancement or washout were not significantly different between the types (all Ps>0.05). Regarding morphologic and ancillary features, presence of bile duct encasement; and lymph node enlargement were significantly associated with the LD type (SD vs. LD type: 41.7%, 25/60 vs. 81.8%, 18/22; 23.3% 14/60 vs 14/22 63.6%, P=0.013 and 0.007, respectively). Lesion size did not show a significant difference (5.73 cm ± 3.34 vs. 4.79 cm ± 2.26, P=0.227). On multivariate analysis, presence of arterial hyper-enhancement, absence of bile duct encasement, lobulated contour, and absence of lymph node enlargement were significant MDCT findings suggestive of SD type rather than LD type IMCCs (all Ps<0.05).

CONCLUSION
MDCT imaging features including the presence of arterial hyper-enhancement and absence of bile duct encasement can help differentiate SD type from LD type IMCCs.

CLINICAL RELEVANCE/APPLICATION
As SD type and LD type IMCCs are known to have different prognoses, preoperative differentiation of subtype using MDCT would be important for patient management and prediction of outcomes.

SSE08-04 Added Value of Gadoxetic Acid Enhanced T1 Weighted Magnetic Resonance Cholangiography in Diagnosing Biliary Complications of Liver Transplant

Participants
Monday, Nov. 28 3:30PM - 3:40PM Room: E353C
Biliary complications after liver transplantation (LT) are common. We compared T2 weighted (T2w) and gadoxetic acid enhanced T1 weighted (T1w) magnetic resonance cholangiography (MRC) to evaluate the additional value of contrast-enhanced MRC to depict anastomosis stenosis (AST), non-anastomotic strictures (NAS), and biliary casts.

**METHOD AND MATERIALS**

Retrospective analysis of the local transplant database identified 60 patients with high suspicion of biliary complications after LT who underwent T2w MRCP and gadoxetic enhanced T1w MRC followed by endoscopic retrograde or percutaneous transhepatic cholangiography. Two readers independently reviewed the MRC datasets and rated the image quality (IQ) as well as likelihood for AST, NAS and biliary casts on a 5-point Likert scale. Sensitivity and specificity values were calculated as well as receiver operating characteristics (ROC) curves created and inter-reader variability assessed. The number of gadoxetic acid enhanced T1w MRC was questioned for each patient (yes/no, why?).

**RESULTS**

On average IQ was high for all sequences without any statistically significant differences (2.83-2.88). In 39 patients ERCP/PTC detected at least one stricture or cast. Sensitivity/specificity values for AST were 0.69-0.82 for both readers using T2w MRCP, which increased to 0.79-1 using all sequences. For NAS and biliary casts, the addition of gadoxetic enhanced MRC increased sensitivities from 0.57/0.74 to 0.71/0.93 and 0.6/0.68 to 0.76-0.89, respectively, for the two readers. Patients with biliary strictures showed a higher increase in sensitivity values compared to choledocho-choledochostomies. Kappa values were substantial (0.45-0.62). Added value of gadoxetic acid enhanced MRC was found in 75%/83.3% of the cases (enhanced diagnostic certainty, correct diagnosis possible).

**CONCLUSION**

The addition of gadoxetic acid enhanced T1w MRC to T2w MRCP increased the sensitivity and specificity and diagnostic confidence to evaluate biliary complications in patients after LT with suspected biliary complications. Gadoxetic acid enhanced T1w MRC is a valuable tool to evaluate for post-transplant biliary complications.

**CLINICAL RELEVANCE/APPLICATION**

The addition of gadoxetic acid enhanced T1w MRC to T2w MRCP aids in the detection of biliary complications in patients after LT.

**SSE08-05 Non-specific Common Bile Duct Dilation on Ultrasound: Yield of Subsequent MRCP & Role in Patient Management**

**Awards**

**Student Travel Stipend Award**

**Participants**

Kristy Lee, MD, Boston, MA (Presenter) Nothing to Disclose
Katherine M. Troy, MD, Brookline, MA (Abstract Co-Author) Nothing to Disclose
Jesse L. Wei, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Karen S. Lee, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Alexander Brook, PhD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Maryellen R. Sun, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Koenraad J. Mortele, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To assess the yield of MRCP recommended for nonspecific dilation of the CBD on ultrasound (US); to compare MRCP diagnosis with pathology and/or clinical follow up; to identify other imaging or clinical markers that could help triage patients for further management.

**METHOD AND MATERIALS**

A retrospective review was performed of all patients in 2014 with an abdominal US in which MRCP was recommended for evaluation of new CBD dilation without a sonographically evident cause. Patients with pre-existing CBD stents were excluded. Accuracy, sensitivity, specificity, PPV and NPV of MRCP was calculated using pathology and/or ≥1 year clinical outcomes as reference standard. T-tests comparing lab values, CBD diameter, and the presence of pancreatic duct dilation at imaging between those with pancreaticobiliary pathology and those without were determined to establish if there were any secondary parameters that could predict pathology on MRCP.

**RESULTS**

131 cases were relevant to the study. 63/131 (48%) cases of CBD dilation without an identifiable cause at US underwent MRCP. MRCP revealed a specific pancreaticobiliary (PB) cause for obstruction in 67% of cases (56% benign and 11% malignant), a non-PB cause in 17% of cases, normal in 13% of cases and 3% of cases were indeterminate. Accuracy of MRCP for detection of pathology was 90% (sensitivity 92%, specificity 85%, PPV 92%; NPV 85%). 68/131 patients did not undergo MRCP. Of these, 30/68 underwent ERCP. A specific PB cause was identified in 66% of cases (57% benign and 13% malignant). A non-PB cause was identified in 7% of cases and 27% of cases were normal. 38/131 did not undergo MRCP or ERCP. Only alkaline phosphate was found to be significantly greater in those with a PB pathology compared to those without.

**CONCLUSION**

Of all patients with a new dilated CBD without any identifiable cause on US, approximately 50% underwent MRCP as per the
Of all patients with a new dilated CBD without any identifiable cause on US, approximately 50% underwent MRCP as per the recommendation. Of those, 67% of patients will have a specific PB cause for the dilation. The incidence of PB malignancy was found in 10% of all cases. Biochemical or additional US features are not reliably consistent at predicting which patients are more likely to have disease.

**CLINICAL RELEVANCE/APPLICATION**

MRCP is an accurate and non-invasive means of further characterizing PB pathology and has high yield in patients with a new dilated CBD without any identifiable cause on US.

**SSE08-06  Feasibility of 3D MRCP with Compressed Sensing at 3T: Comparison with Navigator-Triggered 3D MRCP**

Monday, Nov. 28 3:50PM - 4:00PM Room: E353C

Participants
Nieun Seo, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Mi-Suk Park, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jin-Young Choi, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Honsoul Kim, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hye Jin Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Minsu Lee, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Heejin Bae, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Myeong-Jin Kim, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Research Grant, Bayer AG

**PURPOSE**

To assess the feasibility of 3-dimensional (3D) MR cholangiopancreatography (MRCP) with compressed sensing (CS) in clinical use compared with standard 3D navigator-triggered MRCP without CS

**METHOD AND MATERIALS**

From January 2016 to March 2016, 30 patients who required MRCP for suspected pancreaticobiliary disease were prospectively enrolled in this study. All patients underwent 3D navigator-triggered MRCP with and without CS. Acquisition times of both sequences were recorded. Quantitative comparison including relative duct-to-periductal contrast ratio (RC) at three biliary segments and acquisition times between two sequences were performed. Qualitative evaluation regarding the visualization of seven segments of the pancreaticobiliary tree and the degree of artifacts was performed by six radiologists of three different experience subgroups with blinding. The data were analyzed using the paired t-test and the Wilcoxon paired signed-rank test. Interobserver agreement of qualitative evaluation was calculated using the weighted κ statistics.

**RESULTS**

The mean acquisition time of MRCP with CS (131.87 ± 33.60 sec) was significantly shorter than that of MRCP without CS (253.63 ± 56.08 sec) (P<0.001). On quantitative evaluation, RC at two segments using MRCP with CS was slightly lower than that using MRCP without CS (P=0.007 and P=0.002), and RC of one segment was similar between MRCP with and without CS (P=0.816). On qualitative analysis, the visualization of seven pancreaticobiliary segments and the degree of artifacts were not significant different between MRCP with and without CS (P>0.08) in all three experience groups. The interobserver agreement was moderate to good ranging from 0.475 to 0.632 according to the segment.

**CONCLUSION**

MRCP with CS application can provide comparable image quality with standard navigator-triggered MRCP without CS in about half the acquisition time. Therefore, CS is feasible for 3D navigator triggered MRCP in a clinical setting.

**CLINICAL RELEVANCE/APPLICATION**

CS is a recently introduced undersampling method, and clinical applications of CS have been increasing. CS is a promising time-saving, and feasible technique for 3D navigator-triggered MRCP.
SSE11

Genitourinary (Gynecology and Genitourinary Ultrasound)

Monday, Nov. 28 3:00PM - 4:00PM Room: E353B

GU US

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

FDA Discussions may include off-label uses.

Participants
Mary C. Frates, MD, Sharon, MA (Moderator) Nothing to Disclose
Elizabeth A. Sadowski, MD, Madison, WI (Moderator) Nothing to Disclose

Sub-Events

SSE11-01 Risk Stratification of Ovarian Cysts and Cystic Masses: Diagnostic Performance of Society of Radiologists in Ultrasound (SRU) Guidelines

Monday, Nov. 28 3:00PM - 3:10PM Room: E353B

Awards
Student Travel Stipend Award

Participants
Alexander D. Blaty, BS, Ann Arbor, MI (Presenter) Nothing to Disclose
Katherine E. Maturen, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Ashish P. Wasnik, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Krupa K. Patel-Lippmann, MD, Durham, NC (Abstract Co-Author) Nothing to Disclose
Jessica B. Robbins, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Sarah L. Averill, MD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose
Elizabeth B. Maddox, Madison, WI (Abstract Co-Author) Nothing to Disclose
Lisa Barmilhet, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Laura Huffman, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Elizabeth A. Sadowski, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose

PURPOSE
In 2010, the Society of Radiologists in Ultrasound (SRU) published a consensus statement directing management of asymptomatic adnexal cysts. The guidelines, based on the literature and expert opinion, have not been formally evaluated for diagnostic efficacy. The purpose of this study is to evaluate the predictive power of the guidelines for a large group of cysts with known outcomes.

METHOD AND MATERIALS
IRB approved retrospective review of US-detected adnexal cysts from Jan-Jun 2011. Cysts with surgical diagnosis, ≥ 2 years imaging stability or resolution, or normal pelvic exam ≥ 2 years after index study were included. We applied the SRU guidelines based on imaging features (SRU 0=no followup needed; SRU 1=ultrasound followup; SRU 2=MRI characterization; and SRU 3=surgical evaluation), and compared ratings with final outcome (benign non-neoplastic, benign neoplasm, malignant neoplasm). Where guidelines give two options, we binarized into "Surgically Focused" and "MRI Center" contexts.

RESULTS
570 cysts in 500 women were included, of which 475 (83.3%) were benign non-neoplastic, 77 (13.5%) benign neoplasms, and 18 (3.2%) malignant neoplasms. In surgically focused context, proportions of neoplasm and malignancy respectively were 1.1% and 0% in the SRU 0 group, 16.8% and 0.6% in SRU 1, 47.6% and 0% in SRU 2, and 47.7% and 15.6% in SRU 3 (p <.0001 for both trends by Cochran-Armitage test). In MRI center context, proportions of neoplasm and malignancy were 1.1% and 0% in the SRU 0 group, 17.2% and 0.6% in SRU 1, 38.3% and 5.0% in SRU 2, and 80.9% and 52.4% in SRU 3 (p <.0001, both trends). 82 (89%) fewer benign cysts were sent to surgical evaluation in the MRI center context. In logistic regression including age, menopause, and cyst size, SRU rating remained a highly significant predictor of both neoplasm and malignancy (OR 4.94, 95%CI 1.62, 15.11; p=.005 for malignancy).

CONCLUSION
SRU consensus guidelines effectively risk-stratified adnexal cysts in this study. Interpretation of guidelines in MRI center context markedly reduced the number of benign cysts sent for up-front surgical evaluation.

CLINICAL RELEVANCE/APPLICATION
Society of Radiologists in Ultrasound (SRU) 2010 adnexal cyst management guidelines appropriately stratified cysts and cystic masses into low, intermediate, and high risk categories.

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/

Katherine E. Maturen, MD - 2014 Honored Educator
Determining the incidence of ovarian cancer in sonographically indeterminate adnexal lesions is an important step in the formulation of appropriate recommendations for follow up of these lesions.

**RESULTS**

166 cystic adnexal lesions in 158 women (mean age 43 ± 14 years) met the inclusion criteria. 71.7% (119/166) of US indeterminate lesions resolved on follow up or were physiologic cysts on pathology. 24.1% (40/166) were benign ovarian neoplasms (cystadenomas; dermoids). 3.0% (5/166) were borderline or low-grade ovarian neoplasms. 1.2% (2/166) were clear cell or high-grade serous/endometroid carcinomas.

**CONCLUSION**

In our cohort of sonographically indeterminate lesions, 71.7% were non-neoplastic, 24.1% were benign ovarian neoplasms, and 4.2% were either borderline tumors or carcinomas. Study accrual is ongoing to increase the number of indeterminate lesions. Continued analysis will be important to accurately access the incidence of ovarian cancer in sonographically indeterminate lesions, which may help guide management of women with indeterminate adnexal lesions in the future.

**CLINICAL RELEVANCE/APPLICATION**

Determining the incidence of ovarian cancer in sonographically indeterminate adnexal lesions is an important step in the formulation of appropriate recommendations for follow up of these lesions.
analysis was performed. Confidence intervals were computed using generalized estimating equations to account for repeated measurements per patient.

RESULTS
152 patients who underwent both TVUS and SIS were selected. Seven patients were excluded for having non-diagnostic TVUS images by at least one reader, leaving 145 for analysis. From the combined assessments of both readers, 47% were negative for polyps by TVUS, 28% equivocal, and 25% positive. Inter-reader agreement was good with Cohen's kappa = 0.67 (95% CI: 0.57-0.77). SIS has greater sensitivity (p<0.001) and specificity (p=0.03) than TVUS when grade II polyp diagnosis was considered, however SIS and TVUS have similar sensitivity in cases when grade I and grade II polyp diagnosis is considered by TVUS.

CONCLUSION
When confidence is high that a polyp is present or absent on TVUS, SIS is not necessary to confirm their presence. Indeterminate or equivocal cases still benefit from SIS to confirm that a polyp is indeed present or absent.

CLINICAL RELEVANCE/APPLICATION
TVUS is of high enough sensitivity and specificity, equal to that of SIS such that when confidence is high that TVUS is positive or negative, SIS is not necessary to confirm the findings on TVUS prior to hysteroscopy. However when the findings are equivocal, SIS adds to diagnostic confidence significantly.

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/

Theodore J. Dubinsky, MD - 2012 Honored Educator
Theodore J. Dubinsky, MD - 2013 Honored Educator

SSE11-04 Value of 4-Dimensional Hysterosalpingo-contrast Sonography with SonoVue in the Assessment of Patency of the Fimbriated Extremity of Fallopian-Tube

Participants
wei q. wang, guangzhou, China (Presenter) Nothing to Disclose
Ya f. Gong, Guanzhou, China (Abstract Co-Author) Nothing to Disclose
qiu l. zhou, Guangdong, China (Abstract Co-Author) Nothing to Disclose
zhi y. chen, Guangdong, China (Abstract Co-Author) Nothing to Disclose

CONCLUSION
Four D- SonoVue-HyCoSy could dynamically show fimbria end shape, contrast agent overflow conditions. It should be considered clinically valuable as a practical, non-invasive, primary investigatory tool for evaluating the patency and function of the fimbriated extremity of the fallopian tube and a viable alternative to the lap and dye procedure, which was widely used in clinical.

Background
It is estimated that 30% to 35% of infertility is caused by tubal factors and evaluation of tubal status is an important initial step in the diagnostic work-up of infertile women. It is very important to evaluate the patency of fallopian tubes in the diagnosis and treatment of infertility. Hysterosalpingo-contrast sonography (HyCoSy) method currently available to assess tubal patency include two-dimensional HyCoSy (2D-HyCoSy), and three-dimensional HyCoSy (3D-HyCoSy). Previous investigations, using lap and dye findings as the gold standard, have shown that the diagnostic accuracy of 2D HyCoSy is about 65–85%, and that of 3D HyCoSy is 90%. FourD-HyCoSy, has achieved the aim of a real-time, dynamic, intuitive examination. The aim of this study was to evaluate the accuracy of using 4D HyCoSy with SonoVue in assessing the patency of the fimbriated extremity of the fallopian tube.

Evaluation
Our results show that 4D SonoVue-HyCoSy had a sensitivity of 93.8%, specificity of 92.2% and diagnostic accuracy of 92.9%. The testpositive rates of 4D SonoVue-HyCoSy versus lap and dye were not significantly different. The accuracy of 4D- HyCoSy was slightly higher than other tests.

Discussion
It is very important to evaluate the patency of fallopian tubes in the diagnosis and treatment of infertility. During the 4D-HyCoSy examination, Sonologist faces challenges in diagnosis. Using frame dynamic playback technology, 4D-HyCoSy dynamic real-time imaging method to carefully observe the developing of fallopian tube shape and whether there is contrast agent overflow in tube end. After contrast agent injection, 0.9% saline solution was injected to observed whether the liquid will flow from the uterine horn then flow in the corresponding side of fallopian tube end. It contribute to determine the patency of the fallopian tube end.

SSE11-05 The Value of Real-time Elastography Applied in Hysteromyoma before and after the Treatment of Sclerotherapy

Participants
Xia Zhou, MD, Suzhou, China (Presenter) Nothing to Disclose
Yang-Gui Xie, Nantong, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To study the clinic value of real-time elastography (RTE) applied in examining hysteromyoma before and after the treatment of sclerotherapy.
METHOD AND MATERIALS

Ninety-three premenopausal women (mean age was 46±3 years) with 99 uterine fibroids were prospectively included for ultrasound guided treatment of uterine fibroids by injecting lauromacrogol at a dose of 10-20ml during the year from July 2012 to July 2015. Each fibroid was examined by conventional ultrasound and RTE before treatment and the 1st and the 6th month after treatment. Fibroid size, volume, blood supply and strain ratio (SR) were obtained and compared. According to the blood supply of the fibroids disappeared or not in the 6th month after treatment, all fibroids were divided into two groups, no blood supply group and residual blood supply group, and the differences of SR were analysed. SR performance in predicting curative effect was also evaluated by receiver operating characteristic (ROC) curve analyses.

RESULTS

A total of 99 fibroids, no blood supply group (n=59), and residual blood supply group (n=40). Prior to the treatment, all data demonstrated no statistical significance except SR (2.7±1.8 vs. 1.3±0.8, P<0.05). One month after treatment, the volume of the fibroids decreased by 38% (P<0.05); the difference of SR between the two groups demonstrated statistical significance (2.8±2.1 vs. 1.2±0.6, P<0.05), but the SR in both groups demonstrated no statistical significance compared with the baseline (P>0.05). Six months after treatment, the fibroid volume decreased by 58% (P<0.05); the difference of SR between the two groups also demonstrated statistical significance (3.8±3.1 vs. 1.8±0.9, P<0.05), and the SR of the two groups both increased significantly compared with the baseline (P<0.05). Area under the ROC curve (AUC) was 0.7 for SR, the cutoff level at 1.715 provided a high specificity (78%) and a high sensitivity (71%) for a prediction of cured fibroid at the 6th month after treatment.

CONCLUSION

RTE has the potential to serve as a non-invasive tool in elevating curative effects of sclerotherapy in fibroids.

CLINICAL RELEVANCE/APPLICATION

Strain ratio provided by RTE can predict curative effect of sclerotherapy procedure on fibroids. Meanwhile, it can also be applied in the follow-up evaluation of the curative effect combined with conventional ultrasound after treatment.

SSE11-06 Quantitative Assessment of Bladder Neck Stiffness in Continent Women Using Sonographic Shear Wave Elastography

Participants
Yasmine Ahmed, Cleveland, OH (Presenter) Nothing to Disclose
David Sheyn, MD, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Alex Soriano, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Sangeeta T. Mahajan, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Adoniz Hijaz, Cleveland, OH (Abstract Co-Author) Nothing to Disclose
Nami R. Azar, MD, Highland Heights, OH (Abstract Co-Author) Nothing to Disclose

PURPOSE

Bladder disorders are diagnosed by urodynamics, which is invasive and can provoke anxiety. Noninvasive methods are limited to sonographic assessment of the post-void residual. Shear wave elastography (SWE) is a novel technology that measures propagation of shear waves in tissue that can be used to calculate Young's modulus (E). Our purpose was to assess feasibility of SWE in assessing the bladder neck of continent women undergoing pelvic ultrasound.

METHOD AND MATERIALS

Women were recruited from a large gynecology practice at a tertiary medical center after being scheduled for a pelvic ultrasound. Women were instructed to drink 32 oz of water 1 hour prior to the ultrasound. They then underwent a trans-abdominal ultrasound. Bladder volume (mL) and multiple thickness (mm) measurements were obtained of the anterior and posterior bladder neck, then, SWE was performed to measure shear-wave velocity (m/s) in multiple regions of the bladder neck (Figure 1). The average shear-wave velocity was used to calculate the Young's modulus (E) of each region of the bladder using the equation: E = 3pc², where c is shear wave velocity and ρ is tissue density (1000 cm³). Descriptive statistics, including means, medians, standard deviations, and ranges were obtained. The relationship between bladder elasticity and age, gravidity, parity, BMI, bladder neck thickness, and bladder volume were assessed using Spearman's correlation coefficients. Statistical analysis was performed using Stata, version 14.0.

RESULTS

55 women were imaged. Eight were excluded due to incomplete measurements and 4 were excluded for presence of urinary incontinence. Of the 43 women remaining, average age was 37 (+/-9.7) years, average BMI was 30 (+/-7.6) m/kg², 23 were multiparous, 6 were primiparous and 9 were nulliparous. A significant positive correlation was seen between age and bladder stiffness (r = 0.41052, p = 0.008). There were no significant relationships between bladder neck stiffness and BMI, bladder neck thickness, and bladder volume were assessed using Spearman's correlation coefficients. Statistical analysis was performed using Stata, version 14.0.

CONCLUSION

Trans-abdominal shear wave elastography is feasible for evaluating the bladder neck and able to demonstrate age related changes in tissue stiffness.

CLINICAL RELEVANCE/APPLICATION

SWE may be a useful adjunct for evaluation of mechanical and physiologic bladder disorders.
**Vascular Interventional (Non-vascular Interventions)**

Monday, Nov. 28 3:00PM - 4:00PM Room: N226

**SSE25-01** CT-Guided Transgluteal Biopsy for Systematic Sampling of the Prostate in Patients without Rectal Access: A 13-Year Single-Center Experience

### Participants
- **Juan C. Camacho, MD, Charleston, SC** (Moderator) Nothing to Disclose
- **Thomas-Evangelos G. Vrachliotis, MD, PhD, Athens, Greece** (Moderator) Nothing to Disclose

### Purpose
Complexities of prostate sampling in patients without rectal access may delay a referral for biopsy, resulting in delayed diagnosis of prostate cancer (CaP). Our purpose was to review safety and efficacy of CT-guided transgluteal systematic prostate biopsy in this patient population.

### Method and Materials
Retrospective review identified 73 CT-guided transgluteal prostate biopsies in 65 men (mean age 64 years; range 40-87) without rectal access (2002-2015). Mean PSA was 7.8 ng/mL (range 0.37-31.5). Biopsies were performed to obtain tissue samples from both sides of the prostate base and apex. Technical success was defined as placement of biopsy device into prostate yielding diagnostic tissue specimens. Electronic medical records were reviewed for procedural details and peri-procedure complications. Mean PSA and number of cores in malignant and benign cohorts were compared with Student’s t-test.

### Results
97.2% (71/73) biopsies were technically successful (mean cores 8.5, range 3-28). Only complication was an asymptomatic hematoma (1/73; 1.4%). Mean effective radiation dose was 18.5 mSv (median 15.0, range 4.4-86.2) (n=46). 43.6% (31/71) biopsies yielded malignancy (mean Gleason score 7, range 6-10) and 56.3% (40/71) yielded benign tissue. In 14 patients who underwent surgery, Gleason scores were concordant in 71.4% (10/14) and discordant in 28.6% (4/14; Gleason 6 on biopsy but Gleason 7 on surgical specimen). 25% (10/40) patients from benign cohort had no subsequent followup at our institution. Mean follow-up in others was 3.5 years (range: 2 months-10 years). 13% (4/30) patients had rising PSA and were subsequently diagnosed with malignancy: two on follow-up CT-guided biopsies 6 months and 2 years later, one on prostate MRI, and fourth on biopsy of an enlarging bone lesion. There was no significant difference in mean PSA (p=0.06) or number of cores (p=0.38) between malignant and benign cohorts.

### Conclusion
CT-guided transgluteal biopsy is a safe and reliable technique for prostate sampling and detection of clinically significant CaP in men without rectal access. In patients with initial negative biopsy, repeat CT-guided biopsy or MRI should be considered if there is a persistent PSA rise.

### Clinical Relevance/Application
CT-guided transgluteal biopsy is safe and reliable for prostate sampling and detection of clinically significant CaP in the growing population of patients without rectal access.

**SSE25-02** CT-guided Intramuscular Injection of Botulinum Toxin a for Treatment of Myofascial Pelvic Pain: Single Center Evaluation of Safety and Early Efficacy

### Awards
- Student Travel Stipend Award

### Participants
- **Anna Moreland, MD, Baltimore, MD** (Presenter) Consultant, NeuWave Medical, Inc
- **Greg Minwell, MD, Baltimore, MD** (Abstract Co-Author) Nothing to Disclose
- **Alexander J. Kieger, MD, Baltimore, MD** (Abstract Co-Author) Nothing to Disclose
- **Douglas B. Yim, MD, San Diego, CA** (Abstract Co-Author) Nothing to Disclose
- **Kelvin K. Hong, MD, Baltimore, MD** (Abstract Co-Author) Scientific Advisory Board, Boston Scientific Corporation

### Purpose
- **Anna Moreland, MD, Baltimore, MD** (Presenter) Consultant, NeuWave Medical, Inc
- **Greg Minwell, MD, Baltimore, MD** (Abstract Co-Author) Nothing to Disclose
- **Alexander J. Kieger, MD, Baltimore, MD** (Abstract Co-Author) Nothing to Disclose
- **Douglas B. Yim, MD, San Diego, CA** (Abstract Co-Author) Nothing to Disclose
- **Kelvin K. Hong, MD, Baltimore, MD** (Abstract Co-Author) Scientific Advisory Board, Boston Scientific Corporation
Myofascial pelvic pain and spasm are a significant source of morbidity among affected patients, and may be treated with botulinum toxin A (Botox) injection into pelvic floor muscles. Conventional injections are performed by a gynecologist using physical exam landmarks without imaging guidance. CT-guidance of injections may offer benefits due to ability for definitive localization of injections to target. The present study aims to evaluate the safety and efficacy of CT-guided intramuscular injection of Botox for treatment of myofascial pelvic pain.

METHOD AND MATERIALS
Between 07/2013 and 03/2016, n = 57 patients with myofascial pelvic pain and spasm were treated with CT-guided pelvic floor muscle Botox injections in 76 treatment sessions. Referrals were made by gynecologists specializing in chronic pelvic pain, who requested injection of specific pelvic floor muscles in each patient according to point tenderness on pelvic exam. Following scout CT, a 22 gauge needle was placed into each target muscle under CT fluoroscopic guidance. Botox suspended in saline was injected into the piriformis, obturator internus, and/or levator ani (n = 53, 6, and 12 treatments, respectively). Visual analog scale pain scores (on a 10-point scale) were compared immediately pre- and post-procedure, and at follow-up clinic appointments.

RESULTS
Successful injection of the full dose of Botox to the target muscle was accomplished in all cases, conferring a technical success rate of 100%. There were no major or minor complications by SIR criteria as assessed immediately post procedure or at follow up clinic appointments, including no patient report of urinary or fecal incontinence in any case. Lower visual analog pain scores were reported post procedure following 68% of treatments, with the difference in scores demonstrating statistical significance (p = 0.03).

CONCLUSION
CT-guided Botox injection of pelvic floor muscles is a technically feasible, safe, and frequently efficacious option for treatment of myofascial pelvic pain. Further evaluation of the durability of response, predictors of efficacy to guide patient selection, and comparison to conventional injections without CT guidance may be warranted.

CLINICAL RELEVANCE/APPLICATION
CT-guided percutaneous injection of Botox into pelvic floor muscles for treatment of myofascial pelvic pain demonstrates similar efficacy and lower complication rates as compared to those published for non-CT-guided injections.

SSE2S-03 Portable Ultrasound-Guided High Intensity Focused Ultrasound with 3D Electronic Steering and Targeting Forecast Function: Prospective Clinical Trial for Uterine Fibroids

Participants
Jae Young Lee, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Hyun-Joon Chung, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Soo Yeon Kang, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Dong Hyuk Park, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kook Jin Kang, Seoul, Korea, Republic Of (Abstract Co-Author) Employee, Alpinion Medical Systems Co, Ltd
Keonho Son, Seoul, Korea, Republic Of (Abstract Co-Author) Employee, Alpinion Medical Systems Co, Ltd
Joon Koo Han, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To investigate efficacy and safety of a new portable ultrasound-guided high intensity focused ultrasound (HIFU) with advanced targeting technology for the treatment of uterine fibroids

METHOD AND MATERIALS
This prospective study was approved by institutional review board and informed consent was obtained in all participants. Fifty-nine uterine fibroids of 36 patients (mean age, 44.9 ± 4.1 years) were enrolled. All patients were treated with HIFU with 3D electronic steering. MR imaging studies were performed before HIFU, immediately after HIFU, 1 month, 3 (or 5) months and 1 year after HIFU treatment. Non-perfused volume ratio (NPVR), fibroid volume shrinkage rate (FVSR), symptom improvement, quantified life quality assessment and safety were analyzed.

RESULTS
The volume of treated uterine fibroids ranged from 7.5 cm³ to 274.4 cm³ (mean, 69.8 cm³; SD, 64.3 cm³). Mean NPVR on immediate post-HIFU MR imaging was 74.8 ± 25.2%. Mean FVSR was 17.3 % at 1-month; 33.3 % at 3 months; 44.8% at 5 months; and 43.7% at 1 year after HIFU treatment. CT-guidance of injections may offer benefits due to ability for definitive localization of injections to target. The present study aims to evaluate the safety and efficacy of CT-guided intramuscular injection of Botox for treatment of myofascial pelvic pain.

CONCLUSION
This clinical trial showed that ultrasound-guided HIFU with advanced function may be effective, time-saving and safe for the treatment of uterine fibroids.

CLINICAL RELEVANCE/APPLICATION
1. A portable ultrasound-guided HIFU device provides 3D electronic steering and targeting forecast function, which is helpful to reduce treatment time and to increase safety.
2. A portable ultrasound-guided HIFU device can effectively and safely treat uterine fibroid in a noninvasive manner.
3. Significant number of patients who were treated showed significant volume reduction of treated uterine fibroids and significant symptom improvement.
SSE25-04  Fibroid Treated by MRgFUS: MR-Texture Parameters are Associated with Ablathermy Efficacy

Participants

Monday, Nov. 28 3:30PM - 3:40PM Room: N226

PURPOSE

to assess the potential association between texture parameter analysis, derived from T2 weighted images and treatment efficacy using the Magnetic resonance guided focused ultrasound(MRGFUS) Sonalleve system to treat uterine fibroids.

METHOD AND MATERIALS

The study protocol was approved by the institution's human research committee. Informed consent was not necessary for this retrospective study. 55 women with 55 fibroids treated by MRgFUS Sonalleve system were included. Texture parameters calculated with Mazda software from 3D T2 weighted images, fibroids/muscular T2 ratio, Funaki type, and fibroid depth were correlated using uni- and multivariate linear regression with treatment efficacy defined as ratio of non-perfused volume on post-treatment contrast-enhanced MRI by total volume of treatment-cells sizes used.

RESULTS

Among the 15 texture parameters, 6 were significantly correlated with NPV ratio: fibroid/muscular T2 ratio; mean signal intensity; skewness; kurtosis; sum of square; sum of entropy. In multivariate linear regression, fibroid/muscular T2 ratio and Mean Sum of entropy were associated with NPV ratio. The formula of the multivariate model was: Y = 15.744 + -8.012*MeanSumEntropy + -0.128*T2ratio (Total R2=0.2).

CONCLUSION

Fibroids texture parameters provide complementary information to T2 ratio, predicting MRgFUS efficacy. Sum of Entropy and T2Wratio were both retained in multivariate model significantly associated with treatment efficacy while Funaki type was not.

CLINICAL RELEVANCE/APPLICATION

Heterogeneity of fibroid texture is negatively correlated with MRgFUS efficacy

SSE25-05  Comparison of Laser Ablation with Radiofrequency Ablation for Treatment of Benign Thyroid Nodules: A Retrospective Multicentric Analysis

Participants

Monday, Nov. 28 3:40PM - 3:50PM Room: N226

PURPOSE

To retrospectively compare laser ablation (LA) and radiofrequency ablation (RFA) in the treatment of benign thyroid.

METHOD AND MATERIALS

Six hundred one symptomatic thyroid benign nodules in 601 euthyroid patients were ablated in eight centers between 2009 and 2015. 441 (mean age 57±14) have undergone LA while 152 (mean age, 57±14) RFA. LA was performed with a fixed-power protocol (3W) while number of applicators and illumination times were different according to target size. RFA was performed in a single session based on the “moving-shot” technique. During the manoeuvre the output power ranged from 40 to 80W. Patients of each group were matched by applying one-to-one propensity score matching.

RESULTS

The mean basal volume of nodules treated with LA and RFA was 21.5±16.5 mL and 24.6±17.9 mL (P=.065) respectively. At 12 months mean nodule volume decreased to 8.0±7.2mL (P<.001) in LA patients and to 9.9±4.5mL (P<.001) in RFA patients. The nodules with basal volume >30 mL have had a percentage volume reduction (PVR) at 12th month significantly higher in LA patients than in RFA patients (-64±16% vs -56±21%, respectively; P=.033). The total energy delivered was significantly higher in RFA patients than in LA ones (64.6±58 vs 5.8±2.7 KJ; P=.001).A total of 138 patients from each group were matched. After this adjustment, mean nodule reduction at 6th and 12th month was -67%±19% vs -57%±21% (P<.001) and -70%±19% vs 62%±22%.
Vertebroplasty and Kyphoplasty Outcomes in Spinal Metastatic Osseous Lesions: A Systematic Review and Meta-Analysis

Monday, Nov. 28 3:50PM - 4:00PM Room: N226

(P = .001) in LA and RFA group, respectively. A lower release of energy in the LA group was confirmed (6.1±2.7 vs 61.6±51.4 KJ, respectively; P = .001). No changes in thyroid function were observed.

CONCLUSION
RFA and LA seem to provide similar results in the small and medium nodules while LA appear more effective in treating larger nodules, RFA requiring more energy to achieve the ablation.

CLINICAL RELEVANCE/APPLICATION
Both LA and RFA are able to achieve similar significant volume reduction of symptomatic benign thyroid nodules.

Vertebroplasty and Kyphoplasty Outcomes in Spinal Metastatic Osseous Lesions: A Systematic Review and Meta-Analysis

Monday, Nov. 28 3:50PM - 4:00PM Room: N226

PURPOSE
Vertebroplasty (VP) and kyphoplasty (KP) are widely utilized percutaneous techniques used to relieve pain and restore stability in metastatic spinal disease with pathologic vertebral compression fractures. The purpose of this systematic review is to compare outcomes between VP and KP in terms of safety and efficacy in providing pain relief and improving patient’s functional status.

METHOD AND MATERIALS
A PRISMA compliant systematic review was performed utilizing the electronic database Pubmed from conception to 2016. Levels of evidence and grades of recommendation were established based on the Oxford Centre for Evidence-Based Medicine guidelines. MedCalc (16.2.1) was used for data entry and analysis. Comparison between the groups (VP & KP) in terms of cement leakage and complications were calculated using a chi-square test. Pain level was assessed using the visual analog scale (VAS) and the groups were compared using t-test. P value <0.05 was considered as statistical significant.

RESULTS
10 published studies on KP and 3 published studies on VP for metastatic spine lesions met the inclusion criteria, representing 342 patients undergoing VP and KP at various levels of the spine with most common treated level being the thoracic spine. No significant difference in the cement leaks (p=0.35) and incidence of perioperative complication (p=0.77) was noted between the KP and VP groups. KP group showed significant reduction in the VAS by postoperative day 1-3 (p<0.0001) and by postoperative month 0.5-3 (p<0.0001). Within the KP group, significant decrease in Oswestry Disability Index from baseline was observed by postoperative day 1-3 and by postoperative month 0.5-3.

CONCLUSION
Our systematic review shows KP is more effective in reducing pain as early as postoperative day 1-3. Furthermore, patients who underwent KP had significant improvement in their functional status from baseline by as early as postoperative day 1-3 with continued improved functional status lasting up to a year. Meanwhile, no difference in cement leaks or perioperative complication rate was observed between the KP and VP groups.

CLINICAL RELEVANCE/APPLICATION
KP is more effective in providing pain relief as early as postoperative day 1-3, improving patient’s functional status for up to a year postoperatively without an increase in cement leaks/perioperative complications in comparison to VP.
Participants
Aya Kamaya, MD, Stanford, CA (Presenter) Nothing to Disclose
Nirvika Dahiya, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Shweta Bhatt, MD, MBBS, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Jade J. Wong-You-Cheong, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Maryellen R. Sun, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Robert A. Kane, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
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Maitray D. Patel, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
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Amelia Wnorowski, MD, Ellicott City, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS
1) Participants will learn to list the sonographic appearances of common and uncommon diseases. 2) Participants will learn to describe the differentiating features between similar diseases via a case based format. 3) Participants will learn to discuss the pathophysiology of diseases that are responsible for the sonographic appearance.
Musculoskeletal Series: Ultrasound
Tuesday, Nov. 29 8:30AM - 12:00PM Room: E450A

ARK Category 1 Credits ™: 3.25
ARRT Category A+ Credits: 4.00

Participants
Marnix T. van Holsbeeck, MD, Detroit, MI, (marnix@rad.hfh.edu) (Moderator) Consultant, General Electric Company; Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder MedEd3D; Grant, Siemens AG; Grant, General Electric Company;
Connie Y. Chang, MD, Boston, MA, (cychang@mgh.harvard.edu ) (Moderator) Nothing to Disclose
Jon A. Jacobson, MD, Ann Arbor, MI, (jjacobson@umich.edu) (Presenter) Consultant, BioClinica, Inc; Royalties, Reed Elsevier; ;
Ogonna K. Nwawka, MD, New York, NY (Moderator) Research Grant, General Electric Company

LEARNING OBJECTIVES
1) The "Ultrasound" Series Course will review musculoskeletal sonography through live instruction by expert refresher course instructors, interspersed with scientific presentations.

Sub-Events
RC304-01 Shoulder Ultrasound (Demonstration)
Tuesday, Nov. 29 8:30AM - 9:00AM Room: E450A

Participants
Jon A. Jacobson, MD, Ann Arbor, MI, (jjacobson@umich.edu) (Presenter) Consultant, BioClinica, Inc; Royalties, Reed Elsevier; ;

LEARNING OBJECTIVES
1. List the fundamental steps in performing an ultrasound examination of the shoulder2. Understand common pitfalls in shoulder ultrasound3. Utilize dynamic imaging in the evaluation of shoulder pathology

ABSTRACT

LEARNING OBJECTIVES
View learning objectives under main course title.

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

Jon A. Jacobson, MD - 2012 Honored Educator

RC304-02 Impact of Musculoskeletal Shoulder Ultrasound on Clinical Decision Making
Tuesday, Nov. 29 9:00AM - 9:10AM Room: E450A

Participants
Michael V. Friedman, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Travis J. Hillen, MD, Saint Louis, MO (Abstract Co-Author) Consultant, Biomedical Systems; Instructor, DFine, Inc
David V. Holland, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
James M. Essenberg, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Jennifer L. Demertzis, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the impact of musculoskeletal (MSK) shoulder ultrasound (US) on clinical decision making.

METHOD AND MATERIALS
IRB approval was obtained. 912 patients with 1037 consecutive MSK shoulder US, ordered and performed at our institution over a 12 month period, were retrospectively reviewed. 125 patients had bilateral exams which were managed and scored independently. 102 patient exams were excluded from the study. (89 exams had no follow up or initial clinic note; 11 exams were duplicate; and two exams were performed for contralateral comparison.) 935 total patient exams had both pre- and post-US clinical evaluations, meeting inclusion criteria. The medical records and clinic notes of each patient were analyzed, recording immediate pre- and post-US management plans. Data was analyzed for changes in clinical management based upon US results using nonparametric statistical methods.

RESULTS
Of 935 patient exams, 679 (72.6%) had a post-US treatment plan that differed from pre-US management, demonstrating a statistically significant impact of shoulder US on patient management (p<0.001). The diagnosis was changed to non-shoulder pathology in 23 patients (2.5%), and 12 patients (1.3%) were referred for additional imaging. In 450 patient exams (48%), the treating physician refrained from making a treatment plan until the shoulder US was obtained. Of the 485 patient exams with a defined pre-US management plan, the invasiveness of the plan was increased in 108 (22.3%) subjects based on the shoulder US
results. Clinical management was altered in nine patients (1.9%) from surgical to nonsurgical treatment, and in 78 patients (16.1%) from nonsurgical to surgical management. US also played a role in surgical planning, with 25 studies (2.7%) specifically performed to evaluate rotator cuff integrity and muscle atrophy when deciding between conventional and reverse shoulder arthroplasty.

CONCLUSION

MSK shoulder US is a useful diagnostic imaging modality with significant impact on clinical decision making.

CLINICAL RELEVANCE/APPLICATION

Musculoskeletal shoulder US is a validated diagnostic imaging modality for the evaluation of rotator cuff pathology, and has a significant impact on clinical decision making and patient management.

RC304-03  T2/T2* Maps and Ultrasound Shear Wave Elastography: A Potential Relationship that Could Improve the Quantitative Assessment of the Supraspinatus Tendon on MRI

Tuesday, Nov. 29 9:10AM - 9:20AM Room: E450A

Participants
Konstantin Krepkin, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Alexander N. Merkle, MD, New York, NY (Presenter) Nothing to Disclose
Mary Bruno, RT, New York, NY (Abstract Co-Author) Nothing to Disclose
Jose Maria Raya Garcia Del Olmo, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Ronald S. Adler, MD, PhD, New York, NY (Abstract Co-Author) Nothing to Disclose
Soterios Gyftopoulos, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE

To determine whether there is an association between T2/T2* mapping and supraspinatus tendon mechanical properties as assessed by shear-wave ultrasound elastography (SWE).

METHOD AND MATERIALS

This HIPAA compliant prospective study received approval from our hospital’s institutional review board. Eight patients (3 males/5 females; age range 44-72 years) and 9 shoulders underwent conventional shoulder MRI and T2/T2* mapping on a 3T scanner, and ultrasound evaluation with SWE. All ultrasound examinations were performed by a single musculoskeletal radiologist with more than 20 years of musculoskeletal ultrasound experience. Shear wave velocities (SWV) were obtained in multiple 1.5 mm square regions of interest (ROIs) drawn within the insertional 1-2 cm of the supraspinatus tendon at the mid-portion of the superior greater tuberosity facet. The ROIs were organized, and averaged when necessary, into one of 3 locations within the insertional portion of the tendon: lateral, medial and middle. Two musculoskeletal radiologists reviewed the MRI exams in consensus for evidence of supraspinatus tendon pathology, with tear size and retraction measured for full-thickness tears. T2 and T2* values were calculated from coronal T2/T2* maps using equidistant ROIs corresponding to the same medial, middle, and lateral locations as on ultrasound. Pearson correlation coefficients between T2/T2* values and SWV, as well as between T2, T2*, SWV and tear size and retraction were calculated.

RESULTS

There was a significant negative correlation between T2* and SWV in the lateral location ROI ($r = -0.86, p = 0.013$) and overall mean ROI ($r = -0.90, p = 0.006$). There was significant positive correlation between T2 and measures of tear size in the lateral and mean ROIs ($r$ range $0.71 \text{ to } 0.77, p$ range $0.016 \text{ to } 0.034$). There was significant negative correlation between SWV and tear size in the middle and mean ROIs ($r$ range $-0.79 \text{ to } -0.68, p$ range $0.011 \text{ to } 0.046$).

CONCLUSION

This pilot study shows the feasibility of doing T2/T2* mapping in the supraspinatus tendon and reveals a potential relationship between the tendon’s T2* values and its mechanical properties.

CLINICAL RELEVANCE/APPLICATION

T2/T2* mapping has the potential to improve our description of rotator cuff disease on MRI by providing a more objective measure of tendon quality; information that can be useful to the patient and surgeon considering rotator cuff repair surgery.

RC304-04  Early Detection of Brachial Plexus Neuritis by Means of High-Resolution Ultrasonography of the Suprascapular Nerve

Tuesday, Nov. 29 9:20AM - 9:30AM Room: E450A

Participants
Alexander Loizides, MD, Innsbruck, Austria (Presenter) Nothing to Disclose
Leonhard Gruber, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose
Wolfgang Loescher, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose
Hannes Gruber, MD, PhD, Innsbruck, Austria (Abstract Co-Author) Nothing to Disclose

PURPOSE

Brachial plexus neuritis (BPN) is a rare condition with initial shoulder pain up to two weeks after symptom onset and consecutive shoulder girdle paresis. We assessed the diagnostic value of ultrasound examinations of the suprascapular nerve (SSN) in the early diagnosis of BPN.

METHOD AND MATERIALS

The cross-section areas (CSA) of the SSN at the root and at the omohyoid muscle were assessed in seven patients with clinically definitive BPN and 30 healthy volunteers. To compare group means, an ordinary one-sided ANOVA with Holm-Sidak’s multiple testing correction was performed. To determine ideal cut-offs, receiver-operator-characteristics (ROC) curves were generated and according contingency tables were constructed to calculate sensitivity, specificity, positive (PPV) and negative predictive values (NPV), likelihood ratios (LR) and odds ratios (OR). To account for confounding factors, a bootstrapped binary regression analysis
(10,000 iterations, 95% bias-corrected and accelerated confidence intervals [CI]) was carried out.

RESULTS

Patients with BNP had significantly higher CSAs of the SSN at the omohyoid muscle (5.99±2.08 vs. 2.79±0.82 mm², p < 0.0001) and significantly higher ratios of SSN CSAs of the affected to contralateral side at the omohyoid muscle (223.0±94.4% vs. 127.7±51.1%, p = 0.0016) as well as ratios of SSN CSA at the omohyoid muscle to the root (180.7±49.1%) vs. 99.0 ± 28.3%, p = 0.0006). SSN root CSAs did not differ significantly (3.63±1.23 vs. 2.90±0.90 mm², p = 0.14). With a SSN CSA at the omohyoid muscle greater 4.2mm², the ROC area under the curve was 0.933. Sensitivity was 85.7% (42.1–99.9%), specificity 96.7% (82.8–99.9%), PPV 85.7% (42.1–99.9%), NPV 96.7% (82.8–99.9%), OR 174.0 (9.5–3190.0) and LR 25.7 (95% CI in parentheses). Multivariate analysis identified SSN swelling at the omohyoid muscle as a strong predictor (B = -344.3 ± 55.1; p = 0.001). Age (B = -14.1 ± 2.3; p = 0.001) and BMI (B = 17.8 ± 5.3; p = 0.005) had a minor influence, gender none (B = -20.0 ± 26.2; p = 0.22).

CONCLUSION

Increased SSN CSA at the omohyoid muscle can reliably identify BNP in case of clinical suspicion of neuralgic shoulder amyotrophy.

CLINICAL RELEVANCE/APPLICATION

An increase in CSA beyond 4.2mm² of the suprascapular nerve at the level of the omohyoid muscle is highly indicative of brachial plexus neuritis. Further studies should focus on treatment strategies.

RC304-05 Stress Ultrasound to Diagnose UCL Tears at the Elbow: Which Joint Gapping Threshold to Use?

Tuesday, Nov. 29 9:30AM - 9:40AM Room: E450A

Participants
Johannes B. Roedl, MD, PhD, Philadelphia, PA (Presenter) Nothing to Disclose
Adam C. Zoga, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Mika T. Nevalainen, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Levon N. Nazarian, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE

To assess different joint gapping thresholds for stress ultrasound in the diagnosis of ulnar collateral ligament (UCL) tears in baseball players.

METHOD AND MATERIALS

Throwing athletes with surgically or arthroscopically proven UCL tears underwent stressUS. The interval gapping of the medial elbow joint was measured between rest and valgus stress both at the injured (ipsilateral) and at the uninjured (contralateral) elbow. The relative gapping between both elbows (ipsilateral gapping minus contralateral gapping) was calculated. Throwing athletes without UCL tears were available as a control group. Receiver operator curve (ROC) analysis determined retrospectively the most accurate thresholds to predict UCL tears. Institutional review board approval was obtained and the requirement for informed consent was waived. The study is compliant with HIPAA.

RESULTS

In this retrospective analysis, 71 athletes with UCL tears were compared to 122 athletes without UCL tears. The ROC analysis determined the following thresholds in order of decreasing specificity: A relative joint gapping threshold of 2.6 mm had a specificity of 100% and a sensitivity of 81%. A threshold of 1.0 mm resulted in a specificity of 91% and a sensitivity of 81%. A threshold of 1.5 mm resulted in a specificity of 91% and a sensitivity of 81%. A threshold of 2.0 mm resulted in a specificity of 81% and a sensitivity of 96%.

CONCLUSION

The above listed thresholds can be used and it depends on the clinical practice whether higher specificity or sensitivity is desired.

CLINICAL RELEVANCE/APPLICATION

Elbow stress ultrasound is an emerging technique and the thresholds provided will help the Radiologist in the diagnosis of UCL tears.

RC304-06 Elbow Ultrasound (Demonstration)

Tuesday, Nov. 29 9:40AM - 10:10AM Room: E450A

Participants
Marnix T. van Holsbeeck, MD, Detroit, MI (Presenter) Consultant, General Electric Company; Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder MedEd3D; Grant, Siemens AG; Grant, General Electric Company; Kathy Quenneville, BS, RT, Commerce Township, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC304-07 Knee Ultrasound (Demonstration)

Tuesday, Nov. 29 10:05AM - 10:50AM Room: E450A

Participants
Ronald S. Adler, MD, PhD, New York, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.
Role of Real-Time (RTE) and Shear-Wave (SWE) Sonoelastography in the Follow-up of Muscle Thigh Injury in Athletes: A Three-Years Longitudinal Study

Tuesday, Nov. 29 10:50AM - 11:00AM Room: E450A

Participants

Davide Orlandi, MD, PhD, Genova, Italy (Presenter) Nothing to Disclose
Angelo Corazza, MD, Genova, Italy (Abstract Co-Author) Nothing to Disclose
Luca Maria Sconfienza, MD, PhD, Milano, Italy (Abstract Co-Author) Travel support, Bracco Group
Enzo Silvestri, MD, Genoa, Italy (Abstract Co-Author) Nothing to Disclose

PURPOSE

The aim of the current study is to assess the reliability and effectiveness of the RTE and SWE in the evaluation and follow-up of traumatic lower limb muscle tears in a cohort of professional athletes using MRI as a reference standard.

METHOD AND MATERIALS

143 male athletes (aged 23 ± 5) with MRI confirmed indirect thigh muscle injury was included in our study and evaluated with ultrasound (US) over a period of 36 months and for a total of 112 muscles. Muscle tears were evaluated with B-mode US, RTE and SWE using two different US apparels (LOGIQ E9, GE Healthcare; RS80 Prestige, Samsung Medical) at baseline, 2, 4 and 6 weeks in order to evaluate the healing process of the injury also comparing the obtained results with the healthy contralateral side. Statistical analysis of the obtained data was performed, also assessing intra- and inter-observer reproducibility with the Bland-Altman test.

RESULTS

The results derived from the current study highlight a direct relationship between the clinical recovery of the injured muscle and its appearance and the elastic features of the regenerative scar tissue. In particular SWE quantitative elasticity assessment was able to provide meaningful data about the quality of the regenerated tissue, furnishing thresholds (11.3 ± 7.6 kPa: newly formed healing tissue; 28.3 ± 4.6 kPa: complete recovery) and contralateral normal muscle (15.4 ± 5.8 kPa) with high measurement reliability index (RMI): 0.7 ± 0.2.

CONCLUSION

The dynamic features of US, combined with RTE and SWE techniques are able to provide qualitative and quantitative elasticity assessment of the healing process of an injured muscle. This can be crucial in the management and early recovery of athletes.

CLINICAL RELEVANCE/APPLICATION

SWE is able to perform a quantitative assessment of muscle healing process and could be extremely useful in athletes follow-up.
CORRELATION BETWEEN HBA1C AND STIFFNESS MEASUREMENTS IN MEDIAN NERVE AT THE CARPAL TUNNEL

PURPOSE

To assess whether commonly used ultrasound (US) measurements for carpal tunnel syndrome (CTS) are reliable in diabetics.

METHOD AND MATERIALS

We retrospectively assessed the cross-section area (CSA) of the median nerve at the level of the carpal tunnel (CT) and the pronator quadratus muscle in 236 wrists of 157 symptomatic patients with clinical suspicion of CTS and calculated the wrist-to-forearm ratio (WFR). Furthermore, 14 wrists in seven asymptomatic diabetics were examined. HbA1c values at the time of ultrasound examination were collected. Values for CSAs and WFR of patients grouped by presence or absence of diabetes and by HbA1c values were compared via an ordinary one-way ANOVA with Holm-Sidak correction for multiple testing after logarithmic transformation to achieve normal distribution. Correlations between HbA1c and WFR as well as CSAs were furthermore quantified through a linear regression analysis. Finally receiver-operator characteristics (ROC) curves were generated to assess the diagnostic utility of WFR measurements.

RESULTS

The average WFR was 1.90±0.55 in asymptomatic diabetics, 2.10±0.77 in symptomatic diabetics and 2.37±0.75 in symptomatic non-diabetic. Diabetic patients had a significantly lower WFR than otherwise healthy patients with CTS (p=0.037). There were no other significant differences between CSA values at the CT (p=0.278). No difference was found for CSA values at the CT (p=0.52). There was no correlation between HbA1c values and WFR (R² = 0.0072), CSA at the CT (R² = 0.0004) or CSA at the pronator quadratus (R² = 0.0009). ROC curve analysis demonstrated a lack of discriminatory power of US between diabetics with and without CTS (area under the curve 0.551).

CONCLUSION

Ultrasound should not be used in the evaluation of CTS in diabetic patients, as its discriminatory power is very low in this patient group, probably due to prevalent neuropathic changes.

CLINICAL RELEVANCE/APPLICATION

Ultrasound is not suited for confirmation of primary CTS in diabetics, but still can be used to rule out other secondary causes of neural compression.
**CLINICAL RELEVANCE/APPLICATION**

Median nerve stiffness increases from forearm to its distal portion. Therefore, when evaluating nerve pathologies, stiffness must be compared to the same portion of the contralateral nerve rather than its proximal or distal portions.

**RC304-12  Hand and Wrist Ultrasound (Demonstration)**  
Tuesday, Nov. 29 11:30AM - 12:00PM Room: E450A

Participants
Viviane Khoury, MD, Philadelphia, PA, (Viviane.khoury@uphs.upenn.edu) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.
First Trimester Ultrasound

Tuesday, Nov. 29 8:30AM - 10:00AM Room: S402AB

Participants

Active Handout: Carol Beer Benson


Sub-Events

RC310A  Ectopic Pregnancy

Participants

Peter M. Doubilet, MD, PhD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) More accurately diagnose tubal ectopic pregnancies. 2) Diagnose unusual ectopic pregnancies, including cervical and interstitial pregnancies. 3) Distinguish early intrauterine pregnancy from ectopic pregnancy.

ABSTRACT

Active Handout: Peter Michael Doubilet


RC310B  Diagnosis of Failed Pregnancy

Participants

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

LEARNING OBJECTIVES

1) Review normal embryonic development in the first trimester. 2) Describe issues related to safe interpretation of first trimester pregnancy including definitely normal, definitely abnormal and indeterminate findings that require follow up. 3) List criteria that are diagnostic for pregnancy failure and distinguish from those that are suspicious for pregnancy failure.

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/

Mindy M. Horrow, MD - 2013 Honored Educator
Mindy M. Horrow, MD - 2016 Honored Educator

RC310C  Mid-late First Trimester

Participants

Carol B. Benson, MD, Boston, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the importance of evaluating the developing fetal head during the late first trimester for early detection of large neural tube defects. 2) Incorporate measurement of the nuchal translucency into their assessment of the fetuses of gestational age 11-14 weeks. 3) Recognize sonographic abnormalities of the ventral wall to distinguish normal physiologic bowel herniation from defects including omphalocele and gastroschisis.

ABSTRACT

This lecture will discuss the sonographic appearance of fetal anatomy in the latter part of the third trimester in order to help participants recognize abnormalities of the fetus at this early gestational age. While many anomalies cannot be detected until later in pregnancy, the discussion will focus on those anomalies that can be detected in the first trimester. Specific topics covered will be central nervous system anomalies, including anencephaly, encephalocele and holoprosencephaly, ventral wall defects including omphalocele and gastroschisis, bladder outlet obstruction, and skeletal anomalies including skeletal dysplasias. Detection of anomalies early in gestation, before the second trimester, permits time to assess the fetus for other anomalies, syndromes, and aneuploidy.
Participants

Georgia Giakourmis Spear, MD

PROGRAM INFORMATION

In changing times of legislative mandates and informed patients, Dr. Spear discusses how Invenia ABUS proves to be an effective adjunctive screening tool for detection of breast cancer in women with dense breast tissue. She will review clinical relevance, practice guidelines and how to successfully implement ABUS into a hybrid academic/private practice.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Participants

PARTICIPANTS

A. Thomas Stavros, MD

PROGRAM INFORMATION

In an era of supplemental screening options, it is time to look differently at breast ultrasound. This session will discuss philosophy, false positives, learning curve, auditing, and health economics of incorporating breast ultrasound into today’s clinical practice.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Breast Imaging (Ultrasound Advanced Applications)

Tuesday, Nov. 29 3:00PM - 4:00PM Room: E450A

SSJ02-01  Sub-Hertz Analysis of ViscoElasticity (SAVE) for Differentiation of Breast Masses

PURPOSE
To evaluate the diagnostic performance of sub-Hertz analysis of viscoelasticity (SAVE) in differentiating breast masses.

METHOD AND MATERIALS
The study was conducted under a protocol approved by Institutional Review Board (IRB). Female patients with clinically suspicious breast masses participated in the study. HIPAA compliant written informed consent was obtained from each enrolled patient. The study included 42 women (mean age, 52.62 years; age range, 21–79 years) with 43 breast masses (18 benign, 25 malignant; mean mass size, 17.90mm); pathology results were available after the ultrasound test for all cases. Using a general purpose investigational ultrasound machine (Verasonics, Kirkland, WA) masses were first identified by an expert sonographer using conventional B-mode followed by acquiring SAVE data. This method consisted of applying a ramp-and-hold force on skin above the mass area for about 10 seconds using a custom-made automated compression device capable of ultrasound data acquisition. Sequences of raw ultrasound data obtained during the compression period were used for estimation of the strain-time curves. The resulting strain-time data were then used to calculate the viscoelastic properties of the tissue based on a general Klevin-Voigt model. Using registered B-mode images, regions of interests (ROI) were selected from the mass and surrounding normal tissue. Diagnostic performance of each viscoelasticity measure, including “retardation time”, T1, was evaluated using a receiver operating characteristic analysis.

RESULTS
The lesion to normal retardation time contrast in benign lesions was significantly higher than malignant (P<0.0001). Using retardation time contrast for diagnosis resulted in 88.9% specificity, 96.0% sensitivity and 96.9% negative predictive value (AUC: 0.98).

CONCLUSION
These results suggest that the SAVE method is a valuable diagnostic tool for differentiation of breast masses.

CLINICAL RELEVANCE/APPLICATION
The addition of viscoelasticity measures using SAVE method to ultrasound can greatly improve the specificity in differentiation of the breast masses; thus potentially can help reducing the number of unnecessary biopsies.

SSJ02-02  Effect of Calcifications on Shear Wave Elastography in Evaluating Breast Lesions

PURPOSE
To investigate the effect of calcifications on shear wave elastography (SWE) in evaluating breast lesions.
**METHOD AND MATERIALS**

We retrospectively reviewed ultrasound (US) images of 807 consecutive patients who had breast US with SWE between October 2013 and March 2014. We excluded the patients who no mammography (n=54) or no measured Emean (n=51) or no follow up data (n=47), and the patients who had neoadjuvant chemotherapy before the US examination (n=24). Finally included 631 patients with 673 breast lesions were included in this study. We analyzed US findings of the lesions: type (mass or non-mass), size, Breast Imaging Reporting and Data System (BI-RADS) category and the elasticity score (Emean) measured at the stiffest area of the lesions. And we compared the UST between breast lesions with calcifications and without calcifications in three subgroups: benign lesions, in situ carcinoma, and invasive carcinoma. We also analyzed the influence of other US factors on the Emean of the breast lesions.

**RESULTS**

Breast lesions were confirmed by histologically (n=409) or by follow up images for more than 2 years (n=264). Calcifications were present in 25.3% (170/673) lesions and absent in 74.7% (503/673) lesions. Emean was 33.9 kPa in overall benign lesions; 62.8 kPa in benign lesions with calcifications and 29.8 kPa in benign lesions without calcifications (p= 0.000). In situ carcinoma showed 97.0 kPa; lesions with calcifications showed 114.6 kPa while lesions without calcifications showed 52.8 kPa (p=0.037). In invasive carcinoma, the overall Emean was 157.6 kPa, and Emean of lesions with calcifications and without calcifications were 146.4 kPa and 171.9 kPa (p=0.018). Other US factors such as lesion type (mass or non-mass), size, BI-RADS final category showed no statistically significant correlations with elasticity score in the lesions with same pathologic results.

**CONCLUSION**

The presence of calcifications significantly increased the Emean of breast lesions. Elastography should be carefully interpreted considering the presence of calcifications within the lesions.

**CLINICAL RELEVANCE/APPLICATION**

The presence of calcifications significantly increased the elasticity score of breast lesions in shear wave elastography.

**SS302-03 Toward High Resolution Whole Breast Imaging using Ultrasound Tomography: A Comparison with MRI**

**Participants**

Neb Duric, PhD, Detroit, MI (Presenter) Officer, Delphinus Medical Technologies, Inc
Gursharan Sandhu, PhD, Plymouth, MI (Abstract Co-Author) Employee, Delphinus Medical Technologies, Inc
Olivier Roy, Plymouth, MI (Abstract Co-Author) Employee, Delphinus Medical Technologies, Inc
CuiPing Li, PhD, Plymouth, MI (Abstract Co-Author) Employee, Delphinus Medical Technologies, Inc
Peter J. Littrup, MD, Providence, RI (Abstract Co-Author) Founder, CryoMedix, LLC; Research Grant, Galil Medical Ltd; Research Grant, Endo International plc; Consultant, Delphinus Medical Technologies, Inc
Mark Sak, PhD, Plymouth, MI (Abstract Co-Author) Employee, Delphinus Medical Technologies, Inc
Rachel F. Brem, MD, Washington, DC (Abstract Co-Author) Board of Directors, iCAD, Inc; Board of Directors, Dilon Technologies LLC; Stock options, iCAD, Inc; Stockholder, Dilon Technologies LLC; Consultant, U-Systems, Inc; Consultant, Dilon Technologies LLC; Consultant, Dune Medical Devices Ltd

**METHOD AND MATERIALS**

A HIPAA compliant, IRB approved study investigating Ultrasound Tomography (UST) to image the breast to compare the spatial resolution of UST reconstructions with contrast enhanced MRI due to its high sensitivity as well as the similar breast positioning, i.e. pendant, uncompressed breast, and both yielding true 3-D volumetric imaging. A total of 50 women had MR imaging performed during their workup as well as UST imaging. The UST coronal images are separated by 2mm increments and compared with MR images reconstructed in the coronal plane. The UST and MRI images were synchronized to allow slice-by slice comparisons. Images were compared by a single experienced radiologist. The spatial resolution of the UST sound speed images and the MR images were measured by creating profile cuts across sub-mm sized parenchymal features and using a Gaussian fit to model the width of such features. The full-width–half maximum measure was used to determine the spatial resolution in the coronal plane. 50 measurements were made for both the UST and MR images and the spatial resolution was 0 determined by taking the average of the 50 measurements and determining the standard deviation.

**RESULTS**

The spatial resolution of the UST sound speed images was 0.7 +/- 0.1 mm. The MR resolution was 1.6 +/- 0.1 mm in the coronal plane. In the other planes, the resolution was 0.8 +/- 0.1 mm for MRI and 2.0 +/- 0.3 mm for UST sound speed. Examples of comparative images are shown in Figure 1.

**CONCLUSION**

A novel algorithm, based on waveform tomography, was applied to UST data to generate sound speed images that have comparable resolution to MRI.

**CLINICAL RELEVANCE/APPLICATION**

The similarity in spatial resolution between UST and MRI opens avenues to further develop high resolution 3D imaging using ultrasound for the detection of breast cancer. Waveform based UST imaging may become an important tool for future clinical use.

**SS302-04 Quantitative Analysis of Contrast-enhanced Ultrasound Imaging in Invasive Breast Cancer: A Novel Technique using Enhancement Area Ratio to Predict Histopathological Microvessel Density**

**Participants**

Cuiping Li, PhD, Plymouth, MI (Abstract Co-Author) Employee, Delphinus Medical Technologies, Inc
Mark Sak, PhD, Plymouth, MI (Abstract Co-Author) Employee, Delphinus Medical Technologies, Inc
Rachel F. Brem, MD, Washington, DC (Abstract Co-Author) Board of Directors, iCAD, Inc; Board of Directors, Dilon Technologies LLC; Stock options, iCAD, Inc; Stockholder, Dilon Technologies LLC; Consultant, U-Systems, Inc; Consultant, Dilon Technologies LLC; Consultant, Dune Medical Devices Ltd

**METHOD AND MATERIALS**

A novel algorithm, based on concept of waveform tomography has been applied to ultrasound tomography of the breast (UST) to create high resolution images of tissue sound speed. The purpose of this study is to compare, for the first time, the spatial resolution of the sound speed images with MRI.
METHOD AND MATERIALS

The Institutional Review Board approved this retrospective study, and waived the requirement for informed consent. Between August 2014 and December 2015, consecutive 40 patients with invasive breast cancer lesions underwent contrast-enhanced ultrasound (US). Manual segmentation covering the entire tumor volume was made on precontrast US image. Ratios between enhanced areas and segmented tumor areas (enhancement area ratio) was obtained with the new method at peak and delayed phases (50–54, 55–59, 60–64, 65–69s). For each patient, we also analyzed time-intensity curves (TIC) in three regions of interest (ROI), with the supposed strongest enhancement, to obtain mean value of peak intensity (PI) and area under curve (AUC) of three ROIs. All parameters were measured by two observers independently and were correlated with histological MVD of surgical specimens.

RESULTS

Enhancement area ratios in both peak and delayed phases (50–54, 55–59, 60–64, 65–69s) were significantly correlated with histopathological MVD \( (r=0.57, 0.62, 0.68, 0.61 and 0.58; P<0.0001, <0.0001, <0.0001, <0.0001 and 0.0001, respectively) \), and with almost perfect inter-observer reliability \( (0.971, 0.972, 0.961, 0.952 and 0.959, respectively). \) In TIC analysis, PI was significantly correlated \( (r=43; P=0.0073) \) with substantial inter-observer reliability \( (0.782) \), whereas AUC was not \( (r=0.29; P=0.0769). \)

CONCLUSION

Enhancement area ratios obtained by the new method were reliably correlated with MVD in invasive breast cancer.

CLINICAL RELEVANCE/APPLICATION

MVD information might be obtainable for multiple lesions during one session of contrast-agent injection changing scanning planes during delayed phases by using our new method.

Purpose of Study: The purpose of this study was to evaluate the feasibility and clinical value of a novel method to measure relative vascularity of breast tumors using contrast-enhanced ultrasound (CEUS). We aimed to correlate the relative vascularity of breast tumors with histological microvessel density (MVD) and to assess clinical differences in the interpretation of whole-breast physician-performed handheld ultrasound (HHUS) and supine automated ultrasound (AUS).

Methods: This was a retrospective study involving 40 consecutive patients with invasive breast cancer who underwent CEUS at our institution. The relative vascularity of breast tumors was quantified using a novel method that computes enhancement area ratios in both peak and delayed phases. Tumor MVD was determined histologically. Time-intensity curves were analyzed to assess temporal changes in tumor vascularity. The study was approved by the institutional review board, and informed consent was waived.

Results: Enhancement area ratios in both peak and delayed phases were significantly correlated with histological MVD. Almost perfect inter-observer reliability was observed. In TIC analysis, peak intensity (PI) was significantly correlated with substantial inter-observer reliability, whereas area under curve (AUC) was not.

Conclusion: The novel method for measuring relative vascularity of breast tumors using CEUS was feasible and correlated well with histological MVD. This method may provide valuable information for clinical decision-making.

Clinical Relevance: Clinical Relevance: This method has the potential to improve the accuracy and consistency of tumor vascularity assessment in breast cancer, offering additional insights for clinical management.

Keywords: Breast cancer, contrast-enhanced ultrasound, relative vascularity, microvessel density, time-intensity curves.
DBT or MRI findings, 2nd look after MRI, extent of disease, and prebiopsy cases. Using a cut point of BI-RADS ≥ 3 for clinical significance of mismatches, HHUS had 24.2% and AUS 28.6%. Mismatches in non-screening cases were related to misinterpretation of artifacts as lesions, investigator assignment of category 3 when protocol required BI-RADS 2, and interpretive error, explanations that decreased during the second year of the study. Screening: 191 women had no lesions on AUS or HHUS. 94 women had 148 lesions, with 306 (90.3%) matching BI-RADS or BI-RADS ≤ 2.

CONCLUSION

BI-RADS mismatches between automated and handheld scans are few and clinically insignificant for screening. Complexity of cases and inexperience with automated display may result in clinically significant BI-RADS mismatches that with training and case experience, as with other new breast imaging modalities should be reduced, promoting acceptance.

CLINICAL RELEVANCE/APPLICATION

Automated US can be used for US screening as an option to handheld; for diagnosis, advantages of whole breast US coronal display in demonstrating multiple bilateral masses when palpable mass is benign appearing can reduce BI-RADS assessment from BI-RADS 3 to 2.

SSJ02-06  Feasibility of Microbubble Contrast-Enhanced Ultrasound (CEUS) Sentinel Lymph Node Imaging with Guided Biopsy in Breast Cancer Patients

Tuesday, Nov. 29 3:50PM - 4:00PM Room: E450A

Participants
Basak E. Dogan, MD, Houston, TX (Presenter) Nothing to Disclose
Lumarie Santiago, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Rosa Hwang, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose
Elizabeth Mittendorf, MD, Houston, TX (Abstract Co-Author) Nothing to Disclose

PURPOSE

To determine the feasibility of using microbubble contrast-enhanced ultrasound (CEUS) with fine needle aspiration biopsy (FNAB) to identify and pre-operatively evaluate sentinel lymph nodes (SLN) in breast cancer patients.

METHOD AND MATERIALS

Twenty-one patients with newly-diagnosed early-stage (clinical T1-T2, N0) invasive breast cancer who had pre-operative axillary gray scale ultrasound (US) with or without US-guided FNAB revealing benign results were enrolled in an IRB-approved prospective, single-institutional clinical trial. All patients underwent ipsilateral subareolar microbubble contrast injection, followed by CEUS of the axilla. The first CEUS-visualized node was subjected to FNAB, followed by I-125 radioactive seed localization (RSL) of the node. Contrast dose, contrast travel length, travel time, side effects and FNA results were recorded. All patients underwent standard of care (SOC) SLN biopsy using Tc99m with or without blue dye. Correlation of the CEUS-identified node with surgical SLN was performed. Pre-operative FNAB result [benign or malignant] was compared with the final pathologic assessment of that node.

RESULTS

Median patient age was 61yrs (range 37-72). Median cancer size on pre-operative imaging was 12mm (range 6-27). In 20 of 21 (95.2%) patients, CEUS was technically successful. Median node contrast uptake time was 3 min (range 1-10), and travel length was 13cm (range 9-19). All (100%) biopsied and localized nodes correlated with a SLN identified surgically. In 18 (90%) patients, the CEUS-identified, localized node correlated with the hottest SLN. Pathologic evaluation of the SLN(s) revealed metastasis in a single lymph node in 2 (10%) patients, one of which was pre-operatively identified with CEUS-guided FNAB. No significant side effects were recorded in the immediate or 30 day follow up periods.

CONCLUSION

Pre-operative CEUS-guided SLNB is a minimally invasive technique that does not involve radiation exposure, and has no significant side effects. In a first North American experience, this feasibility study confirmed the ability of using microbubble CEUS to identify the SLN in early stage breast cancer patients, suggesting that further evaluation of the technology in larger cohorts is warranted.

CLINICAL RELEVANCE/APPLICATION

CEUS and guided FNAB of SNL is a minimally invasive procedure which may be useful as an alternative to surgical lymph node staging in breast cancer patients.
### SSJ07-01 Prospective Intraindividual Comparison of Non-Contrast MRI and US as a Surveillance Tool for HCC in Patients with Cirrhosis at High Risk of HCC

**Tuesday, Nov. 29 3:00PM - 3:10PM Room: E350**

**Participants**
- Hero K. Hussain, MD, Ann Arbor, MI (Moderator) Nothing to Disclose
- Steven S. Raman, MD, Santa Monica, CA (Moderator) Nothing to Disclose

**Sub-Events**

**SSJ07-01** Prospective Intraindividual Comparison of Non-Contrast MRI and US as a Surveillance Tool for HCC in Patients with Cirrhosis at High Risk of HCC

**Tuesday, Nov. 29 3:00PM - 3:10PM Room: E350**

**Participants**
- Hye Young Jang, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
- So Yeon Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- Jae Ho Byun, MD, SEOUL, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- So Jung 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
- Jihyun An, SEOUL, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- Seong Ho Park, MD, SEOUL, Korea, Republic Of (Abstract Co-Author) Research Grant, DONGKOOK Pharmaceutical Co, Ltd

**PURPOSE**
To prospectively compare the diagnostic yield of non-contrast MRI including diffusion-weighted imaging (DWI) and US as a surveillance tool for detecting HCCs in patients with cirrhosis at high risk of HCC.

**METHOD AND MATERIALS**
A prospective surveillance study included 407 consecutive cirrhosis patients with an estimated annual risk of HCC > 5% who underwent one to three, biannual screening examinations with paired liver MRI and US between November 2011 and August 2014. The referral criteria for HCC on non-contrast MRI were defined as a nodule showing one of the following criteria: the presence of intraleisional fat, mild to moderate hyperintensity on T2-weighted imaging, or hyperintensity on DWI at b-500 s/mm2. On US, a discrete focal lesion equal or more than 1cm in diameter or suspicious tumor thrombosis was referred for a further work-up for HCC. During image interpretation, radiologists were blinded to the results of the other imaging modality. The confirmation of HCC was based on the results of a histologic examination and/or typical CT images of HCC. Per-lesion sensitivity of HCC and per-exam specificity were compared between non-contrast MRI and US.

**RESULTS**
In 1,100 screening rounds of paired MRI and US, 48 HCCs were diagnosed in 43 patients. Among the 48 HCCs, intraleisional fat was detected in 4 HCCs (8.3%), 31 HCCs (64.6%) showed mild to moderate hyperintensity on T2-weighted imaging, and 37 HCC (77.1%) appeared hyperintensity on DWI at b-500 s/mm2. On US, a discrete focal lesion equal or more than 1cm in diameter or suspicious tumor thrombosis was referred for a further work-up for HCC. Using the diagnostic criteria, per lesion sensitivity of non-contrast MRI was 81.3% (39/48), which was significantly higher that of 25% (12/48) (P<0.001). Non-contrast MRI showed a significantly higher per-exam specificity that US [98.0% (1036/1057) vs. 94.4% (998/1057), P<0.001].

**CONCLUSION**
In this prospective intraindividual comparison study, non-contrast MRI including DWI outperformed US as a surveillance test for HCC in patients with cirrhosis at high risk of HCC.

**CLINICAL RELEVANCE/APPLICATION**
In patients with cirrhosis at high risk of HCC, the non-contrast MRI including DWI can be considered to an alternative surveillance tool to US.

### SSJ07-02 Diagnostic Accuracy of Prospective Applications of Liver Imaging Reporting and Data System (LI-RADS) on Gadoxetic Acid-Enhanced MRI

**Tuesday, Nov. 29 3:10PM - 3:20PM Room: E350**

**Participants**
- Yeun Yoon Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
- Chansik An, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- Sungwon Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
- Myeong-Jin Kim, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Research Grant, Bayer AG

**PURPOSE**
To evaluate the diagnostic accuracy of prospectively applied Liver Imaging Reporting and Data System (LI-RADS, v2014) for hepatocellular carcinoma (HCC) on gadoxetic acid-enhanced liver MRI.
METHOD AND MATERIALS
This study included 528 hepatic observations from 268 patients who met the following criteria: 1) at high risk for HCC, 2) underwent gadoxetic acid-enhanced liver MRI in 2014 at our institution, 3) not previously treated for HCC, and 4) whose radiologic reports were prospectively reported using LI-RADS. Final diagnoses were determined histologically for all non-HCC malignancies (two cholangiocarcinomas [CCs] and four combined HCC-CCs), 110 of 122 HCCs, seven regenerative or dysplastic nodules, and one hemangiomata. Fifty benign lesions and 12 HCCs were clinically diagnosed with follow-up imaging. The sensitivities and specificities of LI-RADS categories were calculated with 95% confidence intervals (CIs).

RESULTS
None of the nine (0%) LR-1, one of 22 (4.5%) LR-2, 14 of 35 (40.0%) LR-3, 19 of 27 (70.4%) LR-4, 73 of 75 (97.3%) LR-5, and all of the five (100%) LR-5V observations were HCCs. Two of 75 (2.7%) LR-5 observations were combined HCC-CCs. Of 13 LR-M lesions, only three (23.1%) were non-HCC malignancies and the remainder were HCCs. Three of six (50%) non-HCC malignancies were categorized as LR-4 or LR-5. When LR-5 and LR-5V were considered positive diagnosis for HCC, the sensitivity and specificity were 63.9% (95% CI, 54.6–72.4) and 96.9% (95% CI, 89.2–99.6), respectively. When LR-4, LR-5, and LR-5V were considered positive, the sensitivity and specificity were 79.5% (95% CI, 71.3–86.3) and 84.4% (95% CI, 73.1–92.2), respectively.

CONCLUSION
In high-risk patients for HCC, LR-5 and LR-5V showed a high specificity for diagnosing HCC. However, a significant portion of non-HCC malignancies were categorized as LR-4 or LR-5 and a majority of LR-M lesions were HCCs, which suggests the necessity for modification of criteria for the LR-M category.

CLINICAL RELEVANCE/APPLICATION
LR-M category of LI-RADS v2014 needs improvement to better exclude non-HCC malignancies in high risk patients for HCC and to decrease the misdiagnosis rate of HCCs as non-HCC malignancies.

SSJ07-03 Abdominal Ultrasound Compared to Cross-Sectional Imaging for Surveillance of Hepatocellular Carcinoma in High Risk Patients: Results of 5-year Cohort Follow-up

Tuesday, Nov. 29 3:20PM - 3:30PM Room: E350

Participants
Francois Willemsen, MD, Hoogstraten, Belgium (Presenter) Nothing to Disclose
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Roy S Dwarkasing, MD, PhD, Rotterdam, Netherlands (Abstract Co-Author) Nothing to Disclose

PURPOSE
Hepatocellular carcinoma (HCC) is the most common primary malignant tumor of the liver and is the third leading cancer-related cause of death. Major risk factors are identified including cirrhosis caused by viral hepatitis B and C infection, and hereditary hemochromatosis. According to European guidelines patients at risk for HCC should be surveyed with abdominal ultrasound (US) every 6 months.

METHOD AND MATERIALS
In our tertiary referral institute, we selected all patients between October 2005-October 2010 from our HCC database. Inclusion criteria were: pathological or histochemical confirmed HCC, abdominal ultrasound and contrast-enhanced computed tomography (CT) or magnetic resonance imaging (MRI) within three months. Number and size of the detected lesions were compared.

RESULTS
In 88 patients included, 83 HCC lesions were described at US evaluation compared to 181 lesions detected using CT or MRI. Lesions found on US had a mean diameter of 60mm (range 5-135mm, median 45mm), on cross-sectional imaging the mean diameter was 56mm (range 5-160mm, median 45mm). In 30 of the 88 (34%) patients US was negative, while cross-sectional imaging detected HCC lesions. In 18 of those 30 cases all lesions were smaller than 25mm (60%). Of all the patients (n=25) with lesions smaller than 25mm, 18 ultrasound examinations were false negative (72%).

CONCLUSION
Surveillance for HCC in high-risk patients using US is inadequate. A significant number of HCC lesions are missed using US surveillance, especially small lesions, resulting in a false negative examination in a third of the cases.

CLINICAL RELEVANCE/APPLICATION
This warrants the question if surveillance for HCC should be performed with advanced cross sectional imaging modalities.

SSJ07-04 Effect of Threshold Growth on Liver Imaging Reporting and Data System Categorization

Tuesday, Nov. 29 3:30PM - 3:40PM Room: E350

Participants
Victoria Chernyak, MD, Bronx, NY (Presenter) Nothing to Disclose
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Claude B. Sirlin, MD, San Diego, CA (Abstract Co-Author) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Guerbet SA; 

PURPOSE
Liver Imaging Reporting and Data System (LI-RADS, LR) uses major features (arterial phase hyperenhancement [APHE], “washout” [WO], “capsule”, diameter, threshold growth [TG]) to codify probability of an observation being hepatocellular carcinoma. Inclusion of TG in the LI-RADS algorithm was based on expert opinion rather than scientific evidence. The goal of this study was to assess the effect of TG on LR categorization.
METHOD AND MATERIALS

All MR and CT reports created using a standardized LR v2014 template at one tertiary care center between 4/15–2/16 were identified. For each LR3, LR4, and LR5 reported observation, the presence of every LR major feature was recorded retrospectively. Two LR categories were then assigned: one using all LR-v2014 major features and one using a revised system that disregards TG (LR-revised). Categories assigned using LR-v2014 and LR-revised were compared. Some analyses were repeated excluding patients without prior exams (TG not applicable).

RESULTS

136 patients (85 [62%] male, mean age 62 [±10] years) with 297 observations (median diameter 13mm, IQR 9-20mm) were included. Of 297 observations, 204 (69%) had APHE, 186 (63%) had WO, 49 (16%) had “capsule” and 40 (14%) had TG. Of 40 observations with TG, 26 (65%) were new observations ≥10mm, 8 (20%) had diameter increase ≥50% in ≤6 months and 6 (15%) had diameter increase ≥100% in >6 months. LR-v2014 categories were LR3 in 131/297 (44%), LR4 in 87/297 (29%) and LR5 in 79/297 (27%). LR-revised categories were LR3 in 147/297 (50%), LR4 in 78/297 (26%) and LR5 in 72/297 (24%). Assigned categories were discrepant in 22/297 (7%) observations. 7/79 (9%) observations categorized LR5 with LR-v2014 were recategorized LR4 with LR-revised. Of these, all 7 were 10-19 mm and had APHE; 5/7 (71%) were new observations and 2/7 (29%) had diameter increase ≥50% in ≤6 months. When excluding 70 observations without prior exams, 22/227 (10%) categories were discrepant; 7/50 (14%) observations categorized LR5 with LR-v2014 were recategorized LR4 with LR-revised.

CONCLUSION

TG affects LI-RADS category in the minority of cases. Disregarding TG causes a small but meaningful proportion of LRS observations to be downgraded to LR4.

CLINICAL RELEVANCE/APPLICATION

Removing threshold growth as a major feature to simplify LI-RADS algorithm would not affect final LI-RADS category in most cases but would cause downgrading of a meaningful proportion of LR5 observations.

SSJ07-05  Risk Assessment for Hepatocellular Carcinoma by Using Magnetic Resonance Elastography during Follow-up

Tuesday, Nov. 29 3:40PM - 3:50PM Room: E350

Participants
Shintaro Ichikawa, MD, Chuo-Shi, Japan (Presenter) Nothing to Disclose
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PURPOSE

To evaluate magnetic resonance elastography (MRE) as a means for predicting the development of hepatocellular carcinoma (HCC) in chronic liver disease.

METHOD AND MATERIALS

We reviewed data from 161 patients with chronic liver disease with the following inclusion criteria: had 2 MRE examinations between days 365–1424 with >12 month interval, no prior history of or development of HCC between the two exams, and available laboratory results. Liver stiffness was classified as low (<3 kPa), moderate (3–4.7 kPa), and high (>4.7 kPa). The classification for change in stiffness between the two MREs is as follows: high on both or high on the first and moderate on the second (group A, n=61), low on both (group C, n=39), and other combinations (group B, n=61). We used Cox analyses and Kaplan-Meyer methods to determine the risk of developing HCC.

RESULTS

Forty-seven patients (29.2%) developed HCC during the follow-up period (45.9% (28/61) of group A, 27.9% (17/61) of group B; 5.1% (2/39) of group C). There was a significant difference in the disease-free survival rates between groups A (54.9%), B (73.9%), and C (87.6%) at 3-years (p=0.0001). The independent risk factors for development of HCC included: belonging to Group A (hazard ratio [HR] versus group C=6.0, P=0.0001; versus group B=2.16, P=0.0268), age (HR = 1.04, P=0.0154), and alanine aminotransferase level (HR=1.02, P =0.0196).

CONCLUSION

Results from MRE can stratify the risk of developing HCC during the follow-up of patients with chronic liver disease.

CLINICAL RELEVANCE/APPLICATION

Patients with chronic liver disease with high liver stiffness (>4.7 kPa) on their first MR elastography are at high risk for developing an HCC, regardless of the results of their second MR elastography. Thus, they should have meticulous follow-up and be screened for HCC development.

SSJ07-06  Evaluation of Texture Analysis Parameters for Response Prediction and Monitoring in Patients with Hepatocellular Carcinoma Undergoing Transarterial Chemoembolization Using Biphasic Contrast-Enhanced CT Image Data: Correlation with Results of Liver Pe

Tuesday, Nov. 29 3:50PM - 4:00PM Room: E350

Participants
Christopher Kloth, Tuebingen, Germany (Presenter) Nothing to Disclose
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Gerd Grzinger, MD, Tubingen, Germany (Abstract Co-Author) Nothing to Disclose
Roland Syha, Tuebingen, Germany (Abstract Co-Author) Nothing to Disclose
PURPOSE
To analyze the value of different parameters derived from CT texture analysis (CTTA) image data in hepatocellular carcinoma (HCC) for prediction of response and response evaluation to transarterial chemoembolization (TACE).

METHOD AND MATERIALS
The study group consisted of 56 HCC in 28 patients (27 male; mean age 67.2±10.4) who underwent CECT examinations before and after TACE therapy. The study was approved by the local ethic committee. Mean time between the two CT examinations was 39.93 ± 62.21 days. Standard of reference was perfusion-CT of the liver additionally to arterial and portal-venous post-contrast phases. Patients were assigned into subgroups: no response-NR (n=9), partial response-PR (n=34) and complete response-CR (n=13). CTTA parameters were: heterogeneity/intensity/average/deviation/skewness/contrast of NGTDM (Neighborhood Grey-Tone Difference Matrix). For each parameter mean, entropy and uniformity were calculated. Blood flow (BF), blood volume (BV), arterial liver perfusion (ALP), portal-venous perfusion (PVP) and hepatic perfusion index (HPI) were calculated in the pre- and post-TACE settings by liver perfusion-CT.

RESULTS
Patients with CR showed higher tumor perfusion parameters before TACE and a significant decrease in BF/BV/ALP/HPI after TACE (p=0.002/0.002/0.002/0.003). Patients with PR showed similar results, but only in responding tumor parts. ROC analysis of CTTA parameters yielded predictive cut-off values for CR in the arterial CECT-phase (sensitivity/specificity) for mean intensity (88.9%/69.8%), mean average (88.9%/69.8%) and skewness (90.0%/58.1%). In the portal-venous CECT-phase similar for uniformity of heterogeneity, uniformity of skewness and mean contrast (92.3%/81.8%/92.3%/54.5%/92.3%/95.2%). Significant correlations were registered between changes in mean heterogeneity and BF (p=0.004, r=-0.815), BV (p=0.002, r=-0.851) and ALP (p=0.002, r=-0.851) in the arterial phase in CR and PR.

CONCLUSION
Significant correlations exist between CTTA parameters and those derived from perfusion-CT both in the pre- and post-TACE setting with predictive value for TACE outcome.

CLINICAL RELEVANCE/APPLICATION
Prediction of response to local therapy (TACE) by means of CTTA can be implemented for choosing the best treatment strategy. Improved response monitoring by CTTA is beneficial for optimal patient management and could be a substitute for more sophisticated imaging techniques like perfusion-CT or MRI.
SSJ08-01  Characterization of Malignant versus Benign Focal Liver Lesions with Lumason-Enhanced Ultrasound Imaging

Participants
Anthony E. Samir, MD, Boston, MA (Moderator) Consultant, Pfizer Inc Consultant, General Electric Company Consultant, PARXEL International Corporation Research Grant, Koninklijke Philips NV Research Grant, Siemens AG Research Grant, Toshiba Corporation Research Grant, General Electric Company Research Grant, Samsung Electronics Co, Ltd Research Grant, Analogic Corporation Research support, SuperSonic Imagine Research support, Hitachi, Ltd
Jessica B. Robbins, MD, Madison, WI (Moderator) Nothing to Disclose

Sub-Events
SSJ08-01  Characterization of Malignant versus Benign Focal Liver Lesions with Lumason-Enhanced Ultrasound Imaging

Participants
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Edward G. Grant, MD, Los Angeles, CA (Abstract Co-Author) Research Grant, General Electric Company; Medical Advisory Board, Nuance Communications, Inc
Dirk-Andre Clevert, MD, Muenchen, Germany (Abstract Co-Author) Speaker, Siemens AG; Speaker, Koninklijke Philips NV; Speaker, Bracco Group;
Barry B. Goldberg, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
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Wui K. Chong, MD, Chapel Hill, NC (Abstract Co-Author) Advisory Board, Bracco Group;
Deike H. Strobel, MD, Erlangen, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
To compare the diagnostic performance of contrast-enhanced ultrasound (CEUS) with Lumason (sulfur hexafluoride lipid-type A microspheres) to that of unenhanced ultrasound (UEUS) for characterization of malignant versus benign focal liver lesions (FLLs).

METHOD AND MATERIALS
Two multicenter clinical trials of identical design were conducted in adult subjects with at least one FLL requiring work-up for characterization; subjects underwent UEUS followed by CEUS with 2.4 mL Lumason. UEUS and CEUS images were evaluated by on-site investigators and 3 off-site, blinded readers unaffiliated with the enrolment centers and blinded to any clinical data. Diagnostic performance of UEUS and CEUS for FLL characterization was determined using tissue pathology/histology (when FLL biopsy could be performed), or 6-month follow-up with contrast-enhanced CT or MRI as truth standard.

RESULTS
A total of 499 subjects were included in the 2 trials. Per truth standard, 256 lesions were benign (n=116 hemangioma, n=64 focal nodular hyperplasia, n=76 other) and 243 were malignant (n=131 hepatocellular carcinoma, n=78 metastases, n=34 other). For the off-site reads, the pooled sensitivity, specificity, and accuracy were 43.6%, 34.0%, 38.7%, respectively for UEUS and 72.4%, 80.5%, 76.6%, respectively for CEUS (p<.05). For on-site reads, sensitivity, specificity, and accuracy were 37.0%, 21.5%, 29.1%, respectively for UEUS and 89.3%, 84.0%, 86.6%, respectively for CEUS (p<.05). No serious adverse events related to Lumason administration were reported.

CONCLUSION
Overall, Lumason-enhanced ultrasound imaging provided an improvement from UEUS for characterization of FLLs.

CLINICAL RELEVANCE/APPLICATION
The results suggest that CEUS with 2.4 mL of Lumason is safe and may be useful to improve characterization of focal liver lesions when UEUS is inconclusive.
**SSJ08-03** Relationship between Liver Tissue Stiffness and Histopathological Findings Analyzed by Shear Wave Eastography in Patients with Non-alcoholic Fatty Liver Disease  

Tuesday, Nov. 29 3:20PM - 3:30PM Room: E353A

Laurent Milot, Lyon, France (Abstract Co-Author) Nothing to Disclose  
Stephanie R. Wilson, MD, Calgary, AB (Abstract Co-Author) Equipment support, Siemens AG; Equipment support, Koninklijke Philips NV

**PURPOSE**

In light of recent FDA approval of a microbubble for liver CEUS in the USA, we propose that CEUS is superior to grayscale ultrasound and equivalent to institutional CT and MR for characterization of focal liver masses.

**METHOD AND MATERIALS**

This prospective study comprises 224 patients, from 5 geographically separate centres, presenting for evaluation of a focal liver mass (12 adenoma, 8 cholangiocarcinoma, 55 FNH, 71 HCC, 25 metastasis, 12 other). All had US/CEUS and CT and/or MR. CEUS was performed with Definity (Lantheus, Billerica MA) on standard US systems. They included a continuous cine of wash-in to peak enhancement, and still portal venous and delayed images to 5 minutes. CT and MR were performed as standard care with institutional protocols. Pre-contrast, arterial phase and portal venous phase images were included. Three separate electronic blind read files; one for each of CEUS (including grayscale and Doppler images), CT and MR were created and read blindly by four radiologists, two for CEUS and two for CT/MR utilizing a Microsoft Access based questionnaire regarding the arterial, portal venous and delayed phase enhancement of each lesion. Readers also provided a preference for malignancy or benignancy, a final diagnosis as well as a confidence level. Results of the blind read were compared with the truth standard from pathology, long-term stability or expert consensus.

**RESULTS**

Our results show that CEUS is superior to grayscale/Doppler ultrasound and at least equivalent to CT and MR both in determining the malignancy of a lesion and in diagnostic accuracy, with an increase in confidence from a mean of 1.6 for grayscale/Doppler to 3.9 on CEUS on a 5 point scale. Sensitivity, specificity and accuracy of CEUS are 95%, 82%, 67%; of grayscale/Doppler are 81%, 56%, 40%; of CT are 89%, 75%, 62% and of MR are 85%, 79%, 62% respectively.

**CONCLUSION**

CEUS is superior to grayscale ultrasound both for determination of malignancy and when assigning a final diagnosis for a focal liver mass. Additionally, CEUS is equivalent, and in select cases performs better, in the characterization of focal liver lesions than institutional CT and MRI.

**CLINICAL RELEVANCE/APPLICATION**

In the evaluation of a focal liver mass, CEUS is a necessary adjuvant to grayscale/Doppler ultrasound and is equivalent to CT and MR in its ability to predict malignancy and provide a diagnosis.

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**SSJ08-04** Noninvasive Evaluation of Liver Fibrosis using Two-dimensional Shear Wave Elastography: A Comparison with Different Serum Fibrosis Indices in Chronic Hepatitis B  

Tuesday, Nov. 29 3:30PM - 3:40PM Room: E353A

Laurent Milot, Lyon, France (Abstract Co-Author) Nothing to Disclose  
Stephanie R. Wilson, MD, Calgary, AB (Abstract Co-Author) Equipment support, Siemens AG; Equipment support, Koninklijke Philips NV

**PURPOSE**

Shear wave elastography (SWE) is validated in chronic hepatitis C and B; however, limited data are available in Non-Alcoholic Fatty Liver Disease (NAFLD). This study is aimed to assess the accuracy and the efficacy of SWE for the detection of fibrosis in patients with NAFLD and to evaluate the effect of other histologic parameters on SWE measurement.

**METHOD AND MATERIALS**

Written informed consent was obtained from all subjects, and the local ethics committee approved the study. Seventy-one patients with histologically proven NAFLD (mean age, 50.8 years ± 15.7) were examined. All patients underwent SWE (AixplorerTM; SuperSonic Imagine) and FIB4 index (based on age, aspartate aminotransferase [AST] and alanine aminotransferase [ALT] levels, and platelet counts). SWE measurements were compared to the histologic features based on NAFLD activity score and FIB4 index.

**RESULTS**

The area under the ROC curve (AUC) for the diagnosis of hepatic fibrosis stages 3 or higher was 0.821 (optimal cutoff value, 13.1 kPa; sensitivity, 62.5%; specificity, 57.4%) for SWE, as was 0.822 (optimal cutoff value, 1.41; sensitivity, 71.9%; specificity, 53.9%) for FIB4 index, respectively. Median liver stiffness values measured using SWE showed a stepwise increase with increasing hepatic fibrosis stage (P<0.001), inflammation score (P=0.018), and ballooning score (P<0.001), and showed a stepwise decrease with increase hepatic steatosis stage (P=0.046).

**CONCLUSION**

SWE is a promising imaging modality for assessing the presence or absence of advanced fibrosis in patients with NAFLD. The effect of steatosis on SWE measurements may be controversial.

**CLINICAL RELEVANCE/APPLICATION**

SWE is a rapid and noninvasive method of detecting fibrosis in patients with nonalcoholic fatty liver disease.

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**SSJ08-05** Noninvasive Evaluation of Liver Fibrosis using Two-dimensional Shear Wave Elastography: A Comparison with Different Serum Fibrosis Indices in Chronic Hepatitis B  

Tuesday, Nov. 29 3:40PM - 3:50PM Room: E353A

Laurent Milot, Lyon, France (Abstract Co-Author) Nothing to Disclose  
Stephanie R. Wilson, MD, Calgary, AB (Abstract Co-Author) Equipment support, Siemens AG; Equipment support, Koninklijke Philips NV

**PURPOSE**

This prospective study comprises 224 patients, from 5 geographically separate centres, presenting for evaluation of a focal liver mass (12 adenoma, 8 cholangiocarcinoma, 55 FNH, 71 HCC, 25 metastasis, 12 other). All had US/CEUS and CT and/or MR. CEUS was performed with Definity (Lantheus, Billerica MA) on standard US systems. They included a continuous cine of wash-in to peak enhancement, and still portal venous and delayed images to 5 minutes. CT and MR were performed as standard care with institutional protocols. Pre-contrast, arterial phase and portal venous phase images were included. Three separate electronic blind read files; one for each of CEUS (including grayscale and Doppler images), CT and MR were created and read blindly by four radiologists, two for CEUS and two for CT/MR utilizing a Microsoft Access based questionnaire regarding the arterial, portal venous and delayed phase enhancement of each lesion. Readers also provided a preference for malignancy or benignancy, a final diagnosis as well as a confidence level. Results of the blind read were compared with the truth standard from pathology, long-term stability or expert consensus.

**RESULTS**

Our results show that CEUS is superior to grayscale/Doppler ultrasound and at least equivalent to CT and MR both in determining the malignancy of a lesion and in diagnostic accuracy, with an increase in confidence from a mean of 1.6 for grayscale/Doppler to 3.9 on CEUS on a 5 point scale. Sensitivity, specificity and accuracy of CEUS are 95%, 82%, 67%; of grayscale/Doppler are 81%, 56%, 40%; of CT are 89%, 75%, 62% and of MR are 85%, 79%, 62% respectively.

**CONCLUSION**

CEUS is superior to grayscale ultrasound both for determination of malignancy and when assigning a final diagnosis for a focal liver mass. Additionally, CEUS is equivalent, and in select cases performs better, in the characterization of focal liver lesions than institutional CT and MRI.

**CLINICAL RELEVANCE/APPLICATION**

In the evaluation of a focal liver mass, CEUS is a necessary adjuvant to grayscale/Doppler ultrasound and is equivalent to CT and MR in its ability to predict malignancy and provide a diagnosis.
Participants
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Wenping Wang, MD, PhD, Shanghai, China (Abstract Co-Author) Nothing to Disclose

PURPOSE
To explore the value of 2D-SWE in assessing the extent of liver fibrosis with chronic hepatitis B (CHB) and to compare its diagnostic accuracy with different fibrosis indices involving aminotransferase/platelet ratio index (APRI), fibrosis index based on the 4 factors (FIB-4), King’s score and Forns index.

METHOD AND MATERIALS
A total of 384 subjects (304 with CHB and 80 controls) who underwent partial hepatectomy were enrolled and divided into five groups (S0–S4) according to Scheuer scoring system histologically. All patients were examined with 2D-SWE to obtain liver stiffness measurements (LSMs), which were compared with the histological findings and analyzed with factors including age, gender and several blood markers that might influence the value of LSMs.

RESULTS
The intraclass correlation coefficient of five LSMs with 2D-SWE was 0.948. The average LSMs were 5.74±1.10 kPa for fibrosis S0 (n=10), 6.53±0.96 kPa for S1 (n=30), 7.94±0.89 kPa for S2 (n=50), 9.40±1.31 kPa for S3 (n=47), and 14.52±3.55 kPa for S4 (n=167). The multiple comparisons of LSMs showed significant statistical difference between every two fibrotic groups expect between S0 and S1 groups. For the prediction of S≥2 and S=4, the optimal cut-off values of LSMs were 7.6 kPa and 10.4 kPa, with a sensitivity of 92.0% and 94.6% and a specificity of 90.0% and 94.9%, respectively. All these methods correlated with fibrosis stages statistically (p<0.05) and the correlation coefficients between pathological stages with LSMs, APRI, FIB-4, King’s score and Forns index were 0.875, 0.409, 0.397, 0.428 and 0.452, respectively. The AUROC in diagnosing fibrosis S≥2 were 0.970, 0.771, 0.727, 0.787, and 0.765, respectively; and the AUROC were 0.986, 0.703, 0.712, 0.716, and 0.740 for diagnosing S=4, respectively. Liver fibrosis stages, inflammatory activity grades and the level of gamma glutamyltranspeptidas (GGT), alkaline aminotransferase (ALT), and aspartate aminotransferase (AST) significantly correlated with LSMs (β=0.618, 0.015, 0.079, -0.083 and 0.146, respectively; p<0.05).

CONCLUSION
2D-SWE could be used to predict significant fibrosis (S≥2) and cirrhosis (S=4) in CHB patients with notable higher diagnostic accuracy than serum fibrosis models. In terms of LSM associated with hepatic fibrosis, the confounding factors including inflammatory activity, and the level of GGT, ALT, and AST that independently influence the value of LSMs with 2D-SWE.

CLINICAL RELEVANCE/APPLICATION
N/A

SSJ08-05 Initial Experience Using a Telerobotic Ultrasound System to Perform Adult Abdominal Examinations

Tuesday, Nov. 29 3:40PM - 3:50PM Room: E353A

Awards
Student Travel Stipend Award

Participants
Scott J. Adams, Saskatoon, SK (Presenter) Nothing to Disclose
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Rhonda Bryce, MD, Saskatoon, SK (Abstract Co-Author) Nothing to Disclose
Luis Bustamante, Saskatoon, SK (Abstract Co-Author) Nothing to Disclose

PURPOSE
To assess the feasibility of performing adult abdominal examinations using a telerobotic ultrasound system in which radiologists/sonographers can control fine movements of a transducer and all ultrasound settings from a remote location.

METHOD AND MATERIALS
Eighteen patients prospectively underwent a conventional sonography examination (using EPIQ 5, Philips or LOGIQ E9, GE Healthcare) followed by a telerobotic sonography examination (using the MELODY System, AdEchoTech; SonixTablet, BK Ultrasound; and TE30 All-in-One HD Videoconferencing Endpoint, Huawei Technologies) according to a standardized abdominal imaging protocol. For telerobotic examinations, patients located at an imaging clinic were scanned remotely by a sonographer 2.75 km away. Conventional examinations were read independently from telerobotic examinations. We assessed the ability of the system to generate images of diagnostic quality and acceptability of the system to patients and sonographers.

RESULTS
92% of organs visualized on conventional examinations were sufficiently visualized on telerobotic examinations. Five pathological findings were identified on both telerobotic and conventional examinations, three findings were identified using only conventional sonography and two findings were identified using only telerobotic sonography. A paired sample t-test showed no significant difference between the two modalities in measurements of the liver, spleen, and diameter of the proximal aorta; however, telerobotic assessments overestimated distal aorta and common bile duct diameters and underestimated kidney lengths (p-values <0.05). All patients strongly agreed or somewhat agreed that they would be willing to have another telerobotic examination.

CONCLUSION
CLINICAL RELEVANCE/APPLICATION

A telerobotic ultrasound system is feasible for performing abdominal ultrasound examinations at a distant location with minimal training and set-up requirements and may improve access to care.

Honored Educators

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Paul S. Babyn, MD - 2012 Honored Educator

PURPOSE

To assess whether the analysis of time-intensity curves obtained after sulphur hexafluoride-filled microbubble contrast agent injection could differentiate inflammatory from fibrotic ileal stenoses among patients with Crohn’s disease (CD).

METHOD AND MATERIALS

Sixty-five consecutive patients (40 male and 25 female; mean age ± SD, 42.2 years ± 12.22) with a diagnosis of CD were included. Inclusion criteria were: (1) CD involving the terminal ileal loop as shown by endoscopy with serial deep mucosal biopsies or cross sectional imaging with a thickness of the terminal ileal loop >3mm; (2) availability of the histologic score based on mucosal ulceration (grade 0–3), edema (grade 0–3), and quantity (grade 0–3) and depth (grade 0–4) of neutrophilic infiltration; (3) availability of mural fibrosis diagnosis when abnormal depositions of collagens were identified in the edges of mucosal ulceration; (4) at least 12 weeks of clinical follow-up in CD diagnosed no more than 2 years before the study. In each patient the terminal ileal loop was scanned by a convex-array probe (2–5 MHz) before and after sulfur hexafluoride-filled microbubble injection. The digital cine-clips registered after microbubble injection during the first-pass dynamic enhancement was quantified in linear units by a dedicated software through manually-drawn regions of interest (ROIs) encompassing the anterior bowel wall. Time-intensity curves from patients with inflammatory and fibrotic stenosis were compared. The peak enhancement, rise time, time to peak, area under the time-intensity curve (AUC), AUC during wash-in (AUCWI), and AUC during wash-out (AUCWO) were compared between patients with inflammatory or fibrotic strictures.

RESULTS

Inflammatory (n=40) vs fibrotic stenoses (n=25) differed in the AUC (234274 ± 293293 vs 89787 ± 53819; P = <0.05), AUCWI (53256 ± 53871 vs 30993 ± 19454; P = <0.05), AUCWO (150910 ± 177859 vs 61930 ± 36181; P = <0.05) and peak enhancement (11556 ± 11298 vs 6252 ± 5504; P<.05).

CONCLUSION

The quantitative analysis of small bowel wall contrast enhancement after microbubble contrast agent injection may differentiate inflammatory from fibrotic ileal stenoses in patients with CD.

CLINICAL RELEVANCE/APPLICATION

Contrast-enhanced ultrasound provides an early identification of those patients with a fibrotic ileal stricture who deserve surgical resection from those patients with an inflammatory stricture who deserve pharmacologic treatment.
SSJ11

Disposition after Percutaneous Thermal Ablation of localized RCC: Risk Factors Associated with Need for Hospitalization

Tuesday, Nov. 29 3:00PM - 3:10PM Room: E353B

Participants
David D. Childs, MD, Clemmons, NC (Moderator) Nothing to Disclose
Steven S. Raman, MD, Santa Monica, CA (Moderator) Nothing to Disclose

Sub-Events
SSJ11-01 Disposition after Percutaneous Thermal Ablation of localized RCC: Risk Factors Associated with Need for Hospitalization

Tuesday, Nov. 29 3:00PM - 3:10PM Room: E353B

Participants
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Meghan G. Lubner, MD, Madison, WI (Abstract Co-Author) Grant, Koninklijke Philips NV; Grant, Johnson & Johnson;
Fred T. Lee JR, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Jason Abel, Madison, WI (Abstract Co-Author) Nothing to Disclose

PURPOSE
To identify patient and tumor characteristics predictive of early procedure related complications in patients undergoing thermal ablation of localized renal cell carcinoma.

METHOD AND MATERIALS
Retrospective review of 235 consecutive patients who underwent percutaneous thermal ablation for localized RCC from 2001-2015. Patient demographics, comorbidities, pathology, tumor size, RENAL score, procedure and hospital course details, and 30 day complications were recorded. We used an inclusive retrospective assessment to determine which patients benefited from overnight hospitalization. This included patients experiencing a complication, those who stayed >24 hours and those readmitted within 72 hours from discharge. Fischer’s exact, Wilcoxon rank sum, and univariate logistic regression tests were used as appropriate.

RESULTS
High-grade complications (3.4%) were rare. Six patients (2.5%) had a bleeding complication. These patients had a higher BMI (39.4 vs 31.3, p=0.047), larger tumors (median 4.0 vs 2.6cm, p=0.04), higher RENAL score (9 vs 7, p=0.056) and were more likely to have a hematoma on immediate post-procedure CT (67% vs 12%, p=0.004). Patients with a hematoma were 14.3x more likely to have a bleeding complication (p=0.0028). The use of ≥3 ablation applicators was associated with an 18.9x risk of bleeding (p=0.008). In retrospect, 14 patients (6%) were judged to benefit from hospital admission. Factors associated with this include tumor ≥3cm (OR 4.4, p=0.152), RENAL score >8 (OR 7.2, p=0.0012), post-procedure hematoma (OR 5.6, p=0.0029), and using ≥3 ablation applicators (OR 7.2, p=0.0007).

CONCLUSION
High-grade complications, including significant bleeding, are rare following thermal ablation of localized RCC. Larger tumors, higher tumor complexity, post-procedure hematoma, and higher BMI increase the risk for complications. These patients may benefit from overnight hospital admission.

CLINICAL RELEVANCE/APPLICATION
The majority of patients who undergo percutaneous thermal ablation of renal cell carcinoma can be safely discharged on the day of the procedure and avoid the cost and inconvenience of hospitalization.

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/

Meghan G. Lubner, MD - 2014 Honored Educator
Meghan G. Lubner, MD - 2015 Honored Educator

SSJ11-02 Single Institutional Review of 15 Years of Renal Mass Biopsy

Tuesday, Nov. 29 3:10PM - 3:20PM Room: E353B

Participants
Rosaleen B. Parsons, MD, Philadelphia, PA (Presenter) Nothing to Disclose
David B. Cahn, DO, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Alexander Kutikov, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
David Y. Chen, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Richard E. Greenberg, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Rosalie Viterbo, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Marc Smaldone, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Robert Uzzo, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

PURPOSE
The purpose of this study was to review our 15 yr institutional experience with renal mass biopsy

METHOD AND MATERIALS
Using our prospectively maintained database we identified patients who underwent renal mass biopsy and reviewed our institutional experience and assessed pathologic and histologic features and concordance rates.

RESULTS
A total of 374 renal biopsies were performed from 1999-2015. Core(+/- FNA) was performed in 65.2% of the cases and 41% underwent surgical resection. Core was nondiagnostic in 9% of surgical cases and subsequently diagnosed with RCC. 11% of biopsies were benign and no surgery was performed. Of the benign lesions 69% were oncocytoma and 2.% angiomyolipoma. RCC diagnosed on core sampling that underwent resection demonstrated histological grade concordance of 94.3% /62.5%. All discordant grades were upgraded at surgery. FNA was performed on 22.7% of cases and at final pathology histologic concordance was 72.5% and 5% were upgraded from benign to malignant.

CONCLUSION
Renal lesion biopsy is effective in the evaluation of renal masses and our data is consistent with previously published data. This underscores that although biopsy harbors clinical uncertainties diagnostic accuracy may assist in clinical management. Pathways incorporating renal biopsy may decrease over treatment but may also risk under treatment based on poor grade concordance.

CLINICAL RELEVANCE/APPLICATION
Renal mass biopsy is becoming increasingly important in the patient management and as radiologists we should anticipate that requests for biopsy of renal masses will continue.

SSJ11-04  
MRgFUS as Minimvasive Alternative Therapy in the Treatment of Submucosal Fibroids: Effectiveness and Safety

Participants
Fabiana Ferrari, MD, LAquila, Italy (Abstract Co-Author) Nothing to Disclose
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Francesco Arrigoni, Coppito, Italy (Abstract Co-Author) Nothing to Disclose
From July 2012 to June 2014, 13 patients (mean age 48 years), affected by submucosal uterine fibroids, were treated using MRgFUS. The patients were submitted to preliminary MRI to classify the sub-mucosal fibroids (FIGO classification) and to measure the pre-treatment fibroid volumes. Sub-mucosal fibroids of type 0, 1 and 2 (measuring between 1.5 and 4 cm) were treated using MRgFUS. Five out of 13 patients presented only a single submucosal fibroid (2 of type 1, 2 of type 2 and 1 of type 0). Eight out of 13 patients were simultaneously affected by sub-mucosal fibroids (6 of type 2, 3 of type 1 and 2 of type 0) and other fibroids (type 3-6). The patients were submitted to one treatment alone. Immediately after treatment, the patients were submitted to c.e. MRI to evaluate the Non Perfused Volume (NPV) on the c.e. T1–weighed sequences and measure the radicalization of the treatment in comparison to the pre-treatment volume and after 2-4 years from the treatment.

RESULTS
All treated patients presented a mean extension of the NPV of 90% with a significant radicalization of the treatment without complications or side effects. After 2-4 years from the treatment, 7/13 (54%) showed progressive reduction of the volume with a regularization of the uterine wall. Five out of 13 patients (38%) showed significant reduction of fibroid volume (about 80%). In one patient (8%), the fibroids of type 0 were partially eliminated from inside the uterine cavity. In this case, the patient was submitted to close MRI follow-up, which showed progressive elimination of the necrotic product. A poor vaginal bleeding lasted 15 days without necessity of hysterectomy.

CONCLUSION
MRgFUS represent a valid minimvasive and radical approach in the treatment of submucosal fibroids. It allows treatment of the intramural part of the fibroid that cannot be completely treated with hysterectomy.

CLINICAL RELEVANCE/APPLICATION
MRgFUS is promising technique in submucosal fibroids without significant risks and complications.
Awards

Student Travel Stipend Award

Participants
Sumin S. Lee, MD, Winston-Salem, NC (Presenter) Nothing to Disclose
Keyanoosh Hosseinzadeh, MD, Winston Salem, NC (Abstract Co-Author) Nothing to Disclose
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PURPOSE

PATSS is a debilitating condition, an under-recognized complication of combined endometrial ablation and surgical sterilization. The aim is to determine imaging features of PATSS in symptomatic women.

METHOD AND MATERIALS

Retrospective chart review revealed 104 women who had endometrial ablation (EA) and surgical sterilization (SS). Inclusion criteria consisted of symptomatic women with imaging studies. 38 patients with total of 55 studies were included. Two radiologists independently reviewed randomized studies in a blinded fashion for presence or absence of: cornual hematometra, central hematometra, hematosalpinx or fluid filled fallopian tube, adhesions, endometriosis, and adenomyosis. Discordances were resolved by a third radiologist. Interobserver agreement was assessed by kappa statistics for the imaging features and diagnosis of PATSS (fluid filled fallopian tube and either central or cornual hematometra).

RESULTS

18 CT, 34 ultrasound, and 3 MRI studies were performed. Kappa values for CT and US were: cornual hematometra (0.77 vs 0.59), central hematometra (0.43 vs 0.15), fluid filled fallopian tube (0.63 vs 0.69), PATSS (0.68 vs 0.64), adhesions (0.15 vs 0.42), adenomyosis (0.55 vs 0.39), and endometriosis (1.0 vs 0.65). Interobserver analysis on MRI was excluded due to the small number. PATSS was diagnosed in 6/34 (18%) US, 5/18 (28%) CT, and 3/3 (100%) MRI. Concordance rates for PATSS with final radiology reports were: 4/6 (67%) US, 2/5 (40%) CT, and 3/3 (100%) MRI. 4 out of 11 (36%) women diagnosed with PATSS underwent hysterectomies, often without salpingectomies, with pathology report demonstrating changes consistent with only endometrial ablation.

CONCLUSION

PATSS is under-diagnosed in symptomatic women with history of endometrial ablation and surgical sterilization, with fair to good agreement by US and CT. Limited hysterectomy pathologies are not diagnostic for PATSS. Rather, given the data above, radiologic studies should be considered diagnostic in evaluation of this new entity given management considerations.

CLINICAL RELEVANCE/APPLICATION

Radiologists need to recognize imaging features related to complications of EA and SS procedure with increasing awareness of PATSS.
Participants
Zheng Feng Lu, PhD, Chicago, IL (Moderator) Nothing to Disclose
R. Jason Stafford, PhD, Houston, TX (Moderator) Nothing to Disclose

Sub-Events
SSJ21-01 Monitoring Neoadjuvant Chemotherapy Response of Breast Cancer using 4D Subharmonic Aided Pressure Estimation and Imaging with Ultrasound Contrast Agents

Participants
Kibo Nam, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
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Flemming Forsberg, PhD, Philadelphia, PA (Presenter) Equipment support, Toshiba Corporation; Research Grant, Toshiba Corporation; Equipment support, Siemens AG; In-kind support, General Electric Company; In-kind support, Lantheus Medical Imaging, Inc.

PURPOSE
To determine if 4D subharmonic aided pressure estimation (SHAPE) and imaging (SHI) can predict the response of breast cancer to neoadjuvant chemotherapy based on changes in interstitial fluid pressures and breast tumor vascularity.

METHOD AND MATERIALS
Seventeen patients scheduled for neoadjuvant therapy of a localized breast cancer underwent 4 ultrasound exams: immediately prior to therapy, at 10%, 60%, and 100% completion of chemotherapy. The exams were performed using a modified Logiq 9 scanner with a 4D10L probe (GE Healthcare, Milwaukee, WI). Modified software enabled RF data collection from 4D subharmonic imaging (transmitting pulses at 5.8 MHz and receiving at 2.9 MHz) before and during infusion of the contrast agent Definity (Lantheus Medical Imaging, N Billerica, MA) at acoustic settings optimized for SHAPE and SHI separately. The maximum subharmonic frequency magnitude and mean subharmonic intensity were calculated from the RF data of SHAPE and SHI, respectively, for all 4 exams. The relative signal differences in the tumor relatively to the surrounding area were then compared according to the final tumor treatment response.

RESULTS
Four patients left the study and 2 patients’ data were discarded due to technical problems. Patients’ clinical outcomes consisted of 6 complete responders (final tumor size < 10% of the original) and 5 partial/non responders. The results from 10% completion of the therapy showed the subharmonic signal increased more in the tumor than in the surrounding area for complete responders compared to partial/non responders (3.23 ± 1.41 dB vs. -0.88 ± 1.46 dB; p = 0.001 from SHAPE and 1.32 ± 0.73 dB vs. -0.82 ± 0.88 dB; p = 0.002 from SHI). Also the relative subharmonic signal in the tumor increased for complete responders, but decreased for partial/non responders after 10% completion of the therapy relatively to that before the therapy. Moreover, 3 patients whose tumor size increased after 10% completion of the therapy were predicted by SHAPE and SHI to be complete responders.

CONCLUSION
4D SHAPE and SHI have the potential to predict neoadjuvant chemotherapy response of breast cancer as early as at 10% completion of the therapy; albeit based on a small sample size.

CLINICAL RELEVANCE/APPLICATION
It may be possible to predict neoadjuvant chemotherapy treatment response of breast cancers prior to changes in tumor size using contrast-enhanced SHAPE or SHI.
To compare shear-wave speed (SWS) measured by US-based point shear-wave elastography (pSWE) using acoustic radiation force impulse (ARFI) technology and magnetic resonance elastography (MRE) on phantoms with known shear modulus, and to assess the method validity and variability.

RESULTS

Four homogeneous phantoms of different stiffness were made for this study. Their shear modulus was physically measured by rheometer, and this value used as standard. Ten SWS measurements were obtained with 1.0 – 4.5 MHz convex (4C1) and 4.0 – 9.0 MHz linear (9L4) transducers using pSWE, at four different depths each (2, 4, 6, 8cm for 4C1 transducer and 1, 2, 3, 4 cm for 9L4). Spin-echo echo planar imaging (SE-EPI) MRE was carried out once per phantom, and SWS at five different depths (2, 3, 4, 5, 6 cm) was obtained. These SWS were then compared with those obtained by rheometer using linear regression analyses. Repeatability of the 10-repeat pSWE measurement was assessed with single-measure intraclass correlation coefficient (ICC).

CONCLUSION

SWS’ from pSWE and MRE showed a strong correlation with rheometer-determined SWS. Although based on phantom studies SWS’ obtained with these methods are not always equivalent, the measurement can be thought of as reliable and these SWS’ were reasonably close to each other for the middle range of stiffness within the measurable range.

SWS’ from pSWE and MRE gave similar SWS for the middle range of stiffness within the measurable range, on the other hand, SWS’ obtained with these modalities were not equivalent for the extremes of the total measurement range.

SSJ21-03 Improved Measurement of Portal Pressures Using Subharmonic Contrast Imaging and Pulse Shaping

Tuesday, Nov. 29 3:20PM - 3:30PM Room: S403A

Participants

Iphita Gupta, MS, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Flemming Forsberg, PhD, Philadelphia, PA (Presenter) Equipment support, Toshiba Corporation; Research Grant, Toshiba Corporation; Equipment support, Siemens AG; In-kind support, General Electric Company; In-kind support, Lantheus Medical Imaging, Inc
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Ji-Bin Liu, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
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Michael C. Soulen, MD, Philadelphia, PA (Abstract Co-Author) Royalties, Cambridge University Press; Consultant, Guerbet SA; Research support, Guerbet SA; Consultant, BTG International Ltd; Research support, BTG International Ltd; Consultant, Merit Medical Systems, Inc; Speaker, Sirtex Medical Ltd; Consultant, Terumo Corporation; Consultant, Bayer AG
Chandra Sehgal, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
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John R. Eisenbrey, PhD, Philadelphia, PA (Abstract Co-Author) Support, General Electric Company; Support, Lantheus Medical Imaging, Inc

PURPOSE

To analyze the effect of pulse shape on the sensitivity of subharmonic aided pressure estimation (SHAPE) in vitro and in vivo, and using SHAPE to estimate portal pressures in patients undergoing a transjugular liver biopsy compared to the hepatic venous pressure gradient (HVPG).

METHOD AND MATERIALS

A Logiq 9 ultrasound scanner with a 4C curvi-linear probe (GE, Milwaukee, WI) was used to acquire radio frequency data. The SHAPE mode was set to transmit 4 cycle pulses at 2.5 MHz and receive subharmonic signals at 1.25 MHz. The contrast agent Sonazoid (GE, Oslo, Norway) was infused at a rate of 0.024 μL/kg/min. Eight different pulse waveforms (3 narrowband and 5 broadband) were implemented and tested in vitro and in vivo in 3 canines. Sensitivity of the pulses for SHAPE was based on the decrease in the subharmonic signal amplitude with increasing ambient pressure and correlation coefficients. Next, 43 transjugular liver biopsy subjects were enrolled as part of an ongoing IRB approved protocol. Post biopsy, patients received an infusion of Sonazoid. An ROI within the portal vein was selected and an automated power control algorithm was initiated to determine the optimal acoustic output power for maximum SHAPE sensitivity. Cine loops were collected in triplicate, averaged and compared to the HVPG.

RESULTS

A linear decrease in subharmonic amplitude with increased pressure was observed for all waveforms (r from -0.77 to -0.93; p<0.001) in vitro. Data from 1 of the 3 canines was eliminated for technical reasons, while the other 2 produced similar results to
those obtained in vitro (r from -0.72 to -0.98; p<0.01). Overall, the broadband pulses performed better (p<0.05). Within the broadband group, the Gaussian windowed binomial filtered square wave was the most sensitive. The linear relationship between the SHAPE gradient (obtained with the new pulse) and HVPG over the patient dataset showed a good correlation (r = 0.72).

CONCLUSION
Pulse shaping can greatly improve the sensitivity of SHAPE. A Gaussian windowed binomial filtered square wave gives the highest correlation between changes in subharmonic amplitude of the microbubbles and ambient pressure changes. Results in patients indicate SHAPE may be useful for estimation of portal pressures.

CLINICAL RELEVANCE/APPLICATION
It may be possible to noninvasively quantify portal vein pressures and accurately diagnose portal hypertension using SHAPE.

SSJ21-04 A Novel Wearable Fluorescence Surgical Navigation System for Segmentectomy

Tuesday, Nov. 29 3:30PM - 3:40PM Room: S403A

Participants
Kunshan He, Beijing, China (Abstract Co-Author) Nothing to Disclose
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Yamin Mao, Beijing, China (Abstract Co-Author) Nothing to Disclose
Jie Tian, PhD, Beijing, China (Abstract Co-Author) Nothing to Disclose
Kun Wang, Beijing, China (Presenter) Nothing to Disclose

PURPOSE
Recently, segmentectomy has become a secure and effective treatment for certain small, early-stage lung cancer, especially in patients with emphysema. To achieve complete segmentectomy, it is critical to precisely identify adjacent lung segments, which is difficult for surgeons without suitable interventions. Thus, a novel technique by transbronchial or intravenous injection of indocyanine green (ICG) has been developed, which can efficiently avert needless resection, lower the costs and reduce complications. However, lack of intraoperative fluorescence imaging systems has seriously impeded the further development of this method. So, we developed a novel wireless wearable fluorescence surgical navigation system (WFNS).

METHOD AND MATERIALS
WFNS is composed of a laptop, Google glass, light source and handle, which consists of a filter, C mount lens and CCD camera. Firstly, NIR light excited by the light source transmitted through the filter, illuminated the target and then was collected by the NIR camera installed in the handle. An application was written to capture real-time images. Finally, the result was displayed synchronizing the Google glass with the laptop.

RESULTS
Twelve swine were equally divided into two groups. Group A was injected with 0.2mg/kg ICG into the marginal ear vein and Group B was injected with 0.6mg/kg ICG. Five seconds later after injection, the black-and-white transition borders among the targeted segment and the non-targeted segments were easily recognized visually in all swine. Real-time videos were displayed on the prism screen of the Google glass during the surgery. Using ImageJ (Image Processing and Analysis Application in Java), the corresponding SBR of the two groups (Group A and Group B) were 9.00±0.70 and 8.96±1.23 respectively. The NIR fluorescent images of Group A lasted ten minutes and those of Group B lasted up to fourteen minutes until the SBR was 1. Besides, the surgical field was 200 mm×200mm.

CONCLUSION
This study demonstrates our system has major advantages in identifying intersegmental planes and potentials in determining the margin of tumors.

SSJ21-05 Clinical Evaluation of Real-Time Optical Tracking to Provide Feedback During Blinded Contrast-Enhanced Ultrasound Imaging

Tuesday, Nov. 29 3:40PM - 3:50PM Room: S403A

Participants
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Rosa Maria Silveira Sigrist, MD, Palo Alto, CA (Abstract Co-Author) Nothing to Disclose
Juergen K. Willmann, MD, Stanford, CA (Abstract Co-Author) Research Consultant, Bracco Group; Research Grant, Siemens AG; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company; Advisory Board, Lantheus Medical Imaging, Inc; Advisory Board, Bracco Group
Dimitre Hristov, PhD, Stanford, CA (Abstract Co-Author) Research Consultant, Bracco Group, Koninklijke Philips NV; Partner, SoniTrack Systems, Inc

CONCLUSION
To the best of our knowledge, this study is the first to demonstrate the feasibility of tracking for 3D DCE-US to provide feedback during lengthy scan sessions.

Background
Current commercial matrix transducers for 3D Dynamic Contrast-Enhanced Ultrasound (3D DCE-US) do not display side-by-side B-mode and contrast-mode images, thus leaving the operator with no position feedback during lengthy acquisitions. The purpose of this study was to demonstrate the feasibility of using tracking to provide positioning feedback and to assess resulting improvements.
Evaluation

A tracking system was developed in house using infrared camera (Polaris, NDI, Canada) and a 3D-printed tracking target attached to a X6-1 matrix transducer. Cameras were connected to a PC, enabling real-time streaming of transducer coordinates and display of virtual probe on a separate screen. The tracking system captures a reference position to provide operators positioning feedback when no B-mode image is available. To test this set-up, five experienced operators were asked to locate an image landmark within a healthy volunteer liver in B-mode images using the X6-1 connected to an EPIQ7 system (Philips, Bothell, WA). Operators were then asked to maintain the transducer position for 4 min under three feedback methods: i) B-mode, ii) display of real-time virtual transducer, iii) blind. The magnitude of displacement of a voxel over the cine was computed relative to the reference position as an estimate of the imaging position error.

Discussion

Results suggest that tracking can assist operators maintain a position during a lengthy acquisition. An average displacement of 3.75 mm with standard deviation (S.D.) of 3.31 mm and displacement histogram skewness of -0.18 was noted when using B-mode feedback. When blinded, an average displacement of 4.58 mm (S.D. 2.65 mm; skewness 6.19) was noted. In contrast, the average displacement for tracking-feedback was comparable to that from B-mode at 3.48 mm (S.D. 0.8 mm; skewness 0.09). One operator performed better with tracking than B-mode; one operator performed better blinded than with tracking and B-Mode.

SSJ21-06 An Experimental Study for the Evaluation of the Photoacoustic Effect of Pectin-melanin Admixture in the Subcutaneous Muscle Layer and Liver of Rat as a Long-retaining Inoculating Photoacoustic Contrast Agent

Tuesday, Nov. 29 3:50PM - 4:00PM Room: S403A

Participants
Won Jae Lee, MD, Seoul, Korea, Republic Of (Presenter) Research Grant, Samsung Electronics Co, Ltd
Hyo Keun Lim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE

To evaluate the feasibility of biocompatible pectin-melanin admixture to be used as a long-retaining, inoculating photoacoustic (PA) contrast agent by comparing the sustainability for the PA effect of melanin alone and pectin-melanin admixture in the subcutaneous muscle layer and liver of rat.

METHOD AND MATERIALS

Two types of biocompatible PA contrast agents, i.e., the 'melanin alone' (3% melanin) and 'pectin-melanin admixture' (2% pectin and 3% melanin) were inoculated into two organs, i.e., the subcutaneous muscle (hypovascular) and liver (hypervascular) of 40 rats so that each contrast agent was inoculated into ten of each organ. PA imaging was obtained every week after the contrast inoculation for four weeks, and analyzed qualitatively (the presence of PA signal) and quantitatively (the measurement of relative PA signal intensity). PA imaging was performed with a L5-13 linear array transducer (Accuvix A30, Samsung Medison, Seoul, Korea) combined with a Nd:YAG laser (Phocusmobile, Optek, USA).

RESULTS

Both 'melanin alone' and 'pectin-melanin admixture' groups showed persistent PA signals during four weeks when inoculated into the subcutaneous layer, while only 'pectin-melanin admixture' group showed persistent PA signals during four weeks when inoculated into the liver.

CONCLUSION

The biocompatible 'pectin-melanin admixture' can be used as a long-retaining, inoculating PA contrast agent, regardless of the organ vascularity.

CLINICAL RELEVANCE/APPLICATION

If this biocompatible PA contrast agent becomes available clinically, PA imaging combined with this contrast agent can be used for pre- or intra-operative localization of various cancers such as breast cancer and liver metastasis after chemotherapy.
Thyroid and Neck Ultrasound (An Interactive Session)
Tuesday, Nov. 29 4:30PM - 6:00PM Room: E451A

RC410A Thyroid Nodules: When and What to Biopsy

Participants
Mary C. Frates, MD, Sharon, MA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Discuss the sonographic characteristics that are associated with a high probability that a thyroid nodule is likely malignant or likely benign. 2) Gain an understanding of the rationale of the current guidelines for recommending thyroid fine needle aspiration.

ABSTRACT
This presentation will review the epidemiology of thyroid nodules and thyroid cancer and correlate the sonographic findings of thyroid nodules with the risk of malignancy. Analysis of the sonographic features of thyroid nodules has become the preeminent non-invasive tool for analyzing the risk of malignancy of thyroid nodules and aids in selecting which nodules should undergo fine needle aspiration (FNA). A number of sonographic features have shown a high specificity for the diagnosis of thyroid cancer and include marked hypoechogenicity, the presence of microcalcifications, infiltrating or micro-lobulated borders, and a taller-wide shape. Sonographic patterns can also identify those nodules with a very low risk of malignancy, making biopsy unnecessary in low risk adults. The current guidelines for recommending thyroid fine needle aspiration and the timing of sonographic follow-up imaging will also be discussed.

RC410B Thyroid Elastography

Participants
Richard G. Barr, MD, PhD, Youngstown, OH (Presenter) Consultant, Siemens AG; Consultant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, SuperSonic Imagine; Speakers Bureau, Koninklijke Philips NV; Research Grant, Bracco Group; Speakers Bureau, Siemens AG; Consultant, Toshiba Corporation; Research Grant, Esaote SpA; Research Grant, B and K Ultrasound; Research Grant, Hitachi Aloka Ultrasound

LEARNING OBJECTIVES
1) Explain the difference between strain and shear wave elastography. 2) Understand the techniques to be able to perform thyroid ultrasound elastography. 3) Apply ultrasound elastography into routine clinical practice of thyroid nodules.

ABSTRACT

RC410C Parathyroid and Other Neck Masses including Lymph Nodes Post-Thyroidectomy

Participants
Michael D. Beland, MD, Providence, RI, (mbeland@lifespan.org ) (Presenter) Consultant, Hitachi, Ltd

LEARNING OBJECTIVES
1) Identify abnormal parathyroid glands based on sonographic characteristics. 2) Develop an accurate differential for cystic lesions in the neck based on sonographic characteristics, lesion location and clinical circumstances. 3) List the most common etiologies of other solid and cystic lesions located in the neck. 4) Recognize the sonographic characteristics that suggest metastatic disease in cervical lymph nodes.

ABSTRACT
LEARNING OBJECTIVES

1) Describe the sonographic characteristics of thyroid nodules that are suspicious for malignancy. 2) a. Discuss the Bethesda Cytology Classification of Thyroid FNA results and the risk of malignancy associated with each category. b. Describe the indications for new genetic tests that may be performed on FNAs obtained from thyroid nodules with indeterminate cytology. 3) a. Describe the technique of US-guided biopsy of thyroid nodules and cervical lymph nodes in patients who have undergone thyroidectomy for thyroid cancer. b. Discuss the rationale and method of performance of US-guided ethanol ablation of malignant cervical adenopathy in post thyroidectomy patients.

ABSTRACT

This presentation will consist of a three individual presentations. The first will review the sonographic characteristics of thyroid nodules that are suggestive of malignancy. Recommendations for selecting which thyroid nodules require ultrasound-guided biopsies which have been provided by both Radiology consensus conferences and published Endocrinology guidelines will be discussed. The second presentation will review with the Bethesda Cytology Classification of Thyroid FNA results and the risk of malignancy associated with each category. Additionally this presentation describes the indications for two new genetic tests that may be performed on FNAs obtained from thyroid nodules with indeterminate cytology. The last presentation will provide a detailed description of the technique for performing ultrasound guided biopsy of thyroid nodules and cervical lymph nodes. Various methods will be discussed and required equipment outlined. Possible complications, though rare, will be described. A comparison of the typical sonographic features of normal versus abnormal lymph nodes will be presented in an effort to identify those patients in whom sonographic follow up can be used instead of biopsy. A discussion of the possible advantages of adding thyroglobulin assay to cytologic evaluation will be provided. The rationale for and technique of performing ultrasound guided ethanol ablation of malignant cervical lymph nodes in patients with thyroid cancer will be undertaken.
Nerve Ultrasound Based on a Regional Approach: Elbow to Hand (Hands-on)

Tuesday, Nov. 29 4:30PM - 6:00PM Room: E264

Participants
Carlo Martinoli, MD, Genova, Italy (Presenter) Nothing to Disclose
Etienne Cardinal, MD, Montreal, QC (Presenter) Nothing to Disclose
Mary M. Chiavaras, MD, PhD, Ancaster, ON (Presenter) Consultant, Toshiba Medical Systems Corporation; Research Grant, Arthrex, Inc.;
Joseph G. Craig, MD, Detroit, MI (Presenter) Nothing to Disclose
Michael A. Dipietro, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
David P. Fessell, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Ghiyath Habra, MD, Detroit, MI (Presenter) Nothing to Disclose
Mary M. Chiavaras, MD, PhD, Ancaster, ON (Presenter) Consultant, Toshiba Medical Systems Corporation; Research Grant, Arthrex, Inc.;
Joseph G. Craig, MD, Detroit, MI (Presenter) Nothing to Disclose
Michael A. Dipietro, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Ghiyath Habra, MD, Detroit, MI (Presenter) Nothing to Disclose
Marnix T. van Holsbeeck, MD, Detroit, MI (Presenter) Consultant, General Electric Company; Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder MedEd3D; Grant, Siemens AG; Grant, General Electric Company;
Joseph H. Introcaso, MD, Neenah, WI (Presenter) Nothing to Disclose
Jon A. Jacobson, MD, Ann Arbor, MI (Presenter) Consultant, BioClinica, Inc; Royalties, Reed Elsevier;
Viviane Khoury, MD, Philadelphia, PA (Viviane.khoury@uphs.upenn.edu) (Presenter) Nothing to Disclose
Maia Kislakova, MD, Moscow, Russia (mislakova@yandex.ru) (Presenter) Nothing to Disclose
Andrea Krauser, MD, Reith bei Seefeld, Austria (Presenter) Nothing to Disclose
Kenneth S. Lee, MD, Madison, WI (klee2@uwhealth.org) (Presenter) Grant, General Electric Company; Research support, SuperSonic Imagine; Research support, Johnson & Johnson; Consultant, Echometrix, LLC; Royalties, Reed Elsevier
Humberto G. Rosas, MD, Madison, WI (Presenter) Nothing to Disclose
Matthieu Rutten, MD, Hertogenbosch, Netherlands (Presenter) Nothing to Disclose
Courtney E. Scher, DO, Detroit, MI (Presenter) Nothing to Disclose
Alberto S. Tagliafico, MD, Genova, Italy (Presenter) Nothing to Disclose
Ximena L. Wortsman, MD, Santiago, Chile, (xworts@yahoo.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Familiarize course participants with the ultrasound appearance of nerves and the scanning techniques used to image them in the distal upper extremity. 2) Emphasize the ultrasound anatomy of the median, ulnar, radial nerves and their divisional branches at the most common sites of entrapments, including the carpal tunnel and the cubital tunnel. 3) Learn the technique to image some minor nerves in their course throughout the distal upper extremity, such as the the lateral and the medial antebrachial cutaneous. 4) Outline the range of clinical conditions where ultrasound is appropriate as the primary imaging modality for nerve assessment.

ABSTRACT
In recent years, ultrasound of the musculoskeletal and peripheral nervous systems is becoming an increasingly imaging tool with an expanding evidence base to support its use. However, the operator dependent nature and level of technical expertise required to perform an adequate ultrasound assessment means that appropriate training is required. For this purpose, the present course will demonstrate the basic principles of musculoskeletal ultrasound with a special focus on nerves of the distal upper extremity (elbow to hand). The standardized techniques of performing an adequate ultrasound study of the median, ulnar, radial and their divisional branches, lateral cutaneous of the forearm and medial cutaneous of the arm and the forearm will be illustrated. The hands-on workshops will provide the opportunity to interactively discuss the role of ultrasound in this field with expert instructors. Participants will be encouraged to directly scan model patients. A careful ultrasound approach with thorough understanding of soft-tissue planes and extensive familiarity with anatomy are prerequisites for obtaining reliable information regarding the affected structure and the site and nature of the disease process affecting it.

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Michael A. Dipietro, MD - 2016 Honored Educator
Jon A. Jacobson, MD - 2012 Honored Educator
Ultrasound Wednesday Case of the Day

Wednesday, Nov. 30 7:00AM - 11:59PM Room: Case of Day, Learning Center

AMA PRA Category 1 Credit ™: .50

Participants
Aya Kamaya, MD, Stanford, CA (Presenter) Nothing to Disclose
Nirvikar Dahiya, MD, Saint Louis, MO (Abstract Co-Author) Nothing to Disclose
Shweta Bhatt, MD, MBBS, Rochester, NY (Abstract Co-Author) Nothing to Disclose
Jade J. Wong-You-Cheong, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Maryellen R. Sun, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Robert A. Kane, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Linda N. Morimoto, MD, Stanford, CA (Abstract Co-Author) Nothing to Disclose
Jennifer A. Steinkeler, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Christopher Czaplicki, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Maitray D. Patel, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Scott W. Young, MD, Scottsdale, AZ (Abstract Co-Author) Nothing to Disclose
Jeffry S. Kriegshauser, MD, Phoenix, AZ (Abstract Co-Author) Nothing to Disclose
Amelia Wnorowski, MD, Ellicott City, MD (Abstract Co-Author) Nothing to Disclose

TEACHING POINTS

1) Participants will learn to list the sonographic appearances of common and uncommon diseases. 2) Participants will learn to describe the differentiating features between similar diseases via a case based format. 3) Participants will learn to discuss the pathophysiology of diseases that are responsible for the sonographic appearance.
Liver Doppler, Contrast and Elastography

Wednesday, Nov. 30 8:30AM - 10:00AM Room: E353C

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

Participants

LEARNING OBJECTIVES

1) Understand the normal anatomy, anatomic variants of the hepatic vasculature. 2) Identify the normal Doppler flow profiles of the hepatic vasculature. 3) Understand the hemodynamic principles of portal hypertension and how they impact the Doppler waveforms of the hepatic arteries, portal veins and hepatic veins. 4) Understand the role of ultrasound in the evaluation of variceal pathways. 4) Indications when to use contrast enhanced ultrasound (CEUS) in focal liver diseases. 5) Kinetics of US contrast agents 6) Learning about the importance of the three contrast phases, how CEUS performs in detecting and characterizing focal liver lesions. 7) Learning about the potential value as well as the limitations of CEUS in liver disease. 8) Learning how CEUS performs when compared to B-mode, color Doppler, CT and MRT imaging. 9) Understand the concept of liver fibrosis grading and the implications for healthcare management. 10) Review the basis for the assessment of liver fibrosis using elastography, with emphasis on the different techniques. 11) Understand the differences in the techniques and the variability in measurement assessment. 12) Achieve and overview of the need and position of this technique in clinical care.

Sub-Events

RC510A   Imaging and Doppler of Portal Hypertension

Participants

Paul S. Sidhu, MRCP, FRCR, London, United Kingdom, (paulsidhu@nhs.net) (Presenter) Speaker, Koninklijke Philips NV; Speaker, Bracco Group; Speaker, Hitachi, Ltd; Speaker, Siemens AG

LEARNING OBJECTIVES

1) Understand the concept of liver fibrosis grading and the implications for healthcare management. 2) Review the basis for the
1) Understand the concept of liver fibrosis grading and the implications for healthcare management. 2) Review the basis for the assessment of liver fibrosis using elastography, with emphasis on the different techniques. 3) Understand the differences in the techniques and the variability in measurement assessment. 4) Achieve an overview of the need and position of this technique in clinical care.

ABSTRACT

Liver fibrosis and cirrhosis from many causes is an important cause of long term morbidity and mortality. Most cases are a consequence of chronic viral disease (Hepatitis B and C) with alcoholic liver disease an important etiological factor. The degree of liver fibrosis, and the presence of established cirrhosis confer different management strategies, with imaging playing an important role in the non-invasive assessment of patients with chronic liver disease. Fibrosis grading traditionally performed using the Metavir or Ishak scoring system is essentially a histological grading system. Ultimately the possibility to avoid a liver biopsy is the aim, if a non-invasive technique can stage the grade of fibrosis, establishing correct patient management. Liver ultrasound elastography is a developing technique that offers this possibility, with varying methods of assessment ranging from strain methods and shear wave methods. These techniques will be explained, the status of the current standing of the techniques will be summarised, and the level of technology offered by different machines will be reviewed. An overall summary of the current status and the implications for clinical practice will be discussed.
Emerging Technology: Elastography - Opportunities and Challenges

Wednesday, Nov. 30 8:30AM - 10:00AM Room: S505AB

**Participants**
Juergen K. Willmann, MD, Stanford, CA, (willmann@stanford.edu) (Moderator) Research Consultant, Bracco Group; Research Grant, Siemens AG; Research Grant, Bracco Group; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company; Advisory Board, Lantheus Medical Imaging, Inc; Advisory Board, Bracco Group

**LEARNING OBJECTIVES**
1) To understand how elastography measurements are integrated into the management of patients with chronic liver disease. 2) To learn imaging techniques and protocols of ultrasound and MR elastography. 3) To compare US and MR elastography in assessing liver fibrosis. 4) To review emerging clinical indications of US and MR elastography. 5) To understand limitations of current elastography techniques.

**Sub-Events**

**RCS17A  Elastography of the Liver: What the Clinician Wants to Know**

**Participants**
Mindie Nguyen, MD, Stanford, CA (Presenter) Consultant, Intercept Pharmaceuticals, Inc; Consultant, Johnson & Johnson; Consultant, Gilead Sciences, Inc; Consultant, Alnylam Pharmaceuticals, Inc; Consultant, Dynavax Technologies Corporation; Research Grant, Johnson & Johnson; Research Grant, Gilead Sciences, Inc; Research Grant, Bristol-Myers Squibb Company

**LEARNING OBJECTIVES**
View learning objectives under the main course title.

**RCS17B  Ultrasound Elastography: How and When?**

**Participants**
Juergen K. Willmann, MD, Stanford, CA, (willmann@stanford.edu) (Presenter) Research Consultant, Bracco Group; Research Grant, Siemens AG; Research Grant, Bracco Group; Research Grant, Koninklijke Philips NV; Research Grant, General Electric Company; Advisory Board, Lantheus Medical Imaging, Inc; Advisory Board, Bracco Group

**LEARNING OBJECTIVES**
1) Understand the clinical indications of ultrasound elastography (USE). 2) Learn about the various techniques and imaging protocols of USE. 3) Review the diagnostic accuracy of USE in the assessment of elasticity in liver fibrosis and other clinical applications in the body. 4) Compare USE with MR elastography. 5) Understand current limitations of USE.

**ABSTRACT**
Ultrasound elastography (USE) is a general term for various techniques available for objectively and quantitatively assessing tissue stiffness using ultrasonic techniques, creating noninvasive images of mechanical characteristics of tissues. Elastography is based on the fact that the elasticity of a tissue is changed by pathological or physiological processes. For example, cancer or fibrosis associated with various disease processes including chronic liver disease or chronic pancreatitis result in increased tissue stiffness. Recently, various USE techniques have been cleared by the FDA and all major ultrasound companies offer different approaches of measuring tissue stiffness on their ultrasound machines. The objective of this talk is to familiarize the audience with the clinical indications, imaging techniques and protocols, interpretation, diagnostic accuracy, and limitations of the various USE technique for assessment of tissue stiffness, with special focus on assessment of fibrosis in chronic liver disease.

**RCS17C  MR Elastography: How and When?**

**Participants**
Richard L. Ehman, MD, Rochester, MN (Presenter) CEO, Resoundant, Inc; Stockholder, Resoundant, Inc

**LEARNING OBJECTIVES**
View learning objectives under the main course title.

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Richard L. Ehman, MD - 2016 Honored Educator
Tips, Tricks and Pitfalls in Body Oncological Imaging - Experts Tell All

Wednesday, Nov. 30 8:30AM - 10:00AM Room: E351

CT MR US

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

Participants

LEARNING OBJECTIVES

1) Identify ultrasound features that differentiate between benign and malignant disease, particularly in the female pelvis. 2) Recommend specific scanning techniques and protocols for difficult cases. 3) Develop biopsy strategies for indeterminate masses that need tissue sampling for diagnosis. 4) To discuss newer MRI techniques that are now applied for body oncologic imaging that allows faster, better or more accurate disease diagnosis. 5) To highlight the applications and pitfalls of diffusion-weighted imaging for assessing upper abdominal cancers, peritoneal involvement, pelvic disease and bone marrow involvement (whole body MRI). 6) To survey the applications and limitations of motion insensitive radial-acquisition MR techniques for dynamic contrast enhanced imaging for cancer evaluation.

Sub-Events

RC518A US

Participants

Roya Sohaey, MD, Portland, OR (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify ultrasound features that differentiate between benign and malignant disease, particularly in the female pelvis. 2) Recommend specific scanning techniques and protocols for difficult cases. 3) Develop biopsy strategies for indeterminate masses that need tissue sampling for diagnosis.

ABSTRACT

The course will focus on benign and malignant masses that mimic each other, particularly in the area of gynecology. Emphasis is placed on the importance of knowing patient history and using good ultrasound technique in order to make accurate diagnoses with ultrasound alone. However, at times, further imaging and tissue sampling is necessary. The participant will be encouraged to “push the envelope” with ultrasound-guided biopsy for appropriate cases.

RC518B CT

Participants

Dushyant V. Sahani, MD, Boston, MA (Presenter) Research support, General Electric Company; Medical Advisory Board, Allena Pharmaceuticals, Inc

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Dushyant V. Sahani, MD - 2012 Honored Educator
Dushyant V. Sahani, MD - 2015 Honored Educator
Dushyant V. Sahani, MD - 2016 Honored Educator

RC518C MRI

Participants

Dow-Mu Koh, MD,FRCR, Sutton, United Kingdom (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) To discuss newer MRI techniques that are now applied for body oncologic imaging that allows faster, better or more accurate disease diagnosis. 2) To highlight the applications and pitfalls of diffusion-weighted imaging for assessing upper abdominal cancers, peritoneal involvement, pelvic disease and bone marrow involvement (whole body MRI). 3) To survey the applications and limitations of motion insensitive radial-acquisition MR techniques for dynamic contrast enhanced imaging for cancer evaluation.
LEARNING OBJECTIVES

1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography. 2) Define and discuss technical aspects, rationale, and pitfalls involved in musculoskeletal interventional sonographic care procedures. 3) Successfully perform basic portions of hands-on US-guided MSK procedures in a tissue simulation learning module, including core biopsy, small abscess drainage, cyst aspiration, soft tissue foreign body removal, and intraarticular steroid injection. 4) Incorporate these component skill sets into further life-long learning for expansion of competency and preparation for more advanced interventional sonographic learning opportunities.

ABSTRACT

Ultrasound Guided Foreign Body Removal: Simulation Training and Clinical implementation Outcomes Purpose: USFBR can be taught to radiologists to generate competency. Radiologists can apply the technique in the patient setting to remove foreign bodies. Materials and Methods: Proof of concept was performed by a radiologist and surgeon removing nine 1-cm foreign bodies using the USFBR method (P) and traditional surgery (S) with and without wire guidance (W) on the cadaver model. Next, USFBR was taught to 48 radiologists at 4 hospitals. Training included didactic and hands-on instruction covering 7 components: instrument alignment, hand/transducer position, forceps use, foreign body definition, forceps grasp, recognition of volume averaging, and oblique cross cut artifact. Pre-training testing assessed single toothpick removal from turkey breast in 15 minutes. Post-training evaluation consisted of 5 toothpick removals. Ongoing clinical implementation data of USFBR by trained radiologists are being collected. Parameters including age of patient, which radiologist, removal success, type and size of foreign body, incision size, foreign body retention time, reason for removal, symptoms, modalities used in detection, wound closure, and sedation are recorded. Data analyzed using chi-squared and Fisher's exact tests for categorical outcomes and analysis of variance for continuous outcomes. Results: USFBR technique shows a higher success rate and smaller incision size in comparison to surgical technique alone in the cadaver. Removal success: P 100%, S 78%, and W 89%. Radiologists' scores improved from 21-52% pre-training to 90-100% post-training (p<0.001 for each component). In the clinical setting to date, USFBR has been 100% successful, ages 9-73 years, by four radiologists. Parameters included; length 4 to 30 mm, retention 2 to 864 days, incision, 2 to 8 mm. Conclusion: USFBR is superior to non-guided surgical technique. The approach taught in simulation improves radiologist technique and outcomes.

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Michael A. Dipietro, MD - 2016 Honored Educator
Dynamic Musculoskeletal US: Clicks and Clunks of the Upper Extremity (Hands-on)

Wednesday, Nov. 30 8:30AM - 10:00AM Room: E264

Participants
Viviane Khoury, MD, Philadelphia, PA, (Viviane.khoury@uphs.upenn.edu) (Presenter) Nothing to Disclose
Etienne Cardinal, MD, Montreal, QC (Presenter) Nothing to Disclose
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Joseph G. Craig, MD, Detroit, MI (Presenter) Nothing to Disclose
David P. Fessell, MD, Ann Arbor, MI (Presenter) Nothing to Disclose
Ghiyath Habra, MD, Detroit, MI (Presenter) Nothing to Disclose
Joseph H. Introcaso, MD, Neenah, WI (Presenter) Nothing to Disclose
Kenneth S. Lee, MD, Madison, WI (Presenter) Grant, General Electric Company; Research support, SuperSonic Imagine; Research support, Johnson & Johnson; Consultant, Echometrix, LLC; Royalties, Reed Elsevier
Humberto G. Rosas, MD, Madison, WI (Presenter) Nothing to Disclose
Marnix T. van Holsbeeck, MD, Detroit, MI, (marnix@rad.hfh.edu) (Presenter) Consultant, General Electric Company; Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder MedEd3D; Grant, Siemens AG; Grant, General Electric Company;
Kambiz Motamedi, MD, Los Angeles, CA, (kmotamedi@mednet.ucla.edu) (Presenter) Nothing to Disclose
Mark Cresswell, MBChB, Vancouver, BC (Presenter) Research Consultant, RepliCel Life Sciences Inc; Investigator, RepliCel Life Sciences Inc; ; ;
Robert R. Lopez, MD, Charlotte, NC (Presenter) Nothing to Disclose
Colin D. Strickland, MD, Denver, CO (Presenter) Nothing to Disclose
Georgina M. Allen, MBCh, FRCR, Oxford, United Kingdom (Presenter) Nothing to Disclose
Gandikota Girish, MBBS, FRCR, Ann Arbor, MI (Presenter) Nothing to Disclose
Benjamin D. Levine, MD, Santa Monica, CA, (blevine@mednet.ucla.edu) (Presenter) Research Consultant, Merck & Co, Inc
Carlo Martinoli, MD, Genova, Italy (Presenter) Nothing to Disclose
J. Antonio Bouffard, MD, Bloomfield Hills, MI (Presenter) Nothing to Disclose
Ximena L. Wortsman, MD, Santiago, Chile, (xworts@yahoo.com) (Presenter) Nothing to Disclose
Andrew J. Grainger, MRCP, FRCR, Leeds, United Kingdom, (andrewegrainger@nhs.net) (Presenter) Speaker, General Electric Company; Equipment support, Siemens AG; Consultant, Medivir AB; Medical Advisor, Medivir AB
David J. Wilson, MD, Oxford, United Kingdom, (davidwilson.stlukes@btconnect.com) (Presenter) Royalties, Reed Elsevier;
Lodewijk J. van Holsbeeck, MD, Northville, MI (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify anatomic structures which can impinge or move abnormally in the upper extremity causing pain during normal range of motion. 2) Describe the ultrasound anatomy and scanning technique for a dynamic examination of these lesions. 3) Position patients optimally for the dynamic evaluation of the upper extremity respecting ergonomics.

ABSTRACT
This course will demonstrate standardized techniques of performing the dynamic examination of upper extremity conditions that are only or best demonstrated dynamically. These include shoulder impingement syndrome, long head of biceps dislocation, medial elbow joint instability, ulnar nerve/medial triceps dislocation, extensor carpi ulnaris dislocation, skier's thumb, median nerve movement, and trigger finger. In the first portion of the course, probe positioning will be demonstrated on a model patient with overhead projection during live scanning. In the second portion of the course, an international group of expert radiologists will assist participants in learning positioning and scanning of the shoulder, elbow, and wrist/ finger lesions described. An emphasis on dynamic maneuvers and ergonomic documentation of tissue dynamics will be taught. Participants will be encouraged to directly scan model patients.

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Jon A. Jacobson, MD - 2012 Honored Educator
SSK02

Science Session with Keynote: Breast Imaging (Ultrasound Screening)

Wednesday, Nov. 30 10:30AM - 12:00PM Room: E451A

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

FDA Discussions may include off-label uses.

Participants
Regina J. Hooley, MD, New Haven, CT (Moderator) Consultant, FUJIFILM Holdings Corporation; Consultant, Siemens AG
Paula B. Gordon, MD, Vancouver, BC (Moderator) Stockholder, OncoGenex Pharmaceuticals, Inc ; Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd
Nariya Cho, MD, PhD, Seoul, Korea, Republic Of (Moderator) Nothing to Disclose

Sub-Events

SSK02-01 Breast Imaging Keynote Speaker: Update on Screening Ultrasound

Participants
Regina J. Hooley, MD, New Haven, CT (Presenter) Consultant, FUJIFILM Holdings Corporation; Consultant, Siemens AG

SSK02-02 Should the Axilla Be Included in Screening Ultrasound?

Participants
Su Hyun Lee, MD, PhD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Ann Yi, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung Min Chang, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Nariya Cho, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Woo Kyung Moon, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the outcome of routine bilateral axillary scanning while performing supplemental screening ultrasound (US).

METHOD AND MATERIALS
This retrospective study was approved by our institutional review board and the requirement for written informed consent was waived. Between January 2012 and December 2014, 20327 supplemental screening US examinations were performed in 13056 women with negative mammograms at a single health screening center. Bilateral whole breast US examinations were performed with a handheld device by experienced radiologists and bilateral axillary regions were routinely scanned and representative images were documented. The abnormal interpretation rates, cancer detection rates, and positive predictive values (PPVs) of supplemental screening US for the breasts only and both breasts and axillae were calculated, respectively.

RESULTS
Of 13056 women, 12624 (97%) were at low risk and 432 (3%) were at intermediate-to-high risk for breast cancer. Bilateral whole breast US showed positive results in 1715 exams (abnormal interpretation rate, 8.4% [1715/20327]) and detected 27 breast cancers (cancer detection rate, 1.3 per 1000 exams) with PPV1 (abnormal interpretation) of 1.6% (27/1715) and PPV3 (biopsy performed) of 7.8% (23/295). Bilateral axillary US showed positive results in 46 exams (with negative results on bilateral whole breast US in 34 exams; positive results on bilateral whole breast US in 12 exams) which yielded no malignancy by follow-up (n=33), core needle biopsy (n=12), or fine needle aspiration (n=1). The abnormal interpretation rate of supplemental screening US for the both breasts and axillae minimally increased to 8.6% [1749/20327]. The PPVs slightly decreased (PPV1, 1.5% [27/1749]; PPV3, 7.5% [23/307]) without changes in the cancer detection rate.

CONCLUSION
Routine bilateral axillary scanning had no effects on the cancer detection rates of supplemental screening US, however increased false-positive findings.

CLINICAL RELEVANCE/APPLICATION
Routine bilateral axillary scanning is unnecessary for supplemental screening US. Automated breast volume scanner, which cannot cover axillary regions, could be used for supplemental breast screening.

SSK02-03 Decreasing Short-term Interval Follow-up and Biopsies by Following BI-RADS Category 3 Lesions at 1 Year, A Prospective Study: Preliminary Results

Participants
Richard G. Barr, MD, PhD, Youngstown, OH (Presenter) Consultant, Siemens AG; Consultant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, SuperSonic Imagine; Speakers Bureau, Koninklijke Philips NV; Research Grant, Bracco Group; Speakers Bureau, Siemens AG; Consultant, Toshiba Corporation; Research Grant, Esaote SpA; Research Grant, B and K Ultrasound; Research Grant, Hitachi Aloka Ultrasound
Federica Manzoni, PhD, Pavia, Italy (Abstract Co-Author) Nothing to Disclose
Annalisa DeSilvestri, PhD, Pavia, Italy (Abstract Co-Author) Nothing to Disclose
Carmine Tinelli, MD, MSC, Pavia, Italy (Abstract Co-Author) Nothing to Disclose
**PURPOSE**

Supplemental breast US in dense breasts can detect cancers not identified on mammography. However, the large number of short-term interval follow-ups and low PPV3 are not cost effective. The majority of these are due to BI-RADS 3 (B3) lesions with an incidence of cancer of less than 1%. This prospective study evaluates the effect of following B3 lesions detected on supplemental ultrasound at 1 year.

**METHOD AND MATERIALS**

Patients with BI-RADS 1 or 2 screening mammogram with density 3 or 4 of any risk were asked to receive a free automated volume whole breast supplemental ultrasound (AVBS) in this HIPPA compliant study. The AVBS was performed on a Siemens S2000 using a 15cm L14-5 transducer. AVBS was read by a radiologist with 2 years experience with AVBUS and 20 years of breast US experience. AVBS scans were read as BI-RADS 1, 2, 3, or 0. Category 0 patients were scheduled for a hand held breast US (HH) of the abnormality. Patients were followed for 2 years.

**RESULTS**

Of 19,417 patients receiving a screening mammogram 5833 (30%) had density 3 or 4 breasts and asked to participate in the study. 1412 (24.2%) agreed to participate in the study (50 yo mean, range 31 to 90), (93.1% average risk (1314/1412), 6.9% (98/1412) high risk). The AVBS was interpreted as BI-RADS 1 (B1) in 748 (53%), BI-RADS 2 (B2) in 345 (24.4%), BI-RADS 3 (B3) in 265 (18.8%) and BI-RADS 0 (B0) in 54 (3.8%). Of the 265 B3 patients, 176 had 1-year follow-up and were cancer free 0% (95% CI: 0-2.1%), 85 had 2-year follow-up and were cancer free 0% (95% CI: 0-4.2%). Of the 54 B0 patients, (recall rate 3.8%; 95% CI: 2.9-5.0%) on HH 9 (16.7%) were B1 (artifacts), 39 (72.2%) were B2, 0 (0%) were B3, 4 (7.4%) were B4, and 2 (3.7%) were B5. The B4 and 5 lesions were biopsied and 2 B4A lesions were fibroadenomas, 2 B4C lesions were IDC, and 2 B5 lesions were IDC. The biopsy rate was 0.4% (6/1412) (95% CI: 0.2-0.9%) with a positive biopsy rate (PPV3) of 66.7% (4/6). The supplemental ultrasound detected 2.8/1000 additional cancers (4/1412) (95%CI: 0.7-7.2/1000).

**CONCLUSION**

Following B3 lesions at 1 year substantially decreases the recall rate (8.8% (233/2637) ACRIN 6666 to 3.8% (54/1412)) (p<0.001) and increases the PPV3 (8.9% (21/235)ACRIN 6666 to 66.7% (4/6)) (p<0.001) without substantial cancer misses.

**CLINICAL RELEVANCE/APPLICATION**

Following B3 lesions at 1 year interval substantially decreases the recall rate and increases the PPV without cancer misses.

**SSK02-04 Faster Evaluation of Automated 3D Breast Ultrasound using Computer Aided Detection without Compromising Accuracy**

Wednesday, Nov. 30 11:00AM - 11:10AM Room: E451A

Participants

Jan Van Zelst, MD, Nijmegen, Netherlands (Abstract Co-Author) Nothing to Disclose
Tao Tan, Nijmegen, Netherlands (Abstract Co-Author) Research Grant, QView Medical, Inc
Paola Clauser, MD, Vienna, Austria (Abstract Co-Author) Nothing to Disclose
Michael Golatta, MD, PhD, Heidelberg, Germany (Abstract Co-Author) Nothing to Disclose
Matthieu Rutten, MD, Hertogenbosch, Netherlands (Abstract Co-Author) Nothing to Disclose
Mathijn D. De Jong, MD, ’s-Hertogenbosch, Netherlands (Abstract Co-Author) Nothing to Disclose
Angels Domingo, MD, TARRAGONA, Spain (Abstract Co-Author) Nothing to Disclose
Rudolf Pijnappel, MD, PhD, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Monique D. Dorrius, MD, PhD, Groningen, Netherlands (Abstract Co-Author) Nothing to Disclose
Nicola Kansszemjejer, PhD, Nijmegen, Netherlands (Abstract Co-Author) Shareholder, Matakana Technology Limited Consultant, QView Medical, Inc Shareholder, QView Medical, Inc Director, ScreenPoint Medical BV Shareholder, ScreenPoint Medical BV
Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (Presenter) Research agreement; Siemens AG; Research agreement, Seno Medical Instruments, Inc

**PURPOSE**

Automated 3D breast ultrasound (ABUS) has been shown to increase cancer detection as a supplement to mammography. Nevertheless, ABUS consists of multiple views per breast and therefore reading ABUS may be relatively time-consuming and cancers may be overlooked. We investigated whether dedicated computer aided detection software improves reading performance and reduces reading time (RT) of breast radiologists reading ABUS.

**METHOD AND MATERIALS**

The need for informed consent was waived by the IRB. 120 unilateral ABUS exams (378 views) (SIEMENS, Erlangen, Germany) of women with heterogeneously or extremely dense breasts were randomly selected from a large imaging archive. We included 30 malignant cases (two-third mammographic negative), 30 benign cases and 60 normal exams. All cases had histological verification or >2 years of negative follow up. Eight dedicated breast radiologists, with 0-7 years of experience with ABUS, were asked to read all cases once conventionally and once using a CAD-based (Qview, Medical, Los Altos, CA, USA) step-by-step screening workflow in a dedicated workstation developed for this study. Readers underwent a short training in using the CAD-software. Reading sessions were at least 8 weeks apart and the reading modes and order of the cases were randomized for each reader. Suspicious findings were scored using the BI-RADS scoring system and a likelihood scale from 0-100. Multi-case-multi-reader AFROC analysis was used to evaluate reader performance. T-tests were used to compare RT. McNemar test was used to compare sensitivity and specificity.

**RESULTS**

The mean AUC for conventional ABUS reading was 0.82 and this remained unchanged at 0.83 using CAD (p=0.29). Specificity improved in 7/8 readers (p<0.0001) while sensitivity decreased minimally in 2/8 readers. Mean RT decreased from 153.8s (SD 78.6) to 133.4 (SD 61.9) (p<0.001).

**CONCLUSION**

Evaluating ABUS examinations using a CAD-based reading workflow is significantly faster than conventional ABUS reading, while the accuracy is maintained.
Using dedicated CAD-software for automated 3D breast ultrasound may improve the efficiency of supplemental ABUS screening in women with dense breasts.

**SSK02-05 Large 1000 Case Reader Study of Radiologists' Performance in Reading Automated Breast Ultrasound (ABVS) Images with the Aid of a Computer Aided Detection (CADe) System**

**METHOD AND MATERIALS**

The study was conducted as a retrospective observer study. A total of 1000 cases were selected from ABVS exams acquired in our institution in 2012. Among those cases were 206 cancer, 486 benign, and 308 normal cases. The cancer cases were consecutive, the benign and normal cases were randomly selected. All cancer and benign cases were confirmed by biopsy or surgery and normal cases were confirmed by 2-year follow-up.

9 radiologists from our institution participated in the study. Among those, 3 had more than 8 years ultrasound and more than 4 years ABVS experience (A), 3 had more than 5 years ultrasound experience (B), and 3 had more than 1 year ultrasound experience (C).

The CADe system used was the QVCAD System from QView Medical, Inc, Los Altos, California, USA. It is designed to aid radiologists in searching for suspicious areas in the ABVS images. The QVCAD results are presented to the reader simultaneously with the ABVS images, i.e., the radiologist read the ABVS images concurrently with the QVCAD results.

The cases were randomly assigned for each reader into 2 equal size groups, 1 and 2. Initially the readers read their group 1 cases with the aid of QVCAD and their group 2 cases without the aid of QVCAD. After a 1-month washout period, they reread their group 1 cases without the aid of QVCAD and their group 2 cases with the aid of QVCAD.

ROC analysis was used to compare the area under the ROC curve (AUC) of the QVCAD aided readings to those of the un-aided readings. Additionally, the reading time per case for each reader was recorded.

**RESULTS**

The AUC of all readers were 0.784 for reading with QVCAD and 0.747 without QVCAD. AUCs with and without QVCAD are 0.833 and 0.829 for A, 0.757 and 0.696 for B, 0.759 and 0.718 for C. All the differences in AUCs are statistically significant (p < 0.05), except for A. The average reading time was 10% faster with the aid of QVCAD for all readers.

**CONCLUSION**

QVCAD improves radiologist performance in both accuracy and reading time for the detection of breast cancer using ABVS, especially for those inexperienced with ABVS.

**CLINICAL RELEVANCE/APPLICATION**

QVCAD can potentially improve breast cancer detection using ABVS.
Comparison with age-matched patients showed 17.7% of patients undergoing screening mammography and 18.4% of patients electing to undergo screening ultrasound at our facility had a 20% or higher lifetime risk of breast cancer. Additionally, 33.3% of screening mammography detected malignancies were found in women at an elevated lifetime risk greater than 20% and another 7 women had a personal history of malignancy.

CONCLUSION

Screening breast ultrasound finds malignancy in average and high risk patients in a similar fashion to screening mammography, with 37.5% and 33.3% of cancers occurring in high risk patients, respectively.

CLINICAL RELEVANCE/APPLICATION

Screening breast ultrasound performed for dense breast tissue finds mammographically occult cancer in both high risk and average risk women.

**SSK02-07 Can Acoustic Radiation Force Impulse Imaging Aid in the differentiation of Benign from Malignant Breast Lesions?**

*Wednesday, Nov. 30 11:30AM - 11:40AM Room: E451A*

Participants
Panagiotis Kapetas, Vienna, Austria (*Presenter*) Nothing to Disclose
Ramona Woitek, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Paola Clauzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Maria Adele Marino, MD, Messina, Italy (*Abstract Co-Author*) Nothing to Disclose
Sara Vigano, MD, San Severo Milanese, Italy (*Abstract Co-Author*) Nothing to Disclose
Katja Pinker-Domenig, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Maria Bernathova, Wien, Austria (*Abstract Co-Author*) Nothing to Disclose
Thomas H. Helbich, MD, Vienna, Austria (*Abstract Co-Author*) Research Grant, Medicer, Inc
Pascal A. Baltzer, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

To evaluate the added value of Acoustic Radiation Force Impulse (ARFI) imaging with Virtual Touch IQ (VTIQ) compared to B-mode breast ultrasound as well as to identify “rule-in” and “rule-out” thresholds for the probability of malignancy.

**METHOD AND MATERIALS**

189 patients with 196 sonographically evident lesions were included in this retrospective, IRB-approved study. B-mode and quantitative ARFI images with VTIQ of each lesion were obtained. 4 radiologists independently reviewed all B-mode images and assigned a BI-RADS score. Subsequently the VTIQ images were reviewed and a new BI-RADS score for each lesion was assigned. ROC-curve analysis was used to calculate the diagnostic performance of B-mode and ARFI imaging as well as to specify “rule-in” and “rule-out” thresholds for the probability of malignancy. The standard of reference was either histopathology or follow-up stability for >18 months.

**RESULTS**

84 lesions were malignant and 112 benign. The combined B-mode and ARFI imaging reading showed a tendency towards better accuracy for most of the readers (AUC 0.873-0.914 vs. 0.851-0.900 respectively), a finding that didn’t reach statistical significance. All readers reported a higher diagnostic confidence through the combined reading. The application of a “rule-in” Shear Wave Velocity (SWV) cutoff value of 1.9m/s led to a sensitivity of 98%, whereas a “rule-in” SWV cutoff value of 6.5m/s suggested a probability of malignancy of >95%.

**CONCLUSION**

ARFI imaging with VTIQ can aid in the differentiation of malignant from benign breast lesions and raise the diagnostic confidence of the examiner. The application of “rule-in” and “rule-out” thresholds is feasible.

**CLINICAL RELEVANCE/APPLICATION**

ARFI imaging with VTIQ, a novel sonographic elastography technique, provides data, valid for the differentiation of benign and malignant breast lesions. Application of “rule-in” and “rule-out” cutoff values has the potential to reduce unnecessary breast biopsies.
mastectomy and 362 (82.6%) received adjuvant endocrine therapy. Of 366 invasive cancers, 51 (13.9%) had lymph node metastases and 176 (48.1%) received chemotherapy. Of 366 invasive cancers, 291 (79.5%) were TNM stage I, 65 (17.8%) were stage II, and 10 (2.7%) were stage III. Invasive cancers were classified as 291 (79.5%) hormone receptor (HR)-positive/HER2-negative, 22 (6.0%) HR-positive/HER2-positive, 17 (4.6%) HR-negative/HER2-positive, and 36 (9.8%) triple negative. Kaplan-Meier analysis was performed to calculate recurrence-free survival (RFS). Cox proportional hazard analysis was performed to determine the patient and disease characteristics associated with recurrence.

RESULTS

At a median follow-up of 7 years (range, 5-12 years), there were 13 recurrences. The 5-year RFS was 98.2% and 10-year RFS was 97.0%. Among 13 recurrences, 10 were invasive cancers (6 in contralateral breast, 2 in remnant breast, and 2 distant metastasis in lung), and 3 were DCIS (2 in contralateral breast and 1 in remnant breast). There were no deaths. In women with invasive cancers, triple negative (Hazard ratio, 4.742; 95% confidence interval, 1.215-18.515, P=0.025) was independently associated with recurrence in multivariate analysis adjusting for TNM stage and histologic grade.

CONCLUSION

Clinical outcome of mammography-negative and US-detected breast cancers was favorable. Triple negative subtype was independently associated with recurrence in women with invasive breast cancers.

CLINICAL RELEVANCE/APPLICATION

Most women with US-detected breast cancers have an excellent outcome. Tumor subtype may identify patients with high risk for recurrence.

SSK02-09 Utility of Whole Breast Screening Ultrasound in Women Undergoing Digital Breast Tomosynthesis

Wednesday, Nov. 30 11:50AM - 12:00PM Room: E451A

Participants
Janice S. Sung, MD, New York, NY (Presenter) Nothing to Disclose
Carol H. Lee, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Elizabeth A. Morris, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Christopher E. Comstock, MD, New York, NY (Abstract Co-Author) Nothing to Disclose

PURPOSE

To prospectively evaluate the clinical utility of whole breast screening ultrasound (WBUS) in women undergoing digital breast tomosynthesis (DBT.)

METHOD AND MATERIALS

This is a prospective IRB approved trial recruiting asymptomatic women scheduled for a screening DBT and WBUS within 30 days of one another. Between July 2014 – March, 2016, 560 women enrolled. The DBT and WBUS were performed at the same visit and interpreted independently by 2 radiologists blinded to the other modality. Once final recommendations for each modality were recorded, the patient was managed per standard institutional practice after integrating findings of both studies. The cancer detection rate, PPV3 of biopsy, and risk factors (breast density, family history (FH), personal history (PH), BRCA status, prior high risk lesion) were recorded.

RESULTS

Mean patient age was 56 years (range: 30-84). 417/560 (74%) of women had dense breasts. 184 (33%) had no additional risk factors, 127 (23%) a PH of breast cancer, and 96 (17%) a FH in a 1st degree relative. 75 (13%) women had >1 additional risk factor. 3 cancers (2 IDC, 1 DCIS) were detected on the 2D images, tomosynthesis images, and WBUS. The two node negative IDCs (mean size: 0.7 cm) were seen on the 2D images, tomosynthesis images, and WBUS. 1 case of DCIS was detected only on the tomosynthesis images and WBUS. The PPV3 was 19% for DBT and 27% for WBUS. The addition of tomosynthesis views reduced the number of recalls from the 2D mammographic views by 15%.

CONCLUSION

Both DBT and WBUS increase the cancer detection rate compared to a 2D mammogram. However, no additional cancers were detected on WBUS compared to DBT. The addition of tomosynthesis images had the added benefit of reducing the recall rate by 15%.

CLINICAL RELEVANCE/APPLICATION

The clinical value of WBUS may be reduced in women undergoing DBT compared to a 2D mammogram.
Participants

PARTICIPANTS

Joseph Russo, MD

PROGRAM INFORMATION

This one-hour workshop led by a Peer Educator will introduce 3D Automated Breast Ultrasound (ABUS) interpretation, including how to navigate the coronal plane to efficiently highlight potential abnormalities and streamline the screening workflow. Attendees will:

- Learn how 3D ABUS screening helps increase cancer detection in women with Dense Breast Tissue
- See how quickly whole breast image volumes are acquired on the Invenia™ ABUS Scan Station
- Review clinical cases on the Invenia™ABUS Workstation during physician guided hands-on exam interpretation.

Registration

http://ge.cvent.com/events/ge-breast-health-advantage-workshop/event-summary-b904d22132614dc2b7633ee3b34f22de.aspx
Emerging Topics in Ultrasound - Bridging Current Clinical Perspectives with Future Potential: Supported by Bracco
Wednesday, Nov. 30 1:30PM - 3:00PM Room: S101AB

Participants

PARTICIPANTS

Richard Barr, MD, Professor of Radiology, Northeast Ohio Medical University, Southwoods Imaging Kasse Darge, MD Professor of Radiology and Surgery Perelman School of Medicine, University of Pennsylvania Chief, Division of Body Imaging The Children's Hospital of Philadelphia Hisham Tchelepi, MD Associate Professor of Clinical Radiology Section Chief of Ultrasound Keck School of Medicine of USC Juergen Willmann, MD Division Chief, Body Imaging Professor of Radiology Department of Radiology Stanford University

PROGRAM INFORMATION

Agenda: 1:30pm Welcome and Objectives 1:35pm The future promise of CEUS 1:50pm Clinical applications of contrast enhanced ultrasound (CEUS) in liver disease 2:05pm Clinical applications of CEUS in the abdomen 2:20pm Safety and efficacy of CEUS in the pediatric population 2:35pm Clinical applications of ultrasound in body imaging - current status 2:50pm Q and A Session Accreditation and Limited Seating: Please Note: Limited Seating. This program will be designated for CME and SDMS credit CME credit is available through a third party provider. This activity is held in conjunction with the RSNA 2016 Annual Meeting but is not part of the RSNA CME program. CME credit must be claimed separately through Northwest Imaging Forums/IMS. Attendance is open to RSNA Annual Meeting registrants only. Northwest Imaging Forums in joint providership with The Institute for Medical Studies (IMS) will provide CME for physicians. Northwest Imaging Forums will also accredit through SDMS for Sonographers.

RSVP

http://www.nwifinvite.com
Case-based Review of US (An Interactive Session)

Wednesday, Nov. 30 1:30PM - 3:00PM Room: S406A

US

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

FDA Discussions may include off-label uses.

Participants
Deborah J. Rubens, MD, Rochester, NY, (Deborah_rubens@urmc.rochester.edu) (Director) Nothing to Disclose

Sub-Events

MSCU41A  Discordance of CEUS with CT and MR: Why Does It Happen and How Does It Help?

Participants
Stephanie R. Wilson, MD, Calgary, AB, (stephanie.wilson@ahs.ca) (Presenter) Equipment support, Siemens AG; Equipment support, Koninklijke Philips NV

LEARNING OBJECTIVES
1) Understand the fundamental differences between contrast enhanced imaging with US, CT and MR scan, to appreciate the advantages afforded by real time Ultrasound. 2) Recognize advantages of using a purely intravascular contrast agent for CEUS.

ABSTRACT

MSCU41B  Small Body Parts Ultrasound

Participants
Jason M. Wagner, MD, Oklahoma City, OK, (jason-wagner@ouhsc.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Classify thyroid nodules into risk categories using sonographic and clinical features. 2) Differentiate subcutaneous lipomas from other superficial masses. 3) Apply color and spectral Doppler findings to evaluate for testicular torsion.

ABSTRACT

MSCU41C  OB and GYN Ultrasound

Participants
Mindy M. Horrow, MD, Philadelphia, PA (Presenter) Spouse, Employee, Merck & Co, Inc

LEARNING OBJECTIVES
1) Describe criteria for a failed first trimester pregnancy. 2) List sonographic findings to distinguish adenomyosis from fibroids. 3) Categorize findings of unusual ectopic pregnancies partially or completely within the uterus. 4) Review classic signs that indicate a tubal origin of an adnexal mass.

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/

Mindy M. Horrow, MD - 2013 Honored Educator
Mindy M. Horrow, MD - 2016 Honored Educator
Genitourinary (Benign Gynecological Disease)

Wednesday, Nov. 30 3:00PM - 4:00PM Room: E351

**SSM10-01** Colorectal Endometriosis: Indication to Bowel Resection Based on Pelvic MR Findings in A Single Center

Wednesday, Nov. 30 3:00PM - 3:10PM Room: E351

**Participants**
Julia R. Fielding, MD, Dallas, TX (Moderator) Nothing to Disclose
Raj M. Paspulati, MD, Cleveland, OH (Moderator) Nothing to Disclose

**Sub-Events**

**SSM10-01**

**PURPOSE**
To establish the role of MRI in predicting the need and the type of surgery in patients with colorectal endometriosis.

**METHOD AND MATERIALS**
The MR images of 195 patients operated for pelvic endometriosis were reviewed in consensus by two experienced radiologists. All MR scans were acquired with a 1.5 T scanner and a phased array coil. A standard high resolution pelvic MR was performed in all patients consisting in a standard High resolution pelvic MRI protocol (T2w TSE sequences in the axial, sagittal and coronal plane and in T1w and THRIVE sequences in the axial plane) completed by MR- Colonography (MR-C) in all the cases. The presence of endometriotic pelvic lesions was annotated. Intestinal lesion were measured in short and long axis and the grade of stenosis was established on MR-C. A multivariate logistic regression was used to establish the predictors of intestinal resection in the laparoscopic procedure, while one way ANOVA was used to compare nodules resected with different techniques (shaving, discoid or segmental resection).

**RESULTS**
56/195 (29%) patients received an intestinal resection, namely 20/56 received a discoid resection and 36/56 segmental resection). Multivariate logistic regression demonstrated a predictive value of nodular short axis (OR=2.29 (1.21-4.35); p=0.011) and the degree of stenosis (OR=1.20 (1.06-1.35); p=0.03). ROC analysis demonstrated an AUC of 0.98 for the “short axis” and 0.97 for the parameter “stenosis”. Using a cut off value of 11 mm of short axis and 30% of stenosis sensitivity and specificity values were respectively 93%-98% and 94%-98%. ANOVA analysis showed significantly higher values of Short axis, long Axis and Stenosis for patients receiving segmental resection vs discoid resection vs adhesiolysis and rectal shaving.

**CONCLUSION**
The presence of an endometriotic rectal nodule > 11 mm in short axis causing a luminal stenosis > 30% in pelvic MRI reliably predict the need of a rectal resection. Nodule size differs significantly in women receiving different type of resection.

**CLINICAL RELEVANCE/APPLICATION**
MRI is a non invasive method that can predict the need and the type of bowel resection in patients with colorectal endometriosis.

**SSM10-02** Society of Radiologists in Ultrasound (SRU) Guidelines for Adnexal Cysts: Adherence and Practical Challenges

Wednesday, Nov. 30 3:10PM - 3:20PM Room: E351

**Participants**
Katherine E. Maturen, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Alexander D. Blaty, BS, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Ashish P. Wasnik, MD, Ann Arbor, MI (Abstract Co-Author) Nothing to Disclose
Krupa K. Patel-Lipmann, MD, Durham, NC (Abstract Co-Author) Nothing to Disclose
Jessica B. Robbins, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Sarah L. Aveni, MD, Iowa City, IA (Abstract Co-Author) Nothing to Disclose
Elizabeth B. Maddox, Madison, WI (Abstract Co-Author) Nothing to Disclose
Laura Huffman, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Lisa Barroilhet, MD, Madison, WI (Abstract Co-Author) Nothing to Disclose
Elizabeth A. Sadowski, MD, Madison, WI (Presenter) Nothing to Disclose

**PURPOSE**
In 2010, the Society of Radiologists in Ultrasound (SRU) published a consensus statement directing management of asymptomatic adnexal cysts. The purpose of this study is to evaluate radiologists’ subsequent adherence to the guidelines for a large group of cysts with known outcomes.
**METHOD AND MATERIALS**

IRB-approved retrospective multi-institutional study evaluated ultrasound (US) imaging features, dictated recommendations, and clinical outcomes of consecutive adnexal cysts from Jan-Jun 2011. Dictated reports were categorized according to specific recommendation when articulated, or via subjective assessment of the degree of concern expressed in the report language. Images were reviewed and SRU rating retrospectively assigned.

**RESULTS**

Images and reports were analyzed for 556 cysts. Specific recommendations were made in dictated reports for 349 (62.8%) cysts: 64 no followup (11.5%), 231 US (41.5%), 27 MRI (4.9%) and 27 surgical evaluation (4.9%). The overall correlation between dictated report and SRU approach was weak (Pearson’s R=0.34 [95% CI 0.26-0.41] p <.0001). In total, SRU and original dictations concurred on management in 245 (44%) cysts. Original reports underecommended followup in 152 (27.3%) cysts and overrecommended followup in 159 (28.7%) cysts. If recommendations are binarized into “no followup” and “any followup”, Sn, Sp, PPV and NPV for neoplasm were 80.4%, 37.1%, 20.2% and 90.5% for the original reports and 96.7%, 54.7%, 29.8% and 98.8% for the SRU rating. In logistic regression, both recommendation types were predictors of neoplasm but a one unit increase in SRU rating conferred a higher odds ratio (SRU OR 2.59 [95% CI 2.06;3.27], p<.0001 vs. original dictation OR 1.59 [95% CI 1.15,2.22], p=.005).

**CONCLUSION**

Adherence to SRU management guidelines for adnexal cysts was 44% in originally dictated reports. Original dictations recommended followup for fewer neoplasms and more physiologic cysts, and were overall less predictive of neoplasm than the retrospectively applied SRU approach.

**CLINICAL RELEVANCE/APPLICATION**

The 2010 Society of Radiologists in Ultrasound (SRU) guidelines for management of adnexal cysts provide a framework for clear management recommendations and are more predictive of neoplasm than an unstructured approach.

**Honored Educators**

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Katherine E. Maturen, MD - 2014 Honored Educator

**SSM10-03 Uterine Adenomyosis: Development of an US and MRI Based Scoring System While Comparing the Diagnostic Accuracy of Two Modalities**

**Wednesday, Nov. 30 3:20PM - 3:30PM Room: E351**

Participants

Anil Chauhan, MD, Philadelphia, PA (Presenter) Nothing to Disclose
William A. Shaffer, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Evan S. Siegelman, MD, Philadelphia, PA (Abstract Co-Author) Consultant, Bioclinica, Inc Consultant, ICON plc Consultant, ACR Image Metrix
Lisa P. Jones, MD, PhD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Jill E. Langer, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Steven C. Horii, MD, Philadelphia, PA (Abstract Co-Author) Spouse, Employee, Cerner Corporation
Maria C. Reyes, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose
Hanna M. Zafar, MD, Philadelphia, PA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

Major studies defining US and MRI criteria for diagnosing uterine adenomyosis have been published more than a decade ago. Imaging technology, indications of imaging and clinical management of uterine symptomatology has overwhelmingly changed since then and this warrants a re-assessment of diagnostic accuracy of US and MRI in diagnosing adenomyosis. The purpose of this study was: 1) To compare the accuracy of US and MRI for the diagnosis of adenomyosis; and 2) To develop US and MRI based scoring systems for diagnosis of adenomyosis.

**METHOD AND MATERIALS**

We retrospectively identified 76 patients who have had hysterectomy along with pre-operative US and MRI exams. Cases with no transvaginal exam, and mass lesions involving more than half of the uterus were excluded. The imaging exams were interpreted blindly by experienced radiologists. Multiple imaging features were recorded along with confidence level of radiologist for interpreting these exams. Nine US and 10 MRI features were given scores of one each in pursuit of developing a scoring system.

**RESULTS**

Adenomyosis was present in 42 out of 76 (55%) patients on pathology. The sensitivity, specificity, positive predictive value and negative predictive value of US were 86%, 56%, 71%, and 76%, respectively. Similar values for MRI were 69%, 71%, 74%, and 65%. Maximum Junctional Zone thickness and presence of subendometrial/myometrial T2 hyperintensities on MRI demonstrated sensitivity/specificity of 50%/85% and 62%/76%, respectively. Moderate/Severe heterogeneity, linear striations, hyperechoic foci, and echogenic islands within the myometrium led to sensitivity and specificity of 88% and 56%. US score of > 3 and >6 led to Sensitivity/Specificity of 67%/67% and 38%/85%, respectively. MRI score of >2 and >4 led to Sensitivity/Specificity of 57%/85% and 43%/91%, respectively. Thirty out of 76 (40%) cases had US-MRI discordance, with US being more correct (12 vs 5) in presence of disease and MRI being more correct (9 vs 4) in absence of disease.

**CONCLUSION**

Although both US and MRI have inherent limitations for diagnosing adenomyosis, adding scoring system can potentially improve specificity of the imaging diagnosis.
**CLINICAL RELEVANCE/APPLICATION**

Adenomyosis is highly prevalent in symptomatic female patient and imaging has potential limitations in its diagnosis. Therefore, a scoring system based on common imaging features may add value in improving specificity of adenomyosis diagnosis by imaging.

**Honored Educators**

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Evan S. Siegelman, MD - 2013 Honored Educator

**SSM10-04 Monitoring Leiomyoma Response to Uterine Artery Embolization Using Diffusion and Perfusion Indices from Diffusion-Weighted Imaging**

Wednesday, Nov. 30 3:30PM - 3:40PM Room: E351

Participants
Menggui Cao, Shanghai, China (Presenter) Nothing to Disclose
Shiteng Suo, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Yan Zhou, PhD, shanghai, China (Abstract Co-Author) Nothing to Disclose
Xuebin Zhang, Shanghai, China (Abstract Co-Author) Nothing to Disclose
Jianrong Xu, Shanghai, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To investigate the potential of diffusion and perfusion indices (ADC and perfusion fraction f) from DWI at 3.0 T in monitoring treatment response to uterine artery embolization (UAE) at 6-month follow-up.

**METHOD AND MATERIALS**

Twelve female patients (median age, 42 years; range, 24–56 years) with symptomatic uterine fibroids who underwent pelvic MRI and DWI before and 6 months after UAE were included. 3.0-T DWI was acquired by using b-values of 0 and 1000 s/mm² for ADC calculation, and 0–1200 s/mm² for perfusion fraction f calculation. The Wilcoxon signed-rank test and Spearman rank correlation test were used for statistics.

**RESULTS**

All patients underwent successful UAE procedures with a relief of symptoms, reduced fibroid volume and complete infarction at follow-up MRI. A total of 17 fibroids were studied. The median ADCs showed a statistically significant increase from $1.20 \times 10^{-3}$ mm²/s (range, 0.86–1.66 $\times 10^{-3}$ mm²/s) at baseline to $1.56 \times 10^{-3}$ mm²/s (range, 1.00–1.86 $\times 10^{-3}$ mm²/s) at 6-month follow-up ($P = 0.0003$). Conversely, the median perfusion fraction f was significantly decreased after UAE ($P = 0.0001$), with a median pre-UAE value of 14.2% (range, 6.7%–17.6%) and a median post-UAE value of 9.2% (range, 3.2%–14.6%). Significant correlations were found between fibroid volume reduction rate and percentage changes in ADC and perfusion fraction f at 6-month follow-up relative to baseline, with $p$ values of -0.50 ($P = 0.04$) and 0.55 ($P = 0.02$), respectively.

**CONCLUSION**

ADC and perfusion fraction f obtained from DWI at 3.0 T may help to evaluate treatment response to UAE.

**CLINICAL RELEVANCE/APPLICATION**

DWI-derived diffusion and perfusion indices (ADC and perfusion fraction f) may facilitate the quantitative assessment of treatment response to UAE at 6-month follow-up.

**SSM10-05 The Predictive Value of Quantitative DCE Metrics for Immediate Therapeutic Response of High-Intensity Focused Ultrasound Ablation of Symptomatic Uterine Fibroids**

Wednesday, Nov. 30 3:40PM - 3:50PM Room: E351

Participants
Chao Wei, HeFei, China (Presenter) Nothing to Disclose
Jiang Ning Dong, Hefei, China (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To investigate the value of quantitative dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) parameters in the prediction of the immediate therapeutic response of high-intensity focused ultrasound (HIFU) therapy in the treatment of symptomatic uterine fibroids.

**METHOD AND MATERIALS**

A total of 78 symptomatic uterine fibroids (diameter: 3.0 cm-9.3 cm) in 65 female patients were treated with MR-HIFU therapy. All patients underwent conventional and DCE MRI scan in 3 days before and after HIFU treatment. Permeability parameters Ktrans, Ke, Ve, and T1 perfusion parameters BF, BV of Pretreatment were measured as a baseline; and immediate non-perfused volume ratio (NPVR) was used as an immediate ablation efficiency. Dates were assigned to NPVR >70 % and NPVR <70 % group. Then the differences of DCE-MRI parameters between the previous group and the correlations between the DCE-MRI parameters and NPVR were analyzed retrospectively. The ROC curve analyses were performed to study the predictive performance of different parameters for ablation efficacy.

**RESULTS**

(1) It was observed that the pretreatment Ktrans, Ke, Ve, BF values of the NPVR >70 % group was significantly lower than the NPVR <70 % group($p<0.05$). (2) The immediate NPVR was negatively correlated with the Ktrans, BF, BV values before HIFU treatment (r = -0.561, -0.712 and -0.528, respectively; p<0.05 for all). (3)The AUC of pretreatment Ktrans, BF, BV values used to
predict the immediate NPVR were 0.810, 0.909, 0.795 respectively (p<0.05 for all). At the cut-off value, Ktrans, BF, BV provided the higher sensitivity (Ktrans: 96.8%, BF:90.3%, BV:71.0%) and specificity (Ktrans: 57.4%, BF:81.9%, BV:74.5%) in predicting for the ablation efficacy.

CONCLUSION

A higher Ktrans, BF, BV value at baseline DCE-MRI suggested a poor ablation efficacy of HIFU therapy for symptomatic uterine fibroids. The BF values showed the best predictive value, followed by Ktrans and then BV.

CLINICAL RELEVANCE/APPLICATION

The pretreatment DCE-MRI parameters could be useful biomarkers for prediction the ablation efficacy in selecting of suitable candidates for HIFU treatment or changing the treatment plan which most likely to yield optimum results.

SSM10-06  Deeply Infiltrative Endometriosis (DIE) with Myometrial Invasion: 'Mantle-shaped' Pattern (MSP)-A Marker for Severe DIE Associated with High Prevalence of Intestinal and Bladder Lesions

Wednesday, Nov. 30 3:50PM - 4:00PM Room: E351

Participants
Luciana P. Chamie, MD, PhD, Sao Paulo, Brazil (Presenter) Nothing to Disclose
Duarte M. Ribeiro, MD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Gladis R. Ribeiro, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Tatiana Bonetti, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose
Paulo C. Serafini, MD, PhD, Sao Paulo, Brazil (Abstract Co-Author) Nothing to Disclose

PURPOSE

The purpose of this manuscript is to describe a form of DIE with deep myometrial invasion called "mantle-shaped" pattern (MSP) that is a marker for severe DIE with high prevalence of intestinal and bladder lesions.

METHOD AND MATERIALS

This is prospective cross-sectional study from August 2010 to June 2015. 2737 women (mean age of 35.9 years) suspected of having DIE underwent a transvaginal sonography after bowel preparation (TVSBP) by an experienced radiologist for the diagnosis and mapping of the disease. The clinical suspicion was based on the complaining of chronic pelvic pain and infertility for more than 1 year. The imaging protocol was based on previous published data. The imaging criteria for severe DIE were also established. Among patients with positive imaging findings for DIE, the presence of the MSP was assessed along with the other sites affected.

RESULTS

From all 2737 women assessed, 1065 did not have endometriosis (46.4%) and 1468 of them demonstrated DIE lesions (53.6%). The MSP was identified in 151 women (5.5%) among DIE group. The group of DIE women without MSP exhibited 4 sites of DIE involvement, while the group with MSP had an average of 7.5 DIE sites affected. Women with MSP had 68.2% of intestinal lesions compared to 25% of those without MSP. Bladder lesions were identified in 15.2% of women with MSP compared to 1.7% of women without MSP. The posterior compartment of the pelvic cavity was the most common location for the MSP (70.9%) against the anterior compartment (30.5%). The retrocervical region was the most common location of DIE lesions in both groups.

CONCLUSION

The MSP is a form of DIE associated with deep myometrial invasion and is a marker for severe disease with high prevalence of visceral involvement, such as bladder and intestinal lesions. It is also a predictor for worse fertile prognosis and for potential residual disease after surgery. Patients with complete removal of these tissue are risky for uterine rupture during pregnancy.

CLINICAL RELEVANCE/APPLICATION

The MSP is a marker for severe DIE with high prevalence of intestinal and bladder lesions.
Case-based Review of Ultrasound (An Interactive Session)

Wednesday, Nov. 30 3:30PM - 5:00PM Room: S406A

US

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

Participants
Deborah J. Rubens, MD, Rochester, NY, (Deborah_rubens@urmc.rochester.edu) (Director) Nothing to Disclose

Sub-Events

MSCU42A  Vascular Ultrasound

Participants
Leslie M. Scoutt, MD, New Haven, CT (Presenter) Consultant, Koninklijke Philips NV

Honored Educators

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Leslie M. Scoutt, MD - 2014 Honored Educator

MSCU42B  Pearls and Pitfalls in Interventional US

Participants
Michael D. Beland, MD, Providence, RI (Presenter) Consultant, Hitachi, Ltd

LEARNING OBJECTIVES

1) Understand the wide range of applications of ultrasound for interventional guidance. 2) Identify methods to increase the likelihood of a successful procedure using interventional ultrasound. 3) Avoid some of the more common potential pitfalls encountered in interventional ultrasound.

ABSTRACT

Through an interactive case-based format, participants will be exposed to some of the wide range of potential applications of ultrasound for interventional guidance. Techniques will be suggested to increase the likelihood of a successful procedure using interventional ultrasound. Opportunities to avoid some of the more common potential pitfalls encountered in interventional ultrasound will be described.

MSCU42C  Abdominal Ultrasound

Participants
Deborah J. Rubens, MD, Rochester, NY, (Deborah_rubens@urmc.rochester.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the technical parameters to optimize to improve ultrasound diagnosis in the abdomen. 2) Identify discrete ultrasound features to discriminate between various pathologic entities. 3) Characterize disease processes in visceral organs and the retroperitoneum.

ABSTRACT

This session will highlight a variety of disease processes in the visceral organs and in the retroperitoneum, using grayscale, color and spectral Doppler ultrasound. Technique and potential pitfalls will be highlighted as they contribute to diagnostic acumen of the sonologist. Cases will include neoplastic, infectious and vascular processes in multiple organs. Differential diagnosis will be stressed with multiple companion case examples.
Participants
Douglas S. Katz, MD, Mineola, NY, (dkatz@winthrop.org) (Moderator) Nothing to Disclose
Mariam Moshiri, MD, Seattle, WA, (moshiri@uw.edu) (Moderator) Consultant, Reed Elsevier; Author, Reed Elsevier;

LEARNING OBJECTIVES
1) To overview the current role of ultrasound, CT, and MR in the imaging of non-pregnant and pregnant women with known or suspected acute pelvic conditions, with an emphasis on evidence-based information and societal guidelines, to discuss the advantages and disadvantages of ultrasound, CT, and MR for imaging the acute female pelvis in several common/relatively common scenarios to overview specific protocols for performing effective and accurate ultrasound, CT, and MR imaging examinations of the acute female pelvis, to discuss current controversies regarding the roles of ultrasound, CT, and MR in the imaging of the acute female pelvis.

ABSTRACT

LEARNING OBJECTIVES
1) Review the Role of MRI in acute Pelvic conditions in the Pregnant and Nonpregnant Patient in Case-Based format. 2) Discuss the role of MRI in evaluating indeterminant lesions at US and CT in acute GYN conditions.

ABSTRACT

Honored Educators
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Christine O. Menias, MD - 2013 Honored Educator
Christine O. Menias, MD - 2014 Honored Educator
Teaching Points

1. Participants will learn to list the sonographic appearances of common and uncommon diseases.
2. Participants will learn to describe the differentiating features between similar diseases via a case-based format.
3. Participants will learn to discuss the pathophysiology of diseases that are responsible for the sonographic appearance.
Participants

Sub-Events

RC610A  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.

ABSTRACT
At the conclusion of the refresher course, the learners should be familiar with how carotid waveforms change with systemic, regional and local vascular disease. They should also be able to recognize common waveform variants and their attendant clinical significance.

RC610B  Upper Extremity Arterial and Venous Doppler: Beyond the Basics

Participants
Gowthaman Gunabushanam, MD, New Haven, CT (Presenter) Editor, WebMD Health Corp

LEARNING OBJECTIVES
1) Review qualitative and quantitative criteria for diagnosing arterial abnormalities in the upper extremity. 2) Describe the technique for dynamic testing using provocative maneuvers. 3) Describe the pitfalls and limitations of Doppler ultrasound in diagnosing arterial and venous diseases of the upper extremity.

ABSTRACT
RC610C  Leg Pain and Swelling: The Usual and Unusual Suspects

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

Honored Educators

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Leslie M. Scoutt, MD - 2014 Honored Educator
BI-RADS (An Interactive Session)

Thursday, Dec. 1 8:30AM - 10:00AM Room: E450A

Participants
Cherie M. Kuzmiak, DO, Chapel Hill, NC, (Cherie_kuzmiak@med.unc.edu) (Moderator) Research Grant, FUJIFILM Holdings Corporation;

LEARNING OBJECTIVES
1) Improve basic knowledge of the descriptive terms in the updated BI-RADS mammography lexicon. 2) Develop an understanding of the BI-RADS management terminology and explanations for each assessment category. 3) Apply the mammography lexicon descriptors appropriately and assign the most appropriate BI-RADS assessment category to various mammographic breast lesions. 4) Review updated BI-RADS ultrasound lexicon terms and assessment categories. 5) Provide a case-based illustration of BI-RADS ultrasound lexicon descriptors and assessment categories. 6) Test knowledge of concepts with challenging unknown cases. 7) Be able to apply a systematic approach to using MRI BI-RADS. 8) Recognize the similarities between BI-RADS for MRI and mammography. 9) Recognize situations where a BI-RADS assessment is not used for MRI.

ABSTRACT

RC615A  Mammography

Participants
Cecilia L. Mercado, MD, New York, NY, (cecilia.mercado@nyumc.org) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Improve basic knowledge of the descriptive terms in the updated BI-RADS mammography lexicon. 2) Develop an understanding of the BI-RADS management terminology and explanations for each assessment category. 3) Apply the mammography lexicon descriptors appropriately and assign the most appropriate BI-RADS assessment category to various mammographic breast lesions.

ABSTRACT

RC615B  Ultrasound

Participants
Eun L. Langman, MD, Chapel Hill, NC, (EJL@med.unc.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review updated BI-RADS ultrasound lexicon terms and assessment categories. 2) Provide a case-based illustration of BI-RADS ultrasound lexicon descriptors and assessment categories. 3) Test knowledge of concepts with challenging unknown cases.

ABSTRACT

RC615C  Breast MRI

Participants
Bonnie N. Joe, MD, PhD, San Francisco, CA, (bonnie.joe@uchsf.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Be able to apply a systematic approach to using MRI BI-RADS. 2) Recognize the similarities between BI-RADS for MRI and mammography. 3) Recognize situations where a BI-RADS assessment is not used for MRI.

ABSTRACT

Breast MRI BI-RADS follows a systematic approach analogous to mammography BI-RADS. BI-RADS includes three important components: (a) a lexicon of descriptors, (b) a reporting structure to include final assessment categories and management recommendations, and (c) a framework for data collection and auditing. This session will use an interactive format (audience response system) to review appropriate use of BI-RADS for breast MRI interpretation including scenarios where BI-RADS assessments are not appropriate.
Emerging Technology: High Intensity Focused Ultrasound - Opportunities and Challenges

Thursday, Dec. 1 8:30AM - 10:00AM Room: S504CD

IR US

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

FDA Discussions may include off-label uses.

Participants
Alessandro Napoli, MD, Rome, Italy (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) To become familiar with high intensity focused ultrasound principles, different image guidance and clinical applications. 2) To understand clinical applications of different HIFU systems with both US and MRI guidance. 3) To integrate essential knowledge for radiologists facing new opportunities with a totally non-invasive IR tool.

ABSTRACT
The concept of ideal tumor surgery is to remove the neoplastic tissue without damaging adjacent normal structures. High-intensity focused ultrasound (HIFU) was developed in the 1940s as a viable thermal tissue ablation approach. In clinical practice, HIFU has been applied to treat a variety of solid benign and malignant lesions, including pancreas, liver, prostate, and breast carcinomas, soft tissue sarcomas, and uterine fibroids. More recently, magnetic resonance guidance has been applied for treatment monitoring during focused ultrasound procedures (magnetic resonance-guided focused ultrasound, MRgFUS). Intraoperative magnetic resonance imaging provides the best possible tumor extension and dynamic control of energy deposition using real-time magnetic resonance imaging thermometry. This course will introduce the fundamental principles and the most attractive clinical indications of high intensity focused ultrasound technique in practice.

Sub-Events

RC617A From Technology to HIFU Clinic

Participants
Pejman Ghanouni, MD, PhD, Stanford, CA, (ghanouni@stanford.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Technical aspects of focused ultrasound, including introduction to the physics of the technology, and to MR thermometry. 2) Advantages of MR guidance during focused ultrasound therapy. 3) Keys to successful clinical utilization of the technology.

ABSTRACT
Focused ultrasound can be used to non-invasively treat structures deep within the body, using ultrasound or magnetic resonance imaging for guidance. A large area ultrasound transducer array is focused geometrically and electronically, with energy focused to achieve high intensity deep within the body, while sparing intervening tissues. With MR guided focused ultrasound (MRgFUS), treatment can be precisely monitored intra-operatively using proton resonant shift thermometry, and results can be evaluated with immediate post-operative imaging. MRgFUS is used clinically in the United States for the treatment of uterine fibroids, benign and malignant bone tumors, soft tissue tumors, and movement disorders. Translating this technology to a robust clinical service involves close collaboration between radiologists and the clinicians that directly manage these patients, with centralized, dispersed, and center of excellence options as models for these clinical relationships.

RC617B High Intensity Focused Ultrasound - Uterine Fibroid

Participants
Young-Sun Kim, MD, Seoul, Korea, Republic Of, (jeants.kim@gmail.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Explain pros and cons of HIFU (high-intensity focused ultrasound) ablation in the treatment of uterine fibroids as compared to other therapeutic modalities. 2) Assess important factors in screening MR exams for HIFU therapy of uterine fibroids. 3) Explain treatment strategy of HIFU ablation for uterine fibroids to improve therapeutic outcomes. 4) Describe the current limitations of HIFU of uterine fibroids and explain how to overcome them including a hormone pretreatment.

ABSTRACT
Uterine fibroid is the most popular clinical applications of HIFU (high-intensity focused ultrasound) therapy. As a totally non-invasive interventional therapeutic modality using small foci of hyperthermia (65-70°C), HIFU has pros and cons as compared to other therapeutic modalities. However, owing to its greatest merit of complete non-invasiveness, its clinical adoptions are increasing worldwide.HIFU therapy has certain inborn limitations, therefore, appropriate screening for uterine fibroids is extremely important to improve overall therapeutic outcomes. In order to do so, the cases which will be benefited from this therapy should be chosen well, and then, the properties of the target fibroids, safe pathway of sonication, complication-related factors should be well analyzed in screening MR exams. Furthermore, the symptom-relevant fibroid or the portion of fibroid should be recognized and completely ablated. As accumulations of clinical experiences of HIFU therapy, the evidences of therapeutic efficacy and safety of HIFU ablation of uterine fibroids are increasing and there have been several techniques or strategies developed to overcome the limitations or to improve therapeutic efficacy, which will be covered in this presentation.

RC617C High Intensity Focused Ultrasound - Bone
LEARNING OBJECTIVES

1) Patient selection for MR guided focused ultrasound palliation of painful bone metastases and benign bone lesions. 2) Results of MR guided focused ultrasound for palliation of painful bone metastases and Osteoid Osteoma. 3) Technical aspects of successful patient treatment. 4) Immediate post-treatment imaging-based assessment of results.

ABSTRACT

Magnetic resonance imaging-guided focused ultrasound (MRgFUS) is an alternative noninvasive method for reducing pain in skeletal metastases. The concentration of acoustic energy on the intact surface of the cortical bone produces a rapid temperature increase that mediates critical thermal damage to the adjacent periosteum—the most innervated component of mature bone tissue. Such thermal ablation has been shown to be an extremely effective approach for pain management. This technique has also a potential role in achieving local tumor control, allowing de-novo mineralization of trabecular bone or reduction in lesion size. In our department, we are evaluating the safety and efficacy of MRgFUS treatment for pain palliation in patients with malignant (bone metastases) as well as benign (osteoid osteoma) lesions. Local tumor control was demonstrated by a reduction of lesion viability following MRgFUS procedure and by remineralization of spongy bone. Regarding the ablation of osteoid osteoma, MRgFUS was proposed as an alternative treatment option among other consolidated modalities, including radiofrequency ablation. At present, radiofrequency ablation is the most popular percutaneous technique, but it requires some degree of intervention. Our preliminary study demonstrates that MRgFUS for osteoid osteoma seems to be safe with good success and without treatment-related morbidity. Unlike other ablative techniques, MRgFUS is totally noninvasive and can be performed relatively fast in a single session with limited amount of energy deposition. In conclusion, MRgFUS is a completely noninvasive modality that allows effective and durable pain palliation in a single session even if a specific anesthesia protocol is needed. In bone metastasis, focused ultrasound energy may also detect metastasis necrosis, thus having potential future role for local tumor control. Furthermore, MRgFUS can be performed safely and effectively in patients with symptomatic osteoid osteoma. Describe patient selection for MR guided focused ultrasound palliation of painful bone metastases.

Participants
Pejman Ghanouni, MD, PhD, Stanford, CA (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under the main course title.
Interactive Game: Challenging Cases in Body Oncologic Imaging

Thursday, Dec. 1 8:30AM - 10:00AM Room: S103AB

CT  MR  NM  OI  US

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

Participants

Sub-Events

RC618A  Ultrasound

Participants
Deborah J. Rubens, MD, Rochester, NY, (Deborah_rubens@urmc.rochester.edu) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the technical parameters to optimize to improve ultrasound diagnosis. 2) Identify discrete ultrasound features to discriminate between various pathologic entities. 3) Characterize disease processes in solid organs, vessels and soft tissues using the unique features of ultrasound and appreciate how ultrasound is complementary to CT, MRI and PET in the oncology patient.

ABSTRACT
This session will highlight a variety of disease processes in the oncology patient using grayscale, color and spectral Doppler ultrasound. Technique and potential pitfalls will be highlighted as they contribute to diagnostic acumen of the sonologist. Cases will include neoplastic, infectious and vascular processes in multiple organs. Differential diagnosis will be stressed with companion case examples, as well as when to use comparative imaging such as CT, MRI or PET/CT.

RC618B  Magnetic Resonance Imaging

Participants
Alexander R. Guimaraes, MD, PhD, Portland, OR, (guimaraa@ohsu.edu) (Presenter) Speakers Bureau, Siemens AG;

LEARNING OBJECTIVES
This course is designed to update the attendee on novel MRI techniques and the benefits of MRI in diagnosing challenging cases within the abdomen and pelvis. Multiparametric MRI offers the unique ability to monitor the tumor microenvironment. Increasingly, multiparametric MRI is used for diagnosis and grading of malignancy in various organ systems (e.g. prostate cancer). At the end of this course the attendee through case studies will demonstrate a greater understanding of the following:1) Updated understanding of soft tissue contrast mechanisms inherent in MRI including T1rho, diffusion weighted imaging, DCE-MRI. 2) Updated protocols for each organ site. 3) Potential benefits of PET/MRI in diagnosing disease.

ABSTRACT

RC618C  PET/CT

Participants
Gary A. Ulaner, MD, PhD, New York, NY, (ulanerg@mskcc.org) (Presenter) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd

LEARNING OBJECTIVES
1) Learn where CT findings can improve FDG PET interpretation and where FDG PET findings can improve CT interpretation.

ABSTRACT
FDG PET/CT has become an indispensible modality in the treatment of cancer. While proven to be of great clinical benefit in the management of a wide array of malignancies, there are many potential pitfalls which may be detrimental if not properly identified and explained. In particular, FDG-avidity may be incorrectly ascribed to malignancy when corresponding CT findings demonstrate the FDG-avidity to be benign. In other cases, the presence of FDG avidity correctly determines the presence of malignancy despite to lack of correlate findings on CT. In this presentation, challenging FDG PET/CT cases will be used to demonstrate how correlation of FDG PET and CT findings leads to optimal FDG PET/CT interpretation.
Techniques for Interventional Sonography and Thermal Ablation (Hands-on)

Thursday, Dec. 1 8:30AM - 10:00AM Room: E264

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

FDA Discussions may include off-label uses.

Participants
Patrick Warren, MD, Columbus, OH (Presenter) Nothing to Disclose
Stephen C. O'Connor, MD, Boston, MA (Presenter) Nothing to Disclose
Veronica J. Rooks, MD, Honolulu, HI (Presenter) Nothing to Disclose
Corrie M. Yablon, MD, Ann Arbor, MI, (cyablon@med.umich.edu ) (Presenter) Nothing to Disclose
Kristin M. Dittmar, MD, Columbus, OH (Presenter) Nothing to Disclose
Kal Dulaimy, MD, Springfield, MA (Presenter) Nothing to Disclose
Mahesh M. Thapa, MD, Seattle, WA (Presenter) Nothing to Disclose
John M. Racadio, MD, Cincinnati, OH (Presenter) Nothing to Disclose
Andrew J. Rabe, DO, Columbus, OH (Presenter) Nothing to Disclose
Hisham A. Tchelepi, MD, Los Angeles, CA (Presenter) Research Grant, General Electric Company; Research Grant, Roper Industries, Inc
Christian L. Carlson, MD, MS, Jbsa Ft Sam Houston, TX (Presenter) Nothing to Disclose
Adam S. Young, MD, MBA, Boston, MA (Presenter) Nothing to Disclose
Linda J. Warren, MD, Vancouver, BC, (lwarren@vancouverbreastcentre.com) (Presenter) Shareholder, Hologic, Inc
Andrada R. Popescu, MD, Chicago, IL (Presenter) Nothing to Disclose
Christopher A. Molvar, MD, Chicago, IL, (cmolvar@lumc.edu ) (Presenter) Nothing to Disclose
Allison S. Aguado, MD, Cincinnati, OH (Presenter) Nothing to Disclose
Jeremiah J. Sabado, MD, Columbus, OH (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography. 2) Discuss and perform basic skills involved in thermal tumor ablation in a live learning model. 3) Perform specific US-guided procedures to include core biopsy, abscess drainage, vascular access, cyst aspiration, soft tissue foreign body removal, and radiofrequency tumor ablation. 4) Incorporate these component skill sets into further life-long learning for expansion of competency and preparation for more advanced interventional sonographic learning opportunities.

ABSTRACT
Ultrasound Guided Foreign Body Removal: Simulation Training and Clinical implementation Outcomes ; Purpose: USFBR can be taught to radiologists to generate competency, and radiologists can apply the technique in the patient setting to remove foreign bodies. ; Materials and Methods: Proof of concept was performed by a radiologist and surgeon removing nine 1-cm foreign bodies using the USFBR method (P) and traditional surgery (S) with and without wire guidance (W) on the cadaver model. ; Next, USFBR was taught to 48 radiologists at 4 hospitals. Training included didactic and hands-on instruction covering 7 components: instrument alignment, hand/transducer position, forceps use, foreign body definition, forceps grasp, recognition of volume averaging, and oblique cross cut artifact. Pre-training testing assessed single toothpick removal from turkey breast in 15 minutes.; Post-training evaluation consisted of 5 toothpick removals. ; Ongoing clinical implementation data of USFBR by trained radiologists are being collected. Parameters including age of patient, which radiologist, removal success, type and size of foreign body, incision size, foreign body retention time, reason for removal, symptoms, modalities used in detection, wound closure, and sedation are recorded. Data analyzed using chi-squared and Fisher#39;s exact tests for categorical outcomes and analysis of variance for continuous outcomes. ; Results: USFBR technique shows a higher success rate and smaller incision size in comparison to surgical technique alone in the cadaver. Removal success: P 100%, S 78%, and W 89%; With USFBR training, radiologists; scores improved from 21-52% pre-training to 90-100% post-training (p;0.001 for each component). In the clinical setting to date, USFBR has been 100% successful in 7 (of 25 expected) patients, ages 9-73 years, by four radiologists. Parameters included; length 4 to 30 mm, retention 2 to 864 days, incision, 2 to 8 mm. 1 suture closure. 1 sedation.
**SSQ17-01 Abdominal Computed Tomography in Pediatric Blunt Trauma: The Significance of Isolated Free Fluid**

**Participants**
Anne Marie Cahill, MBChB, Philadelphia, PA (Moderator) Nothing to Disclose
Christopher I. Cassady, MD, Houston, TX (Moderator) Nothing to Disclose

**Sub-Events**

**PURPOSE**
Computed tomography of the abdomen and pelvis (CTAP) is widely used by both trauma surgeons and Emergency Department physicians for the identification of intraabdominal injury in the pediatric trauma patient. Multidetector computed tomography (MDCT) is the mainstay of imaging these days and CTAP is the imaging workhorse for diagnostic evaluation of blunt abdominal trauma. Incidental finding of intraperitoneal free fluid in absence of identifiable injury, referred to as isolated free fluid (IFF), may create a clinical dilemma in the pediatric blunt trauma patient. The uncertainty of the significance of IFF may lead clinicians to manage the patient with in-house observation, potentially leading to increased hospital length of stay and unnecessary hospital costs. We hypothesize that the presence of IFF in the pediatric blunt trauma patient does not require further diagnostic workup and should not mandate additional care.

**METHOD AND MATERIALS**
A retrospective review of all pediatric trauma patients ≤18yrs with a blunt mechanism of injury who received a CTAP (2011-2015, n=671) was performed at our Level 1 Adult/Level 2 Pediatric Trauma Center. Admission radiology reports were collected and analyzed, while repeat scans during the same hospital stay were excluded. We defined IFF as simple free fluid with Hounsfield units of <20 along with the absence of identifiable injury, referred to as isolated free fluid (IFF), may create a clinical dilemma in the pediatric blunt trauma patient. The uncertainty of the significance of IFF may lead clinicians to manage the patient with in-house observation, potentially leading to increased hospital length of stay and unnecessary hospital costs. We hypothesize that the presence of IFF in the pediatric blunt trauma patient does not require further diagnostic workup and should not mandate additional care.

**RESULTS**
A total 671 patients ≤18years with a blunt mechanism of injury had a CTAP performed on admission to the trauma service during the study period. We found 120 (17.9%) patients had IFF as the only positive finding on CTAP scan. Females were more than twice as likely to have IFF than their male counterparts (29% v. 13%, p<0.05). No patients with IFF on CTAP developed intraabdominal pathology or required operative management of the abdomen.

**CONCLUSION**
The presence of IFF on CTAP in the pediatric trauma patient with blunt mechanism is not associated with any injuries that require operative management. The presence of IFF should not mandate additional clinical care in the pediatric blunt trauma patient.

**CLINICAL RELEVANCE/APPLICATION**
This research has clinical relevance to changing current management of pediatric trauma patients with blunt mechanism trauma.

**SSQ17-02 Identification of Quality Improvement Areas in Pediatric MRI from Analysis of Patient Safety Reports**

**Participants**
Camilo Jaimes Cobos, MD, Boston, MA (Presenter) Nothing to Disclose
Diana Murcia, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Karen Miguel, RN, MPH, Boston, MA (Abstract Co-Author) Nothing to Disclose
Cathryn DeFuria, RN, Boston, MA (Abstract Co-Author) Nothing to Disclose
Pallavi Sagar, MBBS, Boston, MA (Abstract Co-Author) Nothing to Disclose
Michael S. Gee, MD, PhD, Jamaica Plain, MA (Abstract Co-Author) Nothing to Disclose

**PURPOSE**
To estimate the rate of safety reports in pediatric MRI and determine risk factors associated with safety report frequency.

**METHOD AND MATERIALS**
In a retrospective HIPAA-compliant, IRB-approved study, the RIS was queried to identify MRI studies performed in pediatric patients (0-18 yrs) from 2010-2015 and then cross-matched with the institutional safety incident reporting system. Safety report (SR) severity was graded on a 5-point scale: did not reach/affect the patient, reached but did not affect the patient, caused no harm, caused harm, and caused major harm. The most common causes of SRs were service coordination and adverse drug reactions (n=36) and adverse drug reactions (n=32; 19%). 3482 (20.7%) MRIs involved sedation/GA. There was a significantly increased SR rate in MRIs that used sedation/GA (0.8%) relative to awake MRI (0.46%), with an odds ratio (OR) of 1.75 (P<0.05). SR rate also varied significantly by location (p<0.05), with a rate of 1.2% for inpatients, 0.6% for E.R. patients, and 0.4% for outpatients. Increased SR rates were seen in the younger age categories, with newborns (1.1%), infants (1.1%), and young children (0.9%) associated with SR rates significantly higher than those in older children (P < 0.05). The odds ratio of younger children (<6 yrs) having a SR relative to older children (>6yr) was 2.2.

CONCLUSION
The prevalence of safety reports in MRI performed in children is increased relative to previously published data on adults. The majority of events caused no harm or only minor harm. The most common causes of SRs were service coordination and adverse drug reaction. Children below the age of 6 yrs, inpatients, and use of sedation/GA are all factors associated with higher SR rates and should be the focus of quality improvement strategies.

CLINICAL RELEVANCE/APPLICATION
Data on safety reports in pediatric MRI is sparse. Knowledge of safety profile of pediatric MRI can be used to guide evidence-based recommendations.

RESULTS
A total of 89 SR were identified from a total of 16749 pediatric MRI studies, yielding a prevalence of 0.53%. In 15 reports (17%) the event did not reach and did not harm the patient, 39 (44%) reached the patient but caused no harm, 32 (36%) caused mild harm, and 3 (3%) caused major harm. There were no deaths. The two most common causes for SR were service coordination (n=36) and adverse drug reactions (n=17; 19%). SR rate in MRIs that used sedation/GA (0.8%) relative to awake MRI (0.46%), with an odds ratio (OR) of 1.75 (P<0.05). SR rate also varied significantly by location (p<0.05), with a rate of 1.2% for inpatients, 0.6% for E.R. patients, and 0.4% for outpatients. Increased SR rates were seen in the younger age categories, with newborns (1.1%), infants (1.1%), and young children (0.9%) associated with SR rates significantly higher than those in older children (P < 0.05). The odds ratio of younger children (<6 yrs) having a SR relative to older children (>6yr) was 2.2.

CONCLUSION
The prevalence of safety reports in MRI performed in children is increased relative to previously published data on adults. The majority of events caused no harm or only minor harm. The most common causes of SRs were service coordination and adverse drug reaction. Children below the age of 6 yrs, inpatients, and use of sedation/GA are all factors associated with higher SR rates and should be the focus of quality improvement strategies.

CLINICAL RELEVANCE/APPLICATION
Data on safety reports in pediatric MRI is sparse. Knowledge of safety profile of pediatric MRI can be used to guide evidence-based recommendations.

RESULTS
Skull fractures were identified in 45.14% of patients on CT (n=37) compared to 35.38% on radiographs (n=29). 8 cases with fractures identified on CT did not demonstrate fractures on skull radiographs. There was high confidence level for diagnosis of fractures on CT in these cases, 4 in one and 5 in seven cases. In 1 patient, fracture was suspected on radiographs with low confidence level of 1, and not confirmed on CT. Overall, larger number of separate fractures were identified with CT (n=54) compared to skull radiographs (n=45).

CONCLUSION
CT head is superior to skull radiographs for diagnosis of skull fractures in abusive head trauma. When CT head is also obtained with 3D surface reconstruction, the possibility of omitting skull radiographs from skeletal survey should be considered to diminish risk of generating contradictory reports and moreover, decrease radiation exposure in this vulnerable population.

CLINICAL RELEVANCE/APPLICATION
Abusive head trauma is the leading cause of death in infants and young children. Per ACR guidelines, skeletal survey for suspected abusive injury requires minimum AP and lateral radiographs of the skull. In addition to skeletal survey, majority of these children get CT head for workup. The purpose of this study is to compare CT head with skull radiograph for evaluation of skull fractures, and thereby, ascertain if skull radiographs can be omitted in a skeletal survey if CT head with 3D reconstructions is available to reduce radiation.

SSQ17-04  Quantitative Shape Analysis of Skull Deformity on Head CT Images

Thursday, Dec. 1 10:00AM - 11:00AM Room: S102C

Participants
Min Jin Lee, BS, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Helen Hong, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Kyu Won Shim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Yong Dock Kim, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
**CONCLUSION**

Our method is useful for the quantification of severity of skull deformity for diagnosis, prognosis and surgical planning of craniosynostosis.

**Background**

Craniosynostosis is the premature fusion of the one or more cranial sutures resulting in skull deformity. 3D CT is the most standard imaging for early diagnosis and surgical planning of craniosynostosis. Despite the advances of 3D CT, quantitative assessment of skull deformity remains highly dependent on clinician experience. We propose a quantitative shape analysis of skull deformity on head CT images and apply our method to the classification of craniosynostosis.

**Evaluation**

Our method was tested on dataset consisting of 45 deformity subjects with sagittal(S) and bicoronal(B) synostosis and 45 normal subjects. In deformity subjects, typical and mild deformities were included and the skull with mild deformity subject was similar shape with that of normal subject. To generate the representative planes which reflect skull deformity, the position of S- and B-planes was defined by the region of fused suture. To quantify the severity of skull deformity, shape features which reflect skull morphology were extracted in each S- and B-planes of segmented skull. A cranial index was calculated as the ratio of the width to the length of skull. A cranial radius index was determined by considering the position and degree of a prominent area such as bossing or narrowing of skull. To consider mild deformity subjects, a cranial partial slope index was determined by considering the slope of frontal skull. A cranial extreme spot and near cranial extreme spot indices were determined by considering the distribution of area which maximize the distance between cranial boundary points. For early diagnosis of craniosynostosis, support vector machine was trained with the training shape features and tested with five-fold cross validation. Our results were evaluated by sensitivity, specificity and accuracy of 86%, 95% and 92%, for sagittal, 100%, 98% and 98% for bicoronal, respectively.

**Discussion**

Our method can provide a reliable quantification tool and identify suspected case as mild subjects for assessing the severity of skull deformity and diagnosis of craniosynostosis. This research was supported by the MISP (Ministry of Science, ICT & Future Planning), Korea, under the National Program for Excellence in SW (R7719-16-1002) supervised by the IITP (Institute for Information & communications Technology Promotion) (R7719-16-1002)

**SSQ17-05 Comparison of Image Quality between Conventional VIBE and Radial VIBE in Free-Breathing Pediatric Abdominal MRI**

**Thursday, Dec. 1 11:10AM - 11:20AM Room: S102C**

Participants

Hyun Joo Shin, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Myung-Joon Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Mi-Jung Lee, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Hyun Gi Kim, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

**PURPOSE**

To compare the image quality between conventional volume interpolated breath-hold examination (VIBE) and radial VIBE in contrast-enhanced fat-suppressed T1-weighted images of pediatric abdominal MRI during free-breathing.

**METHOD AND MATERIALS**

We retrospectively reviewed the images from pediatric patients who underwent contrast-enhanced abdominal MRI with a 3.0 T magnet using conventional VIBE (conventional group) and radial VIBE (radial group) while freely breathing. For objective analysis, the mean values of noise and signal-to-noise ratio (SNR) in liver on contrast-enhanced fat-suppressed T1-weighted images were compared. For subjective analysis, overall image quality, respiratory motion, portal vein clarity, and hepatic margin sharpness were assessed by four point scales.

**RESULTS**

Nine patients (mean age of 2.8±2.3 years) in the conventional and 17 patients (mean age of 2.4±2.8 years) in the radial groups were included. By objective analysis, the noise was significantly lower and the SNR was significantly higher in the radial group than those in the conventional group (all, p<0.001). In the subjective analysis, overall image quality, respiratory motion, portal vein clarity, and hepatic margin sharpness were all significantly higher in the radial group (all, p<0.001).

**CONCLUSION**

Pediatric abdominal MR images with radial VIBE showed lower noise with higher SNR in objective analysis and higher image quality in subjective analysis, compared to conventional VIBE.

**CLINICAL RELEVANCE/APPLICATION**

By applying radial VIBE in contrast-enhanced abdominal MR acquisition, we can obtain better image quality even in infants and young children while freely breathing.

**SSQ17-06 Pediatric MRI in the Emergency Department Over Five Years: An Analysis of Usage and Trends**

**Thursday, Dec. 1 11:20AM - 11:30AM Room: S102C**

Participants

Miriam Hulkower, MD, Bronx, NY (Presenter) Nothing to Disclose
Benjamin Taragin, MD, Teaneck, NJ (Abstract Co-Author) Medical Advisory Board, Carestream Health, Inc
Reubin Davoudzadeh, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Dan Wang, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Tao Wang, MD,PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Meir H. Scheinfeld, MD, PhD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
Michele J. Fagan, MD, Bronx, NY (Abstract Co-Author) Nothing to Disclose
PURPOSE
Our institution as well as others have added 24/7 MRI availability for Pediatric Emergency Department (PED) patients. Our purpose was to evaluate MRI usage and trends among pediatric patients.

METHOD AND MATERIALS
IRB exemption was obtained. All MRI exams performed on PED patients from 2011 through 2015 were tabulated along with demographic data. PED triage volume data were also obtained to normalize MRI data. The z-test was used to compare MRI utilization in male and female patients. A Chi-squared test for trend in proportions was used to test for a trend in usage over the five year period. MRI utilization per ED visit versus patient age was tabulated and confidence intervals were calculated. MRI usage for each hour of the day was plotted to determine the hours with the highest volume.

RESULTS
There were a total of 997 MRI exams and 561,704 triages performed over the five year period. Regarding category of MRI exam, 57% were of the brain, 15% were of the spine, 13% were neurologic MRA exams, 6% were of the abdomen, 5% were of the face, 4% were musculoskeletal and 0.3% were of the chest. There was significantly higher MRI utilization for females (MRI performed during 0.21% of ED visits) compared to males (MRI performed during 0.14% of ED visits, p<0.001). There was a statistically significant increasing utilization trend over the five year period (p=0.001) with MRI being performed during 0.12% of visits in 2011 and 0.24% of visits during 2015. Utilization generally increased with patient age, with lowest utilization in 3 year olds (MRI during 0.0033% of visits) and highest utilization in 17 year olds (MRI during 0.54% of visits). Highest PED MRI volume was during the evening and early nighttime hours with peak volume occurring during the 10 PM hour when 8.2% of MRI exams were performed.

CONCLUSION
The most common exams performed in the PED were neurological. Utilization was higher in girls and in older children. Utilization progressively increased over the study period. Evening and early nighttime hours saw the greatest MRI usage.

CLINICAL RELEVANCE/APPLICATION
The data presented demonstrates that there is increasing PED MRI utilization, particularly of neurological studies, suggesting that off-hour resource availability during the evening and early nighttime hours would be well utilized.

SSQ17-07 UltraFast™ Doppler Ultrasonography for Arterial Evaluation in Children: Comparison with Conventional Doppler Ultrasonography

Participants
Yu Jin Kim, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Young Hun Choi, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Jung-Eun Cheon, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Woo Sun Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
In-One Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Ji-Eun Park, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Young Jin Ryu, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose

PURPOSE
To evaluate the utility of UltraFast™ Doppler ultrasonography (US) for Doppler assessment of hepatic and renal arteries in children.

METHOD AND MATERIALS
From March through April 2016, Doppler US examinations for 25 arteries (15 hepatic arteries and 10 renal arteries) were performed in 12 patients (6 boys and 6 girls, mean age 7.2 years). Doppler assessment of each artery was performed under free breathing by using both UltraFast™ Doppler and conventional Doppler US techniques. Peak systolic velocity, end-diastolic velocity, and resistive index were compared between the two techniques. Doppler acquisition times were also evaluated.

RESULTS
The peak systolic velocity was significantly lower in the UltraFast™ Doppler than conventional Doppler US (36.54±12.80 cm/s vs. 38.80±12.51 cm/s, p=0.0007). The end-diastolic velocity showed no significant difference between the two techniques (11.69±4.35 cm/s vs. 11.54±4.01 cm/s, p=0.5987). UltraFast™ Doppler US showed lower resistive index values than conventional Doppler US (0.67±0.06 Vs. 0.69±0.07, p=0.0048). Regarding the acquisition time, conventional Doppler US required 85.2 sec on average (range 12-269 sec) while UltraFast™ Doppler was obtained in a fixed acquisition time of 4 sec.

CONCLUSION
When compared with the conventional Doppler US, UltraFast™ Doppler ultrasonography was associated with lower peak systolic velocity and resistive index values and a shorter acquisition time for arterial evaluation in children.

CLINICAL RELEVANCE/APPLICATION
UltraFast™ Doppler ultrasonography could be a good alternative to conventional Doppler ultrasonography for children who cannot hold their breath.

SSQ17-08 Effect of Motion for Measurement of Tissue Stiffness on Ultrasound Elastography: A Moving Liver Fibrosis Phantom Study

Participants
Hyun Joo Shin, MD, Seoul, Korea, Republic Of (Presenter) Nothing to Disclose
Myung-Joon Kim, MD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
Mi-Jung Lee, MD, PhD, Seoul, Korea, Republic Of (Abstract Co-Author) Nothing to Disclose
PURPOSE
To evaluate the effect of movement for measurement of tissue elasticity on ultrasound elastography using moving liver fibrosis phantoms.

METHOD AND MATERIALS

We used elasticity phantoms (Shear Wave Liver Fibrosis Phantom, model 039, CIRS) of custom-made stiffness of 3.0 and 16.9 kPa. For simulating regular movement, Orbital Shaker (FinePCR SH30) was used to make regular circular and horizontal motion for 35 and 60 times per minute. We used a supersonic shear wave imaging (SSI, Aixplorer, SuperSonic Imagine, Aix-en-Provence, France) with 1-6 MHz convex and 2-10 MHz linear transducers in abdominal settings, and acoustic radiation force impulse imaging (ARFI, ACUSON S3000, Siemens Healthcare, Erlangen, Germany) with 1-6 MHz convex transducer in routine abdominal setting and 4-9 MHz linear transducer in breast ARFI setting. The values were obtained twenty times at each depth of 2, 3, 4 and 5 cm and mean values in kPa were selected. The stiffness values between moving and static status were compared using paired t-test and Wilcoxon signed-rank test.

RESULTS

Using SSI, in the lower velocity movement, convex transducer using 3 kPa phantom was less affected by the movement, regardless of the acquisition depths and the directions of the movement. SSI showed a tendency of increased values during the movement, compared to the static status. In the higher velocity movement, most of the values were significantly different between moving and static status. Using ARFI, 2 cm depth using linear transducer with 3 kPa phantom was less affected by the movement, regardless of the velocities and the directions of the movement. During the lower velocity movement, 4 cm depth using convex transducer with 3 kPa phantom was less affected by the movement, regardless of the direction. ARFI showed higher failure rates during the measurement especially in moving status.

CONCLUSION

The effect of movement on the measurement of elasticity was different according to the machines, stiffness of the phantoms, acquisition depths, transducers, velocity and direction of the movement. We found out the conditions that were less affected by the movement in SSI and ARFI using elasticity phantoms.

CLINICAL RELEVANCE/APPLICATION

This attempt will lead wide application of ultrasound elastography in the patients who have difficulty in holding their breath during the examination, including pediatric population.

SSQ17-09  Gadolinium Deposition in Pediatric Brain: Findings After Multiple Exposures to Gadobenate Dimeglumine

Thursday, Dec. 1 11:50AM - 12:00PM Room: S102C

Participants
Guenther K. Schneider, MD, PhD, Homburg, Germany (Abstract Co-Author) Research Grant, Siemens AG; Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Research Grant, Bracco Group;
Paul S. Raczeck, MD, Homburg, Germany (Presenter) Nothing to Disclose
Amo Buecker, MD, Homburg, Germany (Abstract Co-Author) Research Grant, Siemens AG; Consultant, Bracco Group; Speaker, Bracco Group; Consultant, Medtronic plc; Speaker, Medtronic plc; Research Grant, Novartis AG; Research Grant, GlaxoSmithKline plc; Research Grant, Biostest AG; Research Grant, Oncogenex Pharmaceuticals, Inc; Research Grant, Bristol-Myers Squibb Company; Research Grant, Eli Lilly & Company; Research Grant, Pfizer Inc; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, sanofi-aventis Group; Research Grant, Merinmac Pharmaceuticals, Inc; Research Grant, Sirte Medical Ltd; Research Grant, Concordia Healthcare Corp; Research Grant, AbbVie Inc; Research Grant, Takeda Pharmaceutical Company Limited; Research Grant, Merck & Co, Inc; Research Grant, Affimed NV; Research Grant, Bayer AG; Research Grant, Johnson & Johnson; Research Grant, Seattle Genetics, Inc; Research Grant, Onyx Pharmaceuticals, Inc; Research Grant, Synta Pharmaceuticals Corp; Research Grant, Siemens AG; Research Grant, iSYMED GmbH; Research Grant, St. Jude Medical, Inc; Co-founder, Aachen Resonance GmbH; Jonas Stroeder, MD, Homburg, Germany (Abstract Co-Author) Nothing to Disclose

PURPOSE
The possibility of gadolinium (Gd) deposition in the pediatric brain following exposure to Gd-based contrast agents (GBCA) is an emotive and potentially serious issue. We sought to determine if T1-signal changes potentially indicative of Gd-deposition occur in pediatric brain structures after multiple exposures to gadobenate dimeglumine (MultiHance; Bracco).

METHOD AND MATERIALS

34 patients (Group 1; 17M/17F; mean age: 7.18 years; range: 9 months-17 years; mainly oncologic patients) that received between 5 and 15 injections (mean: 7.8 injections; each at 0.05 mmol/kg bw) of gadobenate over a mean of 2.24 years (range: 9 months-7 years) were compared with 24 control patients (Group 2; 16M/8F; mean age: 8.78 years; range: 7 months-17 years) that had never been exposed to any GBCA. Exposure to gadobenate was for diagnosis and for therapy monitoring. Two blinded readers independently determined the signal intensity (SI) at regions-of-interest placed in the dentate nucleus (DN), globus pallidus (GP), pons, and thalamus on unenhanced T1-weighted spin echo images from both groups. Unpaired t-tests were used to compare SI values and DN-to-pons and GP-to-thalamus SI ratios between Groups 1 and 2.

RESULTS

Mean SI values in the DN, GP, pons and thalamus were 366.4, 360.5, 370.5 and 360.3 (Group 1) and 374.3, 364.4, 377.0 and 363.2 (Group 2) for reader 1, and 367.8, 392.3, 373.6 and 370.5 (Group 1) and 370.9, 380.5, 381.9 and 373.3 (Group 2) for reader 2. No significant differences between groups 1 and 2 were noted by either reader for comparisons of SI values (p>0.5; all comparisons) or for comparisons of mean DN-to-pons and GP-to-thalamus SI ratios (0.989 vs. 0.993 [p=0.383] and 1.0 vs. 1.003 [p=0.572], respectively, for reader 1; 0.984 vs. 0.973[p=0.217] and 1.06 vs. 1.049 [p=0.185], respectively, for reader 2). The number of exposures and the time between first and last exposures did not influence SI values among patients in group 1.

CONCLUSION

SI increases in the DN, GP, pons and thalamus that are potentially indicative of Gd-deposition are not seen in pediatric patients after multiple exposures to gadobenate dimeglumine, even in patients with 15 injections over a time interval of 6 years.
CLINICAL RELEVANCE/APPLICATION

Gadobenate-enhanced MRI of pediatric patients should not be avoided due to fears of Gd deposition.
Participants

Sub-Events

**RC710A  Multiple Gestations**

Participants
Anne M. Kennedy, MD, Salt Lake City, UT, (anne.kennedy@hsc.utah.edu) (Presenter) Author with royalties, Reed Elsevier

**LEARNING OBJECTIVES**

1) Determine chorionicity in multiple pregnancies. 2) Recognize the complications of monochorionic placentation particularly twin twin transfusion syndrome, twin reversed arterial perfusion sequence and the consequences of demise of one twin. 3) Recognize discordant twin growth.

**ABSTRACT**

Active Handout: Anne M. Kennedy


**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/

Anne M. Kennedy, MD - 2016 Honored Educator

**RC710B  Fetal Central Nervous System: Strategies for Accurate Diagnosis**

Participants
Roya Sohaey, MD, Portland, OR (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Develop an anatomic approach for evaluating the fetal brain at the time of mid-gestation anatomy scan. 2) Differentiate between significant and insignificant subtle findings when evaluating the fetal brain. 3) Develop an anatomy-based differential diagnosis for most brain anomalies. 4) Develop an understanding of which cases would benefit from fetal MR.

**ABSTRACT**

By the conclusion of this course, the participant will understand the strength of the current standard mid-gestational calvarial views for detecting subtle and obvious brain malformations. Additional scanning strategies are presented for more specific diagnoses once the anomaly is identified. When an accurate diagnosis is made, then the associations with genetic syndromes and other anomalies can be considered. Fetal MR is often additive and its benefits and limitations will be considered.

**RC710C  Placenta and Cervix**

Participants
Sara M. Durfee, MD, Boston, MA, (sdurfee@partners.org) (Presenter) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the cause of vaginal bleeding in patients with placental abnormalities that include placenta previa and placental abruption. 2) Describe the sonographic features of placenta accreta. 3) Apply practical techniques to a standard transvaginal examination of the cervix in the risk assessment for preterm birth during pregnancy.

**ABSTRACT**
US-guided Interventional Breast Procedures (Hands-on)

Thursday, Dec. 1 4:30PM - 6:00PM Room: E264

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

Participants
Jocelyn A. Rapelyea, MD, Washington, DC (Presenter) Speakers Bureau, General Electric Healthcare Company; Research consultant, Q-view LLC.; Research consultant, QTUS
Margaret M. Szabunio, MD, Lexington, KY, (Margaret.szabunio@uky.edu) (Presenter) Nothing to Disclose
Shambhavi Venkataraman, MD, Boston, MA, (svenkata@bidmc.harvard.edu) (Presenter) Nothing to Disclose
Angelique C. Floerke, MD, Washington, DC (Presenter) Consultant, Becton, Dickinson and Company
Rachel F. Brem, MD, Washington, DC (Presenter) Board of Directors, iCAD, Inc; Board of Directors, Dilon Technologies LLC; Stock options, iCAD, Inc; Stockholder, Dilon Technologies LLC; Consultant, U-Systems, Inc; Consultant, Dilon Technologies LLC; Consultant, Dune Medical Devices Ltd
Karen S. Johnson, MD, Durham, NC (Presenter) Nothing to Disclose
Nicole S. Lewis, MD, Washington, DC (Presenter) Nothing to Disclose
Kathleen R. Gundry, MD, Atlanta, GA (Presenter) Nothing to Disclose
Michael N. Linver, MD, Albuquerque, NM (Presenter) Scientific Advisory Board, Hologic, Inc; Scientific Advisory Board, Real Imaging Ltd; Scientific Advisory Board, Seno Medical Instruments, Inc
Christina G. Marks, MD, Saint Louis, MO (Presenter) Nothing to Disclose
Caroline M. Ling, MD, Darby, PA (Presenter) Nothing to Disclose
Jessica Torrente, MD, Washington, DC (Presenter) Nothing to Disclose
Tilden L. Childs III, MD, Fort Worth, TX (Presenter) Stockholder, Pfizer Inc
Evguenia J. Karimova, MD, Boston, MA (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.
Emerging Technology: Immuno Imaging Probes—Opportunities and Challenges

Friday, Dec. 2 8:30AM - 10:00AM Room: E353A

RC811A  A Primer on 89Zr-ImmunoPET

Participants
Terence Z. Wong, MD, PhD, Chapel Hill, NC (Moderator) Nothing to Disclose

LEARNING OBJECTIVES
1) To learn about the basic physical and chemical properties of the radioisotope 89Zr.
2) To understand the basic components of a 89Zr-labeled radioimmunoconjugate.
3) To understand how 89Zr-labeled radioimmunoconjugates are synthesized and purified.
4) To gain an appreciation of the forces behind the recent advent of 89Zr-based immunoPET imaging.
5) To explore the PSMA-targeting radioimmunoconjugate 89Zr-DFO-J591 as a case study for the journey of an immunoPET imaging agent from the laboratory to the clinic.

ABSTRACT

Currently monoclonal antibodies (mAbs) are an expanding innovative class of cancer drugs. Numerous mAbs, including several antibody-drug conjugates, are in advanced clinical development, forming an important part of the many molecularly targeted anticancer therapeutics currently in development. Development and treatment decisions for registered mAbs could benefit from quantitative biomarkers, enabling visualization of the tissue distribution of (potentially modified) therapeutic mAbs to confirm effective whole-body target expression, engagement, and modulation and to evaluate heterogeneity across lesions and patients. Such biomarkers may be realized with positron emission tomography (PET) imaging of radioactively labeled antibodies, a process called immunoPET or with a fluorescently labeled antibodies and optical imaging. This approach could potentially increase the power and value of trials and clinical practice by improving patient selection, optimizing dose and schedule, and rationalizing observed drug responses.

RC811B  Engineered Antibodies for immunoPET: Probes for Profiling Tumors and Immune Responses

Participants
Anna M. Wu, PhD, Los Angeles, CA, (awu@mednet.ucla.edu) (Presenter) Stockholder, ImaginAb, Inc; Consultant, ImaginAb, Inc; Consultant, Avidity NanoMedicines, LLC;

LEARNING OBJECTIVES
1) Identify key properties of antibodies that can be modified/improved to produce probes optimized for in vivo imaging.
2) Discuss applications of new immunoPET tracers to address challenges in oncology and immunology.
3) Describe the process and potential of translating immunoPET probes into clinical use.

RC811C  Clinical Applications of Immuno Probes in Oncology

Participants
Elisabeth G.E. de Vries, MD, PhD, Groningen, Netherlands (Presenter) Institutional Research Grant, F. Hoffmann-La Roche Ltd; Institutional Research Grant, Amgen Inc; Institutional Research Grant, Novartis Ag; Institutional Research Grant, SERVIER; Data Safety Monitoring Board, BioMarin Pharmaceutical Inc; Advisory Board, Synthon Holding BV; Advisory Board, Merck & Co, Inc;

LEARNING OBJECTIVES
1) To learn about the answers immuno probes can provide in clinical oncology.
2) To learn about the potential of the immuno probes consisting of radioactively labeled antibodies as well as fluorescently labeled antibodies in the clinic.

ABSTRACT

RC811D  Companion Imaging Diagnostics: Small Molecule Ligands versus Immune-Based Agents

Participants
Michael D. Farwell, MD, MA, New York, NY (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Describe desirable properties of a companion diagnostic imaging probe.
2) Discuss likely clinical scenarios where companion diagnostic might be used.
3) List advantages and disadvantages of small molecule versus immune-based probes as comparative diagnostics.
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/

David A. Mankoff, MD, PhD - 2013 Honored Educator
Carotid and Renal Doppler (Hands-on)

Friday, Dec. 2 8:30AM - 10:00AM Room: E264

LEARNING OBJECTIVES

1) Describe the technique and optimally perform carotid Doppler ultrasound. 2) Describe the technique and optimally perform renal Doppler ultrasound. 3) Review qualitative and quantitative criteria for diagnosing abnormalities in carotid and renal ultrasound Doppler examinations.

ABSTRACT

This hands-on course will provide participants with a combination of didactic lectures and an extended "live" scanning opportunity on normal human volunteers, as follows: Didactic lectures (30 minutes): 1. Carotid Doppler Ultrasound: scanning technique, diagnostic criteria and interesting teaching cases. 2. Renal Doppler Ultrasound: scanning technique, diagnostic criteria and interesting teaching cases. Mentored scanning (60 minutes): Following the didactic lectures, the participants will proceed to a scanning area with normal human volunteers and ultrasound machines from different manufacturers. Participants will be able to perform live scanning with direct assistance (if needed) by faculty. Faculty will be able to offer feedback, help participants improve their scanning technique as well as answer any questions. Faculty will also be available to answer general questions relating to all aspects of vascular Doppler, not limited to carotid and renal Doppler studies.

Honored Educators

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

Leslie M. Scoult, MD - 2014 Honored Educator
Sadhna Verma, MD - 2013 Honored Educator

Friday, Dec. 2 9:45AM - 10:45AM Room: E253BCD

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

FDA Discussions may include off-label uses.

Participants
Takamichi Murakami, MD, PhD, Osakasayama, Japan (Moderator) Nothing to Disclose
Won Jae Lee, MD, Seoul, Korea, Republic Of (Director) Research Grant, Samsung Electronics Co, Ltd
Judy Yee, MD, Clayton, CA, (judy.yee@ucsf.edu) (Director) Research Grant, EchoPixel, Inc
Marc Zins, MD, Paris, France (Director) Nothing to Disclose
Takamichi Murakami, MD, PhD, Osakasayama, Japan (Director) Nothing to Disclose

Sub-Events

SPHT62A Gadoxetic Acid (Gd-EOB-DTPA) Enhanced MR Imaging of Hepatocellular Carcinoma: Molecular and Genetic Background

Participants
Azusa Kitao, MD, Kanazawa, Japan (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1. Estimate the molecular background (haptocyte membrane transporter expression) of enhancement mechanism on gadoxetic acid enhanced MR imaging in hepatocellular carcinoma (HCC). 2. Describe the reason of usefulness of gadoxetic acid enhanced MR imaging in early diagnosis of HCC. 3. Identify molecular subtype of HCC by gadoxetic acid enhanced MR imaging and apply to personalized medicine.

ABSTRACT
In hepatocellular carcinoma (HCC), organic anion transporting polypeptide 1B3 (OATP1B3) is the main uptake transporter of gadoxetic acid. The hepatobiliary phase of gadoxetic acid enhanced MR imaging is a molecular imaging that sensitively reflects expression of OATP1B3. From the stage of high-grade dysplastic nodule to overt HCC, the enhancement ratio on hepatobiliary phase decreases in accordance with the decline of OATP1B3 expression. The decrease of enhancement ratio on hepatobiliary phase is the most useful finding for early diagnosis of HCC among existing imaging modality. In other word, decrease of OATP1B3 is a sensitive molecular marker reflecting early stage of hepatocarcinogenesis. In addition, most of overt HCC show low contrast enhancement on hepatobiliary phase with decreased expression of OATP1B3, whereas 10% of them show high enhancement due to atypically increased expression of OATP1B3. There highly enhanced HCC may be classified into a less aggressive subtype of HCC with some particular molecular backgrounds such as beta-catenin or hepatocyte nuclear factor 4a activation. It can be applied to the future personalized medicine. In conclusion, to understand the molecular background of gadoxetic acid enhanced MR imaging is important to appropriate diagnosis and treatment for HCC.

SPHT62B Hepatic Dynamic CT with Iterative Reconstruction

Participants
Takeshi Nakaura, MD, Kumamoto, Japan, (kff00712@nifty.com) (Presenter) Nothing to Disclose

LEARNING OBJECTIVES
1) Review the technical explanation and the non-linear nature of MBIR as compared with FBP reconstruction. 2) Address the point of optimal MBIR setting for hepatic dynamic CT. 3) Display hepatic dynamic CT images reconstructed with FBP, IR and MBIR.

ABSTRACT
Image noise is a serious problem in hepatic dynamic CT because of the requirements for low-contrast detectability. Additionally low kilo-voltage (kVp) scan is recently used for low contrast and low radiation dose CT; however, increased image noise is a problem. It is difficult to achieve the high-resolution and high-quality CT images without increase in radiation dose because image noise of filtered back projection (FBP) technique is proportional to radiation dose. Iterative reconstruction (IR) techniques have re-emerged in CT reconstruction to increase image quality and decrease radiation dose. Recent introduced model based IR (MBIR) dramatically reduces image noise, offers accurate CT attenuation, and enables improvement in low-contrast detectability especially at thin slice images. CT manufacturers take unique approaches to offer the high image quality, and also provide complicated settings and the nonlinear nature for these iterative reconstruction techniques. At a glance, the principles of these reconstruction techniques seem very complicated; however, the required knowledge for clinicians about the recent advantages is not complicated. We aim to demonstrate the recent advances in CT reconstruction techniques, and the required knowledge to optimize the reconstruction setting for the hepatic dynamic CT.

URL
LEARNING OBJECTIVES

1) To review various imaging based approaches to evaluate perfusion characteristics of the liver and hepatocellular carcinomas. 2) To address strengths and weaknesses of imaging modalities for evaluation of liver perfusion. 3) To illustrate the potential role of perfusion imaging in management of liver cirrhosis and HCC.

ABSTRACT

Recent technological development of magnetic resonance imaging (MRI) and multidetector CT (MDCT) with wide detector or dual source technology improved temporal resolution significantly, which resulted in more practical use of perfusion imaging techniques for evaluation of hepatocellular carcinoma (HCC) and liver cirrhosis. Currently, intravoxel incoherent motion (IVIM) diffusion-weighted imaging (DWI), dynamic contrast-enhanced MRI (DCE-MRI), dual energy CT and perfusion CT are common imaging based tools to evaluate perfusion properties of liver tumors. Moreover, IVIM-DWI and DCE-MRI can be performed during the same session of liver MRI, thus providing a comprehensive "one-step" morphological and functional evaluation of HCC and background liver parenchyma. These functional imaging techniques may predict prognosis or clinical outcome before treatment, and also, may play an important role for post-treatment assessment, especially after Sorafenib treatment or interventional treatments. The aim of this short presentation is to describe possible applications of new perfusion imaging techniques in management of patients with HCCs, with a particular emphasis on prognostic stratification and post-treatment monitoring.

Participants

Yasunori Minami, MD, PhD, Osaka-sayama, Japan (Presenter) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand properties of Sonazoid contrast-enhanced ultrasonography (CEUS) and realize the differences of other contrast agents. 2) Learn the typical enhancement patterns of HCC during the vascular phase and defects during the post vascular phase on Sonazoid CEUS. 3) Understand Sonazoid CEUS improve the diagnosis of HCC using defect reinjection technique.

ABSTRACT

Two breakthroughs in the field of US technology, harmonic imaging and the development of second-generation contrast agents, have demonstrated the potential to dramatically broaden the scope of US diagnosis of hepatic lesions. Second-generation microbubbles provide stable nonlinear oscillation in a low power acoustic field because of the hard shell of these bubbles, producing great detail in the harmonic signals in real-time. Perfluorocarbon microbubbles (Sonazoid®) is the only contrast agent that can be taken up by Kupffer cells in the liver. Contrast-enhanced US (CEUS) using Sonazoid® can provide detailed data, not only of the perfusion features during the vascular phase, but also of Kupffer imaging during the post vascular phase. The typical Sonazoid CEUS findings of typical hepatocellular carcinoma (HCC) show diffuse enhancement during the vascular phase and defects during the post vascular phase. However, Sonazoid CEUS findings of HCC can vary according to the degree of differentiation. Hepatocarcinogenesis is the step-wise development from a low-grade dysplastic nodule (DN), high-grade DN, high-grade DN with malignant foci, and well-differentiated HCC, to classical HCC. The intranodular blood supply changes in accordance with this progression. Moreover, an additional injection of Sonazoid® is used to determine the presence or absence of arterial blood flow in the defective area (defect reinjection test). A fast wash-in of arterial flow in the Kupffer defect area can confirm the diagnosis of HCC. Worldwide, US imaging plays an important role not only in screening, evaluating, staging and monitoring disease, but also in surveillance following tumor ablation. Advances in US imaging techniques increase our ability to detect and characterize focal liver lesions.

URL
**PURPOSE**

Preprocedure coagulation testing prior to image guided musculoskeletal (MSK) soft tissue and bone biopsy can increase cost and delay patient care. The purpose of the study is to evaluate the safety of withholding preprocedure coagulation blood testing, international normalized ratio (INR) and platelets, in a population undergoing musculoskeletal soft tissue and bone biopsies.

**METHOD AND MATERIALS**

Prior to 10/7/2014 all patients undergoing image guided bone or soft tissue biopsy at one institution underwent pre-procedure INR and platelet count testing. All cases (N=1167) from 1/5/2006 through 10/2/2014 were retrospectively reviewed to determine the incidence of biopsy related bleeding complication (hematoma, ecchymosis, or excessive bleeding). Due to the low rate of bleeding complications a policy was adopted whereby patients were screened with a bleeding risk questionnaire, and unless risk factors were identified, pre-procedure blood tests were withheld. Under the new policy, all cases (N=190) from 10/7/2014 through 10/28/2015 were prospectively followed and the incidence of bleeding complications recorded.

**RESULTS**

Preceding the new policy there were 551 soft tissue biopsies and 616 bone biopsies. In total there were 30 biopsy related bleeding complications (2.6%). Soft tissue biopsies had a higher rate of bleeding than bone (20 vs 10 respectively) (p=0.031). No patient with a bleeding complication had an INR (>1.5) or platelet count (<50) which exceeded the recommended limits based on hospital policy or the Society of Interventional Radiology Consensus Guidelines. In the subsequent year after implementation of the new policy there were 2 bleeding complications (1.1%) which was not significantly different that the prepolicy group (P = 0.201).

**CONCLUSION**

Omitting routine pre-procedure coagulation profiles does not result in an increase in hemorrhagic complications during MSK lesion biopsy. Routine coagulation testing does not help predict which patients will have bleeding complications after undergoing MSK soft tissue or bone biopsy.

**CLINICAL RELEVANCE/APPLICATION**

Radiologists can consider omitting pre-procedure coagulation testing during MSK biopsy as doing so does not adversely affect patient care, and may simplify the pre-procedure work-up and reduce costs.

**PURPOSE**

To assess the utility of repeat image guided core needle biopsy (CNB) of musculoskeletal lesions in the setting of an initially non-
diagnostic biopsy.

METHOD AND MATERIALS
Following IRB approval, a retrospective review was conducted of 1302 consecutive CNBs performed on bone or soft tissue lesions at a single institution. All cases where a repeat biopsy of the same lesion was requested by the referring physician due to non-diagnostic biopsy results were included in the study. Tumor characteristics such as lesion size and type (bone versus soft tissue) were correlated with diagnostic yield on repeat biopsy. Technical factors including the modality used, number of passes performed, gauge of the biopsy device, radiologist performing the procedure and portion of the lesion biopsied were also correlated.

RESULTS
Of the 1302 CNBs performed, 26 (2.0%) were referred for repeat biopsy. A diagnosis was obtained in 38.5% (10/26) of cases following a repeat CNB. In 5 out of the 26 cases (19.2%), a repeat CNB yielded malignancy. Overall, eleven cases were ultimately of malignant histology, of which 5 (45.4%) were diagnostic following rebiopsy. Fourteen cases were benign, of which 5 (35.7%) were diagnostic following rebiopsy. One case was lost to follow-up. A statistically significant difference in diagnostic yield was found between cases where an increased number of passes were made between the initial and repeat (p=0.047) biopsies.

CONCLUSION
Repeat core needle biopsy of initially non-diagnostic musculoskeletal lesions can be potentially useful. Increasing the number of passes on the second biopsy can increase diagnostic yield.

CLINICAL RELEVANCE/APPLICATION
Repeat CNB of musculoskeletal lesions should be considered after an initially non-diagnostic result as an alternative to more invasive and costly surgical biopsy.

Participants
Jan Fritz, MD, Baltimore, MD (Presenter) Research Grant, Siemens AG; Scientific Advisor, Siemens AG; Scientific Advisor, Alexion Pharmaceuticals, Inc; Speaker, Siemens AG
A. L. Dellon, Towson, MD (Abstract Co-Author) Nothing to Disclose
Eric H. Williams, MD, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Gedge D. Rosson, Baltimore, MD (Abstract Co-Author) License agreement, Aegeria Soft Tissue LLC
Alan Belzberg, Baltimore, MD (Abstract Co-Author) Nothing to Disclose
Frederick Eckhauser, Baltimore, MD (Abstract Co-Author) Nothing to Disclose

PURPOSE
Diagnostic genitofemoral nerve blocks are frequently utilized to establish and validate the diagnosis of genitofemoral neuralgia. Genitofemoral nerve blocks in the groin area are widely performed, but are prone to inaccuracies due to concomitant anesthesia of nearby nerves. Therefore, we prospectively evaluate the technical and diagnostic effectiveness and safety of 3-Tesla MR neurography-guided retroperitoneal genitofemoral nerve blocks.

METHOD AND MATERIALS
Our institutional review board approved this prospective HIPAA compliant study. Informed consent was obtained from all participants. Patients with intractable groin pain were included. Diagnostic MR neurography-guided genitofemoral nerve blocks were performed using a retroperitoneal approach and clinical wide-bore 3 Tesla MRI system. Outcome variables were assessed including technical success, complications, and efficacy. P-values ≤ 0.05 were considered statistically significant.

RESULTS
30 retroperitoneal genitofemoral nerve blocks were performed in 26 subjects (16 men, 10 women; mean age, 42 years; age range, 24–78 years; mean body mass index (BMI), 28 kg/m2, BMI range 20-35 kg/m2), of which 12/30 (40%) were performed with an anterior, 12/30 (40%) lateral and 6/30 (20%) posterior needle path. Genitofemoral nerve blocks achieved appropriate anesthesia in 24/26 (92%) subjects. No complications occurred. Genitofemoral nerve blocks had a sensitivity, specificity, positive and negative likelihood ratio, and accuracy of 93%, 75%, 3.73, 0.09, and 84%, respectively for the diagnosis of genitofemoral neuralgia.

CONCLUSION
Selective retroperitoneally-directed MR neurography-guided genitofemoral nerve blocks are safe and effective with high technical success and diagnostic accuracy for the diagnosis of genitofemoral neuralgia.

CLINICAL RELEVANCE/APPLICATION
Selective MR neurography-guided genitofemoral nerve blocks in the retroperitoneum are safe, allow for a technical success rate of 92% and a diagnostic accuracy of 84% for the diagnosis of genitofemoral neuralgia.

Participants
Maira Hameed, BA,BMBCh, London, United Kingdom (Abstract Co-Author) Nothing to Disclose
Catriona E. Reid, MBBS, MA, Portsmouth, United Kingdom (Abstract Co-Author) Nothing to Disclose
Ajay Sahu, MBBS, MRCS, Plymouth, United Kingdom (Abstract Co-Author) Nothing to Disclose
Maria B. Johnson, MB CHB, FRCR, Southampton, United Kingdom (Presenter) Nothing to Disclose

PURPOSE
Chronic Achilles tendinopathy is a prevalent overuse injury often observed in athletes. There is significant morbidity associated with
Chronic Achilles tendinopathy is a prevalent overuse injury often observed in athletes. There is significant morbidity associated with surgical treatment and so minimally invasive treatments are now in favour. There are multiple potential modalities of treatment including autologous blood injection and corticosteroids. Dry needling is the procedure of repeatedly passing a fine needle through the abnormal tendon substance under local anaesthesia. Its rationale is to stimulate an inflammatory response followed by formation of reparative tissue, with a view to strengthen the tendon. We aimed to analyse our practice of ultrasound-guided dry needling and percutaneous high volume stripping of the Achilles tendon as a novel treatment paradigm for this condition.

**METHOD AND MATERIALS**

Sixty-four patients with sonographically-confirmed Achilles tendinopathy were analysed. All were symptomatic for more than four months and had failed alternative conservative treatment modalities. Ultrasound-guided dry needling of neovascular areas and percutaneous high volume stripping was undertaken by two dedicated musculoskeletal radiologists. We performed sonographic assessment of the tendon's thickness and neovascularity. Patient satisfaction was the primary outcome measure with a follow up period of three months. Secondary outcome measures included, pain scores (comparing these to pre-procedure levels), complication rate, and success rate.

**RESULTS**

54 out of 64 tendons have been successfully treated and the remainder are still undergoing their long term follow up. Our combined therapeutic intervention led to a significant improvement in pain scores and the majority of the patients, >85%, are satisfied with outcomes. There were no adverse events reported.

**CONCLUSION**

Ultrasound-guided dry needling and percutaneous high volume stripping has a high treatment success rate and few adverse events in our cohort of Achilles tendinopathy. Patients satisfaction rates are high and comparable to those documented in the literature for other minimally invasive treatment options. This option is favourable to the longer recovery time and higher risks associated with surgery.

**CLINICAL RELEVANCE/APPLICATION**

Ultrasound-guided dry needling and percutaneous high volume stripping shows promise as a novel minimally invasive treatment modality for chronic Achilles tendinopathy.


**Friday, Dec. 2 11:30AM - 11:40AM Room: E451A**

**Participants**

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

**PURPOSE**

To evaluate and show the different clinical and instrumental outcome after intratendinous injection of Platelet Rich Plasma (PRP) and percutaneous needle tenothomy (needling) in patients with tendinosis of Achilles tendon.

**METHOD AND MATERIALS**

60 patients (30 men, 30 women, mean age 49.1 years) with refractory Achilles tendon tendinopathy who underwent either dry needling (n=30) or PRP injection (n=30). Pre-treatment evaluation included ultrasound and MRI scan, analysis of visual analogue pain scores (VAS) and VISA-A score for functionality. Clinical (VAS and VISA-A) and instrumental (US and MRI) follow-up was performed 6 months after the treatment.

**RESULTS**

The study group (PRP) showed recovery of tendon echogenicity and MRI signal intensity in 20 patients, 6 patients showed no improvement and 4 patients showed worsening of the tendinopathy. 24 patients (80%) reported mild to moderate pain reduction (mean VAS score 3, range 0-5), 6 patients had no improvement. The mean VISA-A values improvement was 65%. In the control group we noted recovery of tendon echogenicity and MRI signal intensity in 19 patients, 5 patient showed no improvement and 6 patients showed worsening of the tendinopathy. 75% of the patients showed improvement in VAS and 60% in VISA-A values.

**CONCLUSION**

Both PRP and needling are effective minimally invasive treatments for chronic, recalcitrant tendinosis of the Achilles tendon.

**CLINICAL RELEVANCE/APPLICATION**

Dry needling shows promise as an alternative, cheaper and effective treatment for the management of Achilles tendon degenerative pathology. As for PRP injection, it is important to carry out this technique under sonographic guidance so that the abnormal tendon can be targeted precisely for dry needling.

**SST06-08  Short-term Comparison Between Blind and Ultrasound-guided Injection in Morton Neuroma**

**Friday, Dec. 2 11:40AM - 11:50AM Room: E451A**

**Participants**

Fernando Ruiz Santiago, PhD, granada, Spain (Presenter) Nothing to Disclose
Nicolás Prados Olleta, PhD, Granada, Spain (Abstract Co-Author) Nothing to Disclose
Pablo Tomas Munoz, MD, Granada, Spain (Abstract Co-Author) Nothing to Disclose
PURPOSE
The aim of this work in progress report is to compare the effectiveness of blind vs. ultrasound-guided injection in Morton neuroma in order to determine which one is more appropriate as initial procedure in conservative treatment.

METHOD AND MATERIALS
This is a patient-blinded randomized trial. The final sample size has been calculated to be 100 patients. Fifty patients from group 1 will be injected by an experienced orthopaedic surgeon, based upon anatomical landmark. Fifty patients from group 2 will be injected by an experienced musculoskeletal radiologist under ultrasound guidance. The main inclusion criterion is clinical suspicion of Morton neuroma confirmed by ultrasound scan. Patients included are clinically assessed by the VAS score, the Manchester Foot Pain and Disability Schedule (MFPDS), and a generic quality-of-life instrument, the EQ-5D. Injection includes 1 cc of 2% mepivacaine and 40 mg of triamcinolone in each web space with Morton neuroma. According to the patient’s evolution, up to 4 injections were allowed during the first 2 months of follow-up. Follow-up was performed by phone calls and/or scheduled consultations at 15 days, 1 month, 45 days, 2 months, 3 months, 6 months and 1 year. Statistical analysis was performed by unpaired Student’s t-test.

RESULTS
Currently, 33 patients have been included in the study, 16 of which have completed 3 months of follow-up. No differences in age or clinical measures were found at presentation between Group 1 (blind injection) (VAS: 8.1 ± 0.4; MFPDS: 27.6 ± 2.1; EQ-5D: 3.7 ± 0.3) and Group 2 (ultrasound-guided injection) (VAS: 8.1 ± 0.3; MFPDS: 24.6 ± 2.5; EQ-5D: 3.3 ± 0.4). At 3 months of follow-up, both groups showed statistical improvement, although ultrasound-guided group showed greater symptomatic relief (VAS: 6.7 ± 1.2 vs. 3.1 ± 0.9, p = 0.034; MFPDS: 23.8 ± 4.4 vs. 10.4 ± 3.8, p = 0.038; EQ-5D: 3.8 ± 0.9 vs. 2.8 ± 1.2, p = 0.55).

CONCLUSION
Injections relieved symptoms of Morton neuroma in a high percentage of patients.

CLINICAL RELEVANCE/APPLICATION
According to our results, injection under ultrasound guidance is worthwhile because a more significant improvement was observed in comparison with blind injection.

SST06-09 Clinical Outcomes of Percutaneous Lumbar Facet Synovial Cyst Rupture
Friday, Dec. 2 11:50AM - 12:00PM Room: E451A

Participants
Stijn A. Bos, Boston, MA (Presenter) Nothing to Disclose
Ambrose J. Huang, MD, New York, NY (Abstract Co-Author) Nothing to Disclose
Martin Tornani, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Frank J. Simeone, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose
Stuart R. Pomerantz, MD, Boston, MA (Abstract Co-Author) Research Grant, General Electric Company
Miriam A. Bredella, MD, Boston, MA (Abstract Co-Author) Nothing to Disclose

PURPOSE
Lumbar facet synovial cysts (LWSC) can cause low back pain (LBP), spinal stenosis and radiculopathy. The purpose of our study was to evaluate the therapeutic value, safety and clinical outcomes of percutaneous LFSC rupture in patients with LBP.

METHOD AND MATERIALS
Our study was IRB approved and HIPAA compliant. The study group comprised 48 patients (19 m, 29 f, mean age: 67±1.7 (SEM) yrs) with LBP and MRI findings of LFSC that corresponded with the patients’ clinical symptoms, who underwent CT or fluoroscopy-guided percutaneous synovial cyst rupture and steroid injection. Success of LFSC rupture, injectate, complications, and long-term clinical outcome including repeat procedures or surgery were recorded. Groups were compared using the Chi-square or Fisher’s Exact test.

RESULTS
Fifty-six percutaneous LFSC ruptures were performed in 48 patients. CT-guidance was used in 38 cases and fluoroscopy-guidance in 18 cases. LFSC rupture was technically successful in 40/56 cases (71%) confirmed by contrast filling the LFSF and extending into the epidural space. There was a higher likelihood of a technically successful rupture using CT vs fluoroscopy-guidance (p=0.03). In 48 cases LFSC rupture was performed by facet joint injection and in 8 cases by direct puncture of the synovial cyst, which did not result in a difference in technical success rate (p=0.8). In all cases a mix of 1 cc of triamcinolone and 1 cc of anesthetic (lidocaine /ropivacaine) and saline was injected (mean volume 3.7±0.3 cc). Two patients were lost to follow-up. Over a mean follow-up time of 34.45 months, 19 patients (41%) were pain-free, 3 patients (7%) underwent repeat cyst rupture, and 22 patients (48%) eventually underwent surgery. There was no statistical significance between a successful outcome and age, sex or level of LFSC (p>0.1). There were 2 complications (4%) (severe pain following procedure requiring in-hospital observation, n=1; bacterial infection, n=1).

CONCLUSION
Percutaneous LFSC rupture is an effective and safe non-surgical treatment for LFSC with higher technical success rate using CT vs fluoroscopy-guidance. More than half of treated patients were able to avoid subsequent surgery.

CLINICAL RELEVANCE/APPLICATION
Percutaneous LFSC rupture is a safe and effective minimally invasive procedure which may obviate the need for surgical intervention.