Controversy Session: Imaging of Inflammatory Bowel Disease: If There Was Only One Choice—What Would It Be? CT or MR Enterography?

Thursday, 07:15 AM - 08:15 AM • E351

SPSC50 • AMA PRA Category 1 Credit:™:1 • ARRT Category A+ Credit:1

Moderator

Joel G Fletcher, MD *

Joel G Fletcher MD (Presenter) *

LEARNING OBJECTIVES

1) To review the medical justification and appropriateness of CT enterography for Crohn's disease diagnosis and staging. 2) To understand the natural history of Crohn's disease and how the relationship between patient symptoms and biologic activity. 3) To discuss methods for performing CT enterography for Crohn's disease, and how the technique can be adapted for different patients. 4) To briefly review the imaging findings of Crohn's disease at CT enterography. 5) To understand the role of CT enterography in the diagnostic and staging of Crohn's disease (e.g., ileocolonoscopy, capsule endoscopy, MR enterography, fluoroscopy). 6) To discuss the relative merits of CT enterography in comparison to MR enterography.

ABSTRACT

Hot Topic Session: Multimodality Imaging with MR-PET

Thursday, 07:15 AM - 08:15 AM • E350
LEARNING OBJECTIVES
1) Understand challenges and potential solutions associated with PET/MR attenuation correction. 2) Become aware of advanced body applications for PET/MR. 3) Understand challenges of integrating PET/MR into clinical workflow.

SPSH50A • Advanced PET/MR
Ciprian Catana MD, PhD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSH50B • Integration of PET/MR into Clinical Workflow
Kathryn J Fowler MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSH50C • Challenges of Attenuation Correction
Martin Judenhofer PhD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

ASRT®RSNA 2013: Moving Towards Best Practice: Developing National Guidelines through a Collaborative Approach
Thursday, 08:00 AM - 09:00 AM • N230

MSRT51 • AMA PRA Category 1 Credit ™:1 • ARRT Category A+ Credit:1
Mark Given, MRT, RT

LEARNING OBJECTIVES
1) An overview of best practice for medical radiation technologists in Canada. 2) A detailed overview of the processes used to develop the evidenced-based recommendations within each guideline. 3) An understanding of the collaborative approach used to vet the recommendations. 4) A brief tutorial on how to use the guidelines. 5) Discuss how the guidelines are being used to change practice.

ABSTRACT
Guidelines provide a tool to help individuals enhance their professional lives and keep up with changes in their field. The opportunity to develop best practice documentation for medical radiation technologists in Canada was identified as an important strategic step for the profession and a key component of the push to gain greater recognition. In 2010, the Canadian Association of Medical Radiation Technologies (CAMRT) assembled a multidisciplinary committee from across Canada to develop Best Practice Guidelines. Since that time, the group has been identifying and developing new guidelines for MRT professionals across Canada to use in their daily practice. The process of working with this diverse group and developing an interactive Best Practice Guidelines website has been an evolution from start to finish. It provides many lessons and innovations to share with those who wish to pursue this path in the future.

Case-based Review of Neuroradiology: Brain (An Interactive Session)
Thursday, 08:30 AM - 10:00 AM • S100AB

MSCN51 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
Director
Pina C Sanelli, MD

LEARNING OBJECTIVES
1) Provide a review of imaging findings in adult brain pathologies highlighting key diagnostic features. 2) Review pertinent differential diagnostic considerations. 3) Provide important diagnostic imaging pearls and pitfalls.

MSCN51A • Adult Brain
Pina C Sanelli MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

MSCN51B • Pediatric Brain
Tina Y Poussaint MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

MSCN51C • Common Misdiagnoses
Pamela W Schaefer MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

Case-based Review of Pediatric Radiology: Pediatric Thoracic Imaging (An Interactive Session)
Thursday, 08:30 AM - 10:00 AM • S406A

MSCPS1 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
Director
Edward Y Lee, MD, MPH

LEARNING OBJECTIVES
1) Discuss ‘segmental’ approach to aid diagnosis of congenital cardiovascular anomalies. 2) Review imaging techniques. 3) Review clinical aspects and characteristic imaging findings of commonly encountered congenital and acquired cardiovascular diseases in children. 4) Review the common congenital heart disease surgical repairs and their most frequent complications.

MSCPS1B • Thoracic Infections in Infants and Pediatric Patients
LEARNING OBJECTIVES
1) Discuss the different imaging approach of tuberculosis in pediatric patients at different ages and the differential diagnosis. 2) Discuss parenchymal lung infections that present as cavitating lesions in children and their differential diagnosis. 3) Show several examples of unusual thoracic fungal infections in children. 4) Discuss differential diagnosis of chest wall infections in children and imaging approach. 5) Discuss round pneumonia, imaging findings, work up and differential diagnosis.

MSEP51C • Diffuse Lung Disease in Pediatric Population
Edward Y Lee MD, MPH (Presenter)
LEARNING OBJECTIVES
1) Discuss a new classification system of diffuse lung disease in pediatric population. 2) Review helpful clinical aspects and imaging findings of diffuse lung disease in children. 3) Learn characteristic HRCT imaging findings to narrow the differential diagnoses of diffuse lung disease in pediatric patients.

Essentials of Gastrointestinal Imaging
Thursday, 08:30 AM - 10:00 AM • S406B

MSES51 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

MSES51A • Imaging of Inflammatory Bowel Disease
David J Grand MD (Presenter)
LEARNING OBJECTIVES
1) Understanding the role of enterography for imaging of inflammatory bowel disease. 2) Understand how to protocol and perform CT and MR Enterography examinations. 3) Understand the considerations involved in choosing which exam to perform. 4) Identify the findings and complications of inflammatory bowel disease on CT and MR Enterography.

ABSTRACT
CT and MR Enterography have become the most common imaging modalities used to evaluate inflammatory bowel disease. This presentation will discuss technical aspects of how to perform each exam as well as when to perform which exam. It will also demonstrate a simple, yet comprehensive approach to each study with special attention to common findings and complications of inflammatory bowel disease.

MSES51B • Multimodality Imaging and Management of Cystic Pancreatic Lesions
Koenraad J Mortele MD (Presenter)
LEARNING OBJECTIVES
1) To review the spectrum of cystic pancreatic tumors of the pancreas. 2) To review the multi-modality imaging pearls and perils to diagnose and differentiate cystic pancreatic tumors. 3) To review management guidelines for cystic pancreatic tumors.

ABSTRACT
Cystic pancreatic neoplasms are a diverse group of tumors which vary in aggressiveness from benign to dysplastic or pre-malignant to frankly invasive cancers. The true prevalence of pancreatic cystic lesions is unknown but has been previously reported to be between 2.4% and 25%. At the author's institution, Lee reported the prevalence of incidental pancreatic cystic lesions detected on MRI to be 13.5% and showed that both prevalence and cyst size increased with age. Since most cystic pancreatic lesions are neoplastic, accurate diagnosis via a combination of clinical information, imaging, and endoscopic ultrasound (EUS) with cyst fluid analysis is of utmost importance. The primary purpose of this review is to highlight the key imaging findings for a vast array of cystic pancreatic neoplasms. These include the relatively common ones: intraductal papillary mucinous neoplasm (IPMN), serous microcystic adenoma, and mucinous cystic neoplasm (MCN). Secondly, the radiological features of more rare ones, including cystic endocrine tumors, solid pseudopapillary tumor (SPT), cystic metastases, and lymphangiomas, will also be discussed. Finally, this article also provides a comprehensive management algorithm based on lesion size and patient's symptoms, with recommendations when to reimagine patients with those lesions.

MSES51C • Abdominal CT: Technical Advances for Improving Patient Safety
Sebastian T Schindera MD (Presenter) *
LEARNING OBJECTIVES
1) Understand how to optimize the radiation dose of abdominal CT protocols applying technical advances. 2) Understand how to optimize the contrast media injection protocol for different abdominal CT protocols. 3) Understand how to optimize abdominal CT protocols in obese patients.

ABSTRACT
Although CT is a powerful tool that has transformed the practice of medicine, the benefits are accompanied by important risks. Radiologists must understand these risks and the strategies available to minimize them as well as the risks associated with contrast medium delivery in abdominal CT. This presentation will address many of the issues that are related to ensuring patient benefit in abdominal CT, balancing the use of ionizing radiation and iodinated contrast media.

No Course RC601. See Series VSCA51 Cardiac Radiology Series: Cardiac Dual Energy CT
Thursday, 08:30 AM - 10:00 AM

RC601
How To Evaluate Resident Milestones Effectively and Efficiently: Practical Ideas Will Help Program Directors and Residents To Know What Is Expected
Thursday, 08:30 AM - 10:00 AM • S404AB

MPS ED
RC602 • AMA PRA Category 1 Credit ™:1.5
Angela M Paladin MD, FACR
Mary H Scanlon MD, FACR
Todd S Miller MD
LEARNING OBJECTIVES
1) Become familiar with each main milestone category. 2) Learn the constituent parts of each main milestone category and how they are structured into graduated sections organized by level of training. 3) Learn methods of gathering data for each milestone category, section, and level within each using the resources provided by the milestone committee. 4) Learn how to apply proven assessment strategies via review of lessons learned during successful and unsuccessful implementations undertaken by the milestone committee members.

No Course RC603. See Series VSMK51 Musculoskeletal Radiology Series: Hip Imaging: Challenges and Solutions
Thursday, 08:30 AM - 10:00 AM

RC603
No Course RC604. See Series VSMK51 Musculoskeletal Radiology Series: Hip Imaging: Challenges and Solutions
Thursday, 08:30 AM - 10:00 AM
Alzheimer’s Disease

LEARNING OBJECTIVES
1) To review the current role of CT and MR in the workup of the patient with dementia. 2) To understand how a recently revised definition of Alzheimer’s disease is leading to a new paradigm in the workup of patients with dementia, and those at risk. 3) To describe the role of biomarkers, including advanced imaging, in early diagnosis and development of the next generation of therapeutics for Alzheimer’s disease and related disorders.

Neck Imaging

LEARNING OBJECTIVES
1) Learn the CT and MR appearance of common non cystic neck masses in the infrahyoid neck. 2) Learn to develop a differential diagnosis for lesions based on location and imaging appearance. 3) Review the anatomy in the region of the thoracic inlet and location of major nerves in the infrahyoid neck to improve the detection of tumor spread and prediction of potential nerve involvement.

GU Ultrasound 2013: The Expert’s Update on Kidney, Gynecologic and Testicular US

LEARNING OBJECTIVES
1) The learner will be made aware of the importance of acute kidney injury (AKI) and associated ultrasound findings. 2) Ultrasound criteria of cystic adnexal masses will be reviewed. 3) Testicular and scrotal pathology and the importance of ultrasound will be explained.
We will explain the ultrasound findings of acute kidney injury (AKI), the evaluation of pelvic masses and the necessary follow-up. Finally, a review of the testicle and ultrasound findings will complete the course.

The Acute Abdomen and Pelvis (An Interactive Session)

Thursday, 08:30 AM - 10:00 AM • E450A

RC608A • Imaging of Acute Pancreatitis: Current Concepts

Jorge A Soto MD (Presenter) *

LEARNING OBJECTIVES
1) To review the appropriate terminology that should be implemented when describing glandular and peri-glandular findings in acute pancreatitis, following the revision of the Atlanta classification. 2) To identify the importance of glandular necrosis in defining the prognosis of acute pancreatitis. 3) To describe the technical aspects that are necessary for acquiring good quality CT examinations in acute pancreatitis. 4) Illustrate specific situations where MR can be a valuable tool in the evaluation of acute pancreatitis.

RC608B • Non-contrast CT of the Acute Abdomen

Douglas S Katz MD (Presenter)

LEARNING OBJECTIVES
1) To review the current indications for performing non-contrast CT of the acute abdomen and pelvis. 2) To demonstrate examples of non-contrast CT of the acute abdomen and pelvis. 3) To highlight the advantages and potential limitations of non-contrast CT of the acute abdomen and pelvis, compared with other CT protocols/other cross-sectional imaging examinations. 4) To briefly review areas of controversy with CT protocols (e.g. appendicitis).

RC608C • CT of the Acute Female Pelvis

Anjali Agrawal MD (Presenter)

LEARNING OBJECTIVES
1) Highlight the importance of recognition of acute gynecologic conditions on CT. 2) Outline the physiologic processes that may present as acute pelvic pain and their CT findings. 3) Describe the CT features of common pathologic causes of acute female pelvis. 4) Illustrative case examples with correlative imaging findings on sonography or MRI to improve the understanding of the anatomy and pathology on CT.

Gastrointestinal: CT Colonography Update (An Interactive Session)

Thursday, 08:30 AM - 10:00 AM • E353C

RC609A • CT Colonography: Techniques

Seong Ho Park MD (Presenter) *

LEARNING OBJECTIVES
1) Understand the basic bowel preparation steps for CT colonography and related knowledge updates. 2) Design and modify their bowel preparation procedures for CT colonography practice. 3) Explain the procedures during the scanning of CT colonography. 4) Understand the radiation dose of CT colonography and how to reduce it. 5) Identify common pitfalls related to CT colonography techniques and how to avoid them.

RC609B • CT Colonography: Interpretation Workflow

Abraham H Dachman MD (Presenter) *

LEARNING OBJECTIVES
1) Improve knowledge of CTC interpretation workflow. 2) Apply principles to utilize 2D, 3D and novel presentations of CTC data. 3) Avoid some common pitfalls in CTC interpretation.

METHODS OF INTERPRETATION:
- 3D with 2D problem solving
- 2D with 3D problem solving
- Soft tissue windows for flat lesions
- Bone windows for dense oral contrast tagged fluid and stool
- Virtual Pathology (open views)
- Computer-aided diagnosis (CAD) APPROACH TO POLYP CANDIDATE ANALYSIS:
- Polyp vs. fold > use > 3D or MPRs
- Polyp vs. stool > use > texture (W/L or color map)
- If solid . . . Compare supine / prone for mobility
- If mobile, check for long stalk, colonic rotation / flip

PRIMARY 3D READ STRATEGIES:
- Forward and backward
- Supine and prone
Abdominal Vasculature: Ultrasound and Doppler

Thursday, 08:30 AM - 10:00 AM • S103CD

LEARNING OBJECTIVES
1) To understand the most common causes of false positives on CT Colonography. 2) To learn problem solving strategies to avoid missed lesions and false positives. 3) To streamline time - efficient interpretation methodology with high accuracy for lesion detection.

ABSTRACT
Accurate interpretation of CT Colonography requires specific education. Readers must learn the appearance of normal structures and pitfalls in order to avoid errors of interpretation. There are different learning paradigms depending upon the technique employed such as with the use of tagging and computer aided detection. Maintenance of competency in this area requires continued learning and experience.

CT Colonography: Summary of Results

David H Kim MD (Presenter) *

LEARNING OBJECTIVES
1) Be knowledgeable of the major trials establishing CTC performance. 2) Understand the strengths and weaknesses of CTC- and OC- based screening. 3) Be aware of the likely risk estimates from radiation in CTC-based screening.

LEARNING OBJECTIVES
1) Understanding the indications of contrast enhanced ultrasound (CEUS) in different abdominal organs. 2) Learning about the importance of the three contrast phases and how CEUS performs in detecting and characterizing focal liver lesions. 3) Learning the potential value as well as the limitations of CEUS in renal disorders. 4) Learning how CEUS performs in diseases of other solid organs including the intestine and major abdominal vessels.

ABSTRACT
Liver: In patients with favorable scanning conditions CEUS is at least as sensitive as contrast enhanced CT (CECT) in detecting malignant liver lesions. Due to a high temporal resolution, even a short hyper-enhancement of a few seconds can reliably be detected, thus improving the characterization of focal liver lesions. A majority of malignant lesions can therefore be characterized as iso- or hyper-enhancing. During the arterial phase the tumor’s vessel architecture and direction of contrast filling is important for characterizing a lesions character. Due to a high spatial resolution, novel contrast imaging techniques allow detection of washed out lesions down to 3mm in size. CEUS characterizes focal liver lesions with a much higher diagnostic confidence than conventional US and is comparable to CT and MRI. CEUS also improves intraoperative tumor detection and characterization. Using time intensity analysis a change in contrast enhancement and kinetics helps in estimating tumor response to chemotherapy. CEUS is also used to monitor local ablation therapy and is a useful imaging tool to detect early tumor recurrence. Gallbladder: CEUS can be used to better visualize ulceration, perforation, and tumors of its wall. Pancreas: CEUS can be used to reliably image necrosis in acute pancreatitis. It helps to differentiate neuroendocrine tumors from ductal adenocarcinoma. Kidney: CEUS adds great value in detecting and characterizing complicated cysts and is believed to be more accurate than CECT. However, its value in differentiating solid renal tumors is limited. Parenchymal changes due to infectious diseases can be diagnosed by using CEUS. It is highly sensitive in detecting organ infarctions as well. Intestine: CEUS is of great value in characterizing inflammatory diseases and especially in imaging complications. CEUS improves visualization of abdominal vascular disorders.

LEARNING OBJECTIVES
1) To understand the most common causes of false positives on CT Colonography. 2) To learn problem solving strategies to avoid missed lesions and false positives. 3) To streamline time-efficient interpretation methodology with high accuracy for lesion detection.

ABSTRACT
Lung: The lung is the most frequent site in the body for metastatic disease. A majority of these tumors are malignant. Low attenuation areas on a non-contrast CT are often an indication of a tumor. In these cases, CEUS can provide additional information. Especially in patients with multiple small lung lesions CEUS can help to differentiate benign from malignant disease. In patients with metastatic tumors CEUS provides additional information about the number of lesions and the depth of the lesions.

LEARNING OBJECTIVES
1) To understand the sonographic findings in patients with malignant abdominal masses. 2) To recognize the ultrasonic characteristics of histologically verified malignant tumor masses.

ABSTRACT
The sonographic appearance of a malignant tumor mass is usually distinctly different from a benign mass. In malignant masses, the characteristics of high internal reflection, hypo- or anechoic areas, and irregular margins are frequently observed. Vascular invasion is another criterion that helps to characterize a tumor mass as malignant. In patients with solid tumor masses the performance of CEUS is comparable to that of CECT. CEUS is of great value in detecting and characterizing focal liver lesions.
LEARNING OBJECTIVES
1) Understand software methods to cope with lower SPECT counting statistics in order to reduce scan acquisition time and/or radiopharmaceutical injected activity and their clinical impact. 2) Understand instrument advancements that allow new cameras to perform SPECT with markedly reduced acquisition times and/or less radiopharmaceutical activity and their clinical impact. 3) Implement protocols that facilitate patient-centered imaging and that reduce patient radiation exposure. 4) Recognize new software methods to select appropriate patients for cardiac resynchronization therapy (CRT).

ABSTRACT
A long-standing limitation of radionuclide myocardial perfusion SPECT is its relatively lengthy acquisition time, as compared to stress echocardiography and cardiac CT. New software methods and new innovative hardware, however, now allow for significantly shortened SPECT acquisition times without a decrease in image quality. Advancements include iterative reconstruction, resolution recovery, and noise reduction software, and focused collimation and solid state detectors incorporated into new camera designs.

More recently the media, the public, and the medical community have drawn attention to patient radiation exposure associated with radiographic, nuclear medicine, and nuclear cardiology procedures and the potential associated patient risk. The radiology and nuclear imaging communities have responded rapidly and definitively by implementing a variety of guidelines to decrease patient radiation exposure and to avoid exposure in higher risk patient populations. The American Society of Nuclear Cardiology has set a goal to decrease patient radiation exposure associated with myocardial perfusion SPECT to less than 9 mSv per entire study in 50% of patients by 2014, and the ACR Image Wisely Guidelines encourage reduced radiation doses. New software and hardware methods described in this presentation will help us achieve this goal by providing the ability to maintain or improve SPECT image quality with the lower image counting statistics associated with significantly decreased injected radiopharmaceutical doses. There has been an intersocietal effort to promote patient-centered imaging with a focus on appropriateness guidelines, cost-containment, radiation dose reduction, and the selection of the most appropriate imaging test and protocol to suit particular patient needs. The technical advancements described above facilitate implementation of patient-centered imaging.

RC611B • Advances in Cardiac PET
Sharmila Dorbala MBBS (Presenter) *

LEARNING OBJECTIVES
1) Review the advantages and disadvantages of myocardial perfusion PET compared to SPECT for evaluation of coronary artery disease. 2) Learn the added value of absolute quantitative parameters derived from PET for assessment of cardiovascular disease. 3) Update of current and future clinical applications of cardiac PET imaging in cardiovascular medicine.

ABSTRACT
No Course RC612. See Series VSVA51 Vascular Imaging Series: CT Angiography-New Techniques and Their Application
Thursday, 08:30 AM - 10:00 AM

No Course RC614. See Series VSIR51 Interventional Radiology Series: Non-Vascular Interventions
Thursday, 08:30 AM - 10:00 AM

Vascular Lesions in Children: Diagnostic Dilemmas and Treatment Options
Thursday, 08:30 AM - 10:00 AM • S102AB

RC613A • Hemangiomas and Vascular Syndromes
Patricia E Burrows MD (Presenter) *

LEARNING OBJECTIVES
1) Participants will become familiar with the current classification of vascular anomalies, including subtypes of hemangiomia and vascular overgrowth syndromes. 2) They will be familiar with imaging findings associated with different subtypes of hemangiomas, simple vascular malformations and vascular overgrowth syndromes. 3) They will be able to prescribe appropriate imaging studies, based on the clinical findings.

ABSTRACT
This presentation will review a classification of vascular anomalies and associated imaging findings. Hemangiomas are proliferative tumors of infancy. Infantile hemangioma (glut1 positive) is the most common and consists of a soft tissue mass composed of capillaries with dilated feeding and draining vessels. Congenital hemangioma (glut1 negative) (RICH and NICH) are fully formed at birth and behave differently from infantile hemangiomas. Imaging may also be different. Vascular malformations are usually composed of channels without a soft tissue mass. Combined malformations are the exception, as they are often associated with soft tissue overgrowth. Venous malformations are classified as focal, multifocal or diffuse types. Familiar forms include blue rubber bleb nevus syndrome, glomuvenous malformation and cutaneouscysmal venous malformations. Sporadic and cutaneouscysmal venous malformations are caused by TIE2 mutations. Venous malformations are hyperintense on T2 weighted images and usually show slow and partial enhancement. Lymphatic malformations can be cystic [macrocytic, microcytic] or composed of dysfunctional channels. These generally appear hyperintense on T2 weighted imaging and to not enhance. AVM and AV fistula appear as dilated channels, usually within normal or hypertrophied tissue. Angiography shows early venous drainage. Angiarchitecture varies. Associated mutations include ALK1, endoglin, SMAD4, RASA-1, PTEN. Combined malformations can be associated with low flow or fast flow channels and often have associated soft tissue overgrowth. Syndromic forms include Klippel-Trenaunay syndrome (CLVM), CLOVES syndrome, CM macrocephaly syndrome, and PTEN hamartoma syndrome. These patients require careful and extensive imaging to identify the vascular anomalies present, limb length discrepancy and soft tissue anomalies. In summary, vascular anomalies vary in their extent and severity of symptoms. Ultrasoundography is useful to determine flow characterist

RC613B • Treatment of High-Flow Lesions - Manage or Cure?
David M Hovsepian MD (Presenter) *

LEARNING OBJECTIVES
1) Participants will learn about treatment planning for arteriovenous malformation, about challenging cases that require multiple approaches in staged procedures, and possible complications from IR intervention.

ABSTRACT
RC613C • Low-flow Lesions-Basic and Advanced Treatment Options
Leah E Braswell MD (Presenter)

LEARNING OBJECTIVES
Participants will learn about needle sclerotherapy techniques for venous malformation and drain sclerotherapy techniques for macrocytic lymphatic malformation. Complimentary treatment techniques, per-procedural management, and long term follow-up will be discussed.

No Course RC614. See Series VSIR51 Interventional Radiology Series: Non-Vascular Interventions
Thursday, 08:30 AM - 10:00 AM

Breast US
Thursday, 08:30 AM - 10:00 AM • N227

RC615 • AHA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

RC615A • High-Quality Breast US
**LEARNING OBJECTIVES**
1) To review basic ultrasound principles used to create high quality images. 2) To understand appropriate breast ultrasound technique and documentation. 3) To improve knowledge regarding breast ultrasound accreditation, including image evaluation and biopsy case assessment.

**RC615C • US Evaluation of Lymph Nodes**
Robert A Schmidt MD (Presenter) *

**LEARNING OBJECTIVES**
1) Understand how the anatomy of a lymph node affects its sonographic appearance. 2) How metastases alter the sonographic appearance of a lymph node. 3) Several methods of distinguishing whether an abnormal node is more likely metastatic or a benign reactive lymph node. 4) The landmarks that define the axillary lymph node levels, how to assess axillary lymph node levels, and breast cancer metastases spread from level to level in most cases. 5) How to assess a lymph node for peri-nodal invasion and how to perform a biopsy to prove its presence. 6) The various methods of performing biopsy of axillary lymph nodes and how ultrasound guided biopsy of axillary lymph nodes affect management of the breast cancer patient. 7) How ultrasound contrast agents could help assess axillary lymph nodes.

**Service Excellence in Radiology (Sponsored by the RSNA Professionalism Committee) (An Interactive Session)**

**Thursday, 08:30 AM - 10:00 AM • E450B**

**RC616 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**

**Moderator**
Kenneth A Buckwalter , MD
Ella A Kazerooni , MD
Brent J Wagner , MD
Ingrid M Burger , MD, PhD
Bruce J Barron , MD *

**LEARNING OBJECTIVES**
1) Understand who the customer is in Radiology and why customer satisfaction scores are important. 2) Review how Radiology can document the added value role it plays in the enterprise. 3) Discuss how to manage workplace interruptions.

**ABSTRACT**
Service Excellence in healthcare is used generally to refer to patient or customer satisfaction, and our ability to consistently meet if not exceed the expectations of patients, their families and visitors. It can be more widely expanded to include interactions among staff within a group, across groups or job descriptions or across departments. Inherently it is the concept that healthcare is more than just the technical act of delivering service, in radiology that would be the performance of a diagnostic test for example that hit high marks for classic quality metrics like image quality, radiation dose optimization and clarity and accuracy of the interpretation. Service excellence embraces the notion that healthcare must address the psyche, emotions and worries of those we care for, who come to us for service because they are ill and concerned about their health, the impact of disease on themselves and their families. It is about HOW we deliver the care too. From looking people in the eyes at check in, asking if there is anything else we can do for them, letting them know how they will get their test results, acknowledging when we can do better without blame, and knowing when and how to say thank you. On a more tangible level, high marks for Service Excellence also translates into higher employee engagement, retention of staff and a drop in time and resources spent doing service recovery. Hiring for Service Excellence is important to having the right people in your organization, and sometimes letting those go who cannot live up to those expectations may be necessary to move forward. In the end, a commitment to Service Excellence is not about an expensive program delivered by others to you to train to, it is about the right people in your organization who come to us for service because they are ill and concerned about their health, the impact of disease on themselves and their families. It is about HOW we deliver the care too. From looking people in the eyes at check in, asking if there is anything else we can do for them, letting them know how they will get their test results, acknowledging when we can do better without blame, and knowing when and how to say thank you. On a more tangible level, high marks for Service Excellence also translates into higher employee engagement, retention of staff and a drop in time and resources spent doing service recovery. Hiring for Service Excellence is important to having the right people in your organization, and sometimes letting those go who cannot live up to those expectations may be necessary to move forward. In the end, a commitment to Service Excellence is not about an expensive program delivered by others to you to train to, it is about treating everyone with respect and both setting and often exceeding expectations. With higher patient satisfaction scores comes retention of patients/customers, and word of mouth marketing that your program is THE destination for care now and in future.

**Emerging Breast Imaging Strategies**

**Thursday, 08:30 AM - 10:00 AM • S504CD**

**RC617 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**

**Moderator**
Jafi A Lipson , MD

**LEARNING OBJECTIVES**
1) To review basic ultrasound principles used to create high quality images. 2) To understand appropriate breast ultrasound technique and documentation. 3) To improve knowledge regarding breast ultrasound accreditation, including image evaluation and biopsy case assessment.

**Interactive Game: Interactive Quiz Cases in Body Oncologic Imaging**

**Thursday, 08:30 AM - 10:00 AM • E353A**

**RC618 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**

**LEARNING OBJECTIVES**
This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.
RC618A • Chest Masses
Cristina Fuss MD (Presenter)

LEARNING OBJECTIVES
1) Understand the current role of medical physicists and other providers of ultrasound system QC, performance evaluation and user education. 2) Gain an understanding of the longer term potential of medical ultrasound to aid in medical physics planning and training.

ABSTRACT
A very brief overview is given of the innovations that have led to current medical ultrasound systems and QC thereof. A clear connection to clinical performance/cost effectiveness has not been established, but the ratio is improving. To aid in medical physics planning and training, more distant (beyond 10 years) and less robust predictions are ventured than in Dr. Hangiangreous’ talk. The reduction in artifacts and improvement in resolution will be surprisingly large. It is suggested that ultrasound will be headed toward almost ubiquitous use in personal hands as well as those of medical personnel, for monitoring and control of chronic conditions, for direct treatment and for precisely localized drug delivery and enhancement of radiation therapy. Medical physicists who can help keep the computer controls integrated, the systems properly calibrated and the users properly trained will find a substantial role in society.

RC621A • Ultrasonography Perspective
Paul L Carson PhD (Presenter) *

LEARNING OBJECTIVES
1) Describe the current role of ultrasound medical physics in clinical practice. 2) Explain the ultrasound image quality metrics utilized in current ultrasound QA/QC testing. 3) Outline the methods and tools available for ultrasound system QA/QC in current clinical practices. 4) Survey the available standards and voluntary accreditation guidelines for medical ultrasound imaging systems. 5) Understand the need for QC at different levels of time and financial investment.

ABSTRACT
This talk will focus on the present role of ultrasound medical physics in clinical practices. It will review the ultrasound image quality metrics currently utilized in ultrasound QA/QC testing. It will describe testing procedures required and/or recommended by accreditation programs and advisory organizations. General guidelines and available standards will be discussed regarding tolerances for acceptance testing and commissioning of these devices, as well as periodic quality control tests, as applicable to diagnostic B-mode imagers. A brief review of ultrasound phantom used in these testing procedures will be presented.

RC618B • Abdominal Masses
Chandana G Lall MD (Presenter)

LEARNING OBJECTIVES
1) Recognize common benign soft tissue masses with characteristic MRI features, that do not require follow up or biopsy. 2) Evaluate soft tissue masses by location, signal intensity characteristics, size and relationship to certain anatomic structures in order to develop a differential diagnosis. 3) Suggest appropriate management of the soft tissue mass based on MRI features.

ABSTRACT
Several common benign soft tissue masses, such as lipoma, hemangioma, gangion, peripheral nerve sheath tumor, myositis ossificans and hematoma, have characteristic MRI features that allow the radiologist to make the diagnosis, and do not require follow up or biopsy. Lesions that arise from specific structures (e.g., giant cell tumor of the tendon sheath and peripheral nerve sheath tumor) or in certain anatomic locations (e.g., elastofibroma deep to the scapula) can further aid characterization. Size and signal intensity characteristics are additional criteria that help develop an appropriate differential diagnosis. Based on MRI features, the radiologist can suggest appropriate management and advise whether a biopsy is necessary.

RC618C • MSK/Soft Tissue Masses
Sandra Schmahmann MD (Presenter)

LEARNING OBJECTIVES
1) Describe characteristic imaging features of a few benign and malignant abdominal masses on CT and MRI. 2) Characterize features on CT and MRI that may mimic malignancy in benign lesions and vice versa. 3) Discuss logical work-up of lesions, further imaging, need for intervention and follow-up guidelines.

ABSTRACT
Two common descriptors are used in describing pulmonary lesions: nodules and masses. A nodule is small and measures less than 3 cm. Masses by definition are larger than 3 cm. Given their larger size, masses are usually not as difficult to detect as are the smaller nodules. But once detected the differential diagnosis entails more than just primary pulmonary malignancy, although the majority may end up being diagnosed as cancer. Tissue sampling of large masses is usually one of the first steps, but several imaging criteria may help guide and sometimes even obviate invasive procedures. The chronicity, location of the mass and associated symptoms are important factors that should always be taken into consideration when evaluating pulmonary masses, only to name a few.
LEARNING OBJECTIVES
1) Describe techniques for imaging moving targets. 2) Propose methods to account for uncertainties. 3) Highlight clinical integration.

**RC622A • Uncertainties in Moving Targets**
Jasper Nijkamp PhD (Presenter)

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

**RC622B • Clinical Practice**
Laura A Dawson MD (Presenter) *

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

**Minicourse: Recording and Reporting Radiation Dose: Interventional/Angiography/Fluoroscopy**

**Thursday, 08:30 AM - 10:00 AM • N229**

**RC623 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**
**Director**
J. Anthony Seibert , PhD

**RC623A • Issues in Interventional Fluoroscopy Procedures**
Stephen Balter PhD (Presenter)

**LEARNING OBJECTIVES**
1) Be able to describe effects on patient's skin, hair, eyes, and other tissues resulting from fluoroscopically-guided interventional procedures. 2) Be able to adequately communicate FGI radiation risk as part of the informed consent process. 3) Understand the use of real-time displays of radiation quantities and their relation to radiation risks.

**ABSTRACT**
Some fluoroscopically-guided interventional procedures (FGI) require the use of a substantial amount of radiation for their completion. Radiation can be regarded as a toxic agent in the same sense that contrast-media and drugs can be toxic if inappropriately used. The interventional radiologist should have reasonable knowledge of the toxic effects of radiation on patients at dose levels that may occur during IR procedures. These include short-term tissue reactions on the skin, hair loss, and radiogenic cataracts. Longer term effects such as cancer induction are of importance for some patients. Because radiation is potentially toxic, its risks should be appropriately discussed during the informed consent process. The display of reference air kerma and kerma area product provide risk information to the radiologist while performing a procedure. This is intended to provide ongoing inputs into a continuous evaluation of benefit-risk.

**RC623B • Measurements and Dose Calculations**
Beth A Schueler PhD (Presenter)

**LEARNING OBJECTIVES**
1) Review methods of measuring patient radiation dose during fluoroscopically-guided interventional procedures. 2) Compare the advantages and limitations of dose measurement methods. 3) Understand parameters that are used to describe patient entrance dose. 4) Learn about new methods for skin dose calculation and recording.

**ABSTRACT**
The measurement of patient dose during fluoroscopically-guided interventional procedures is an important tool for assessment of individual patient radiation risk. Moreover, the display of patient dose is valuable as feedback to the operator to aid in optimization of radiation exposure. Many different methods of measuring fluoroscopy dose have been developed, including direct methods (dosimeters and film) and indirect methods (fluoroscopy time, dose-area-product meters and reference point air kerma estimation). This presentation will review the advantages and limitations of each of these methods, along with common dose metrics that fluoroscopy operators, medical physicists and technologists should be familiar with. In addition, we will discuss skin dose mapping methods that are currently being developed.

**RC623C • Establishing an Interventional Radiology Patient Radiation Safety Program**
Aaron K Jones PhD (Presenter)

**LEARNING OBJECTIVES**
1) List the radiation dose descriptors that should be recorded at the conclusion of a fluoroscopy-guided procedure. 2) Describe the actions that may be taken during the three phases of a fluoroscopy-guided procedure to enhance patient safety. 3) Discuss how to recognize cases that are outside the normal control limits of an interventional radiology practice.

**ABSTRACT**
An interventional radiology patient safety program is essential to better educate patients who are scheduled to undergo fluoroscopically guided interventional radiology procedures; monitor radiation doses delivered during procedures and reduce the risk of tissue effects; ensure appropriate medical management of patients experiencing significant peak skin doses; and for practice quality improvement through analysis of procedural data and exceptional cases. The program combines preprocedure evaluation and counseling, intraprocedure monitoring, and postprocedure documentation and counseling consistent with guidelines from the National Cancer Institute and the Society of Interventional Radiology. Implementation of a patient safety program is straightforward, requires little infrastructure and few resources, and can be applied in most interventional radiology practices.
disease manifestations, favoring a systemic whole-body (wb) imaging approach. A wb-MRI protocol has to be tailored to the individual type of disease by including high-resolution imaging of bony structures, time-resolved display of inflammatory changes, assessment of the vascular status by angiography and information on cellular density for detection of infiltrative diseases. Therefore, techniques such as contrast-enhanced MR angiography, sequences for cardiac function and delayed contrast enhancement, diffusion weighted imaging and fat-suppressed T1 and T2 weighted studies before and after contrast media injection have to be integrated into the wb-MRI protocol. For robust and time-efficient implementation, innovative approaches such as parallel acquisition techniques, continuous table movement and multi-contrast imaging sequences are required. Clinically established indications include screening for macro-vascular complications in vasculitis, detection and therapy monitoring of joint and ligamentous affection in rheumatic diseases and screening for malignant features in hereditary multifocal exostoses. Arising applications are e.g. cardiovascular risk assessment including whole-body fat quantification, detection of micro- and macro-vascular complications in diabetes and screening for inflammatory foci in immunocompromised patients with fever of unknown origin. For a reliable clinical application, standardized reporting schemes and severity scores are being developed and the results have to be compared to currently applied diagnostic reference standards.

RC624B • Whole Body MRI-Oncologic Applications

Tobias Heye MD (Presenter)

LEARNING OBJECTIVES
1) To learn about the possibilities and challenges of whole body MRI in oncologic imaging. 2) To identify clinical scenarios and oncologic disease entities in which whole body MRI is applicable and offers added value. 3) To be able to create a disease specific whole body MRI protocol which balances acquisition time and the amount of acquired information. 4) To understand how whole body MRI performs in diagnostic accuracy, acquisition time, and cost compared to competing staging modalities.

ABSTRACT
Detection and characterization of local disease in conjunction with identification of distant metastases is the main goal in oncologic imaging. Certain oncologic disease entities are per se affecting the body in a diffused pattern for example multiple myeloma or lymphoma. In both scenarios, local disease with possible distant metastases or diffuse, multifocal disease, imaging protocols using different modalities are incorporated to screen the entire body. The continuous development of MRI technology led to improvements in acquisition time and volume coverage allowing for whole body imaging in a practical time period. However, MRI remains a more challenging imaging method in terms of protocol preparation, actual scanning, providing diagnostic images, patient comfort and acquisition time compared to other imaging modalities which offer whole body coverage such as CT or PET-CT. On the other hand there are abundant MRI specific imaging characteristics available such as different contrasts, diffusion and perfusion imaging, which may provide additional information for a given oncologic disease compared with other modalities. The challenge in whole body MRI is to balance the multitude of available MRI sequences with the amount of information needed to answer the clinical question thus providing a robust imaging protocol tailored to the clinical indication.

RC624C • Whole Body MR in Children: Applications

Prakash M Masand MD (Presenter)

LEARNING OBJECTIVES
1) To learn the technique and principles that revolve around the performance of whole body MRI in children. 2) To understand present day whole body MR applications in pediatrics. 3) Future developments and research avenues linked to whole body MR imaging in children.

ABSTRACT
The applications of whole body Magnetic resonance imaging (MRI) in children continue to evolve and expand and include both oncologic and non oncologic multisystem disorders. Whole body MRI promises to be a “one stop shop” for disease surveillance without the use of ionizing radiation. The present day protocols vary across institutions and in general include fluid sensitive sequences (STIR) at the least. The images are displayed in a coronal plane, after the acquisition over multiple stations as the table moves through the scanner. This technique will be integrated with positron emission tomography in the future which opens an exciting avenue for research endeavors. The current course delves into the technique and clinical applications of whole body MR imaging in pediatrics.

Quantitative Imaging: Volumetric CT as a Biomarker for Disease

Thursday, 08:30 AM - 10:00 AM • N226

RC625 • AMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5

Director
Michael F McNitt-Gray, PhD *

RC625A • Why is Quantitative Imaging (Tumor Volumes) Needed in Oncologic Imaging

Lawrence H Schwartz MD (Presenter)

LEARNING OBJECTIVES
1) To understand the role and value of quantitative volumes in oncology. 2) To understand the challenges associated with quantitative volume calculations in oncology.

RC625B • Understanding Measurement Variation: Lessons Learned from Phantom Studies

Nicholas Petrick PhD (Presenter)

LEARNING OBJECTIVES
1) To review how changes in CT acquisition parameters and nodule characteristics affect measurement error. 2) To review how phantom studies can be used to systematically probe, identify and potentially minimize measurement error and improve our ability to perform quantitative CT imaging. 3) To understand which CT and analysis parameters should be held constant across multiple CT scans, if at all possible, to optimize the evaluation of a patient’s response to therapy.

ABSTRACT
In this refresher course, we will update the audience on the methods and results obtained from various phantom studies developed to assess both absolute lesion size measurements and change over time measurements involving both automated and semi-automated lesion sizing tools.

RC625C • Variability in CT Measurement of Tumor Volumes and Its Impact on Response Assessment

Binsheng Zhao DSc (Presenter)

LEARNING OBJECTIVES
1) Demonstrate the feasibility of computer-aided (tumor) volume measurement and explain its potential to improve conventional response assessment in oncology. 2) Familiarize the audience with sources of variation in measuring tumor volume and tumor volume change. 3) Discuss the need for standardizing both imaging and measurement techniques in the interpretation of tumor measurement and thus in response assessment.

ABSTRACT
Volumetric CT (Volumetric CT) shows potential as a better method to assess tumor response, especially early response, to therapy than the conventional diameter methods. This refresher course will first show how the volumes of solid tumors can be accurately and practically obtained with the help of computer software, then discuss the factors that can affect measurement reproducibility of in vivo tumors during image acquisition and tumor measurement. By becoming acquainted with a well-designed series of (clinical) variability studies, the audience will learn the magnitudes of variability that can occur in the measurement of tumor volumes, as well as in tumor diameter(s).

Latest Developments in Meaningful Use: Ask the Experts

Thursday, 08:30 AM - 10:00 AM • E451A
Health Policy Initiatives in Medical Imaging: Promoting Value and Relevancy in Evolving Healthcare Delivery and Payment Systems

Thursday, 08:30 AM - 10:00 AM • S504AB

RC627 • AMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5

Moderator
Richard Duszak, MD
Bibb Allen, MD
Richard Duszak, MD
Danny Hughes, PhD

LEARNING OBJECTIVES
1) Articulate trends in healthcare delivery system evolution which warrant evidence based policy making founded in credible research. 2) Describe current and future physician payment models as healthcare reform moves compensation from one based on volume to one based on value. 3) Discuss how imaging services can be appropriately considered under future value-based purchasing models. 4) Identify opportunities in health services research to pursue projects focusing on medical imaging.

ABSTRACT
Medical imaging has played an increasingly important and valuable role in patient care, but has captured the attention of payers and policy makers alike. In order to study the role and value of radiology and radiologists in current and evolving healthcare payment and delivery systems, the Harvey L. Neiman Health Policy Institute was founded. Leadership will discuss the need for health services and policy research as they pertain to medical imaging, review projects completed and underway, and describe opportunities for those interested in health services research to collaborate and advance their interests.

Increasing Your Gynecological MRI Referral Base: Reaching Out to the Gynecologists (An Interactive Session)

Thursday, 08:30 AM - 10:00 AM • E353B

RC629 • AMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5

RC629A • Mullerian Anomalies - Guiding Management

Julia R Fielding MD (Presenter)

LEARNING OBJECTIVES
1) Review the MR appearance of the septate and bicornuate uterine anomalies. 2) Define a routine MR protocol to accurately characterize anomalies. 3) Outline the necessary components in the radiology report that are of the most value to the referring physician.

ABSTRACT
These are the FAQ that gynecologists keep asking for their patients, in the gynecology or in the infertility clinic. This course will give answers to these questions through examples of real life cases using the best adapted techniques US and MRI.

RC629B • Pelvic Floor Dysfunction and Other Postpartum Sequelae

Amy S Thurmond MD (Presenter) *

LEARNING OBJECTIVES
1) Comprehend the basic principles of cloud computing and how this technology might apply to Radiology Information Management. 2) Assess the potential advantages of cloud computing for clinical radiology. 3) Compare the advantages and disadvantages of public, private and hybrid cloud computing environments. 4) Assess the costs, challenges, regulatory issues and security concerns that must be dealt with before this technology can be effectively

Cloud Computing for Radiologists: A Primer

Thursday, 08:30 AM - 10:00 AM • S403B

RC630 • AMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5

Moderator
Gary J Wendt, MD,MBA *

LEARNING OBJECTIVES
1) Using virtualized systems to improve access to advanced image processing tools. 2) Using cloud based systems to provide access to advanced imaging tools. 3) Getting hands on experience using 2D / 3D / 4D tools to process data in near real time in a virtual environment. 4) Introduce the basic virtual systems and cloud based systems that are available and how they can be used both within radiology as well as how they apply to referring clinicians from both a image interpretation standpoint as well as their use for teaching.

ABSTRACT
This course will focus on using virtualized systems and cloud based systems to improve access to advanced image processing tools. In addition a focus will be on getting hands on experience using 2D / 3D / 4D tools to process data in near real time in a virtual environment. It will also introduce the basic virtual systems and cloud based systems that are available and how they can be used both within radiology as well as how they apply to referring clinicians from both a image interpretation standpoint as well as their use for teaching.

RC630A • What is Cloud Computing and What Can It Do For Me?

Fred W Prior PhD (Presenter) *

LEARNING OBJECTIVES
1) Comprehend the basic principles of cloud computing and how this technology might apply to Radiology Information Management. 2) Assess the potential advantages of cloud computing for clinical radiology. 3) Compare the advantages and disadvantages of public, private and hybrid cloud computing environments. 4) Assess the costs, challenges, regulatory issues and security concerns that must be dealt with before this technology can be effectively
Tumor Ablation beyond the Liver: How-to and Preliminary Results

Muneeb Ahmed
Anil N Kurup
Terrance T Healey
Debra A Gervais

LEARNING OBJECTIVES
1) Gain knowledge as to how to approach tumor ablation in extrahepatic sites. 2) How to avoid and manage organ specific complications. 3) Review results of Image-guided ablation of lung malignancies is a revolutionary concept whose clinical applications are just beginning to be developed. It has some advantages over traditional radiotherapy and chemotherapy. Its relative survival rate for all stages combined to be only 15%, necessitating the use of alternative therapies. Image-guided ablation of lung malignancies is a

ABSTRACT
Pulmonary malignancies, and specifically lung cancer, are a leading cause of death worldwide. Utilization of best current therapies results in an overall five-year relative survival rate for all stages combined to be only 15%, necessitating the use of alternative therapies. Image-guided ablation of lung malignancies is a revolutionary concept whose clinical applications are just beginning to be developed. It has some advantages over traditional radiotherapy and chemotherapy. Its safety profile is similar to percutaneous image guided lung biopsy. Almost all image-guided ablative procedures can be performed in an outpatient setting, mostly within 2-3 hours. Multiple procedures can be performed without any additional risks. Contraindications are few and include uncontrollable bleeding diathesis and recent use of anticoagulants. Image-guided ablation of lung malignancies is performed with two basic rationales. In the first group it is used with an intention of achieving definitive therapy. These are patients who are not candidates for surgery because of co-morbid medical contraindications to surgery, like poor cardiac reserve or patients refusing to undergo operation. This cohort could potentially derive significant benefit form a minimally invasive alternative therapy. In the second group it is used as a palliative measure as follows: (a) to achieve tumor reduction before chemotherapy (b) to palliate local symptoms related to aggressive tumor growth, such as chest pain, chest wall pain or dyspnea (c) hematogenous painful bony metastatic disease (d) tumor recurrence in patients who are not suitable for repeat radiation therapy or surgery Image-guided ablation is expanding treatment options for the local control of non-small cell lung cancer and metastatic disease.

How to Avoid Failure: Qualities of a Successful Leader

Thursday, 08:30 AM - 10:00 AM • S103AB

LEARNING OBJECTIVES
1) Understand the various definitions in play for the term 'cloud' including its compute and storage aspects. 2) Understand the pricing model of at least one cloud storage vendor. 3) Consider the trade-offs of local storage versus cloud storage in terms of: reliability, latency, costs, and scalability.

ABSTRACT
Cloud computing refers to a technology suite that features virtualized processing and storage capacity and a business model where computing resources and software applications are centrally managed and scheduled with the end user renting capacity on demand. Under this model, virtual machines are outfit with requested software packages that are accessed via the Internet. Cloud computing may also be described in terms of privacy and exclusivity along a continuum from widely available to restricted access Private Clouds. Several critical challenges must be overcome for Public Clouds to be used to support radiology imaging, essentially in place of on-site PACS. Performance, particularly for image visualization and analysis by a radiologist, is a critical requirement. While the data centers that support Cloud computing services have high bandwidth networks internally, the network bandwidth between a radiologist and that data center will not normally be sufficient to support required visualization performance. Simply put, most hospitals focus on internal network performance not connectivity to the Internet. Each covered entity is responsible for ensuring patient privacy and information security. This responsibility would be shared with the Cloud service provider. A Cloud service provider that supports multiple covered entities would be forced, therefore, with a substantial financial risk. Network bandwidth issues would not be exacerbated by the additional complexity of ensuring secure data communication with the Cloud provider. These technical challenges essentially disappear if one considers a Private Cloud managed by the hospital system itself. However, Private Clouds also do away with the advantages of outsourcing computing infrastructure and letting a vendor worry about hardware obsolescence and system maintenance. Thus there are trade-offs that must be weighed in a careful cost-benefit analysis of Cloud computing for radiology.

RC630A • Virtualization and Remote Rendering: Enterprise Imaging in the Cloud

Gary J Wendt MD, MBA (Presenter) *

LEARNING OBJECTIVES
1) Using virtualized systems to improve access to advanced image processing tools. 2) Provide an overview of the benefits of using 3D/4D tools to process data in near real-time in a virtual environment.

ABSTRACT
‘Cloud Computing’ is a highly overloaded and nebulous term in the sense that different people have very different ideas of what it means. To some, it means running applications in someone else's data center, either across town or across the country. To others it means -storing data in someone else's data center. And in both of the preceding examples, the turnaround time for an expansion of services can be measured in days or minutes, depending upon the underlying technology suite used by that cloud vendor. A conventional storage vendor may require days to honor a request for more storage, whereas vendors relying on logical volume management and virtualization could honor the request in minutes. A well established model of the latter is the approach used by Amazon in its Simple Storage Service (S3) offering. Amazon was an early adopter of cloud computing technology and offers two main lines of products. The Elastic Compute Cloud (EC2) relies on creating made to order virtual machines loaded with the applications the customer requires, and this concept was discussed by an earlier presenter. SSS on the other hand, relies on both virtual storage and logical volume management to grow and shrink storage as a customer requires. This presentation will go into some detail on the pricing model used by Amazon, and describe some metrics to look out for beyond mere cost, including uptime, latency, security, turn-around-time and hidden costs. The analysis will draw on an earlier work (Langer SG, ‘Challenges for Data Storage in Medical Imaging Research’, JDI 2011;24(2):203-7. DOI:10.1007/s10278-010-9311-8) to create an evaluation grid useful for comparing across cloud storage vendors - including one's own data center.

RC632A • Traits and States: Management versus Leadership

Alexander R Margulis MD (Presenter)

LEARNING OBJECTIVES
1) To learn that inspired leadership is dedication to team success not self aggrandizement. 2) There is no job that is too big. There are only people lesser than the job. 3) Learn that without resources even well outlined goals cannot be achieved. 4) Absolute transparency is a must. 5) Be a role model.
RC632B • Keys to Avoid Failure: Key Qualities of a Successful Leader
Norman J Beauchamp MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

RC632C • Seamless Transitions: The Importance of Leadership Succession Planning
Kathleen D Eggli MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

Image-guided Biopsy of the Spine (Hands-on Workshop)
Thursday, 08:30 AM - 10:00 AM • E260

RC650A • Pre- and Postbiopsy Assessment
Richard Silbergleit MD (Presenter)

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

RC650B • Equipment Used for Image-guided Biopsies of the Spine
Michele H Johnson MD (Presenter) *

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

RC650C • Thoracic and Lumbar Biopsies
John L Go MD (Presenter)

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

RC650D • Cervical Biopsies
A. Orlando Ortiz MD, MBA (Presenter) *

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

RC650E • Disk Biopsies
Chi-Shing Zee MD (Presenter)

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

Emergency Body MRI: Vascular Emergencies, Abdominal Emergencies and the Pregnant Patient (How-to Workshop)
Thursday, 08:30 AM - 10:00 AM • E261

RC651 • AMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5
Christine O Menias MD, Constantine A Raptis, MD, Vamsi R Narra, MD,FRCR *

LEARNING OBJECTIVES
1) Review the role of MRI as a primary diagnostic modality for evaluation of acute abdominal and pelvic pathologies. 2) Describe the various clinical scenarios as it pertains to vascular emergencies, abdominal emergencies and the evaluation of an acute abdomen in a pregnant patient. 3) Case examples of pertinent entities of Acute abdomen on MRI will be reviewed.

ABSTRACT
Magnetic resonance imaging (MRI) is now more readily available in the emergency room setting and is becoming the primary modality used to diagnose acute abdominal pathologies in situations where there may be relative contraindications to computed tomography (CT). A review by MRI of various acute abdomen conditions is presented. The future directions of MRI in evaluating patients with abdominal emergencies are also briefly discussed.

Review the MRI features of Acute Hepatic and Biliary entities such as Choledocholithiasis, cholecystitis cholangitis, Hepatic abscess and Mirizzi syndrome MRI features of acute pancreatitis and complications such as necrotizing, hemorrhagic and pseudoaneurysm
Review the MRI imaging features of acute Genitourinary entities such as renal abscesses, pyonephrosis and obstructing ureteral stone Acute Gyn entities include MRI imaging of PID; ovarian torsion, hematocolpos, and ruptured hemorrhagic cyst Review the Acute gastrointestinal disorders on MRI such as SBO, mesenteric arterial and venous ischemia crohns, colitis, and Peptic ulcer disease

Dynamic Musculoskeletal US of the Lower Extremity (Hands-on Workshop)
Thursday, 08:30 AM - 10:00 AM • E264
### Learning Objectives

1. Identify anatomic structures which can impinge or move abnormally in the hip and ankle 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 hip and ankle respecting ergonomics.

**Abstract**

This course will demonstrate standardized techniques of performing the dynamic examination of hip and ankle lesions that are only or best demonstrated dynamically. These include the snapping hip, peroneal tendon subluxation/dislocation, flexor hallucis longus impingement, and ankle ligament instability. 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 hip and ankle joint 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.

### Hands-on HL7 Data Manipulation (Hands-on Workshop)

**Thursday, 08:30 AM - 10:00 AM • S401CD**

#### LEARNING OBJECTIVES

1) Understand where radiology ordering, scheduling, and reporting workflows utilize HL7. 2) Develop a basic understanding of HL7 messaging principles. 3) Gain introductory hand-on experience with HL7 data manipulation. 4) Understand how HL7 can be used to build functionality in a variety of radiology workflows.

**Abstract**

HL7 messaging is the foundation upon which many healthcare systems rely for interaction and data exchange. Many common radiology functions including order and report transmission are often dependent on HL7 to function. The goal of this hands-on refresher course is to introduce the attendee to HL7 workflows and some of the tools used to build HL7 interfaces and manipulate HL7 data. More importantly we hope to show why understanding HL7 can be helpful to radiology practices and show where HL7 can be used to build better radiology workflows.

### Advanced Data Analysis with Excel for Research and for Practicing Quality Improvement (Hands-on Workshop)

**Thursday, 08:30 AM - 10:00 AM • S401AB**

#### LEARNING OBJECTIVES

1) Describe techniques for creating a spreadsheet to allow trouble-free data analysis. 2) Describe tools for performing basic descriptive statistics. 3) Identify how to perform simple statistical tests. 4) Identify statistical tasks that require more sophisticated software.

**Abstract**

A spreadsheet program is commonly employed to collect and organize data for practicing quality improvement, for research, and for other purposes. In this refresher course, we will demonstrate how to create a spreadsheet to allow trouble-free data analysis. We will then review an efficient approach for data collection. With a sample dataset, we will demonstrate how to perform basic descriptive statistics and statistical tests can be performed e.g., t-test, chi-square test, correlation analysis, etc. We will provide information on other sophisticated software best suited to perform advanced statistical and quality improvement tasks.

This course will accomplish its learning objective through hands-on tutorial demonstrations with Microsoft Excel – a spreadsheet program. Familiarity with Microsoft Windows and Microsoft Excel environment will be assumed.

### Cardiac Radiology Series: Cardiac Dual Energy CT

**Thursday, 08:30 AM - 12:00 PM • S404CD**

#### LEARNING OBJECTIVES

1) To learn about the basic principles and data acquisition strategies of dual energy CT. 2) To understand the different acquisition strategies for cardiac CT. 3) To learn about dose implications in cardiac dual energy CT.

**Abstract**

Dual-energy cardiac CT represents the combination of two of the most demanding CT applications; special hardware, scan protocols and dedicated data processing algorithms are demanded for both, high scan speed is an additional prerequisite. Dual energy CT (DECT) data acquisition can be achieved by taking two separate scans at different voltages, by rapid kV-switching, or by using dual-source CT operating with different voltages and pre-filtrations. These concepts and the resulting options to determine tissue parameters will be explained.

Cardiac CT requires data acquisition in time intervals as short as possible i.e. data either prospective triggering or retrospective gating. The technical options available allow either single or dual source spiral CT or stepwise sequential acquisition and will also be explained.

Dose levels for cardiac dual energy CT are moderate in general. Details and examples are given in the following lectures.

### VSCA51-02 • Dose Levels and Image Quality of Second-generation 128-slice Dual-source Coronary CT Angiography - Comparison of High-pitch Spiral, Sequential, Retrospectively ECG-gated Spiral and Dual-energy Acquisition Mode

**Moderator**

U. Joseph Schoepf, MD *

**Moderator**

James P Earls, MD *

**Technique**

Willi A Kalender PhD (Presenter) *

#### LEARNING OBJECTIVES

1) To learn about the basic principles and data acquisition strategies of dual energy CT. 2) To understand the different acquisition strategies for cardiac CT. 3) To learn about dose implications in cardiac dual energy CT.

**Abstract**

Dual-energy cardiac CT represents the combination of two of the most demanding CT applications; special hardware, scan protocols and dedicated data processing algorithms are demanded for both, high scan speed is an additional prerequisite. Dual energy CT (DECT) data acquisition can be achieved by taking two separate scans at different voltages, by rapid kV-switching, or by using dual-source CT operating with different voltages and pre-filtrations. These concepts and the resulting options to determine tissue parameters will be explained.

Cardiac CT requires data acquisition in time intervals as short as possible i.e. data either prospective triggering or retrospective gating. The technical options available allow either single or dual source spiral CT or stepwise sequential acquisition and will also be explained.

Dose levels for cardiac dual energy CT are moderate in general. Details and examples are given in the following lectures.

#### Purpose

To compare the radiation exposure and image quality of coronary CT angiography (cCTA) protocols on a second generation 128-slice dual-source CT (DSCT) scanner.
METHOD AND MATERIALS
We prospectively included 100 patients referred for CCTA. Patients with a heart rate below 65 bpm were randomized between prospectively ECG-gated high-pitch mode (group 1) and narrow-window sequential (group 2) acquisition. Patients with a heart rate above 65 bpm were randomly assigned to a retrospectively ECG-gated spiral acquisition protocol in either dual-source (group 3) or dual-energy (group 4) mode. CT dose index volume, dose length product, effective dose, contrast-to-noise and signal-to-noise ratio were compared. Subjective image quality was rated by two observers blinded to the used protocol.

RESULTS
High-pitch spiral cCTA showed a mean estimated radiation dose of 1.27±0.64 mSv, significantly (p<0.05), ranging from 16.03±6.3 (group 1) to 19.3±9.5 (group 4) and 20.1±16.5 (group 2) up to 26.4±23.0 (group 3). Each protocol showed diagnostic image quality in at least 98.4% of evaluated coronary segments.

CONCLUSION
Prospectively ECG-gated DSCT protocols allow cCTA with significant dose reduction. High-pitch spiral mode generates less than 1/2 of the estimated radiation exposure of sequential acquisition mode. In patients with a heart rate above 65 bpm, dual-energy mode should be preferred over spiral DSCT as it significantly decreases estimated dose without compromising diagnostic image quality.

CLINICAL RELEVANCE/APPLICATION
Second-generation DSCT scanners allow cCTA in patients with normo- or arrhythmia that result in significant dose reduction while maintaining diagnostic image quality.

VSCSA1-03  Diabetic Performance of Dual Energy Computed Tomography Stress Myocardial Perfusion Imaging: A Direct Comparison to Cardiac Magnetic Resonance
Sung Min Ko (Presenter) ; Jin-Woo Choi ; Hweung Kgon Hwang ; Meong Gun Song

PURPOSE
This study aimed to determine the diagnostic performance of stress testing by dual-energy computed tomography (DECT) for identification and exclusion of hemodynamically significant stenoses when compared to combined conventional coronary angiography (CCA) and stress perfusion cardiac magnetic resonance (SP-CMR) as reference standards.

METHOD AND MATERIALS
One hundred patients without prior known coronary artery disease without chronic myocardial infarction detected by coronary CT angiography (CCTA) were included and underwent SP-DECT, SP-CMR, and CCA. All CT examinations were performed using a Somatom Definition scanner. DECT-based iodine maps were used for detecting myocardial perfusion defects (MPDs) (per-vessel and per-segment) and compared with SP-CMR. The assessment of MPDs was based on visual analysis instead of quantitative analysis because DECT-based iodine map highlights areas of decreased iodine in the left ventricular myocardium. The three groups all had an average body mass index (BMI) value of 22 kg/m². This scan protocol can substantially reduce iodine intakes for patients while preserving good diagnostic image quality.

RESULTS
The performance of SP-DECT for detecting MPDs compared with SP-CMR was sensitivity, 89%; specificity, 74%; positive predictive value (PPV), 73%; negative predictive value (NPV), 95%; and accuracy, 92%. The SNRs and CNRs were 27.42±4.21 and 21.7±4.5 for 370 group; 27.68±4.09 and 20.1±5.2 for 320 group; and 26.12±5.0 and 21.2±5.3 for 270 group. The visibility of 4 main branches of coronary arteries are all 100% in three groups by two observers. The mean CT value in 270 group (390.65±50.34 HU) was lower than 320 group (466.76±54.63 HU) and 370 group (710.32±45.65 HU), where the difference was statistically significant (p<0.05). The SNRs and CNRs were 27.42±4.21 and 21.7±4.4 for 370 group; 27.68±4.09 and 20.1±5.2 for 320 group; 26.12±5.0 and 21.2±5.3 for 270 group. The area under the receiver operating characteristic curve increased from 0.78 to 0.84 (p=0.02) using CTA/SP-DECT compared with CTA.

CONCLUSION
SP-DECT can play a complimentary role to enhance the accuracy of CTA for identifying hemodynamically significant stenosis.

CLINICAL RELEVANCE/APPLICATION
SP-DECT has the potential to become a robust clinical tool for the detection of myocardial ischemia and can be used as an alternative to other perfusion imaging techniques such as SP-CMR and SPECT.

VSCSA1-04  Diagnostic Value of Dual-energy Computed Tomography (DECT) Combined CT Perfusion and CT Angiography in Patients after Coronary Stent Implantation
Lingyan Kong MD (Presenter) ; Zhengyu Jin MD ; Yining Wang MD

PURPOSE
To evaluate the diagnostic value of dual-energy computed tomography (DECT) combined CT perfusion (CTP) and CT angiography (CTA) in patients after coronary stent implantation, in compare with quantitative coronary angiography (QCA).

METHOD AND MATERIALS

RESULTS
Using QCA as a reference standard, the sensitivity and specificity of DECT for detecting in-stent stenosis was 75.0% and 100%, respectively. The accuracy was 94.3%. For detecting non-stent stenosis on the vessel-based analysis, DE-CTA showed sensitivity of 87.5%, specificity of 100%, and accuracy of 93.3%, while the combination of CTA and CTP showed accuracy of 100%.

CONCLUSION
DECT has high diagnostic accuracy for the detection of in-stent restenosis. CTA combined with CTP may improve the diagnostic accuracy for detecting non-stent significant coronary stenosis.

CLINICAL RELEVANCE/APPLICATION
DECT may evaluate both stenosis of coronary artery and myocardiac perfusion in the assessment of coronary artery disease, and shows value in follow up of coronary stent implantation.

VSCSA1-05  Reduced Contrast Medium in 100kVp Coronary Artery Angiography with Dual-source CT
Dan Han (Presenter) ; Jun Zhang

PURPOSE
To evaluate the image quality of 100kVp dual-source CT coronary angiography using three different contrast media (CM) injection protocols.

METHOD AND MATERIALS

RESULTS
The three groups all had an average body mass index (BMI) value of 22 kg/m². The assigned CM volume was 60 mL in 370 group, 65 mL in 320 and 65 mL in 270 group. The visibility of 4 main branches of coronary arteries are all 100% in three groups by two observers. The mean CT value in 270 group (390.65±50.34 HU) was lower than 320 group (466.76±45.63 HU) and 370 group (710.32±45.65 HU), where the difference was statistically significant (p<0.05). The SNRs and CNRs were 27.42±4.21 and 21.7±4.4 for 370 group; 27.68±4.09 and 20.1±5.2 for 320 group; 26.12±4.31 and 21.2±5.7 for 270 group. There was no statistical difference were found in image noise, SNR, CNR and radiation dose (p>0.05).

CONCLUSION
Using 270 mL 1/ml iodine Contrast Medium and 100 kVp tube voltage scan protocol with dual-source CT coronary angiography is feasible in patients with normal BMI. This scan protocol can substantially reduce iodine intakes for patients while preserve good diagnostic image quality.

CLINICAL RELEVANCE/APPLICATION
Using 270 mL 1/ml iodine Contrast Medium Dual-source CT coronary angiography is equal to 370 mL in detecting plaque of coronary.

VSCSA1-06  Multiple Vulnerable Plaque Characteristic Factors Co-existing in Single Non-obstructive Non Calcified or Mixed Plaques in Coronary Arteries are Higher Risk Predictors of Major Cardiac Events on CT
Hiroyuki Takaoka MD, PhD (Presenter) ; Nobusada Funabashi MD, PhD ; Masae Uehara MD ; Koya Ozawa MD ; Yoshihide Fujimoto ; Yoshihiko Endo

PURPOSE
To evaluate the image quality of 100kVp dual-source CT coronary angiography using three different contrast media (CM) injection protocols.

METHOD AND MATERIALS

RESULTS
The three groups all had an average body mass index (BMI) value of 22 kg/m². The assigned CM volume was 60 mL in 370 group, 65 mL in 320 and 65 mL in 270 group. The visibility of 4 main branches of coronary arteries are all 100% in three groups by two observers. The mean CT value in 270 group (390.65±50.34 HU) was lower than 320 group (466.76±45.63 HU) and 370 group (710.32±45.65 HU), where the difference was statistically significant (p<0.05). The SNRs and CNRs were 27.42±4.21 and 21.7±4.4 for 370 group; 27.68±4.09 and 20.1±5.2 for 320 group; 26.12±4.31 and 21.2±5.7 for 270 group. There was no statistical difference were found in image noise, SNR, CNR and radiation dose (p>0.05).

CONCLUSION
Using 270 mL 1/ml iodine Contrast Medium and 100 kVp tube voltage scan protocol with dual-source CT coronary angiography is feasible in patients with normal BMI. This scan protocol can substantially reduce iodine intakes for patients while preserve good diagnostic image quality.

CLINICAL RELEVANCE/APPLICATION
Using 270 mL 1/ml iodine Contrast Medium Dual-source CT coronary angiography is equal to 370 mL in detecting plaque of coronary.
To evaluate significance of presence of three vulnerable plaque characteristics (VPC) co-existing in single non calcified plaques (NCP) or mixed plaques (MP) in non obstructed coronary arteries on CT: 1) low attenuation (LA) (<30HU), 2) positive remodeling (PR) and 3) spotty calcification (SC), for the risk of major adverse cardiac events (MACE).

### RESULTS

Forty patients with known or suspected coronary artery disease who had a positive stress test for ischemia or had an indication of SPECT study were included. Twenty patients were scanned using a DECT scanner and the other 20 using a SECT scanner. Demographic data was similar in both groups. In all patients, a stress CT scan was carried out first, and 30 minutes later a rest CT scan was complemented. Dipiridamol was used for stress myocardial perfusion imaging in both CT and SPECT studies. A 17 segmental-model analysis was done to determine myocardial segments with perfusion defects. Monochromatic images at different keV from the DECT data and SECT images were evaluated for the detection of myocardial perfusion defects based on Hounsfield units. CT analysis was carried out blinded to SPECT results, considered as the gold standard. Statistical analysis: The 95% confidence interval of the proportions was calculated by the exact binomial data and SECT images were evaluated for the detection of myocardial perfusion defects based on Hounsfield units. CT analysis was carried out blinded to SPECT results, considered as the gold standard. Statistical analysis: The 95% confidence interval of the proportions was calculated by the exact binomial method to determine the presence of myocardial perfusion defects. Correlation between DECT, SECT and SPECT studies was measured by the kappa coefficient.

### RESULTS

The mean radiation dose for each patient was 7.1 +/- 1.2 mSv on DECT exams and 8.1 +/-1.1 mSv on SECT scans. For detection of the presence of myocardial perfusion defects, DECT showed a sensitivity of 82.1%; specificity 96.7%; PPV 85.5%; NPV 96%, with a k=0.77. SECT showed a sensitivity of 70.3%; specificity 90.7%; PPV 79.3%; NPV 85.7%, with a k=0.62.

### CONCLUSION

Stress-Rest DECT myocardial perfusion demonstrated higher specificity and sensitivity than SECT in correlation with SPECT for the detection of myocardial perfusion defects using similar radiation dose. More studies have to be done to validate these results.

### CLINICAL RELEVANCE/APPLICATION

Quantitative myocardial CT perfusion for the assessment of coronary artery disease may have a significant effect on patient care, giving a functional significance to a coronary stenosis.
VSCA51-11  •  Feasibility of Low Concentration Contrast Medium in Dual Energy Spectral Coronary CT Angiography

Xinhuai Wu (Presenter) ; Wei Han ; Junliang Lu

PURPOSE
To investigate the utility of low concentration contrast medium in coronary CT angiography with dual energy spectral imaging mode for overweight patients.

METHOD AND MATERIALS
Four hundred patients who underwent Aortic and/or Mitral valve replacement and/or repair from February 2010 to November 2012 were identified. Of those, 222 patients met inclusion criteria: record of both pre-operative DES chest radiography, and Chest CT or CT Angiography. Dual Energy Subtraction protocol included an initial 60kV acquisition, 150ms delay, followed by 140kV acquisition. The subtracted low energy bone algorithm was evaluated, and compared to standard 140kV CXR for visualization of cardiovascular calcification. Those cases where cardiovascular disease was better visualized on bone window were then further screened, and disease confirmed with correlative CT images. Primary findings were coronary artery calcification (CAC), valvular calcification (both mitral and aortic), Mitral annular calcification (MAC), and aortic arch or descending aorta disease. The final patient cohort was 47, with 29 women (61.7%), and 18 men (38.2%). The age range was 38-92, with an average age of 74.4yrs. Of these patients, 21 underwent subsequent AVR. Twelve patients underwent Aortic Root Reconstruction with valve conduit enlargement. Eight patients underwent AVR and MVR. Three patients underwent subsequent MVR, 2 patients underwent AV-repair with MVR, and 1 patient had AV-repair with MVR.

RESULTS
Of the 47 patients with significant findings on DES radiography, the most common finding was Mitral Annular Calcification with 31 cases (65.9%). Calcific aortic valve (CAV) was seen in 22 patients (46.8%). MV disease was seen in 8 cases, and aortic disease in 5 patients.

CONCLUSION
Dual Energy Subtraction improves visualization of calcified cardiovascular structures. The use of both CT and DES offers an intriguing clinical correlation in the evaluation of cardiovascular calcification. Further prospective studies are warranted.

CLINICAL RELEVANCE/APPLICATION
Dual Energy Radiography enables an enhanced detection of cardiovascular disease compared to standard radiographic techniques.

VSCA51-15  •  Direct Comparison of Stress- and Rest-dual-Energy Computed Tomography with Cardiac Magnetic Resonance for Detection of Myocardial Perfusion Defect

Sung Min Ko (Presenter) ; Jin-Woo Choi ; Hweung Kgon Hwang ; Meong Gun Song

PURPOSE
We assessed the diagnostic performance of stress- and rest-dual-energy computed tomography (DECT) and their incremental value when used with coronary CT angiography (CCTA) for detecting hemodynamically significant stenosis causing myocardial perfusion defect (MPD) compared with combined conventional coronary angiography (CCA)/cardiac magnetic resonance (CMR).

METHOD AND MATERIALS
Seventy-five patients with known coronary artery disease (CAD) detected by CCTA underwent stress-DECT followed by rest-DECT. Among those, 46 patients underwent CMR and 62 underwent CCA. DECT-based iodine maps were compared with CMR. Diagnostic value of CCTA for detecting hemodynamically significant stenosis was assessed before and after stress- and rest-DECT, respectively, on a per-vessel basis, compared with CCA/CMR.

RESULTS
Forty (56%) patients completed all the protocol. Compared to CMR (n=46), sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of stress-DECT for detecting segment (vessel)-based MPDs were 73 (94%), 85 (78%), 70 (72%), and 87 (96%), respectively, and those by using rest-DECT were 29 (47%), 89 (80%), 54 (59%), and 74 (72%), respectively. There was moderate (=0.45) agreement between stress- and rest-DECT iodine maps in identifying segments with MPDs. Compared with the CCA/CMR (n=40) for identifying hemodynamically significant stenosis, per-territory sensitivity, specificity, PPV, and NPV of CTA were 91%, 56%, 55%, and 91%, respectively, those by using CTA/stress-DECT were 87%, 79%, 71%, and 91%, respectively, and those by using CTA/rest-DECT were 42%, 83%, 59%, and 70%, respectively. The area under the receiver operating characteristic curve increased from 0.74 to 0.83 (p<0.02) but decreased to 0.62 (p=0.06), respectively, if using CTA/stress-DECT and CTA/rest-DECT, respectively.

CONCLUSION
Stress-DECT has superior performance for detection of MPDs and incremental value when used with CCTA for detecting hemodynamically significant stenoses compared with rest-DECT.
LEARNING OBJECTIVES

1) To increase understanding of the advancements in computer-assisted quantification of lung nodule size and features. 2) To enhance knowledge of the challenges pertaining to nodule evaluation techniques and their clinical applications.
ABSTRACT

VSCH51-02 • Quantitative Imaging: COPD and Airways

Alexander A Bankier MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) To present up-to-date imaging techniques for assessing airways and lung parenchyma in patients with COPD. 2) To present quantitative imaging approaches to COPD. 3) To discuss the clinical impact of quantitative imaging, notably for phenotyping patients with COPD.

ABSTRACT
This presentation will present current imaging techniques used to assess changes in lung parenchyma and airways in patients with COPD. It will discuss the importance of a quantitative approach to imaging COPD, notably as to phenotyping patients with this disease. Finally, potential future trends in imaging COPD will be discussed.

VSCH51-03 • Reproducibility of Automated Three-dimensional Airway Wall Thickness Measurements in Thoracic Computed Tomography and Influence of Inspiration Depth

Michael Schmidt MSc ; Eva M Van Rikxoort PhD ; Onno M Mets MD ; Pim A De Jong MD, PhD ; Jan-Martin Kuhngik PhD, MS (Presenter) ; Matthias Oudkerk MD, PhD ; Harry De Koning * ; Bram Van Ginneken PhD

PURPOSE
Pathological changes of the airways are strongly associated with lung function impairment in chronic obstructive pulmonary disease (COPD). We investigate the reproducibility of CT-based airway dimension measurements and their dependence on the level of inspiration.

METHOD AND MATERIALS
We analyzed 740 pairs of low-dose chest CT scans of male (former) smokers who were recalled for a three-month follow up scan in the NELSON lung cancer screening trial. Given the slow progression of COPD, we expect that no significant COPD-related changes in airway dimensions should exist between baseline and three-month follow-up. Each scan was analyzed fully automatic using CIRRUS Lung 13.03 and airway wall thickness (P10) and lung volume were recorded. Subjects where processing failed for any of the two scans were excluded for analysis (n=32). First, we analyzed the differences in airway wall thickness measurements for all scan pairs. Next, we determined reproducibility in absence of significant changes in inspiration depth by repeating the analysis for the subset of scans where the difference in lung volume between baseline and follow-up was less than 200ml (n=312). Finally, we investigated the correlation between difference in inspiration depth and airway wall thickness measurements, established a linear correction model for the airway measurements and analyzed differences for corrected measurements.

RESULTS
CONCLUSION
Changes in level of inspiration are significantly associated to changes of airway wall thickness and accounted for approximately 25% of the total differences between baseline and follow-up measurements.

CLINICAL RELEVANCE/APPLICATION
Inspiration depth should be controlled or linear correction should be applied for monitoring of airway wall thickness. This may help to better differentiate COPD subtypes in chest CT scans.

VSCH51-04 • Quantitative Imaging: Interstitial Lung Disease

Jonathan G Goldin MBChb, PhD (Presenter)

PURPOSE
The learning objectives are the following: Approaches to Quantitative Imaging in ICD, Quantitative Imaging in Clinical Trials as a Biomarker and Quantitative Imaging in Clinical Practices.

VSCH51-05 • Phenotypes of Pulmonary Fibrosis in the MUC5B Promoter Site Polymorphism (SNP)

Jonathan H Chung MD (Presenter) * ; Ashish Chawla MD, MBBS ; David Mckean ; Janet Talbert ; Anna Peljto ; David A Lynch MBCh * ; Marvin I Schwarz MD ; David Schwartz

PURPOSE
The purpose of this study was to determine the variation of phenotypic manifestations of pulmonary fibrosis with regard to the MUC5B promoter site (rs35709590) Polymorphism, which has been strongly associated with IPF and familial pulmonary fibrosis.

METHOD AND MATERIALS
HRCT scans of 1,764 subjects were scored as part of a genome-wide association study. Two thoracic radiologists independently evaluated the HRCT scans. Discrepancies were resolved by a third thoracic radiologist. All patients were genotyped specifically for the rs35709590 SNP. Two-tailed Fisher exact or Chi-square tests and t-test or one-way ANOVA tests were used to compare proportions and means, respectively. A P-value of 0.05 was considered statistically significant.

RESULTS
The major and minor alleles at the rs35709590 SNP are guanine (G) and thymine (T), respectively. There were 670 GG, 958 GT, and 136 TT subjects. This distribution showed significant departure from Hardy-Weinberg equilibrium (p significant).

CONCLUSION
Polymorphisms at the MUC5B promoter site are associated with different phenotypes of pulmonary fibrosis on chest CT.

CLINICAL RELEVANCE/APPLICATION
Integration of imaging and genotypic information may provide valuable information regarding patient prognosis and optimal treatment in fibrotic lung disease.

VSCH51-06 • Dual Energy CT: Emerging Applications

Ioannis Vlahos MRCP, FRCr (Presenter) *

LEARNING OBJECTIVES
1) To understand the current potential for dual energy CT in thoracic imaging. 2) To review select current literature supporting the use of dual energy imaging. 3) To highlight emerging areas of clinical evaluation.

VSCH51-07 • Dual-energy CT with Reduced Iodine Load: A New Option for Standard Chest CTA in Patients with Superior Vena Cava Syndrome

Sofiane Bendaud MD (Presenter) ; Olivier Vanaarde MD ; Francesco Molinari MD ; Arianna Simeone MD ; Emanuela Algeri MD ; Martine J Remy-Jardin MD, PhD *

PURPOSE
To evaluate the interpretive conditions for analysis of all thoracic circulations on a chest CT angiographic examination optimized for suspicion of superior vena cava syndrome (SVCS).

METHOD AND MATERIALS
41 patients with suspected SVCS underwent a dual-source, dual-energy CT angiographic examination of the chest with bi-brachial administration of a low-concentration contrast agent (160 mg iodine/mL). From each data set, 3 series of images were systematically reconstructed: (a) the 2 polychromatic series acquired at 80 and 140 kV; and (b) the fused images from both tubes, with a weighting factor of 0.6 (i.e., averaged images equivalent to images acquired at 120 kV). On each series of images, a quantitative and qualitative analysis of 3 anatomical compartments was performed, including the: (a) superior vena cava; (b) pulmonary arteries; and (c) aorta. In the quantitative evaluation: (a) ROIs were placed in each vessel-of-interest to measure mean ±SD attenuation; (b) the signal-to-noise (SNR) and contrast-to-noise (CNR) ratios were calculated. Qualitative analysis evaluated the presence and severity of streak artifacts at the level of nodal stations (i.e., 2R, 4R, 10R). On a patient-by-patient basis, the number of series to-be-interpreted for optimal analysis of all anatomical regions was then assessed.

RESULTS
Average images provided (a) a good to excellent level of opacification within the SVC (n=40 ; 98%) without artifacts at the level of 2R (n=26 ; 63%), 4R (n=40 ; 98%) and 10 R (n=41 ; 100%); (b) aberability of pulmonary arteries down to the subsegmental level (n=31 ; 76%) ; and (c) a good to excellent opacification of the aorta (n=35 ; 85%). In 29 patients (29/41; 71%), averaged images alone provided optimal evaluation of all vascular compartments; in 12 patients (12/41; 29%), they had to be completed by images at 140 kV (n=6) to suppress artifacts at the level of the nodal station 2R and/or images at 80 kV (n=10) to improve the CNR at the level of subsegmental pulmonary arteries and/or the aorta.

END OF ABSTRACT
CONCLUSION
Dual-energy CT enables combination of optimal evaluation of SVCS and diagnostic image quality at the level of the other thoracic circulations.

CLINICAL RELEVANCE/APPLICATION
On-dual-energy CT angiograms obtained with low-concentration contrast material, an optimal analysis of all thoracic vessels requires the reading of a single series of images in the majority of cases.

VSCH51-08 • CT Innovations for Radiation Dose Reduction
John R Mayo MD (Presenter)

LEARNING OBJECTIVES
1) To identify the patient factors that increase CT radiation dose risk. 2) To describe current CT radiation dose reduction techniques. 3) To outline the relationship between CT image noise and the detection of abnormalities. 4) To evaluate the impact of iterative reconstruction on CT radiation dose reduction.

VSCH51-09 • Incidental Findings Detection on CT Pulmonary Angiography Images with Low kVp Techniques
Kanako K Kumamaru MD, PhD (Presenter); Rachna Madan MD; Ritu R Gill MBBS *; Nicole Wake MS; Frank J Rybicki MD, PhD *; Andetta R Hunsaker MD

PURPOSE
To evaluate the effect of reduced kVp on detection of incidental findings in the lungs and mediastinum in patients who underwent CT Pulmonary Angiography (CTPA) for suspected acute pulmonary embolism.

METHOD AND MATERIALS
This IRB-approved HIPAA-compliant study included consecutive CTPA studies performed from January 2008 to April 2010 which used low kVp technique (80kVp for patients weighing >80kVp)

RESULTS
Compared with standard kVp settings, objective/subjective noise scores were significantly greater at lower kVp, while the SNR/CNR/r Student t Test comparison of standard vs low kVp was significant in the detection of lesions of the lung parenchyma (p<0.001). At both kVp, the detection of pulmonary nodules was higher in the reader with more experience. Readers had less confidence in interpretation of images obtained at lower kVp, and the correlation between the readers was weaker for images obtained at lower kVp.

CONCLUSION
Despite the increased image noise, lower kVp techniques in CTPA studies in patients suspected of acute pulmonary embolism does not adversely affect the detection of lung nodules or mediastinal nodes.

CLINICAL RELEVANCE/APPLICATION
Lower kVp does not adversely affect the detection of lung nodules or mediastinal nodes on CTPA studies, despite the increased noise and decreased confidence in the interpretation.

VSCH51-10 • Hyperpolarized Gas MR Imaging
Talissa A Altes MD (Presenter)

LEARNING OBJECTIVES
1) Understand the limitations of proton lung MRI and the strengths and weaknesses of hyperpolarized gas MRI of the lung. 2) Learn about potential research and clinical applications of hyperpolarized gas lung MRI in lung diseases such as CF, asthma, and COPD.

ABSTRACT
VSCH51-11 • Are Hyperpolarized 3He Magnetic Resonance Imaging Ventilation Defects Clinically Relevant in Ex-smokers without Airflow Limitation?
Damien Pike BSc (Presenter); Miranda Kirby PhD; Sarah Svenningsen BSc; Harvey O Coxson PhD *; David McCormack MD; Grace Parraga PhD

PURPOSE
In early or mild chronic obstructive pulmonary disease (COPD), spirometry measurements are relatively insensitive to changes in the "silent zones" of the lung in the small airways (1). However, hyperpolarized 3He magnetic resonance imaging (MRI) has provided evidence of early or very mild emphysema in never-smokers with exposure to second hand smoke (2) as well as early emphysema (3) and airways abnormalities (4) in asymptomatic ex-smokers. We recently evaluated 160 ex-smokers and 71/160 (44%) did not have spirometry measurements diagnostic for COPD. We hypothesized that 3He MRI and computed tomography (CT) measurements of airways disease and emphysema would detect a subgroup of ex-smokers without airflow limitation but with clinically relevant structure-function pulmonary abnormalities.

METHOD AND MATERIALS
Seventy-one ex-smokers (69±10yr, FEV1/FVC=70) underwent spirometry, 3He MRI, thoracic CT and the St. George's Respiratory Questionnaire (SGQR). CT-derived measurements were generated for wall area percent (WA%) and lumen area (LA) of the sub-segmental lower right (RB8) airway and the relative area at -50HU Hot was derived units of the CT density histogram (RAH50). Hyperpolarized 3He MRI ventilation defect percent (VDP), a surrogate of Airways and bullous disease, and apparent diffusion coefficients (ADC), a surrogate of emphysema was generated for whole lung (WL) and lower right lobe (LRL) pulmonary measurements.

RESULTS
Subjects were classified into two sub-groups: ex-smokers with a LRL 3He MRI defect (Defect, n=9) and ex-smokers with no LRL defect (No Defect, n=62). Subjects with a defect had significantly greater VDP, RB8 WA%, smaller RB8 LA and worse symptoms than subjects without a LRL defect.

CONCLUSION
9/71 (13%) ex-smokers without airflow limitation and a LRL ventilation defect, symptoms were worse and 3He MRI and CT measurements showed abnormal airway function and structure that was significantly worse than in a subgroup of ex-smokers without an LRL ventilation defect.

CLINICAL RELEVANCE/APPLICATION
In ex-smokers without airflow limitation and previously undetected but clinically relevant symptoms, lung imaging provided evidence of structure-function abnormalities that require clinical follow-up.

VSCH51-12 • MR Imaging: Recent Advances for Chest Imaging
Jens Bremerich MD (Presenter)

LEARNING OBJECTIVES
1) Understand physical limitations specific to the chest and how to improve image quality. 2) Current applications of MR for imaging morphology and function. 3) Oversee emerging techniques for MR imaging of the entire chest.

ABSTRACT
Introduction: Magnetic Resonance is an attractive tool for imaging of morphology and function of the chest with ionizing radiation. Magnetic properties of the chest, however, remain unfavourable for MR because of low water proton density and considerable magnetic field inhomogeneities. Recently new imaging protocols and sequences became available that may overcome these limitations. This abstract reviews current applications and recent advances of MR of the chest. Methods: Fast imaging techniques such as turbo spin echo or segmented gradient echo can reduce susceptibility artefacts and enable breath held acquisitions. Free breathing respiratory gated sequences may be used alternatively. Standard imaging protocols comprise T1 and T2 weighted images for morphology assessment and edema detection. Diffusion weighted MR may be added to identify diffusion restriction which may indicate malignancy. Pleural infiltration of peripheral masses may be assessed by means of cine imaging during in- and expiration. For further characterisation of masses and inflammatory diseases T1 weighted images pre and post gadolinium may be used. Emerging techniques based on fourier decomposition for assessment of perfusion and ventilation are currently under investigation. Results: Magnetic Resonance may be used to identify and characterise pulmonary masses, monitor pulmonary perfusion and ventilation, assess chest wall motion, identify involvement of chest wall in peripheral lung tumors and to identify pulmonary embolism. Fourier decomposition may enable assessment of perfusion and ventilation and is currently under investigation. Conclusion: Today, MR is a useful tool for assessment of pulmonary morphology, function and tissue characterisation. Recent advances in MR of the chest include fourier decomposition techniques which may enable assessment of perfusion and ventilation without injection of contrast material.
Interventional Radiology Series: Non-Vascular Interventions

Thursday, 08:30 AM - 12:00 PM  •  E352

VSCH51-13 • SUVmax Correlation between PET/MRI and PET/CT in FDG Avid Lesions of the Chest Using a Three Segment Model Attenuation Correction

Andres Kohan MD (Presenter) * ; Christian Rubbert MD * ; Jose L Vercher-Conejero MD * ; Sasan Partovi BS * ; Karin A Herrmann MD ; Luis A Landeras MD ; Peter F Faubel MD *

PURPOSE
PET/MRI combines the superior tissue resolution and multiparametric capabilities of the MRI with the functional capabilities of PET. It's theorized to improve oncologic imaging in multiple areas of the body, specially: brain, liver, pelvis and bone. Nonetheless other areas are bound to benefit from this technology. However, SUVmax calculation from FDG avid lesions in PET/MRI remains a concern, mainly due to the migration from CT attenuation correction to MRI attenuation correction (MRAC). One area of major concern is the chest, where two critical tissue interfaces with very different attenuation coefficients can be found. We studied FDG avid lesions in the chest to determine the correlation between the SUVmax from PET/MRI and PET/CT using a three segment model MRAC.

METHOD AND MATERIALS
First 47 oncologic consecutive patients from a research protocol were included. Final n was 19 due to 6 failed MRAC and 22 patients without chest lesions to analyze. All patients underwent PET/CT (Gemini TF) and PET/MRI (Ingenuity TF) with a single FDG injection. Lesions were identified by direct comparison and sub-classified as mediastinal, lung or chest wall lesions. SUVmax was determined with a spherical ROI including the lesion. Spearman Ranked correlation was performed.

RESULTS
Out of all patients (5 male, 14 female): 9 had lung cancer, 3 breast cancer, 2 head and neck cancer, 2 lymphoma, 1 melanoma, 1 pancreas and 1 colon cancer. Seventy six lesions were analyzed: 21 in the lung, 14 in the chest wall and 41 in the mediastinum. Mean exam scan time: 18±4min (PET/CT) and 21±3 (PET/MRI). Mean time from FDG injection: 66±8min (PET/CT) and 105±20min (PET/MRI). Spearman for SUVmax was 0.93, 0.95, 0.84 and 0.96 for overall, lung, chest wall and mediastinal lesions respectively (p<0.001). Chest wall lesions had a somewhat lower correlation (0.84) than the others (>0.90), probably related to more than half of the lesions being in vertebrae and ribs, whereas the MRAC cannot identify bone tissue. Nonetheless, correlation between SUVmax was very strong (rho>0.8) for all lesions in all areas which raises the question whether there is any clinical relevance to the findings seen in the chest wall.

CLINICAL RELEVANCE/APPLICATION
Reliability of SUVs in an area with air/soft tissue boundaries is vital for PET/CT to succeed in chest oncologic imaging. The high correlation to PET/CT SUVs seen here is a step into that direction.

VSCH51-14 • Innovations in Chest Radiography

Heber Macmahon MD (Presenter) *

LEARNING OBJECTIVES
1) Understand the newer enhancements that have become available for digital chest radiography. 2) Learn how these techniques may improve diagnostic accuracy. 3) Appreciate the benefits and limitations of dual energy radiography, bone suppression, computer-aided nodule detection in clinical practice.

VSCH51-15 • Digital Chest Tomosynthesis

Ase A Johnsson MD, PhD (Presenter)

LEARNING OBJECTIVES
1) The benefits of chest tomosynthesis in comparison to chest radiography. 2) The limitations of chest tomosynthesis in comparison to computed tomography. 3) The role of chest tomosynthesis as a problem solver in daily clinical practice.

ABSTRACT

Interventional Radiology Series: Non-Vascular Interventions

Thursday, 08:30 AM - 12:00 PM  •  E352

VSIR51 • AMA PRA Category 1 Credit ™: 3.25  • ARRT Category A+ Credit:4
Moderator
Peter R Mueller , MD *
Moderator
Jonathan M Lorenz , MD

LEARNING OBJECTIVES
1) Describe evidence concerning timing emergent abscess drainage. 2) Explain the use of celiac plexus block. 3) Describe two techniques to safely perform dangerous biopsies. 4) Outline 3 controversies in non-vascular intervention. 5) List two catastrophic complications of non-vascular intervention. 6) Describe two techniques to facilitate difficult abscess drainage.

VSIR51-01 • Dangerous Biopsy - Spleen, Mediastinum, Capsular Lesions, Cavity Lung Lesions

William W Mayo-Smith MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

VSIR51-02 • CT-guided Biopsy of Pulmonary Nodules: Risk Factor Analysis for Pneumothorax in 650 Patients

Ahmed F Emam MBCh (Presenter) ; Thomas J Vogl MD, PhD ; Nagy N Nagib MSc ; Mohammed A Alsubhi BMBS ; Nour-Eldin A Nour-Eldin MD, MSc

PURPOSE
To evaluate the significant risk factors involved in the development of Pneumothorax during CT-guided Lung of pulmonary Nodules.

METHOD AND MATERIALS
Institutional board approval for the current retrospective study. Patients provided an informed consent for CT-guided biopsy and the anonymous use of the data for research purposes. The study included 650 patients (221 females and 429 males with mean age 56.2 years SD: 5.2) who underwent CT-guided biopsy of pulmonary lesions in the period between January 2008 and January 2013. Factors associated with the development of pneumothorax were analyzed including: Age, emphysema, lesion size, lesion position, coaxial versus non coaxial system, fine needle vs trucut needle. Univariate analysis was performed. P value of < 0.05 was considered as statistically significant.

RESULTS
Significant risk factors involved in the development of pneumothorax were: patients age > 60 years (p=0.04), emphysema (p=0.035), lesion size < 1 cm (p=0.023), central lesions (5 cm (p=0.022), basal pulmonary lesions versus apical lesions (p=0.03). No significant correlation for development of pneumothorax was detected in coaxial versus no-coaxial technique, as well as and fine needle versus tru-cut needle (p > 0.08). The incidence of pneumothorax was 12% (78 out of 650). Manual evacuation was performed in 25 out of 78 patients (32.1%) and the need for intercostal chest tube was 6 out of 78 (7.7%).

CONCLUSION
Significant risk factors involved in the development of pneumothorax were old age, emphysema, subcentemetric lesions, central or basa lesions, and long intrapulmonary needle track.

CLINICAL RELEVANCE/APPLICATION
The incidence of pneumothorax is rather unpredictable and it is associated with certain factors that make certain cases of higher risk for the emergence of pneumothorax.

VSIR51-03 • US-guided Transhepatic Core Biopsy of Right Renal or Adrenal Masses: Safety and Short Term Follow Up

Moon Young Kim MD (Presenter) ; Byung Kwan Park MD ; Sung Yoon Park ; Chan Ky Kim MD, PhD ; So Yoon Park

PURPOSE
To retrospectively evaluate the accuracy and safety of ultrasound (US)-guided trans-hepatic biopsy of right upper renal or adrenal masses.
METHOD AND MATERIALS
Ten US-guided trans-hepatic biopsies were performed in ten patients with six right upper renal masses and four right adrenal masses which were invisible or inaccessible via an extra-hepatic route. The control population comprised of 19 US-guided extra-hepatic biopsies that were performed in 19 patients with 18 right upper renal masses and one right adrenal mass. Trans-hippatic and extra-hepatic biopsies were compared with respect to the diagnostic or complication rates. The size of the mass, biopsy distance, number and length of cores as well as biopsy duration were also compared.

RESULTS
The diagnostic rates of trans-hippatic and extra-hepatic biopsies were 90% (9/10) and 99% (17/19), respectively (p=1.000). The complication rates of trans-hippatic and extra-hepatic biopsies were 10% (1/10) and 21% (4/19), respectively (p=1.000). None of these biopsies resulted in major complications. The sizes (mean ± standard deviation) of the mass, biopsy distances and number of cores for trans-hippatic and extra-hepatic biopsies were 33.0 ± 14.3 mm and 46.9 ± 18.5 mm, 100.5 ± 17.9 mm and 76.5 ± 9.9 mm, and 2.7 ± 0.9 and 4.0 ± 0.7, respectively (p=0.001-0.046). However, the length of cores and biopsy durations were not significantly different between these biopsies (p=0.077-0.91).

CONCLUSION
US-guided trans-hippatic core biopsy appears to be feasible and safe procedure for the histologic diagnosis of right upper renal or adrenal masses which are either invisible or inaccessible via an extra-hepatic route.

CLINICAL RELEVANCE/APPLICATION
Trans-hippatic core biopsy allows for better sampling of right renal or adrenal masses due to excellent US penetration of normal hepatic parenchyma compared to an extra-hepatic core biopsy.

VSIR51-04 • Computer Assisted Electromagnetic Navigation Improves Accuracy in CT Guided Interventions: A Prospective Randomized Clinical Trial
Pierre Durand MD, MSc (Presenter) ; Alexandre Moreau-Gaudry MD, PhD ; Julien Frandon MD ; Emilie Chipon PhD ; Maud Medici MSc ; Ivan Bricault PhD *

PURPOSE
To assess the accuracy and usability of a novel electromagnetic navigation system designed to assist CT guided interventions.

METHOD AND MATERIALS
The tested navigation system prototype uses an electromagnetic localizer in order to track the position and orientation of a needle holder; it can display the needle path in real-time on 2D reconstructed CT-images extracted from the 3D CT volume. This study was approved by the regional ethics committee and all patients gave written informed consent. From June 2010 to January 2012, 120 patients undergoing a routine percutaneous CT procedure (drainage, biopsy, tumor ablation, infiltration, sympathicolyis) were randomized between the conventional procedure (CT group) and a navigation-assisted procedure (NAV group). The main outcome was the distance between the planned trajectory and the actual needle trajectory after a first attempt at placement.

RESULTS
N=120 patients were analyzable in intention-to-treat analysis (CT: 60; NAV: 60). Nineteen radiologists participated in the study; their satisfaction score (0-10) shows that the help provided by the navigation system was favorably appreciated: CT=8[7; 9]; NAV=9[8; 9.5] (p=0.025). The accuracy was improved when the navigation system was used: distance error (mm) with CT=8.86[4.86; 15.09], vs. with NAV=4.07[2.7; 9.14] (p<0.001).

CONCLUSION
Electromagnetic navigation, as compared with conventional CT procedures, provides significant improvement in accuracy. Usability in a real clinical setting is established.

CLINICAL RELEVANCE/APPLICATION
Improvements in accuracy and ability for the radiologist to plan optimal trajectories in any plane can lead to a security benefit for the patient, particularly in case of complicated targets.

VSIR51-05 • Controversies in Non-Vascular Interventions
George I Getrajdman MD (Presenter)

LEARNING OBJECTIVES
Three controversies will be discussed. The participants will learn about lymphocele drainage- ETOH vs iodine sclerosis vs none. Pre procedural antibiotics for chest wall ports- always, never, or sometimes. They will also learn about current management of pneumothorax in outpatients undergoig lung or mediastinal biopsies.

VSIR51-06 • Tough Abscess Drainage
Ronald S Arellano MD (Presenter)

LEARNING OBJECTIVES
1) Review anatomic consideration that impose challenges for image-guided percutaneous abscess drainage. 2) Discuss techniques that can be used to facilitate image-guided percutaneous drainage of technically challenging abscesses.

ABSTRACT
Image-guided percutaneous abscess drainage is one of the most commonly performed procedures in Interventional Radiology. Facility with the various techniques and modalities used for drainage is essential. When most abdominal abscess are readily accessible for image-guided percutaneous drainage, there can be situations when drainage is challenging due to anatomic or patient factors. The purpose of this refreshers course is to discuss techniques, by way of case examples, that can be used to successfully drain challenging abdominal abscesses.

VSIR51-07 • Drainage Catheter Flow Rate Related to the Number and Location of Sideholes: Does It Matter?
David H Ballard MS (Presenter) ; Jeffery A Weisman JD ; Mackenzie A Orchard ; Jason T Williams MPH ; Jonathan S Alexander PhD ; Horacio R D'Agostino MD

PURPOSE
Currently, there is no evidence suggesting that the number or position of sideholes within drainage catheters has been based on fluid dynamics or clinical principles. The purpose of our study was to investigate the effect of varying catheter sidehole number and position on fluid flow rates in an in vitro model.

METHOD AND MATERIALS
Ad hoc customized drainage catheters were constructed with various numbers of sideholes (1 to 6). To optimize flow, each sidehole was created with the same diameter as the lumen of the catheter (15 Fr). Drainage catheters were constructed with sideholes on one side (single-sided model), or pairs of sideholes on opposite sides of the shaft (double-sided model). The drainage reservoir consisted of a cylindrical container filled with water. The cylinder was constructed to maintain a constant pressure independent of catheter fluid evacuation. This constant pressure outflow system was established in the reservoir with a 500 mL pressure head using a fixed fluid inflow with a flow/overflow valve. After the catheters were inserted and the pressure gradient was established, fluid evacuation was evaluated using 10-second intervals by draining the fluid into a collection vessel and recording the volume. A total of 5 trials were performed for each catheter to account for measurement error.

RESULTS
Our data shows that flow rate is maximized at 3 sideholes in the single-sided model catheters. Single-sided model catheters with more than 3 sideholes showed no significant improvement in flow rate. All the double-sided model catheters had significantly better flow rates than their single-sided counterparts. Flow rate was maximal in the double-sided model catheter with 2 holes (one on each side) and there was no significant improvement in the catheters with more bilateral sideholes.

CONCLUSION
Our results suggest that optimal flow in drainage catheters can be achieved through a design consisting of a single pair of sideholes arranged opposite of each other and inclusion of additional sideholes does not significantly improve flow. These in vitro results illustrate that using fluid dynamics principles to redesign drainage catheters could serve to improve catheter performance.

CLINICAL RELEVANCE/APPLICATION
Clinical observations reveal that drainage catheter distal sideholes are often filled with debris that could be a source of sepsis. Our data suggests catheters with few sideholes achieve optimal flow.

VSIR51-08 • Percutaneous Interventions for Management of Post-surgical Pelvic Abscesses in Patients with Rectal Cancer: Does Neo-adjuvant Chemo-radiation Impact Clinical Outcome?
Avinash R Kambadakone MD, FRCP (Presenter) ; Ashraf Thabet MD ; Diane Alagno ; Kara P Stasko MS ; Ronald S Arellano MD ; Debra A Gervais MD * ; Peter R Mueller MD *
PURPOSE
The purpose of this study was to evaluate the impact of peri-operative chemoradiation on the clinical outcome of percutaneous interventions for management of post surgical pelvic abscesses in patients with rectal cancer.

METHOD AND MATERIALS
In this retrospective study we included 54 patients (M: F=33:21, mean age-65yrs, age range: 29-91yrs) with rectal cancer who underwent CT guided percutaneous drainage of pelvic abscesses developing after low anterior or abdominoperineal resection. In this cohort, thirty-three patients (M: F=20:13, mean age -65 yrs) had received neoadjuvant chemoradiation either prior to or after surgical resection (Group A) and 21 patients (12M:9F, mean age-65yrs) did not receive any chemoradiation (Group B). The electronic medical records and imaging studies in these patients were retrospectively evaluated to record the surgical details, chemo radiation details and details of abscess drainage. The technical success, primary and secondary success and treatment failure rates were compared between the two groups.

RESULTS
A total of 80 CT-guided percutaneous abscess drainage procedures were performed on the 54 patients (Group A, n=57 and Group B, n=33). The mean surgery to abscess drainage period was longer in Group A compared to Group B (210 days vs 39 days, p=0.02). The technical success rate was comparable between the two groups (90.5% vs 95.5%). The primary success was higher in Group B as compared to Group A (83.3% vs 54.5%). The total period of catheter drainage was higher in patients who received chemo-radiation (105 days vs 26 days, p=0.02). The abscess recurrence rate (re-accumulation) and catheter malposition was also higher in patients with chemo-radiation (p=0.01). Enteric fistulas complicating drainage of pelvic abscesses were also more common in chemo-radiation group (A: 42% (21/50), B: 21% (4/19)).

CONCLUSION
Peri-operative chemoradiation adversely impacts outcome after percutaneous drainage of post surgical abscess in patients with rectal cancer necessitating prolonged drainage, frequent recurrences and multiple catheter manipulations.

CLINICAL RELEVANCE/APPLICATION
Percutaneous management of post surgical abscesses in patients with rectal cancer can be challenging particularly in patients receiving chemoradiation and therefore needs multidisciplinary management.

Foveal Acetabular Impingement: Is Perifoveal Chondral Damage a Marker of Hip Dysplasia on Delayed Gadolinium Enhanced MRI of Developmental Hip Dysplasia in the Child and Adult

Perifoveal cartilage injury in fovea alta evaluated on dGEMRIC may be an important marker of foveal acetabular impingement in hip dysplasia.

CLINICAL RELEVANCE/APPLICATION
Perifoveal cartilage injury in fovea alta evaluated on dGEMRIC may be an important marker of foveal acetabular impingement in hip dysplasia.
VSMK51-03 • Prevalence and Pattern of Gluteus Tendon Pathology and Muscle Atrophy in Older Individuals

Andrew S Chi MD, MS (Presenter); Suzanne S Long MD; Adam C Zoga MD; Paul J Read MD; Diane M Deely MD; William B Morrison MD

PURPOSE
To evaluate gluteus medius and minimus tendon pathology and muscle atrophy in older individuals.

METHOD AND MATERIALS
A retrospective study of MR imaging of 184 individuals was performed to evaluate for gluteus pathology. Inclusion criteria: age=50. Exclusion criteria: hip surgery, fracture, infection or tumor, or inadequate image quality. Both hips were evaluated for each individual. Greater trochanteric bursitis was graded as none, mild, moderate, or severe. Gluteus medius, gluteus minimus, and iliopectoral tendon pathology was graded as normal, tendinosis, low grade partial tear, high grade partial tear, or full tear. Gluteus medius, gluteus minimus, and iliopectoral muscle fatty atrophy was scored using the Goutallier scale (0=no atrophy to 4=complete atrophy). Insertion of tendon pathology and anterior/posterior location of muscle atrophy was also analyzed.

RESULTS
184 subjects were stratified by age as follows: n=63(50-59 y.o.), 64(60-69 y.o.), 38(70-79 y.o.), 17(80-89 y.o.), 2(90-99 y.o.). Percentage of gluteus medius tendon abnormalities were: 34.9%(50-59 y.o.), 53.9%(60-69 y.o.), 92.9%(70-79 y.o.), 73.5%(80-89 y.o.), 100%(90-99 y.o.). For the gluteus minimus, tendinosis accounted for 68.2% of tendon pathology in 50-59 y.o., low grade tears accounted for 42.0% in 60-69 y.o., and high grade tears accounted for 17.5% in 70-79 y.o.. Average gluteus medius atrophy scores were as follows: 0(50-59 y.o.), 0.6(60-69 y.o.), 1.2(70-79 y.o.), 1.6(80-89 y.o.), and 3.0(90-99 y.o.). Percentage of gluteus minimus tendon abnormalities were: 30.2%(50-59 y.o.), 50.0%(60-69 y.o.), 86.8%(70-79 y.o.), 79.4%(80-89 y.o.), and 100%(90-99 y.o.). For the gluteus minimus, tendinosis accounted for 73.7% of tendon pathology in 50-59 y.o., low grade tears accounted for 53.1% in 60-69 y.o., and high grade tears accounted for 7.6% in 70-79 y.o.. Average gluteus minimus atrophy scores were as follows: 0.4(50-59 y.o.), 0.9(60-69 y.o), 1.7(70-79 y.o.), 2.4(80-89 y.o), and 3.8(90-99 y.o.).

CONCLUSION
Gluteus medius and minimus tendon pathology and muscle atrophy increase with age above 50 years. There appears to be progression from tendinosis to tendon tears with advancing age with an associated progression in muscle atrophy.

CLINICAL RELEVANCE/APPLICATION
Given tendon tear may prelude atrophy and atrophy is greater in fail-related hip fractures, more aggressive therapy could be useful to prevent subsequent falls in patients with gluteus tendon tears.

VSMK51-04 • Intraarticular Hip Pathology

Kawan S Rakhra MD (Presenter)

LEARNING OBJECTIVES
1) Review MRI techniques and protocols for investigating intraarticular causes of hip pain. 2) Recognize the common internal derangements of the hip joint.

ABSTRACT
VSMK51-05 • Ischiofemoral Impingement. Do You Want to Believe?

Roque Oca MD (Presenter); Raquel Prada MD; Maria Gonzalez Vazquez; Maria Costas Alvarez; Gonzalo Tardaguila de la Fuente MD; Ana Fernandez Del Valle MD; Alex Grande Astorquiza MD; Ariana C Bustos Fiore MD

PURPOSE
To find out if there are anatomic and MRI criteria to diagnose ischiofemoral impingement.

METHOD AND MATERIALS
290 MRIs of the hip were retrospectively reviewed from June 2012 to January 2013. A total of 9 ischiofemoral impingement were diagnosed and 20 normal ischiofemoral impingement were included as control. Ischiofemoral space, quadratus femoris space and femoral inclination angle were measured independently by two blinded radiologists. The degree of oedema and fatty infiltration in the quadratus femoris muscle were also assessed visually. Differences in ischiofemoral space, quadratus femoris space and femoral inclination angle were studied between pathological and control cases. The interobserver reliability was obtained for quantitative variables.

RESULTS
CONCLUSION
Ischiofemoral impingement can be accurately diagnosed following anatomic and MRI criteria.

CLINICAL RELEVANCE/APPLICATION
Ischiofemoral impingement is a not very well known syndrome, only referred in a few articles in the trauma and radiological literature. Being aware of it turns diagnosis faster and more accurate.

VSMK51-06 • Psoas Muscle Atrophy in Patients with Ipsilateral Groin Pain: Is there an Association with Prior Hip Surgery and Why?

Adam C Zoga MD (Presenter); George P Hobs MD; Andrew S Chi MD, MS; Suzanne S Long MD; William C Meyers MD; William B Morrison MD

PURPOSE
We sought to establish the incidence of unilateral or asymmetric psoas muscle atrophy in subject group with groin pain and a history of ipsilateral hip or lower abdominal surgery, and then correlate with the prevalence of psoas atrophy in a population without prior surgery.

METHOD AND MATERIALS
A database of patients with pelvic MR for hip/groin pain was queried for a history of prior hip or abdominal surgery, generating 109 subjects; demographics, surgical history, and pain sites were recorded. 2 MSK radiologists independently reviewed MR exams retrospectively for the presence and degree of psoas muscle atrophy (mild = intramuscular signal abnormality, moderate = 50% loss), atrophy within other core muscles, anterior/posterior location of muscle atrophy, tendon or intrinsic hip injuries. A control group of 180 subjects with MR for groin pain but no history of regional surgery was reviewed for asymmetric psoas muscle atrophy. Potential causes of this phenomenon were then explored.

RESULTS
Asymmetric psoas atrophy was present in 24/109(22%) study subjects with reader consensus but only 5/180(2.7%) control subjects (p<0.001).

CONCLUSION
We have documented a significant incidence of asymmetric psoas muscle atrophy at MR patients with hip/groin pain after ipsilateral hip or abdominal surgery. The majority of these subjects had hip arthroscopy and preoperative MRs showed normal psoas bulk when available.

CLINICAL RELEVANCE/APPLICATION
The cause and significance of postoperative psoas atrophy warrants further investigation. Potential contributors include traction during arthroscopy, surgical exposure and perioperative trauma.

VSMK51-07 • Imaging of Sports Pubalgia

Lawrence M White MD (Presenter)

LEARNING OBJECTIVES
1) Review the causes of acute and chronic athletic pubalgia. 2) Understand the etiologic theories as to origin of chronic athletic pubalgia. 3) Review the spectrum of imaging findings observed in the setting of athletic pubalgia. 4) Understand the value and limitations of imaging findings in guiding clinical management of patients with athletic pubalgia.

ABSTRACT
VSMK51-08 • Arthroplasties - What You Need to Know

Jonelle M Petcsavage-Thomas MD, MPH (Presenter)

LEARNING OBJECTIVES
1) Review different types and techniques of hip replacement. 2) Discuss new designs in hip replacement. 3) Review normal radiographic appearances and measurements. 4) Illustrate the imaging appearance of complications of hip arthroplasty and revisions. 5) Understand the role of cross-sectional imaging. 6) Learn techniques to optimize MR and CT imaging of hip replacement.
ABSTRACT

VSMK51-09 • Evaluation of Metal Artifact Reduction MRI in Patients with Total Hip Arthroplasty

Lorenzo Nardo MD (Presenter) ; Roland Krug PhD ; Misung Han ; Craig Sam ; Kevin Koch PhD * ; Andrew Lai ; Pia M Jungmann MD ; Hans Liebl MD ; Ursula R Heilmeier MD ; Thomas M Link MD, PhD *

PURPOSE
The goal of our study was to assess weather adding a multiaquisition variable-resonance image combination (MAVORIC) sequence to the standard hip MRI post total hip replacement (THR) protocol improved the characterization of pathological findings.

METHOD AND MATERIALS
In fifty-five patients with symptoms of hip pain (30 males, 25 females, aged 57-75) hip MRI at 3.0 T was performed with an eight-channel phased-array cardiac coil. The sequence protocol included: MAVRIC PD (coronal), MAVRIC STIR (axial), 2D-FSE T1 (axial and coronal), 2D-FSE PD (axial and coronal), STIR fat suppression (axial and coronal). Each sequence was assessed by two radiologists, independently, for joint effusion and synovitis including findings of aseptic lymphocyte dominated vasculitis-associated lesions (ALVAL), bone marrow edema pattern, osteolysis and insertion tendinopathy at the greater trochanter using a four-point scale (absent (0), probably absent (1), probably present (2), present (3)). Furthermore the extent of the metal artifacts was measured. Wilcoxon signed rank test was used to compare the data from standard FSE sequences to data from MAVRIC sequences. Agreement between the two readers was determined by calculation of kappa values.

RESULTS
Osteolysis, joint effusion and synovitis were characterized on MAVRIC images with higher confidence (p<0.05). The size of metal artifacts was significantly reduced with the MAVRIC (p<0.05). MAVRIC significantly reduced metal artifacts and added important diagnostic information to standard FSE images in patients status post total hip arthroplasty, particularly, when there was concern for AVAL or osteolysis.

CLINICAL RELEVANCE/APPLICATION
Multiacquisition variable-resonance image combination (MAVORIC) sequence adds significant diagnostic information to evaluation of Total Hip Replacement.

VSMK51-10 • Metal-on-Metal Hip Complications

Christian W Pfirrmann MD, MBA (Presenter) *

LEARNING OBJECTIVES
1) To understand the causes of complications in patients with Metal-on-Metal hip implants.
2) Understand the role of imaging in the workup of patients with Metal-on-Metal hip implants.
3) Review the spectrum of imaging findings observed in the setting of Metal-on-Metal hip complications.

VSMK51-11 • Investigating the Painful Metal-on-Metal Hip Arthroplasty: Is 3DCT a Suitable Substitute for MARS MRI?

Elizabeth Robinson (Presenter) ; Shiraz Sabah BSc ; Johann Henckel MD ; Keshthra Satchithananda MBBS * ; Thomas Parsons ; Michael Khoo MRCP, FRCR ; John A Skinner MBBS ; Allister Hart MBBS

PURPOSE
To compare the imaging findings of 3DCT against the gold-standard, MARS MRI.

METHOD AND MATERIALS
We conducted a cohort study to determine the diagnostic accuracy of 3-dimensional computed tomography compared with metal artifact reduction sequence MRI for detection of pathologies associated with MOM hip replacements. 20 patients with painful prostheses were consecutively recruited. MARS MRI images were acquired with a 1.5T scanner and CT images with a 64-slice scanner, according to published protocols. Imaging was reported according to objective criteria by two MSK radiologists blinded to clinical data. Soft tissue lesions, muscle atrophy, osteolysis and tendon avulsion were evaluated. Diagnostic test characteristics were calculated.

RESULTS
3DCT was not a reliable assessment tool for muscle atrophy and provided no information on tendon injuries. However, 3DCT is a useful modality for detecting periprosthetic osteolysis.

CLINICAL RELEVANCE/APPLICATION
MARS MRI should be used for the diagnosis of painful MOM hip arthroplasties. Where MARS MRI is contraindicated or unavailable 3DCT is an unsuitable substitute and other modalities should be considered.

VSMK51-12 • Post-operative Muscle Atrophy on MARS MRI: Clinical- radiological Correlation for 80 Metal-on-Metal Hips

Thomas Parsons (Presenter) ; Shiraz Sabah BSc ; Johann Henckel MD ; Elizabeth Robinson ; Michael Khoo MRCP, FRCR ; Keshthra Satchithananda MBBS ; John A Skinner MBBS ; Allister Hart MBBS

PURPOSE
To assess the reliability of hip abductor muscle atrophy seen on MARS MRI as an indicator of hip function.
To estimate the prevalence of hip abductor muscle atrophy in a metal-on-metal hip cohort.

METHOD AND MATERIALS
179 patients (200 hips) were referred to a tertiary centre with problematic metal-on-metal hips. 80 patients with unilateral implants, an Oxford hip score (scored 0-48) and a MARS MRI scan of the pelvis were retrospectively selected. Peri-prosthetic muscles were graded 0-3 using MARS MRI according to the Bal and Lowe system (0=normal, 1=not exceeding 30% decrease in mass, 2=30-70% fatty change with decreased mass, 3=greater than 70% fatty change with 80% loss in muscle). A linear regression model was used to quantify the value of grading abductor atrophy as a predictor of hip function.

RESULTS
A linear regression model was used to quantify the value of grading abductor atrophy as a predictor of hip function. The size of metal artifacts was significantly reduced with the MAVRIC (p<0.05). The size of metal artifacts was significantly reduced with the MAVRIC (p<0.05). MAVRIC significantly reduced metal artifacts and added important diagnostic information to standard FSE images in patients status post total hip arthroplasty, particularly, when there was concern for AVAL or osteolysis.

CLINICAL RELEVANCE/APPLICATION
MARS MRI should be used for the diagnosis of painful MOM hip arthroplasties. Where MARS MRI is contraindicated or unavailable 3DCT is an unsuitable substitute and other modalities should be considered.

VSMK51-13 • Hip Tumor Imaging and Mimics

Mark J Kransdorf MD (Presenter)

LEARNING OBJECTIVES
1) Identify the common bone and soft tissue lesions in and around the hip joint.
2) Recognize the tumor and tumor-like lesions associated with hip arthroplasty.
3) Identify differentiating features.

ABSTRACT
There are a wide variety of bone and soft tissue tumors, as well as tumor-like conditions, which have a predilection for the hip. Rather than a complete review, this session will highlight the common lesions in and around the hip, emphasizing imaging and diagnosis. The imaging evaluation of a suspected tumor always begins with review of the radiographs. For osseous lesions, radiographs can be highly specific and accurately characterize biological activity. In the assessment of suspected soft tissue lesions, they can depict characteristic calcifications or ossifications, as well as secondary osseous changes, such as remodeling or invasion. MR imaging has emerged as the preferred imaging modality for evaluating osseous and soft tissue masses of the hip by providing information for diagnosis and staging. The MR imaging signal characteristics and enhancement patterns of malignant and benign hip tumors permit specific diagnoses in the majority of cases.
Vascular Imaging Series: CT Angiography—New Techniques and Their Application

Thursday, 08:30 AM - 12:00 PM • SS02AB

VSA51 • AMA PRA Category 1 Credit ™: 3.25 • ARRT Category A+ Credit: 4
Moderator
Dominik Fleischmann, MD *

LEARNING OBJECTIVES
1) To describe and illustrate new techniques for CT angiography. 2) To show present and future clinical applications of these methods.

VSA51-01 • Iterative Reconstruction for CTA
Sandra S Halliburton PhD (Presenter) *

LEARNING OBJECTIVES
1) Understand the basic principles of iterative reconstruction for CT. 2) Describe commercially available iterative reconstruction techniques. 3) Review the advantages and disadvantages of iterative reconstruction. 4) Discuss the incorporation of iterative reconstruction algorithms into clinical protocols for CT angiography.

ABSTRACT
VSA51-02 • Model-based Iterative Image Reconstruction (MBIR) in CT Angiography of the Chest - A Dose Finding Cadaver Study
Stefan Wirth MD (Presenter) *; Fabian Mueck; Zsusanna Deak MD; Sonja Kirchhoff MD; Oliver Peschel; Maximilian F Reiser MD; Michael K Scherr MD

PURPOSE
To compare image quality (IQ) of 64-row CT angiography of the chest, respectively acquired at varying dose levels and reconstructed with model-based iterative reconstruction (MBIR), to standard baseline examinations at full dose and using adaptive statistical iterative image reconstruction (ASIR).

METHOD AND MATERIALS
8 male and 3 female cadavers were included (79±18.5kg; 72.5±17.2y/o; BMI 26.3±5.1). Following injection of contrast media (Angiografix-Macro: Arterial=2000; Virtuaid, Fumedica, Muri; Switzerland) a full-dose baseline reference (FBR) was acquired (CT HD750; GE Healthcare, Waukeasha, IL) using a standard-of-care protocol (120kV, 10.4-400mA modulation, noise index NI=39 VS=0.625; NI = allowed protocol deviation). A single-slab full-circular scan (0.625mm helical, 0.984 pitch, 120kV, 10-400mA modulation, noise index NI=39 VS=0.625; NI = allowed protocol deviation) was acquired for each cadaver. For the dose finding study, 60 cadaveric specimens were included, with each specimen scanned at varying dose levels D1-D5 by changing the dose level independently (NI=35, VS=2.5; D2: NI=70, VS=0.625; D3: NI=70, VS=5; D4: NI=70, VS=2.5; D5: NI=70, VS=5; all reconstructed with MBIR). Except for NI and VS, all other parameters were identical to the FBR, all series reformatted in 3mm axial, coronal and sagittal slices. Two radiologists, blinded to the dose level, independently compared IQ for CT angiography of D0-D5 to the full-dose FBR (IQ: 2:diagnostically inferior, 1:inferior, 0:equal, +1:superior, +2:diagnostically superior; respectively). For statistical analysis ICC and Wilcoxon's test were used.

RESULTS
Mean values were (CTDivol in mgY: D0 = 10.4±0.9, D1 = 7.4±2.6, D2 = 6.6±2.5, D3 = 4.3±1.8, D4 = 2.1±0.9, D5 = 1.1±0.5); (IQ: D0 = +1.0±0.3, D1 = +0.9±0.3, D2 = +0.7±0.3, D3 = +0.5±0.3, D4 = +0.2±0.3, D5 = -0.5±0.6). All values were significantly different from one another; p <0.001.

CONCLUSION
Data reconstruction with MBIR instead of ASIR allows for significant dose reduction of 80% in CT angiography of the chest without impairment of the image quality, resulting in a calculated mean effective dose of 0.94±0.66 mSv.

CLINICAL RELEVANCE/APPLICATION
For standard CT angiography, MBIR allows for diagnostic imaging of the chest below 1mSv without loss of image quality (overall, vessel wall, thrombus material, calcifications).

VSA51-03 • Evaluation of Diagnostic Quality and Image Adequacy of Low Dose CT Angiography with Model Based Iterative Reconstruction in Follow Up of Endovascular Aortic Aneurysm Repair
Neil Hansen MD (Presenter); Ravi K Kaza MD; Katherine E Mautten MD; Peter S Liu MD; Joel F Piatt MD

PURPOSE
To evaluate the image quality and overall adequacy of low dose Computed Tomographic Angiography (LD-CTA) with model based iterative reconstruction (MBIR) in patients evaluated following endovascular aortic aneurysm repair (EVAR) in comparison to standard dose CT (SDA-CTA) with Adaptive Statistical Iterative Reconstruction (ASIR).

METHOD AND MATERIALS
30 patients who had LD-CTA with MBIR and a prior SD-CTA with ASIR following EVAR were included. Two radiologists independently evaluated 60 CTs in a random blinded fashion. Image quality for evaluation of stent configuration, stent lumen, aneurysm outline, vessel outline, and overall vascular and solid organ imaging adequacy were graded on a scale of 1 to 5 (1=poor, 2=acceptable, 3=good, 4=very good, 5=excellent). Maximal aneurysm sac diameter was measured, and the presence or absence of an endoleak was recorded. Image noise and contrast to noise ratio (CNR) were measured for all CTs. Scanner generated CT dose index (CTDI vol) and Dose Length Product (DLP) were recorded for the arterial and delayed phases.

RESULTS
Mean image quality score for LD-CTA averaged in the good to very good range in all categories. There was no significant difference between LD-CTA and SD-CTA in evaluation of stent lumen (4.1 vs. 3.9; p = 0.77). There was a significantly (p <0.001) higher score for the SD-CTA in the following categories: stent configuration (4.5 vs. 3.6), aneurysm outline (4.8 vs. 3.8), vessel outline (4.7 vs. 3.3), overall vascular adequacy (4.6 vs. 4.1), and overall solid organ imaging adequacy (4.6 vs. 3.3). Interobserver evaluation for endoleak detection was good for both groups, but higher for the LD-CTA (kappa = .92 vs .77).

CONCLUSION
In patients being followed up after EVAR, low dose CTA with MBIR produces diagnostically acceptable image quality with significant radiation dose reduction.

CLINICAL RELEVANCE/APPLICATION
Low dose CTA with MBIR after EVAR produces diagnostic image quality with significant patient radiation dose reduction.

VSA51-04 • CT Angiography of the Chest and Abdomen: Image Quality, Interobserver Variability, and Diagnostic Accuracy for Iterative versus Filtered Back Projection Reconstruction
Elizabeth George MBBS (Presenter); Kanako K Kumamaru MD, PhD; Pamela M Deaver MD; Katherine Mullen MD; Sachin S Saboo FRCR, MD; Frank J Rybicki MD, PhD *; Kurt Schultz RT *; Ashish R Khandelwal MD; Michael L Steigner MD *; Dimitris Mitsouras PhD

PURPOSE
To test the hypothesis that CT angiography (CTA) images reconstructed with iterative method (AIDR3D) have superior image quality, lower interobserver variability in anatomical measurements, and higher diagnostic accuracy when compared to the same raw data reconstructed with filtered back projection (FBP).

METHOD AND MATERIALS
All 157 clinical chest and abdominal CTA (Table) acquisitions (320x0.5 mm CT) over 5 months (6/12-10/12) were performed at a reduced radiation dose (compared to standard at our institution) and the raw data was reconstructed with both AIDR3D and FBP. Quality of arterial phase images was assessed by two independent readers (4-point scale) for both reconstructions. For 1/3 of patients (n=53, randomly chosen), signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) was measured at the artery of interest. For renal donors (n=10), kidney size and renal artery length were measured by two readers for both reconstructions, and interobserver variability was assessed. For coronary CTA with reference standard catheter angiography (n=15), degree of coronary stenosis and level of confidence (3-point scale) in assessment was determined by two readers for both reconstructions, interobserver agreement and diagnostic accuracy was assessed.

RESULTS
Image quality score had good interobserver agreement (weighted r=0.67) and was higher (p
Clinical Relevance/Application

Aortic Aneurysm

X-ray tube voltage selection: Intra-individual comparisons

Low-keV monochromatic CTA should be an optional choice for patients who have underlying renal function impairment.

Clinical Relevance/Application

With 29% contrast medium reduction and similar radiation dose, spectral CTA provided better image quality than conventional CTA.

Conclusion

Two radiologists assessed all images with 5-points scale. CTDIvol was recorded. Data were analyzed using student T-test. And noise of the abdominal aorta and muscle at the optimal monochromatic image set of spectral CTA group and at conventional CTA group were measured. Selected for obtaining the best contrast-noise-ratio (CNR) for the abdominal aorta at the renal artery level relative to the erector spine muscle. The CT value groups had 0.625mm slice thickness. Monochromatic images (40-140keV) were generated from the spectral CTA, and from which an optimal energy level was selected for maintaining the best contrast-noise-ratio (CNR) for the abdominal aorta at the renal artery level relative to the erector spine muscle. The CT value and noise of the abdominal aorta and muscle at the optimal monochromatic image set of spectral CTA group and at conventional CTA group were measured.

Results

All studies were considered diagnostic. A different kV level between scan1 and scan2 was automatically selected in 18 patients (28%). Overall subjective IQ (3.30±0.87, 3.56±0.85, p=0.02), SNR (14.6±5.93, 16.65±5.90, p=0.005), CNR (12.13±3.24, 14.08±3.30, p=0.007), and FOM (40.9±24.3, 44.0±44.7, p=0.38) selected for obtaining the best contrast-noise-ratio (CNR) for the abdominal aorta at the renal artery level relative to the erector spine muscle. The CT value groups had 0.625mm slice thickness. Monochromatic images (40-140keV) were generated from the spectral CTA, and from which an optimal energy level was selected for obtaining the best contrast-noise-ratio (CNR) for the abdominal aorta at the renal artery level relative to the erector spine muscle. The CT value and noise of the abdominal aorta and muscle at the optimal monochromatic image set of spectral CTA group and at conventional CTA group were measured.

Conclusion

Two radiologists assessed all images with 5-points scale. CTDIvol was recorded. Data were analyzed using student T-test. And noise of the abdominal aorta and muscle at the optimal monochromatic image set of spectral CTA group and at conventional CTA group were measured. Selected for obtaining the best contrast-noise-ratio (CNR) for the abdominal aorta at the renal artery level relative to the erector spine muscle. The CT value groups had 0.625mm slice thickness. Monochromatic images (40-140keV) were generated from the spectral CTA, and from which an optimal energy level was selected for maintaining the best contrast-noise-ratio (CNR) for the abdominal aorta at the renal artery level relative to the erector spine muscle. The CT value and noise of the abdominal aorta and muscle at the optimal monochromatic image set of spectral CTA group and at conventional CTA group were measured.

Results

All studies were considered diagnostic. A different kV level between scan1 and scan2 was automatically selected in 18 patients (28%). Overall subjective IQ (3.30±0.87, 3.56±0.85, p=0.02), SNR (14.6±5.93, 16.65±5.90, p=0.005), CNR (12.13±3.24, 14.08±3.30, p=0.007), and FOM (20.9±24.3, 44.0±44.7, p=0.38). Patient specific protocol adjustment by automated x-ray tube voltage selection can operator-independently optimize cardiovascular CTA image acquisition parameters with improved objective and subjective image quality.

Clinical Relevance/Application

At cardiovascular CTA, patient specific protocol adjustment by automated voltage selection offers significant radiation reduction across an identical patient population while image quality is enhanced.

Clinical Relevance/Application

Patient specific protocol adjustment by automated x-ray tube voltage selection can operator-independently optimize cardiovascular CTA image acquisition parameters with improved objective and subjective image quality.
METHOD AND MATERIALS

This prospective study included 63 patients. They were randomly divided into 3 groups that were administered different doses of contrast material (600, 300, and 400 mg I/kg). We used an area-detector CT scanner (Aquilion ONE; Toshiba Medical Systems, Japan) and iopamiro (Jopaminor®; Bayer Yakuhin, Ltd., Japan). All patients underwent dual energy CT at 80 and 135 kVp. Conventional image (120kVp) was made from them and 80 and 120 kVp were compared. We measured the average CT value of 4 regions of interests, namely, the left and right femoral and popliteal veins, and a value of =80 HU was considered sufficient contrast for detecting deep vein thrombosis (Goodman, et al. Radiology 2005). Two radiologists evaluated the contrast of veins and muscles with a 3-point confidence scale, and scores within =5 points of the total score were considered adequate.

RESULTS

The mean CT value of images taken at 80 kVp was significantly higher than that taken at 120 kVp (600 mg I/kg, 150.1 ± 19.9 HU vs. 121.8 ± 14.2 HU; 500 mg I/kg, 134.4 ± 19.4 HU; vs. 108.7 ± 14.3 HU; and 400 mg I/kg, 115.9 ± 15.8 HU vs. 91.6 ± 12.2 HU, respectively). The mean CT value was lowest for the image at 120 kVp after administration of 400 mg I/kg of contrast material. The proportion of patients with scores over 80 HU of 400 mg I/kg and at 120 kVp (15/21 [71.4%]) was significantly lower than that of the control group (600 mg I/kg at 120 kVp; 21/21 [100%]). The proportion of patients with scores 5 points higher than the total score of 400 mg I/kg of contrast material and at 120 kVp (12/21 [57.1%]) was significantly lower than that of the control group (600 mg I/kg at 120 kVp; 20/21 [95.2%]). There was no significant difference between the images obtained after administration of 400 mg I/kg of contrast material at 80 kVp and the control images (600 mg I/kg at 120 kVp). Moreover, in this study, the use of 80 kVp rather than 120 kVp showed a 30% reduction in radiation exposure (CTDI VOL [10.4 vs. 14.9 mGy], respectively).

CONCLUSION

By using low tube voltage (80 kVp), the dose of contrast material can be reduced to at least 400 mg I/kg, while keeping sufficient contrast to diagnose deep venous thrombosis.

CLINICAL RELEVANCE/APPLICATION

This study showed that low tube voltage (80 kVp) CT can help reduce the dose of contrast material and radiation exposure.

VSVA51-11  •  Feasibility of Low kV Settings CT-angiography with Ultra Low Contrast Medium Volume for the Assessment of Thoracic and Abdominal Aorta Disease

Camillo R Talei Franzesi (Presenter) ; Davide Ippolito MD ; Pietro A Bonaffini MD ; Davide Fior MD ; Orazio Minutolo MD ; Sandro Sironi MD

PURPOSE

To evaluate the image quality, the diagnostic performance and the radiation dose exposure of low-kV CT angiography (CTA) protocol (100 kV) with ultra low-contrast medium volume (40 mL) in the assessment of thoracic and abdominal aorta disease.

METHOD AND MATERIALS

From July 2011 to February 2013, 76 patients (28 women; mean age 65 years; range, 35-83 years; BMI

RESULTS

In all the CT studies we could correctly visualize and evaluate main branches of thoracic and abdominal aorta. No significant difference of density measurements was achieved between the low-kV protocol (mean attenuation value of thoracic aorta 304HU, abdominal aorta 343HU and renal arteries 331HU) and the control group (mean value of thoracic aorta 320HU, abdominal aorta 339HU and renal arteries 303HU). The radiation dose exposure was significantly lower (p

CONCLUSION

Low-kV protocol provides a diagnostic performance comparable to standard protocol, decreasing significantly the radiation dose exposure (particularly in the abdomen) and with a significant reduction of contrast material volume.

CLINICAL RELEVANCE/APPLICATION

Low-kV and low-contrast volume CT-angiography provides a significant reduction of radiation exposure, maintaining good image quality, also allowing evaluation of patients with renal dysfunction.

VSVA51-12  •  A Novel CT-based Calcium Scoring System of the Lower Extremity Arteries: Impact on Luminal Assessment with CT Angiography

Stacey Schriber (Presenter) ; Waleska M Pabon-Ramos MD ; Holly L Nichols BS ; Mark L Lessne MD ; Charles Y Kim MD *

PURPOSE

Calcification of the lower extremity arteries can hinder luminal visualization on CT angiography. However, not all types and degrees of calcification are problematic. The purpose of this project is to utilize a novel calcium scoring system to correlate calcification characteristics with luminal visibility and diagnostic accuracy.

METHOD AND MATERIALS

The study population consisted of 99 legs in 57 patients (31 male, mean age 65 years) that underwent both CT and conventional angiography of the lower extremities within 3 months of each other. The arteries of each leg were divided into 9 segments. A single axial image was chosen from the CTA in each arterial segment for evaluation. The degree of stenosis (3-point confidence scale, and scores within =5 points of the total score were considered adequate.

RESULTS

371 of 514 arterial segments analyzed had some degree of calcification. Both calcium morphology and circumference scores demonstrated a strong inverse correlation with diagnostic confidence for the infrainguinal arteries but moderate in the iliac arteries (p

CONCLUSION

The proposed calcification scoring system based on calcium morphology and circumference correlated well with diagnostic confidence and accuracy of luminal assessment on CTA.

CLINICAL RELEVANCE/APPLICATION

Characterization of the calcium morphology and circumference on CTA can provide a method for quantifying the diagnostic accuracy of interpretation of luminal patency and stenosis.

VSVA51-14  •  Post Processing, Workflow and Interpretation

Karin E Dill MD (Presenter)

LEARNING OBJECTIVES

1) To illustrate steps in image post-processing for the interpretation of CTA images. 2) To highlight elements that can be used to optimize workflow for multiplanar reformatted images, maximum intensity projections, and three-dimensional volumes.

ABSTRACT
Breast Imaging: Interoperability Challenges and Solutions

Thursday, 10:30 AM - 12:00 PM • S501ABC

LEARNING OBJECTIVES
1) Review the clinical problems once common in the interpretation of digital screening and diagnostic mammograms on vendor-independent and general purpose PACS workstations. 2) Understand the technical solutions provided in the IHE Mammography Image integration profile to those problems. 3) Explore the similar challenges now being faced in the secondary review of Stereotactic Mammography images sets acquired during breast biopsy, while clearly understanding the differences in interpretation requirements. 4) Learn how the new IHE Stereotactic Mammography Image integration profile provides a complete set of solutions to address those challenges. 5) Explore new interoperability challenges presented as Breast Tomosynthesis is adopted. 6) Understand the technical solutions currently available within the DICOM standard that address those challenges, if properly implemented in commercial equipment.

ABSTRACT
The purpose of this session is to review the once prevalent interoperability challenges in Full-Field Digital Mammography acquisition and display that were successfully addressed using the IHE Mammography Image integration profile, and to explore new challenges and solutions in the areas of Digital Stereotactic Mammography (used in breast biopsy) and Breast Tomosynthesis.

Creating, Storing, and Sharing Teaching Files Using RSNA’s MIRC®: A Hands On Course

Thursday, 10:30 AM - 12:00 PM • S401AB

LEARNING OBJECTIVES
1) Learn how easy it is to install the new and improved RSNA teaching file software with the one-click installer. 2) Learn how to create, organize, and share teaching files, create conference documents and save interesting cases for yourself, your group or your department.

Case-based Review of Neuroradiology: Spine (An Interactive Session)

Thursday, 10:30 AM - 12:00 PM • S100AB

LEARNING OBJECTIVES
1) To recognize common patterns for spine and spinal cord pathology and to organize these patterns into categories of diseases processes. 2) To be aware of subtle findings that can lead one to favor one category of disease over another. 3) To be able to differentiate MR artifacts from true pathology in the spine and spinal cord.

Case-based Review of Pediatric Radiology: Pediatric MSK Imaging (An Interactive Session)

Thursday, 10:30 AM - 12:00 PM • S406A

LEARNING OBJECTIVES
1) Attendees will learn to recognize common sports related injuries to the pediatric musculoskeleton. 2) Physisal injury will be emphasized. Attendees will learn to distinguish normal physiologic physisal appearance from pathology. 3) Practical aspects of pediatric musculoskeletal imaging will be discussed. Attendees will learn tips for efficient, high quality MR protocols for MSK trauma.
LEARNING OBJECTIVES
1) Review the classification system of musculoskeletal pediatric masses (by tissue type). 2) Describe clinical aspects, imaging characteristics and differential diagnosis of pediatric benign and malignant masses according to histologic tissue. 3) Discuss imaging-pathologic correlation of pediatric masses according to histologic tissue.

ABSTRACT
A wide range of musculoskeletal tumors occurs in the pediatric population. Radiologists should be aware of the clinical and conventional imaging manifestations of these tumors in order to provide timely specialist referrals so that early diagnosis and treatment can be achieved. Improvements in clinical-imaging diagnosis and treatment have increased the survival of many children with malignant musculoskeletal tumors in the last decade. Recognizing specific imaging characteristics of benign and malignant masses is paramount for prompt narrowing of differential diagnoses. Imaging-pathologic correlation of neoplasms according to histologic type facilitates the understanding of the complexity, diversity and in vivo behaviour of several musculoskeletal tumors.

Initial Experience of Technologist Performed Whole Breast Screening Ultrasound
Andrea S Doria MD (Presenter) *

LEARNING OBJECTIVES
1) Review the classification system of musculoskeletal pediatric masses (by tissue type). 2) Describe clinical aspects, imaging characteristics and differential diagnosis of pediatric benign and malignant masses according to histologic tissue. 3) Discuss imaging-pathologic correlation of pediatric masses according to histologic tissue.

ABSTRACT
A wide range of musculoskeletal tumors occurs in the pediatric population. Radiologists should be aware of the clinical and conventional imaging manifestations of these tumors in order to provide timely specialist referrals so that early diagnosis and treatment can be achieved. Improvements in clinical-imaging diagnosis and treatment have increased the survival of many children with malignant musculoskeletal tumors in the last decade. Recognizing specific imaging characteristics of benign and malignant masses is paramount for prompt narrowing of differential diagnoses. Imaging-pathologic correlation of neoplasms according to histologic type facilitates the understanding of the complexity, diversity and in vivo behaviour of several musculoskeletal tumors.

Skeletal Dysplasia in Pediatric Patients
Teresa Victoria MD, PhD (Presenter)

LEARNING OBJECTIVES
1) To discuss available tools in the imaging armamentarium in order to evaluate the fetus with a presumed diagnosis of skeletal dysplasia. 2) To discuss a systematic approach to evaluate postnatal imaging findings of skeletal dysplasias. 3) To assess and interpret postnatal imaging findings with the goal of constructing a differential diagnosis.

Incidentalomas of the Female Pelvis: How to Avoid Overdiagnosis Without Missing Cancer
Susanna I Lee MD,PhD (Presenter)

LEARNING OBJECTIVES
1) Assess the likelihood that an incidentally detected pelvic mass is cancer based on imaging features and clinical presentation. 2) Effectively and safely evaluate incidental adnexal masses with US, MRI and FDG-PET. 3) Identify and triage endometrial lesions that warrant further workup. 4) Recognize which “enlarged fibroid uterus” may be harboring a cancer.

ABSTRACT
MSES52B • Imaging of Non-Traumatic Abdominal Pain in the Pregnant Patient
Keyanoosh Hosseinzadeh MD (Presenter) *

LEARNING OBJECTIVES
1) Detail safety issues of US, CT and MR during pregnancy with discussion of the risks and benefits of the individual modalities. 2) Discuss imaging algorithm for the common non-obstetric and non-traumatic etiologies of abdominal pain in the pregnant patient with a focus on gastrointestinal, genitourinary and hepatobiliary disorders.

MR Imaging of GU Emergencies
John A Spencer MD (Presenter)

LEARNING OBJECTIVES
1) Unremitting maternal loin pain in pregnancy. 2) Assessment of indeterminate adnexal masses discovered on acute abdominal imaging.

ABSTRACT
Loin pain in pregnancy is not uncommon and may result from urinary tract infection or from hydronephrosis. Usually hydronephrosis results from ‘physiological’ causes and is almost universal in the third trimester, more pronounced on the right side. This not a true ureteric obstruction and differs from that due to obstruction from say a ureteric calculus. MR imaging allows confident distinction between these alternative diagnoses. With physiological hydronephrosis the ureter is extrinsically compressed between the psoas muscle and the gravid uterus. No renal oedema is present nor perinephric fluid as are present with genuine obstruction. Fast MR imaging using heavily T2 weighted ‘water’ sequences identifies the level of calibre change in the ureter and focussed high resolution T2 weighted imaging through this level defines the cause. T2 weighted or diffusion weighted imaging shows differential renal hydration. An obstructed kidney loses its normal corticomedullary pattern and shows cortical oedema. Calculi are shown as filling defects. Evaluation of painful hydronephrosis may produce confusing features. Adnexal torsion and cyst accident (rupture or bleeding) have characteristic MR features. Acute pelvic bleeding conditions are found to have indeterminate pelvic findings on CT. Adnexal emergencies may produce challenging US findings and TVUS is often declined or poorly tolerated by women with pelvic peritonitis. Adnexal torsion and cyst accident (rupture or bleeding) have characteristic MR features. Acute pelvic bleeding may produce confusing features. Adnexal torsion: a multimodality imaging review. Wilkinson C & Sanderson A. Clin Radiol 2012; 67: 476-483. We will review these MR findings using a case based approach.

Breast Imaging (Ultrasound Screening)
Thursday, 10:30 AM - 12:00 PM • Arie Crown Theater

SSQ01 • AMA PRA Category 1 Credit ™ • ARRT Category A+ Credit:1.5
Ellen B Mendelson, MD ; Janice S Sung, MD ; Christopher E Comstock, MD ; D. David Dershaw, MD ; Elizabeth A Morris, MD

PREFERENCE
To evaluate the added cancer detection and false positive rate of a technologist-performed hand-held breast ultrasound program

METHOD AND MATERIALS
IRB approved retrospective review was performed on 890 consecutive women who underwent screening hand held high resolution breast ultrasound performed by a resident and assistant ultrasound technologist between October 2011-February 2013. Radiologist performed targeted ultrasound only in cases if a solid or indeterminate lesion was identified by the sonographer. Clearly benign findings, such as simple and complicated cysts, were neither recorded nor re-evaluated by the radiologist. 63 probably benign or suspicious lesions were identified.

RESULTS
Of the 890 women, 299 (34%) were pre-menopausal and 591 (66%) peri/post-menopausal. 288 (32%) had a personal history of breast cancer, 67(8%) a prior biopsy proven high-risk lesion, and 592(67%) a family history of breast cancer. 769/875(88%) patients had a mammogram within 6 months of the ultrasound. Breast density was predominantly fatty in 31 (3%), scattered fibroglandular densities in 171 (20%), heterogeneously dense in 521 (60%), and extremely dense in 152(17%). 837 (94%) studies were assessed as BI-RADS 1 or 2, 20 (2%) as BI-RADS 3, and 43 (5%) as either BI-RADS 4 or 5. Biopsy was performed for 39/43 suspicious lesions, yielding malignancy in 3/39 (PPV 8%). The cancers were all solid masses between 1.0-1.3 cm in size in heterogeneously dense breasts. Of the 3 women with cancers, 2 had a personal history of breast cancer and the other had no additional risk factor. 2 had a negative mammogram within 5 weeks of the ultrasound and the third within 7 months. The overall cancer detection rate was 3.4 cancers per 1000 women.

CONCLUSION
Technologist performed handheld screening breast ultrasound demonstrates a cancer detection rate (3.4/1000) and PPV (8%) of biopsy similar to that

Breast Imaging (Ultrasound Screening)
Thursday, 10:30 AM - 12:00 PM • Arie Crown Theater

SSQ01 • AMA PRA Category 1 Credit ™ • ARRT Category A+ Credit:1.5
Ellen B Mendelson, MD ; Janice S Sung, MD ; Christopher E Comstock, MD ; D. David Dershaw, MD ; Elizabeth A Morris, MD

PREFERENCE
To evaluate the added cancer detection and false positive rate of a technologist-performed hand-held breast ultrasound program

METHOD AND MATERIALS
IRB approved retrospective review was performed on 890 consecutive women who underwent screening hand held high resolution breast ultrasound performed by a resident and assistant ultrasound technologist between October 2011-February 2013. Radiologist performed targeted ultrasound only in cases if a solid or indeterminate lesion was identified by the sonographer. Clearly benign findings, such as simple and complicated cysts, were neither recorded nor re-evaluated by the radiologist. 63 probably benign or suspicious lesions were identified.

RESULTS
Of the 890 women, 299 (34%) were pre-menopausal and 591 (66%) peri/post-menopausal. 288 (32%) had a personal history of breast cancer, 67(8%) a prior biopsy proven high-risk lesion, and 592(67%) a family history of breast cancer. 769/875(88%) patients had a mammogram within 6 months of the ultrasound. Breast density was predominantly fatty in 31 (3%), scattered fibroglandular densities in 171 (20%), heterogeneously dense in 521 (60%), and extremely dense in 152(17%). 837 (94%) studies were assessed as BI-RADS 1 or 2, 20 (2%) as BI-RADS 3, and 43 (5%) as either BI-RADS 4 or 5. Biopsy was performed for 39/43 suspicious lesions, yielding malignancy in 3/39 (PPV 8%). The cancers were all solid masses between 1.0-1.3 cm in size in heterogeneously dense breasts. Of the 3 women with cancers, 2 had a personal history of breast cancer and the other had no additional risk factor. 2 had a negative mammogram within 5 weeks of the ultrasound and the third within 7 months. The overall cancer detection rate was 3.4 cancers per 1000 women.

CONCLUSION
Technologist performed handheld screening breast ultrasound demonstrates a cancer detection rate (3.4/1000) and PPV (8%) of biopsy similar to that
SSQ01-02 • Comparison of an Automated Breast Volume Scanner and a Hand-held Ultrasound in the Detection of Breast Cancer: An Analysis of 5576 Patient Evaluations

Woo Jung Choi MD (Presenter) ; Seonah Jang ; Joo Hee Cha ; Hak Hee Kim MD ; Hee Jung Shin MD ; Hyunj Kim MD ; Eun Young Chae ; Sun Hye Jeong MD

PURPOSE
To retrospectively compare the accuracy and effectiveness of automated breast volume scanning (ABVS) and hand-held ultrasound (HHUS) in the detection of breast cancer in a large population group with a long-term follow-up, and to investigate whether different ultrasound systems may influence the estimation of cancer detection.

METHOD AND MATERIALS
A total of 1870 ABVS and 3706 HHUS participants, who underwent these procedures at our institute between September 2010 and August 2011, were included in this study. Cancers occurring during the study and subsequent follow-up were evaluated. The reference standard was a combination of histology and follow-up imaging (= 12 months). The diagnostic accuracy, sensitivity, specificity, and positive (PPV) and negative (NPV) predictive values were calculated with exact 95% confidence intervals.

RESULTS

CONCLUSION
ABVS shows a comparable diagnostic performance to HHUS. We thus find that ABVS as an effective supplemental tool for mammography in breast cancer detection in a large population.

CLINICAL RELEVANCE/APPLICATION
In this study, ABVS shows comparable diagnostic performance when compared with HHUS in the detection of breast cancer in a large population group with a long-term follow-up.

SSQ01-03 • Impact of Radiologists' Professional and Practice Characteristics on Breast Cancer Detection in Women with Dense Breasts: A Reader Study Combining Mammography and Automated Breast Ultrasound

Karen Drukker PhD (Presenter) * ; Maryellen L Giger PhD *

PURPOSE
Evaluate variability in the clinical assessment of breast images, and its dependence on radiologists’ professional and practice characteristics, in a retrospective reader study combining X-ray mammography (XRM) and 3D automated breast ultrasound (ABUS) for breast cancer detection in women with dense breasts.

METHOD AND MATERIALS
The study involved 17 breast radiologists of which 7 came from academic radiology practices, 6 from private practice, and 4 from community clinics. A sequential study design was employed with readers first interpreting ‘XRM alone’ followed by an interpretation of the combined ‘XRM+ABUS’, with each interpretation including a forced BI-RADS scale and a likelihood that the woman had breast cancer. The analysis included 164 asymptomatic patients, including 31 breast cancer patients, with dense breasts and a negative screening XRM. Of interest were inter-reader variability in scoring for ‘XRM alone’, ‘XRM+ABUS’, and the dependence on reader experience, fellowship training, and type of practice. Performance analysis included Receiver Operating Characteristic (ROC), percentiele, kappa statistics, correlative, and Bland-Altman analyses. The statistical significance of the impact of consecutive reads was assessed for the kappa statistics using bootstrapping.

RESULTS
The median change in area under the ROC curve after ABUS interpretation was 0.12 (range 0.04—0.19). Reader agreement was fair with the median inter-reader kappa being 0.26 (0.05—0.48) for ‘XRM alone’ and 0.34 (0.11—0.55) for ‘XRM+ABUS’ (95% confidence interval for the difference in kappa [0.06;0.11]). The only factor that appeared to have a substantial effect on reader performance was the type of clinical radiology practice, with the increase in the area under the ROC curve the largest for the 3 radiologists from academic practices, with changes of 0.18, 0.19, and 0.19 respectively.

CONCLUSION
A modest, but statistically significant, increase in inter-reader agreement was observed after interpretation of ABUS, while radiologists from academic practice seemed to benefit the most from ABUS interpretation.

CLINICAL RELEVANCE/APPLICATION
Understanding reader variability and factors such as training and clinical practice will yield informed decisions on the use of multimodality imaging in breast cancer screening.

SSQ01-04 • Whole Breast Ultrasound: Comparison of the Visibility of Suspicious Lesions with Automated Breast Volumetric Scanning versus Hand-held Breast Ultrasound

Cherie M Kuzmiak DO (Presenter) * ; Eun Young Ko MD, PhD ; Laura Tuttle ; Doreen Steed ARRT * ; Donglin Zeng PhD

PURPOSE
To assess how well radiologists visualize relevant features of lesions seen with automated breast volumetric scanning in comparison to hand-held breast ultrasound in population of women going to biopsy.

METHOD AND MATERIALS
Twenty-five patients were consecutively recruited from women who were scheduled to undergo a breast biopsy for at least one BIRADS 4 or 5 lesion identified in a diagnostic setting in this IRB approved study. The enrolled subjects subsequently underwent imaging of the breast(s) of concern using a dedicated FDA-approved ultrasound system that allowed both a hand-held breast ultrasound (HHBUS) and automated breast volumetric scanning (ABVS) to be performed with the same imaging parameters. Five experienced breast imaging radiologists reviewed the randomized cases in a reader study. Each reader was asked to compare side-by-side the breast ABVS exam to the HHBUS exam, including the lesion recommended for biopsy. Each reader was asked to specify the lesion type, size and imaging features, BIRADS score, probability of malignancy for each lesion for each modality and then they were asked to compare the lesion characteristics of shape and margins between the two modalities using a seven-point confidence scale for two sets of modality comparisons.

RESULTS
There were thirty biopsied lesions in this study. All were masses. Seven (23.3%) masses were malignant and 23 (76.4%) were benign. Across all lesions regardless of size or final pathology, there was no significant difference between the two modalities in the readers’ BIRADS classification, probability of malignancy, sensitivity or specificity (P > 0.15). For malignant lesions, the reader visualization confidence scores between the two ultrasound modalities were not significantly different (P > 0.1). However, analysis for non-malignant cases showed a statistically significant increase in reader visualization confidence in lesion shape and margins with ABVS (P < 0.001).

CONCLUSION
Radiologists showed equal confidence in visualization of suspicious masses with automated breast volumetric scanning in comparison to hand-held breast ultrasound mammography and increased confidence in visualization of non-malignant lesions with automated breast volumetric scanning.

CLINICAL RELEVANCE/APPLICATION
Dedicated automated whole breast ultrasound is a novel imaging technology that has the potential application for decreasing hand-held breast imaging use in a busy diagnostic clinic.

SSQ01-05 • Comparison of Transverse versus Coronal View of Automated Breast Ultrasound in Lesion Detection

Sun Young Lee MD (Presenter) ; Joo Hee Cha ; Eun Young Chae ; Hak Hee Kim MD ; Hee Jung Shin MD ; Hyunji Kim MD

PURPOSE
To compare the performance of coronal view of automated breast ultrasound (ABUS) with that of transverse view in the lesion detection

METHOD AND MATERIALS
Three breast radiologists independently interpreted the ABUS images from 113 women, 14 with negative findings and 99 with known breast lesions (99 benign and 53 malignant findings). The readers were asked to detect the presence or absence of the abnormalities using transverse and coronal view in the different reading session. If a lesion was detected, we evaluated the location, characteristics of lesions. Intraclass correlation coefficients and kappa statistics were used for statistical analysis. Time to review and interpret an examination was also evaluated.
RESULTS
The detection rate of malignant lesions was 95.6% and 87.4% for transverse and coronal view ($p=0.0089$). The detection rate of benign lesions was 72.4% and 56.6% for transverse and coronal view ($p=0.0001$). Larger lesions are more consistently detected by coronal view: detection rates were 7.4% at 5 mm or smaller; 48.4% at 6-10 mm; 80.1% at 11-15 mm; 89.1% for lesions larger than 15 mm ($p$).

CONCLUSION
The detection rate of coronal view was significantly lower than that of transverse view for both benign and malignant lesions.

CLINICAL RELEVANCE/APPLICATION
Coronal view can be used as an additional method to transverse view. However, the role of coronal view by ABUS is not yet established, which needs to undergo further studies.

SSQ01-06 • Performance of Whole Breast Ultrasound in Women with Dense Breasts Following 3D Tomosynthesis Mammography

Regina J Hooley MD (Presenter) *; Jaime L Geisel MD; Madhavi Raghu MD *; Melissa A Durand MD; Cary P Gross MD; Susan H Busch; Liane E Philpotts MD

PURPOSE
Both whole breast ultrasound (WBUS) and 3D tomosynthesis (DBT) mammograms are being more widely utilized in the United States and both modalities can detect cancers not visualized on conventional digital mammography. The purpose of this study is to determine the performance of WBUS in women with a recent prior normal DBT mammogram.

METHOD AND MATERIALS
A retrospective chart review was performed on 1039 consecutive women who underwent handheld WBUS between 10/1/2011 and 9/20/2012 and who had a prior normal DBT mammogram performed within 12 months before the WBUS examination. All WBUS exams were performed by a breast ultrasound technologist and were immediately reviewed and interpreted by a radiologist.

RESULTS
The average patient age was 52.3 years (S.D. +/- 9.5 years, range 27-94). The average time between the mammogram and WBUS was 32 days (639 patients had both exams on the same day). Of the 1039 WBUS exams, 599 were prevalence screenings and 440 were incidence screenings. 906 (87.2%) were BI-RADS 1 or 2, 102 (9.8%) were BI-RADS 3 and 31 (3.0%) were BI-RADS 4. There were no BI-RADS 5 lesions. Ultrasound guided aspiration or biopsy was performed in 38 women; including 10 BI-RADS 3 and 30 BI-RADS 4 lesions. Two BI-RADS 4 lesions were malignant infiltrating ductal carcinomas. Both cancers were found on a prevalence WBUS and both were not seen on DBT, even in retrospect. The overall positive predictive value of BI-RADS 4 lesions was 6.5%. The cancer detection rate was 1.9/1000.

CONCLUSION
Supplemental WBUS performed in addition to DBT can detect mammographically occult breast cancers, although the rate is lower than previous studies of WBUS performed in addition to conventional mammography.

CLINICAL RELEVANCE/APPLICATION
Multiple studies have demonstrated that supplemental WBUS has a cancer detection rate of 3-5/1000, although the performance of WBUS as a supplement to DBT mammography has yet to be determined.

SSQ01-07 • Supplemental Ultrasound (US) Screening in Patients with a History of Lobular Neoplasia (LN)

Kanchan Phalak MD (Presenter) ; Basak E Dogan MD ; Denai Milton MS ; Therese Bevers MD ; Wei T Yang MD

PURPOSE
To investigate the role of US screening as an adjunct to mammography (M) in breast cancer detection in women with a history of LN.

METHOD AND MATERIALS
A retrospective review was performed of the clinicopathology database at a single institution between 11/2004 and 11/2011 and yielded 195 women with biopsy proven lobular carcinoma in situ (LCIS) and/or atypical lobular hyperplasia (ALH) who underwent screening M, screening US, and/or screening MR.

RESULTS
A total of 138 patients who had mammography, US, or MR available for review and were included in the study. Mean patient age was 53 years (range 30-83). All 138 patients underwent a mean of 3.0 years of screening with M, 115 (83%) a mean of 2.7 years of screening with US, and 30 (20%) patients a mean of 1.9 rounds of screening with MRI. Eleven (8.0%) patients had the diagnosed with cancer. Of 135 patients who were diagnosed with cancer. Mammographic cancer detection rate 2.6% US cancer detection rate 2.6%, and all these cancers were mammographically occult. A subgroup of 30 patients with LN and lifetime risk >20% received supplemental MRI screening; 5 (16.7%) of whom were diagnosed with cancer. US did not detect any of the 5 cancers, M detected 1 (3%) and MRI detected 2 (6.7%) while remaining 2 were detected clinically. The sensitivity (95% CI) of screening US was 30% (7%-65%), specificity (95% CI), PPV (95% CI), and NPV (95% CI) were 100% (97%-100%), 100% (29%-100%), and 94% (88%-97%), respectively. The sensitivity (95% CI) of screening M was 50% (35%-65%), and NPV was 89% (95% CI: 71%-98%).

CONCLUSION
Annual screening US as a supplement to screening M resulted in an incremental cancer detection rate of 2.6% in patients with a history of LN.

CLINICAL RELEVANCE/APPLICATION
Supplemental US screening in patients with LN who do not fulfill the American Cancer Society criteria for high risk MRI screening may help detect mammographically occult malignancy.

SSQ01-08 • Reassessment and Follow-up Results of BI-RADS Category 3 Lesions Detected on Screening Breast US

Jung Lin Yoo MD (Presenter) ; Joo Hee Cha ; Eun Young Chae ; Hak Hee Kim MD ; Hee Jung Shin MD ; Hyunji Kim MD

PURPOSE
To determine the frequency and the malignancy rate of BI-RADS category 3 lesions detected on screening breast ultrasound and reassess whether they satisfied the ACRIN 6666 protocol.

METHOD AND MATERIALS
During two years, 28,796 asymptomatic women underwent screening mammography. Among them, 8359 women underwent additional breast ultrasound as part of a screening examination. Radiologists analyzed US lesion features and provided a final BI-RADS assessment. We retrospectively reviewed the initial US images with BI-RADS category 3 lesions and their mammography as well. We also investigated the outcome of these lesions. The reference standard was a combination of pathology and clinical follow-up for at least 24 months.

RESULTS
The frequency of category 3 lesions detected on breast US was 16.8% (1403/8359). Of 941 patients with follow up for at least 24 months or biopsy, six eventually proved to be malignant (0.6%). The malignancy rate was 1.5% (4/280) for patients with negative mammogram and 0.5% (2/136) for those with negative mammogram. The ACRIN (American College of Radiology Imaging Network) 6666 protocol was strictly applied, 147 (15.6%) were retrospectively recategorized as BI-RADS 4 (n=7) or BI-RADS 2 (n=140).

CONCLUSION
The malignancy rate of BI-RADS category 3 lesions is very low, especially with negative mammogram.

CLINICAL RELEVANCE/APPLICATION
With BI-RADS category 3, careful assessment is needed to avoid unnecessary biopsy or short-interval follow-up.

SSQ01-09 • Review of Interval Cancers in a Mammographic Screening Programme: What Can We Learn? Are We Being Too Hard on Ourselves?

Katerina Lekanidi MRCP, MBBCh (Presenter) ; Philip Dilks ; Tamara Suaris MBB ; Hema N Purushothaman

PURPOSE
To determine the features of interval breast cancers considered to be detectable on previous screening.

METHOD AND MATERIALS
This study was approved by the clinical governance committee. As a requirement of the national breast screening programme, the previous screening mammograms for all interval breast cancers were reviewed and classified as: no signs, minimal signs or suspicious appearances. Patients with interval breast cancer over a period of 21 years were included in this study if minimal or suspicious signs were seen on most recent screening mammogram. 3 radiologists,
Computer Derived Texture Features on DCE-MRI Can Separate ER+ Breast Cancers with Low and High Oncotype DX Scores

Tao Wan PhD (Presenter); Boris N Bloch MD; Donna M Plecha MD *; Cheryl Thompson BS; Hannah Gilmore; Norbert Avril MD; C. Carl Jaffe MD; Lyndsay Harris MD; Anant Madabhushi MD *

PURPOSE
Oncotype DX (ODX) is a gene-expression based assay for predicting response to hormonal therapy in estrogen receptor positive (ER+) breast cancers (BCa) patients. The goal of this study was to identify whether computer derived texture features on DCE-MRI can distinguish low and high ODX scores (i.e. ER+ BCa patients who would and would not benefit from adjuvant chemotherapy), thereby providing a non-invasive pertherapeutic gene-expression assessment tool predicting tumor treatment response.

METHOD AND MATERIALS
A total of 57 ER+ BCa patient studies were collected, in which 21 breast MRIs were acquired from a Philips 1.5T magnet with a 7-channel breast coil, and 36 MRIs were acquired using a Siemens 1.5T magnet with a 8-channel breast coil, including DCE images obtained prior to, during, and after administration of 0.1 mmol/kg of Gd-DTPA. Each study was accompanied by: i) lesion annotations from an expert radiologist; and ii) ODX scores. A set of 6 morphological features, 3 pharmacokinetic features, 12 enhancement kinetic features (EKF), 12 intensity kinetic features, 312 textural kinetic features, 6 dynamic local binary patterns (DLBP), and 5 dynamic histogram of oriented gradients (DHoG) features were extracted and used to characterize the appearance of the breast lesions. The computed features were evaluated by a linear discriminate analysis (LDA) classifier in terms of their ability to distinguish ER+ BCa with low or high ODX scores via a 2-fold randomized cross validation scheme.

RESULTS
The DHoG, DLBP, and EKF texture features yielded AUC values of 0.85, 0.82, and 0.80 in conjunction with the 2-class LDA classifier for separating low and high ODX ER+ breast lesions.

CONCLUSION
This work to our best knowledge, the first attempt to quantitatively correlate texture measurements on DCE-MRI to patient outcome prediction via the ODX assay. Our results suggested that the DHoG, DLBP, and EKF were robust and stable DCE-MRI markers in distinguishing between low and high ODX scores.

Computerized Characterization of Mass and Non-mass-Like Lesions on Breast MRI

Hui Li PhD (Presenter); Maryellen L Giger PhD *; Li Lan; Sunny Y Duan; Stephen Hu; Gillian M Newstead MD *; Hiroyuki Abe MD; Michelle Lindgren MD

PURPOSE
To investigate the potential usefulness of quantitative imaging analysis on characterizing both mass and non-mass-like enhancement breast lesions in the task of distinguishing between malignant and benign lesions

METHOD AND MATERIALS
Study was performed on 123 biopsy-proven lesions from 103 MRI studies acquired between January 2009 and April 2010, including 35 benign mass, 50 malignant mass, 19 benign non-mass-like and 27 malignant non-mass-like lesions. Our quantitative imaging analysis method incorporated computerized 3D lesion segmentation and feature extraction, including kinetic, enhancement-variance kinetic, morphological, size, and texture features. Output from the system yielded the probability of malignancy from a Bayesiam artificial neural network (BANN). Classification performance was evaluated with a leave-one-case-out method using ROC analysis with area under the ROC curve as the figure of merit.

RESULTS
For mass lesions, the kinetic features of time to peak and curve shape index statistically differed between malignant and benign lesions. However, kinetic features did not contribute significantly in the diagnostic task with non-mass-like breast lesions. By merging computer-features with BANN classifiers, AUC values of 0.88 (SE=0.03), 0.95 (SE=0.02), and 0.82 (SE=0.08) were obtained in the task of distinguishing between malignant and benign lesions on the entire dataset, between malignant and benign mass lesions, and between malignant and benign non-mass-like lesions, respectively.

CONCLUSION
Kinetic characteristics are useful in differentiating malignant from benign mass lesions; however, their performance is reduced when the lesions are non-mass-like. Thus, quantitative analysis for diagnostic decision-making should be performed separately on mass and non-mass-like lesions.

CLINICAL RELEVANCE/APPLICATION
In order to improve clinical diagnostic accuracy, quantitative analysis for diagnostic decision-making should be performed separately on mass and non-mass-like lesions in the classification task.

Use of Quantitative 3D Breast Image Analysis to Inform DCIS Staging

Stephanie M Burda (Presenter); Maryellen L Giger PhD *; Li Lan; Kathy Rodogiannis; Hui Li PhD; Gillian M Newstead MD *; Ken Yamaguichi; Koichi Ishiyama MD; Hiroyuki Abe MD; Michelle Lindgren MD; Adam Starkey

PURPOSE
Uncertainty on which ductal carcinoma in situ (DCIS) cases will progress to invasive breast cancer currently results in overtreatment. Our purpose was to discern quantitative characteristics of pure DCIS, DCIS with an invasive component, and invasive cancers without DCIS to inform prognosis of patients with lesions presenting initially as DCIS.

METHOD AND MATERIALS
Retropective, IRB-approved review of our radiology database 2005-2012 identified 303 pathology-proven cancers with correlative MR imaging. Histology yielded 54 pure DCIS lesions, 56 with both DCIS and invasive pathology, and 193 invasive cancers without DCIS. Quantitative 3D image analysis yielded morphological, kinetic, and texture lesion descriptors following semi-automated lesion

CLINICAL RELEVANCE/APPLICATION
Review of interval breast cancers is a valuable learning tool in breast screening programmes and is more valid if done initially blinded to the position of the subsequent breast cancer.

Breast Imaging (CAD/Quantitative Imaging)

Thursday, 10:30 AM - 12:00 PM • E450A

Results
111/590 interval cancers documented in the study period fulfilled the study inclusion criteria. The mean age at the time of screening mammogram was 59.04 (range 51 - 75). The mean interval to the diagnosis of breast cancer was 17.30 months (range 1 - 36). 61.3% of cases were considered as "minimal signs" and 38.7% as suspicious. In 17.1% of the cases none of the readers identified a relevant abnormality on the screening mammogram. In 21.6% of the cases 1/3 readers identified the abnormality, 27.6% of cases 2/3 readers and 33.3% all 3 readers identified the abnormality. In 50% of one-reader recalls, the mammographic abnormality was an asymmetric density, followed by ill-defined mass (20.8%) and architectural distortion (20.8%). In three-reader recalls, microcalcification was the most common finding (35.1%), followed by asymmetric density (27%) and an ill-defined mass (24.3%). Overall, the most common abnormality was asymmetric density (36%), followed by ill-defined mass (15.3%) and microcalcification with or without a mass (15.3%).

Conclusion
The most common retrospectively and unanimously identified sign of breast cancer is microcalcification and the most common subtle sign is asymmetric density. Interval cancer mammographic review not blinded to the position of subsequent cancer overestimates the percentage of "minimal signs" cases.

Clinical Relevance/Application
Oncotype DX assay provides important information about the likelihood of breast cancer recurrence and the expected benefit from adjuvant therapy. The most commonly utilized tool for breast cancer risk stratification in the ER+ population is the Oncotype DX (ODX) assay. This gene-expression based assay provides a quantitative measure of the likelihood of relapse following neoadjuvant chemotherapy and is an important consideration in the treatment decision-making process for patients with ER+ breast cancer. In this study, we examined the potential usefulness of quantitative imaging analysis on characterizing both mass and non-mass-like enhancement breast lesions in the task of distinguishing between malignant and benign lesions.
RESULTS

The combination of features that best distinguished pure DCIS from invasive cancer included kinetic feature time to peak, texture features of contrast and correlation, and morphological features of circularity, margin, and surface area. The combination of features that was best able to distinguish pure DCIS from invasive cancers with a DCIS component included contrast, margin, and ratio of surface area to volume. The margin characteristics (determined by spiculation and sharpness) and contrast (the difference between the average gray level of the cancer and the surrounding area) were found to be insightful in both comparisons. Time to peak was also significant in the comparison of Pure DCIS and invasive cancers, yielding an AUC value of 0.77. Round-robin evaluation of an LDA yielded AUCs of 0.85 and 0.74 distinguishing pure DCIS from invasive cancers and invasive cancers with a DCIS component, respectively.

CONCLUSION

Image-derived quantitative phenotypes, which indicate a likelihood of invasive disease of pure DCIS, could potentially guide management of DCIS lesions, thus potentially reducing overtreatment.

SSQ02-05 • Immunohistological Factors Affecting the Breast Cancer Size Measurement by MRI Computer-aided Detection (CAD) System

Ji Yeon Park (Presenter) ; Seon Hyeong Choi ; Yoonjung Choi MD ; Chae Hyun Kim ; Shin Ho Kook MD

PURPOSE

To investigate immunohistological factors affecting the breast tumor size measurement discrepancy between the MRI CAD and the pathologic specimen.

METHOD AND MATERIALS

We retrospectively reviewed the 244 cases of breast MRI CAD images and pathologic findings of the 244 patients who underwent operation for breast cancer between July 2011 and December 2012. We compared the CAD generated tumor size with tumor size measured on pathologic specimen. We classified the tumors into three groups: underestimated, adequately measured and overestimated group. We investigated the statistical difference in histopathology including histologic type, presence of DCIS, extensive intraductal component, nuclear grade, ER, PR and HER-2, among the 3 groups.

RESULTS

Median tumor size on CAD and specimen were 20 mm (2-163 mm) and 17 mm (0.8-82 mm), respectively. Adequately measured group was 68.6% (n=168). Invasive ductal carcinoma (IDC) showed significantly more adequate measurement, compared with DCIS (p=0.025). Among IDC, the presence of extensive intraductal component was significantly higher in overestimated group (p<0.01). Size assessment using breast MRI CAD was accurately measured in 68.6%. On MR CAD, breast cancer size was frequently overestimated in cases of DCIS, the presence of extensive intraductal component, and HER-2 negative.

CONCLUSION

Size assessment by breast MRI CAD is accurate but it can be overestimated in cases of DCIS, EIC, and HER-2 negative. Accurate tumor size measurement is critical to surgical plan for breast conservation. Size assessment by breast MRI CAD is accurate but it can be overestimated in cases of DCIS, EIC, and HER-2 negative.

SSQ02-06 • Quantitative MRI-based Phenotypes of Triple Negative Breast Cancers

Hui Li PhD (Presenter) ; Maryellen L Giger PhD * ; Li Lan ; Hiroyuki Abe MD ; Michelle Lindgren MD ; Eric M Blaschke MD ; Gillian M Newstead MD *

PURPOSE

To investigate the potential usefulness of quantitative image analysis on characterizing the molecular subtypes of breast cancer in order to better understand the difference between triple negative and other molecular subtypes of breast cancer.

METHOD AND MATERIALS

Study was performed on 168 biopsy-proven breast cancer MRI studies acquired between November 2008 and August 2011, in which 40 cases were triple negative (ER-, PR-, and HER2-) breast cancers and 128 cases were of other molecular subtypes including Luminal A, Luminal B, and HER2. Quantitative MRI analysis included: 1) 3D lesion segmentation based on a fuzzy c-means clustering algorithm; 2) computerized feature extraction; 3) leave-one-out linear discriminant analysis; and 4) discriminant score estimation using Linear Discriminant Analysis (LDA). The classification performance between triple negative and other molecular subtypes of breast cancer was evaluated using ROC analysis with area under the ROC curve (AUC) as the figure of merit.

RESULTS

The triple negative classification, in a round-robin evaluation, yielded AUC values of 0.90 (SE=0.05) and 0.62 (SE=0.05) on 3T and 1.5T MR scanners, respectively. In the task of distinguishing between triple negative and other molecular subtypes, statistically significantly higher than an AUC value of 0.5 (p-value <0.01). The results from this study indicate that quantitative MRI analysis shows promise in the discrimination of triple negative breast cancer from other molecular subtypes of breast cancer.

CONCLUSION

The identification of the molecular subtypes of breast tumors is expected to allow for improved prognostic assessment and more effective cancer treatment plans.

SSQ02-07 • Features of Undiagnosed Breast Cancers at Screening Breast MRI: Potential Utility and Limitation of Computer-aided Evaluation

Mirinae Seo MD (Presenter) ; Nariya Cho MD ; Min Sun Bae MD, PhD ; Eun Bi Ryu MD ; Jung Min Chang MD ; Hye Ryoung Koo MD ; Su Hyun Lee MD ; Won Hwa Kim MD, MS ; Woo Kyung Moon ; Hye Mi Gweon MD ; A Jung Chu MD

PURPOSE

To evaluate the features of undiagnosed cancers at prior screening breast MRIs in patients who subsequently developed breast cancers and the potential utility and limitation of computer-aided evaluation (CAE).

METHOD AND MATERIALS

Between March 2004 and March 2013, 65 pairs of dynamic contrast enhanced breast MRIs including prior negative screening MRIs and subsequent MRIs with developed cancers (mean interval 36.5 months, range 5.4 – 96.7 months) were identified. The mean histological sizes of developed cancers was 2.0cm (range 0.5 – 9.5 cm) for invasive cancers (n=44) and 1.9cm (range 0.5 – 4.1 cm) for DCIS (n=21). Visible findings, their maximum lesion size and actuariality, as well as causes for overlooked cancers on prior MRI were determined and classified by two experienced radiologists in consensus. A commercially available CAE program was retrospectively applied to the prior MRIs with visible findings for generation of kinetic features including washout, plateau, and persistent enhancement proportions. Presence of a washout component on CAE was also described.
RESULTS
Of the 65 areas where cancer later developed, 51% (33 of 65) of prior MRIs had visible findings and their mean lesion size was 1.0cm (range 0.4 - 5.2 cm). Of these visible findings, 24% (8 of 33) were classified as actionable and 76% (25 of 33) as underthreshold. Causes for actionable findings were mimicking of physiologic enhancement (n=3), mimicking after benign results of biopsy (n=3), and satisfaction of search (n=2). Those of underthreshold findings were small lesion size (n=6), moderate to marked background parenchymal enhancement (n=11), mimicking of post-op scar (n=7), and peripheral location (n=1). Twenty-three of the visible findings were available for CAE and the washout component was found in 14. However, 4 of 14 lesions with a washout component were not marked due to marked background enhancement with multiple enhancing lesions with a washout component. CAE did not show the washout component in 9 of 23 lesions.

CONCLUSION
On prior screening breast MRIs in which cancer later developed, 51% (33 of 65) had visible findings (24% actionable, 76% underthreshold). The addition of CAE has the potential to identify 43% (10 of 23) of overlooked findings. Yet, there are still some limitations on CAE.

CLINICAL RELEVANCE/APPLICATION
When an enhancing lesion shows a washout component on MR-CAE of screening breast MRI, closer attention is warranted.

SSQ02-08 • Evaluation of a Commercial CAD System for Detecting Lesions at Breast Digital Tomosynthesis
Lia Morra PhD *; Silvano Agliozzo PhD *; Luca A Carbonaro MD *; Manuela Durando (Presenter); Barbara Pesce MD; Giovanna Mariscotti; Alberto Bert PhD *

PURPOSE
To evaluate the performance of a commercial computer aided detection (CAD) system (CAD BREAST DTS, im3D S.p.A.) for detecting lesions at digital breast tomosynthesis (DBT) on an independent testing set.

METHOD AND MATERIALS
The CAD system was retrospectively tested on a set of 143 patients. Cranio-caudal (CC) and mediolateral oblique (MLO) DBT projections were acquired with a Hologic Selenia Dimensions system and reconstructed with the Briona library (Real Time Tomography LLC). All patients signed an informed consent form. A total of 80 historic confirmed malignant lesions (57 masses, 18 microcalcification clusters and 6 masses with associated microcalcifications) were detected and annotated by experienced radiologists who drew a 3D bounding box around each lesion view. CAD BREAST DTS yields both masses and microcalcification clusters candidates. For masses, a CAD true positive was registered when the CAD marking overlapped by at least 20% the radiologists marking; for microcalcification clusters, when at least two of the microcalcifications identified by CAD fell within the radiologists marking. A CAD false positive was registered in all other cases, to avoid chance matchings. Masses with associated microcalcifications were considered correctly identified if CAD marked at least a mass or a microcalcification cluster.

RESULTS
At the selected operating point, per-lesion sensitivity was 89% (95% C.I. 80-94%). The system detected 48/56 masses, 17/18 microcalcification clusters and 6/6 masses with microcalcifications. Mean number of false positives per view was 2.8 ± 1.9 (mean ±standard deviation), of which 2 were marked as masses and 0.8 as microcalcification clusters.

CONCLUSION
The DBT CAD sensitivity is comparable to that observed for 2D digital mammography CAD systems, with a fairly low number of false positives per view. Further work, especially on difficult cases such as screening interval cancers, and comparing reading with and without CAD, is needed to understand its role in clinical practice.

CLINICAL RELEVANCE/APPLICATION
A commercial CAD system for masses and microcalcification clusters detection is evaluated on an independent testing set.

SSQ02-09 • Quantitative MRI Morphological Features of Breast Cancer: Correlation with Immunohistochemical Biomarkers and Subtypes
Min Sun Bae MD, PhD (Presenter); Mirinae Seo MD; Woo Kyung Moon; Nariya Cho MD; Jung Min Chang MD; Hye Ryoung Koo MD; Won Hwa Kim MD, MS; Su Hyun Lee MD; Hye Mi Gweon MD

PURPOSE
To investigate the correlation of the tumor roundness measured quantitatively at contrast-enhanced magnetic resonance imaging (MRI) and immunohistochemical biomarkers and subtypes in breast cancer.

METHOD AND MATERIALS
After IRB approval, we retrospectively reviewed 280 consecutive women (median age, 50 years; range, 28-79 years) with 282 invasive breast cancers (< 5 cm size). All patients underwent preoperative breast MRI. Images were assessed independently by two radiologists who were unaware of pathological findings. Tumor roundness was measured quantitatively by a software developed in-house and was calculated according to the following equation: roundness = 4? x A / P2 (A is the cross-sectional area of the tumor and P is the measured perimeter length of the tumor). The means of values measured by the two observers were recorded and interobserver variability was calculated. Associations between the tumor roundness (1-100 %) and biomarker (estrogen receptor [ER], progesterone receptor [PR], HER2, and Ki67) features were evaluated using Pearson's correlation coefficient and a multiple linear regression analysis. Tumor roundness was compared between breast cancer subtypes (luminal A, luminal B, HER2-enriched, and triple-negative).

RESULTS
Interobserver agreement for MRI measurements was moderate with intraclass correlation coefficients of 0.75 (95% confidence interval: 0.67-0.80). A moderate inverse correlation was observed between the ER score and tumor roundness (-0.408, P < .0001). PR score, Ki67 index, and tumor grade correlated with the tumor roundness (P < .0001). In multiple linear regression, ER score (P < .0001) and Ki67 index (P = .003) were independent factors determining tumor roundness. A moderate inverse correlation was observed between the ER score and Ki67 index in breast cancer. Triple-negative tumors showed the highest mean roundness score compared with other subtypes (67.3 for triple-negative vs. 55.9 for HER2-enriched, 53.8 for luminal B, and 51.7 for luminal A; P < .0001).

CONCLUSION
Tumor roundness measured quantitatively at MRI correlated with ER score and Ki67 index in breast cancer. Triple-negative tumors showed the highest mean roundness score compared with other subtypes.

CLINICAL RELEVANCE/APPLICATION
Our data may have implications for possibly stratifying breast cancer patients with different clinical outcomes by using MRI morphological features.

Cardiac (Myocardial Ischemia and Viability)

Thursday, 10:30 AM - 12:00 PM • SS04AB

SSQ03-02 • Dynamic CT Myocardial Perfusion Imaging: Performance of 3D Semi-automated Evaluation Software
Ulrich Ebersberger MD (Presenter); Roy Marcus BS; Lucas L Geyer MD *; Gladys G Lo MD; Christian Canstein *; U. Joseph Schoepf MD *; Yining Wang MD; Fabian Bamberg MD, MPH *; Andrew D McQuiston BS

PURPOSE
To determine the performance and accuracy of dedicated 3D semi-automated evaluation software for the assessment of myocardial blood flow (MBF) and blood volume (MBV) at dynamic CT myocardial perfusion imaging.

METHOD AND MATERIALS
In an IRB-approved study, 37 dynamic, time-resolved myocardial perfusion CT datasets acquired using a 2nd-generation dual-source CT system (Definition Flash, Siemens) were assessed both manually and by use of the semi-automated prototype for MBF and MBV, based on the AHA-segmental model. The prototype software employs an automatic 3D heart chamber segmentation system and a surface-based four-chamber heart model. For automated segmentation, a series of anatomical landmarks in the heart are detected followed by delineation of chambers. Marginal space learning is applied for automatic localization of anatomical structures. Subsequently, the 3D shape of the cardiac chambers is determined using a probabilistic boosting tree-based contour.
**RESULTS**

592 segments were evaluated. 19 (3.21%) were excluded due to insufficient coverage. Based on the results at SPECT, 42 segments in 17 patients were classified as showing pathologic myocardial perfusion (prevalence: 45.9% patient-based). Overall, both approaches yielded higher negative predictive value than positive predictive value, with NPV: 0.99 vs. 0.98 and PPV: 0.65 vs. 0.65 for the manual as compared with the 3D evaluation tool. A comparison of MBF and MBV measurements using the prototype versus manual assessment showed high correlation (Spearman rank correlation coefficient = 0.85/0.83).

**CONCLUSION**

The performance of 3D semi-automated evaluation software for dynamic CT myocardial perfusion imaging correlates highly with manual assessment of MBF/MBV values in good agreement with SPECT. Use of such software substantially decreases post-processing and interpretation times.

---

**CLINICAL RELEVANCE/APPLICATION**

These results show promise for fostering the integration of dynamic CT myocardial perfusion imaging in actual clinical workflows.

---

**SSQ03-02 • Non-concordant Results by Myocardial CT Perfusion Imaging and SPECT Perfusion Imaging Compared with Invasive Coronary Angiography: A Post-hoc Analysis from the CORE320 Trial**

**Vishal C Mehra** MD, PhD (Presenter); **Marcelo F Di Carli** MD *; **Andrew E Arai** MD; **Kakuya Kitagawa** MD, PhD; **Armin Arbab-Zadeh** MD; **Julie Miller** MD *; **Andrea L Vavere**; **Klaus Kofod** MD; **Carlos E Rochitte** MD, PhD; **Marc Dewey** MD *; **Swee Yaw Tan** MBCh, MRCP; **Hiroyuki Niinuma**; **Christopher Cox** *; **Melvin E Clouse** MD; **Joao A Lima** MD *; **Richard T George** MD *

**PURPOSE**

The conventional form of non-invasive testing by stress single photon emission computed tomography (SPECT) perfusion imaging is known to be less reliable in the presence of clinical situations associated with balanced ischemia. The international, multicenter CORE320 trial was designed to test a non invasive risk stratification approach using combined computed tomographic angiography (CTA) and adenosine stress CT perfusion (CTP) imaging compared to the reference standard of combined stress SPECT perfusion imaging and invasive coronary angiography (ICA). This design allows for the head-to-head comparison of the two forms of stress perfusion imaging (CTP and SPECT) vs. the reference standard of ICA in a post-hoc manner. The purpose of this analysis was to examine the non-concordance of CTP and SPECT perfusion imaging among participants of the CORE320 trial and compare to percent stenosis by ICA.

**METHOD AND MATERIALS**

The international, multicenter CORE320 study enrolled 381 symptomatic patients referred for ICA. Prior to ICA, patients underwent rest CTA and adenosine stress CTP as well as SPECT perfusion imaging, CTA, CTP, ICA, and SPECT were all analyzed using parallel methods in blinded independent laboratories. As part of this post-hoc analysis, when SPECT and CTP showed discordant results, we compared these results to the reference standard ICA. ICA was defined as abnormal at the = 50% diameter stenosis threshold.

**RESULTS**

A positive CTP with a negative SPECT study occurred in 113 of the 381 enrolled subjects. Compared to ICA, 62% (70 of 113) of these had single vessel disease or greater and 33% (36 of 113) had multi-vessel (> 2 vessels) or left main disease. Conversely, a negative CTP with a positive SPECT study occurred in 33 subjects Only 27% (9/33) of these had single vessel disease or greater and 15% (7/33) had multi-vessel disease (P=0.004).

**CONCLUSION**

These data suggest that in patients with discordant findings in CTP and SPECT, CTP imaging is more sensitive than SPECT imaging for the detection of anatomic coronary stenosis. The majority of positive CTP studies without concordant SPECT defects do, in fact, demonstrate single, multi-vessel or left main coronary artery disease.

**CLINICAL RELEVANCE/APPLICATION**

CT perfusion imaging is more accurate than SPECT perfusion in predicting significant coronary stenosis, by ICA.

---

**SSQ03-03 • Cardiac Troponin I Predicts the Development of Unrecognized Myocardial Infarctions Detected with Magnetic Resonance Imaging**

**Charlotte Ebeling Barbier** MD (Presenter); **Raquel E Themudo** MD; **Tomas Bjerner** MD, PhD *; **Lars O Johansson** PhD *; **Bertil Lindahl** *; **Lars Lind** MD, PhD; **Hakan K Ahlstrom** MD, PhD

**PURPOSE**

To investigate whether plasma levels of cardiac troponin I measured with a high-sensitivity assay (hs-cTnI) could predict the development of unrecognized myocardial infarctions (UMIs) detected with late enhancement magnetic resonance imaging (LE-MRI).

**METHOD AND MATERIALS**

LE-MRI was performed on 248 randomly selected community-living 70-year-old subjects and hs-cTnI was determined with a highly sensitive premarket assay. Five years later the subjects were invited to a second LE-MRI, and 143 of them (68 women, 75 men) who were free from myocardial scars at 70 years of age and did not have a hospital diagnosis of MI, constitute the present study population. LE involving the subendocardial layer was considered an MI scar.

**RESULTS**

New UMIs were detected in 37 subjects during follow-up. Plasma levels of hs-cTnI at 70 years of age, which were mainly within what is considered to be the normal range, were related to new UMIs at 75 years of age with an adjusted Odds Ratio (OR) of 1.78 for 1 SD increase in hs-cTnI (95%CI: 1.13-2.81; p=0.014). In the third and fourth quartiles of hs-cTnI the adjusted ORs were 5.63 (95%CI: 1.08-29.28; p=0.041) and 10.11 (95%CI: 1.89-54.22; p=0.007) respectively compared to the first quartile. Plasma levels of hs-cTnI at 70 years of age were associated with the volumes of the UMIs detected at 75 years of age (p=0.022).

**CONCLUSION**

hs-cTnI in 70-year-old community-living women and men predicted the development of MRI-detected UMIs within five years.

**CLINICAL RELEVANCE/APPLICATION**

It is debated whether MRI-detected UMIs constitute real MIs. These results may be helpful in understanding the constitution and potential prognostic impact of these UMIs.

---

**SSQ03-04 • T1 and T2 Mapping for the Detection of Myocardial Edema in Acute Myocardial Infarction by Cardiac Magnetic Resonance**

**Jerome Caudron** MD (Presenter); **Valentin Lefebvre**; **Benjamin Dubourg**; **Jeannette Fares** MD; **Jean-Nicolas Dacher** MD *

**PURPOSE**

To evaluate quantitative T1 and T2 mapping sequences in assessing myocardial edema in patients with acute myocardial infarction (AMI)

**METHOD AND MATERIALS**

Single center study involving 24 patients referred for AMI (STEMI) and 24 healthy volunteers who served as controls to determine normal T1 and T2 values of the myocardium. Cardiac MRI was performed between day 2 and day 7 after acute event (Avanto 1.5T, Siemens, Germany). Standard protocol included CINE, T2w STIR, first pass and delayed enhancement (PSIR) sequences. In addition, steady state free precession T2 mapping sequences (3 echoes) and modified Look Locker inversion recovery T1 mapping sequences (11 inversion times) were performed on short axis views at basal, mid and apical levels of the left ventricle. Analysis was performed using the 16 left ventricular segments model, excluding the apex. Quantitative T1 and T2 values (in ms) were obtained from region of interest encomprising each segment. Segments were therefore divided in 3 areas: infarct, peri-infarct and remote. Diagnostic accuracy of T1 and T2 mapping sequences was therefore calculated for detecting infarct area as defined by late gadolinium enhancement.

**RESULTS**

T1 and T2 maps were interpretable in all patients and controls. Mean T1 and T2 values in infarct areas (respectively 1135±69 ms and 69.8±8.7 ms) were significantly longer than T1 and T2 values in peri-infarct (respectively 1018±36 ms and 56.7±4.7 ms) and remote areas (respectively 988±26 ms and 53.5±3.9 ms). T2 maps AUC = 0.922, Se = 82.1, Sp = 92.9, optimal threshold = 61.4 ms - T1 maps AUC = 0.893, Se = 80.3, Sp = 89.6, optimal threshold = 1053 ms. Difference was almost significant between T2 and T1 maps (p=0.05).

**CONCLUSION**

T1 and T2 mapping are effective methods for quantifying myocardial edema in patients referred for AMI. Interestingly, T1 and T2 values of the remote areas in patients are longer than those measured in controls.

**CLINICAL RELEVANCE/APPLICATION**

Quantification of T1 and T2 values could be relevant in the evaluation of area at risk in AMI but also for the evaluation of new treatments, prognostic stratification and patients follow-up

---

**SSQ03-05 • Myocardial CT Delayed Enhancement Using Targeted Spatial Frequency Filtration: Comparison with Conventional Half Scan and MR Delayed Enhancement**

**Jerome Caudron** MD, (Presenter); **Vishal C Mehra** MD, PhD; **Armin Arbab-Zadeh** MD; **Klaus Kofod** MD; **Carlos E Rochitte** MD, PhD; **Marc Dewey** MD *; **Swee Yaw Tan** MBCh, MRCP; **Hiroyuki Niinuma**; **Christopher Cox** *; **Melvin E Clouse** MD; **Joao A Lima** MD *; **Richard T George** MD *

**PURPOSE**

Myocardial CT Delaying Enhanced Using Targeted Spatial Frequency Filtration: Comparison with Conventional Half Scan and MR Delayed Enhancement

**METHOD AND MATERIALS**

To evaluate the resulting segmentation consequently allows for both manual placement of ROIs and calculation of a polar map employing the modified 17-segment AHA myocardial model. Time required for each assessment was recorded. Results were compared to SPECT as the standard of reference.

**RESULTS**

592 segments were evaluated. 19 (3.21%) were excluded due to insufficient coverage. Based on the results at SPECT, 42 segments in 17 patients were classified as showing pathologic myocardial perfusion (prevalence: 45.9% patient-based). Overall, both approaches yielded higher negative predictive value than positive predictive value, with NPV: 0.99 vs. 0.98 and PPV: 0.65 vs. 0.65 for the manual as compared with the 3D evaluation tool. A comparison of MBF and MBV measurements using the prototype versus manual assessment showed high correlation (Spearman rank correlation coefficient = 0.85/0.83).
SSQ03-08 • Prospective International Multicenter Trial

Sung Min Ko

CONCLUSION

99.6% respectively. The grade for transmurality of OMS between DE-CT and DE-MRI was matching at segment level in 41.7%, under-evaluation of OMS was detected in 16.7% and over-evaluation in 41.9%. The sensitivity of DE-CT for detecting OMS was 58.3%, specificity was 100%, positive predictive value was 100% and the negative predictive value was 96.8%.

164 patients for whom a valid assessment was available. Of the 2788 segments, OMS was detected in 24 segments on DE-MRI and in 12 segments on DE-CT. The image quality of DE-CT was good and adequate in 165 (98.8%) patients. The OMS was detected in 12 (7.3%) by DE-MRI and 7 (4.3%) by DE-CT of the 164 patients for whom a valid assessment was available. Of the 2788 segments, OMS was detected in 24 segments on DE-MRI and in 12 segments on DE-CT. The sensitivity of DE-CT for detecting OMS was 58.3%, specificity was 100%, positive predictive value was 100% and the negative predictive value was 96.8%.

The transmurality of OMS in DE-CT and DE-MRI for each scar was assessed in terms of over- or under-evaluation. The transmurality of OMS in DE-CT and DE-MRI was matching at segment level in 41.7%, under-evaluation of transmurality in DE-CT was in 54.2%, and overestimation on DE-CT was 4.2%.

The presence of DE was compared between CT and CMR in 12 patients.

The purpose of this study was to evaluate the feasibility and image quality of CTDE using TSFF in comparison with conventional half scan (CHS) reconstruction.

SSQ03-06 • Age-related Increase and Regional Difference of Extracellular Fraction of Myocardium in Subjects without Coronary Artery Disease: A Cardiac CT Study

Yoshihiko Kurita MD (Presenter); Yukiyoshi Kitagawa PhD; Tatsuto Ito MD; Naoki Nagasawa RT, PhD; Hiroshi Nakajima MD; Hiroshi Nakamori MD; Masaki Ishida MD, PhD; Hajime Sakuma MD *

METHOD AND MATERIALS

Among 82 patients with known or suspected CAD who underwent comprehensive cardiac CT study consisting of non-contrast CT, stress CT perfusion, coronary CTA and myocardial CT delayed enhancement, we retrospectively identified 27 subjects without any of coronary artery stenosis, LV hypertrophy, stress perfusion abnormality and delayed enhancement abnormality. After exclusion of subjects with calcium score of >100 (n=5), poor image quality (n=1), and without hematocrit measurement (n=5), 16 subjects (ages 45-80, median 65 years, 5 females) comprise the study population. CT delayed enhancement was acquired 7 minutes after coronary CTA with a total of 120ml of contrast medium. Based on the 16-segment model, extracellular fraction was calculated as a ratio of the change in Hounsfield unit of the myocardium and the LV blood before and after contrast administration, multiplied by (1-hematocrit). Twenty-two segments (22/236, 8.6%) affected by streak artifacts were excluded from analysis.

METHOD AND MATERIALS

Fractional flow reserve (FFR) at the time of invasive coronary angiography (ICA) is the gold standard for determining lesion-specific ischemia. Non-invasive FFR computed from coronary CT angiogram (FFRCT) enables measurement of lesion-specific ischemia with high concordance to invasive FFR. To date, the performance of FFRCT when stratified by age and gender, has not been examined.

RESULTS

Validation of extracellular fraction by CT is a new approach toward the evaluation of diffuse myocardial fibrosis. The purpose of this study was to describe the normal pattern of age-related and regional variation of extracellular fraction in subjects without coronary artery disease (CAD).

RESULTS

Mean extracellular fraction for each subject by CT was 27.5%±2.2 (range 23.2-29.7%). Showing excellent agreement with the previously reported mean extracellular fraction values determined by MRI using T1 mapping method (mean extracellular fraction of 24.8-26.6%), and was strongly related to age (r=0.806, p<0.001).

CONCLUSION

Extracellular fraction values determined by CT in this study are in excellent agreement with previous reports using MRI. Strong linear correlation between extracellular fraction and age may indicate the ability of CT to demonstrate increasing diffuse fibrosis associated with normal aging.

CLINICAL RELEVANCE/APPLICATION

In the evaluation of diffuse myocardial fibrosis, age-related increase and regional variation of extracellular fraction of LV myocardium demonstrated in this study should be taken into consideration.

SSQ03-07 • Age- and Gender-based Performance of Non-invasive Fractional Flow Reserve Computed from Coronary CT Angiography: Results from a Prospective International Multicenter Trial

Jonathan A Leipsic MD (Presenter) *; Glatin Grunau PhD; Rekha Raju; Carolyn Taylor MD; Ryo Nakazato; Daniel S Berman MD *; Matthew J Budoff MD *; Cameron J Hague MD; James Min MD *

PURPOSE

Evaluation of Accuracy for Detection and Extent of Occult Myocardial Scars Using Delayed-enhancement CT in Patients with Asymptomatic Diabetes: Results from the ACCREDIT Study

Sung Min Ko (Presenter); Joon-Won Kang MD; Sang Il Choi MD; Tae-Hwan Lim MD, PhD

PURPOSE

To evaluate through an exploratory sub-study the accuracy of delayed-enhancement CT (DE-CT) for detecting occult myocardial scars (OMS) and to evaluate the transmurality of OMS using DE-CT compared with delayed enhancement MRI (DE-MRI) in asymptomatic patients with type 2 Diabetes.

RESULTS

The image quality of DE-CT was good and adequate in 165 (98.8%) patients. The OMS was detected in 12 (7.3%) by DE-MRI and 7 (4.3%) by DE-CT of the 164 patients for whom a valid assessment was available. Of the 2788 segments, OMS was detected in 24 segments on DE-MRI and in 12 segments on DE-CT. The sensitivity of DE-CT for detecting OMS was 58.3%, specificity was 100%, positive predictive value was 100% and the negative predictive value was 96.8% at segment level. The sensitivity, specificity, positive and negative predictive values of DE-CT for detecting OMS were 50%, 100%, 100%, and 99.6% respectively. The grade for transmurality of OMS between DE-CT and DE-MRI was matching at segment level in 41.7%, under-evaluation of transmurality on DE-CT was in 54.2%, and overestimation on DE-CT was 4.2%.

CONCLUSION

The sensitivity of DE-CT for detecting OMS is moderate, but the specificity is high. Under-evaluation of the transmurality of OMS is common using DE-CT.
**Chest (Radiation Dose Reduction)**

Thursday, 10:30 AM - 12:00 PM • S405AB

| **SSQ04** • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5 |
|-----------------------------|-----------------------------|
| **Moderator**               | **Moderator**               |
| Prachi P Agarwal, MD        | Mannudeep K Kalra, MD *     |

**Purpose**

To compare pulmonary lesion detection, visibility of small structures and diagnostic acceptability in sparse-sampled CT data of sub-milli Sievert chest CT (SpS-SmSv) reconstructed with Iterative Reconstruction Technique (IRT).

**Method and Materials**

Ten non-obese patients (BMI2, age range:48-82 years) were scanned at standard-dose CT (SD) and at sub milli-sievert (SmSv at 0.9 mSv) dose on a Philips 256-slice CT scanner with double z-sampling in a prospective study. Sparse angular sampling data were reconstructed using 25% of the angular projections from the sub-mSv sinogram to reduce the number of views and radiation dose by about 4-fold (estimated ED 0.2mSv). Three image series were generated per patient (

| Sparse sampled reconstructed with IRT; SpS-SmSv IRT; fully sampled; SmSv-FBP and SD-FBP). Two radiologists independently assessed these image series for detection of lung lesions, visibility of small structures and diagnostic acceptability. Objective noise was measured in thoracic aorta and noise spectral density (NSD) was obtained for SpS-SmSv IRT, SmSv-FBP and SD-FBP.

**Results**

SpS-SmSv IRT resulted in 75%(0.2/0.9 mSv) and 92%(0.2/2.9 mSv) dose reduction, when compared to fully sampled submSv-FBP and SD-FBP, respectively. SpS-SmSv images displayed all 36 lesions (most < 1 cm, 31 lung nodules and 5 ground glass opacities) seen on SmSv-FBP and SD-FBP datasets. Lesion margins with sparse sampled data were deemed acceptable compared to both SmSv-FBP and SD-FBP. Overall diagnostic acceptability was maintained with SpS-SmSv IRT despite presence of minor pixilation artifacts in 3/10 cases. Interobserver agreement was statistically significant (kappa value 0.88; p<0.05). NSD showed that SpS-SmSv IRT gives a linear decrease over power in the semilog plot and an exponential decrease of noise power over frequency compared to submSv FBP and SD-FBP.

**Conclusion**

It is possible to reduce chest CT dose to fifth of a mSv for sparse-sampled CT images reconstructed with IRT while retaining lesion detection and diagnostic acceptability for evaluation of pulmonary findings.

**Clinical Relevance/Application**

More than 90% dose reduction could be achieved with one fourth sparse-sampled and sub milli-sievert chest CT examination when reconstructed with iterative reconstruction technique.

**Chest (Radiation Dose Reduction)**

Thursday, 10:30 AM - 12:00 PM • S405AB

| **SSQ04-01** • Chest CT at One-Fifth of a mSv: Can Sparse Sampled Data Reconstructed with Iterative Reconstrucive Technique Help Make the Cut? |
|-----------------------------|-----------------------------|
| **Presenter**               | **Presenter**               |
| Ranish D Khawaja MBBS, MD   | Atul Padole MD              |
| (Presenter)                 | Mannudeep K Kalra, MD *     |
| Sarabjeet Singh MD          |                             |
| Diego A Lira MD             |                             |
| Synho Do PhD *              |                             |
| Atul Padole MD              |                             |
| Mannudeep K Kalra, MD *     |                             |
| Sarvenaz Pourjabbar MD      |                             |
| Rolf Bippus *               |                             |
| Thomas Koehler PhD *        |                             |
| Kevin M Brown MS *          |                             |

**Purpose**

To directly compare the capability for radiation dose reduction on dynamic chest perfusion area-detector CT aiming lung and nodule perfusion assessments using 3D processing (AIDR 3D) and filter back projection (FBP) methods.

**Method and Materials**

36 consecutive patients (25 male, 11 female; mean age 75 years) with 36 nodules underwent standard-dose perfusion CT (SDCT) using the following parameters: 320×0.5 mm collimation, 80 kVp, 120 mA, and 0.5 sec gantry rotation time. From SDCT raw data, low-dose perfusion ADCTs (LDCTs) at 80mA, 60mA and 40mA were computationally simulated. Then, SDCT and each LDCT were reconstructed by AIDR 3D and FBP methods. From each CT data, perfusion map was computationally generated. Then, image noises of lung parenchyma and nodule, lung and nodule perfusions were evaluated by ROI measurements. To determine the utility of AIDR 3D for radiation dose reduction, both image noises and perfusion parameters from all CT data were statistically compared each other by using Tukey's HSD test. Correlations of both perfusion parameters were evaluated between SDCT and others. Finally, to assess the radiation dose reduction capability between two methods, the limits of agreements (mean±1.96×standard deviation) of each parameter between SDCT and others was assessed by using Bland-Altman analysis.

**Results**

When applied AIDR 3D, image noises of LDCTs at 80mA and 60mA were significantly lower than those by FBP (p conclusion: AIDR 3D method has better potential for radiation dose reduction of chest perfusion ADCT than FBP method in routine clinical practice.

**Clinical Relevance/Application**

When compared with FBP method, AIDR 3D method has better potential for radiation dose reduction of perfusion ADCT for lung and nodule perfusion assessments in routine clinical practice.

**SSQ04-03** • Lung and Nodule Perfusion Assessments on Dynamic First-pass Perfusion Area-detector CT: Capability of Adaptive Iterative Dose Reduction Using 3D Processing (AIDR 3D) for Radiation Dose Reduction as Compared with Filter Back Projection (FBP)

**Presenter**

Yoshiharu Ohno MD, PhD (Presenter) *; Mizuho Nishio MD *; Takeshi Yoshikawa MD *; Sumiaki Matsumoto MD, PhD *; Yasuko Fujisawa MS *; Naoki Sugihara MD *; Hisanobu Koyama MD; Shinichiro Seki; Toshiyuki Tsubakimoto MD; Kazuhiro Sugimura MD, PhD *; Tohru Murakami; Masakazu Kanzawa RT; Marie Laure Chabi PhD *; Ermanno Capuano MD, PhD *

**Purpose**

To compare chest dose and image noise on CT acquisitions performed with low kilovoltage or bismuth shielding, on a phantom study with different prosthesis breast thicknesses.

**Method and Materials**

Phantom study with 3 different breast thicknesses, defined as the distance perpendicular to the breast tangency line.
Five consecutive 64-detector CT acquisitions (Light-speed VCT, GE) performed for each breast thickness at 120 kVp (reference acquisition), then at 100 kVp and 120kVp with shielding. Breast dose measured using two Optically Stimulated Luminescence Dosimeters (OSLD) placed both superficially and deep within the prostatic breast. CT number standard deviation measured within 4 central ROIs at increasing depths for image noise evaluation.

**RESULTS**

Intraclass correlation coefficient for dose measurements was 0.825 [95%CI: 0.726 : 0.923]. Considering all breast thicknesses, averaged breast dose (mean of superficial and deep measurements) was reduced by 42.1% with shielding, compared to 33.0% at 100 kVp (p=0.009). Noise increase within the 2 deepest ROIs was less with shielding (19.0% vs 32.1%, p For 1cm- breast thickness, breast dose was reduced by 46.5% and 29.7% (p=0.01) and in-depth noise increased by 19.5 % and 33.9 % (p=0.01) with shielding or at 100 kVp, respectively. For 2cm- breast thickness, breast dose was reduced by 38.5% and 30.1 %, (p=0.02) and in-depth noise increased by 16.5% and 33.5% (p=0.001) with shielding or at 100 kVp, respectively. For 4cm- breast thickness, breast dose was reduced by 40.6% and 40.5% (p=0.95) and in-depth noise increased by 20.7% and 29.2% (p=0.02) (with shielding or at 100 kVp, respectively).

**CONCLUSION**

For small breast thicknesses, breast dose reduction is greater with shielding. Shielding systematically provides less in-depth noise increase.

**CLINICAL RELEVANCE/APPLICATION**

For an equivalent or greater breast dose reduction, shielding provides less in-depth noise increase than the 100kVp option for CT acquisitions performed on GE equipment.

**SSQ04-04 • Prospective Clinical Trial to Acquire Sub Millisievert Chest CT and Compare 4 Different Reconstruction Techniques (Filtered Back Projection, Image Based, Adaptive Statistical and Model Based Iterative Reconstruction)**

**Atul Padole (Presenter) ; Sarabjeet Singh ; Carol C Wu MD * ; Jeanne B Ackman ; Jo-Anne O Shepard MD * ; Mannudeep K Kalra MD * ; Synho Do PhD * ; Sarvenaz Pourjabbar MD ; Ranish D Khawaja MBBS, MD ; Subba R Digumarthy MD**

**PURPOSE**

To assess diagnostic image quality in sub-milli-Sievert chest CT reconstructed with Filter Back Projection (FBP), SafeCT (image based), Adaptive Statistical (ASIR) and Model Based (MBIR) iterative reconstruction techniques.

**METHOD AND MATERIALS**

In an IRB approved, prospective clinical study, 50 patients (mean age 62 ± 10 years, M:F 33:17, undergoing routine chest CT on a 64 channel MDCT (GE Discovery CT750HD)) gave written informed consent for acquisition of an additional sub-milli-Sievert (submSv) chest CT series. The latter series were acquired with reduced tube current but identical scan length compared to the routine chest CT. Sinogram data of submSv series were reconstructed with FBP, SafeCT (3 settings; Chest4, Lung1, Lung2; MedicVision Inc.), ASIR (SS50, SS70, GE Healthcare) and MBIR (GE Healthcare) and compared with FBP images at standard dose chest CT. All submSv series were reconstructed with FBP, SafeCT, ASIR and MBIR. Noise equivalent dose, noise index (NI), visibility (VS), diagnostic validity and diagnostic acceptability were used for the statistical analyses.

**RESULTS**

Mean CTDIvol were 8±4.4 and 1.8±0.2 mGy for standard and submSv CT, respectively. Of the 287 detected lesions, 196 were less than 1 cm nodules and GGO. Lesion margins were well seen on all submSv reconstruction images except MBIR where they were poorly visualized. Likewise, only submSv MBIR images were deemed suboptimal for visibility of normal structures such as lung vessels in outer 2cm, major fissures, and subsegmental bronchi. Visibility of pericardial fat was superior on submSv MBIR compared to the other image series. MBIR, ASIR, and SafeCT showed similar SSD pattern, although SafeCT had more consistent decrease of SSD over frequency. MBIR had the lowest image noise with different and more homogeneous noise spectrum as compared to other techniques.

**CONCLUSION**

SafeCT, ASIR and MBIR can allow optimal lesion evaluation in chest CT acquired at CTDI vol of 2 mGy. Evaluation of lesion margins is better on SafeCT as compared to some of the other reconstruction techniques although greatest noise reduction is seen with MBIR.

**CLINICAL RELEVANCE/APPLICATION**

Diagnostically acceptable submSv chest CT images can be obtained when using image and model based iterative reconstructions.

**SSQ04-05 • How Low Can We Go: Dose Saving Potential of Model-based Iterative Image Reconstruction (MBIR) in Contrast Enhanced CT Imaging of the Chest - A Dose Finding Cadaver Study**

**Chanyeong Park MD (Presenter) ; Hong-Il Ha MD ; Hye Sun Hwang ; Hye Jeon Hwang MD ; In Jae Lee**

**PURPOSE**

To assess the effectiveness of high-pitch low dose chest CT (HP-LDCT) in reducing radiation dose without deterioration of image quality compared with standard low-dose chest CT (LDCT).

**METHOD AND MATERIALS**

In this Institutional Review Board–approved HIPAA-compliant study, 35 patients underwent HP-LDCT and another 35 patients underwent LDCT. HP-LDCT scan parameters (n=35): pitch 3.0, 128 x 0.6 mm slice acquisition, 0.28 seconds gantry rotation time and fixed 40 mAs at 120 kV. LDCT scan parameters were as follows: pitch=1.2, 0.5 seconds gantry rotation time and other parameters were same as HP-LDCT parameters. Objective image noise was measured in five regions such as air, lung parenchyma, infraspinalus muscle, aorta, subcutaneous fat layer. Two blind radiologists independently assessed the subjective image quality, which was compared with overall diagnostic acceptability with 5-point scale. Independent sample t-test, Mann-Whitney U test and kappa analysis were used for the statistical analyses.

**RESULTS**

BMI between the HP-LDCT group (24.5 ± 2.9 kg/m^2) and the LDCT group (26.3 ± 5.1) was no significant difference (p=0.073). The DLps for HP-LDCT and LDCT were 90.22 ± 4.34 mGycm and 106.14 ± 6.48 mGycm, respectively (p<0.05).

**CONCLUSION**

HP-LDCT was achieved approximately 22% reduction of mean radiation dose with improvement of the suppression of cardiac pulsation and preserving image quality.

**CLINICAL RELEVANCE/APPLICATION**

High-pitch low dose chest CT reduced mean radiation dose from 1.5mSv to 1.2mSv and showed similar image noise but more motion-free images compared with standard low dose chest CT.
SSQ04-07 • Lung Nodule Volumetry on Low- and Ultra-low-Dose CT with Adaptive Iterative Dose Reduction (AIDR 3D): A Phantom Study

Sumiaki Matsumoto MD, PhD (Presenter) *; Yoshiharu Ohno MD, PhD *; Tomoya Okazaki MS *; Atsushi Yaguchi MENG *; Tomoyuki Takeguchi PhD *; Hiroyasu Inokawa *; Kota Aoyagi *; Hitoshi Yamagata PhD *; Kazuero Sugimura MD, PhD *

PURPOSE
To evaluate the effect of adaptive iterative dose reduction (AIDR 3D) on the accuracy and precision of lung nodule volumetry on low- and ultra-low-dose CT.

METHOD AND MATERIALS
This study employed an anthropomorphic thoracic phantom (Lungman, Kyoto Kagaku) and 24 spherical synthetic nodules of 3 density types (100, -630, and -800 HU) with each type comprised of 8 nodules ranging 5-12 mm in diameter. The nodules were placed such that each nodule was attached to either the phantom lung vasculature or mediastinum. The phantom was then scanned with an area-detector CT (Aquilion ONE, Toshiba Medical Systems) using 4 protocols consisting of different tube current settings (80, 40, 20, and 10 mA) and otherwise identical acquisition parameters, where 3 scans were obtained for each protocol. Each scanned data were reconstructed into 1-mm-thick images without and with AIDR 3D, thus resulting in two image datasets per scan. The volumes of all nodules in every image dataset were measured using newly developed software, and measurements were converted to percentage absolute biases (abs-b) and percentage inter-scan standard deviation (ISTD) relative to known volumes of nodules. Resultant values were analyzed by means of mixed effects analysis of variance in order to assess the effect of AIDR 3D on abs-B and ISTD.

RESULTS
AIDR 3D had a significant effect on reducing abs-B (p<0.05). AIDR 3D allowed volumetry of synthetic lung nodules with reduced absolute biases on low- and ultra-low-dose CT and reduced inter-scan variability on ultra-low-dose CT.

CLINICAL RELEVANCE/APPLICATION
The results of this study suggest that, by the use of AIDR 3D, lung nodule volumetry can be improved in terms of accuracy on low-dose CT and both accuracy and precision on ultra-low-dose CT.

SSQ04-08 • Comparison of Dose-length Product between Cranio-caudal and Caudo-cranial Chest CT Scans Using Automatic Exposure Control: A Phantom Experiment with Four Different CT Machines

Yong Hwan Chung RT (Presenter); Tae Hyun Nam; Chang Min Dae; Kwan Hong Min; Kyoung Ho Lee MD; Bohyung Kim PhD

PURPOSE
To compare dose-length product (DLP) between cranio-caudal and caudal-cranial scan directions in scanning the chest of four humanoid phantoms with four CT scanners with automatic exposure control (AEC).

METHOD AND MATERIALS
We scanned four different humanoid phantoms of PBU-50, Norris, Wendy, and Female Rando in the two directions, with Light speed VCT (GE), Aquilion 64 (Toshiba), Somatom Definition Flash (Siemens), and Brilliance ict (Philips) in two hospitals. The scan length was set the same for the two directions for each phantom. Various scan parameters including automatic exposure control were maintained identical standard of practice in each test site. The difference in DLP between the two directions was measured in terms of (craniocaudal DLP – caudocranial DLP) / caudocranial DLP (%).

RESULTS
DLPs were higher with cranio-caudal direction than with caudal-cranial direction for all 16 combinations of the four phantoms and four scanners. For the four phantoms, the percentage difference in DLP ranged 8.6%-10.5%, 10.3%-10.8%, 5.4%-7.4%, and 5.2% -6.4% for the GE, Toshiba, Siemens, and Philips machines, respectively. No notable difference was found in the overall image quality between the two directions.

CONCLUSION
With the same other scan parameters, cranio-caudal scanning had consistently higher radiation dose than caudal-cranial scanning by up to 10% in the four tested machines.

CLINICAL RELEVANCE/APPLICATION
We recommend the same phantom test comparing the two directions, when chest CT scan program is set up in a machine.

SSQ09-09 • Organ-based Tube-current Modulation (OBTCM): Impact on Breast Position

Stephen Taylor MD (Presenter); Diana Litmanovich MD; Maryam Shahrzad MD; Alexander A Bankier MD, PhD *; Pierre A Gevenois MD; Denis M Tack MD, PhD

PURPOSE
To determine the location of breast tissue with respect to the zone of decreased versus increased radiation delivered by OBTCM.

METHOD AND MATERIALS
In two academic centers from the US and Europe, data were collected from 532 clinical thoracic CT examinations performed in women aged 17 to 95 years (498 supine and 34 prone scans – US=332, Europe=200). Inner and outer limits of breast tissue were determined by measuring their angles with respect to the isocenter of the gantry rotation. The percentage of women with breast tissue within and without the zone of decreased radiation was calculated.

RESULTS
In supine position, mean angles of external and of internal breasts limits were 79° (range, 75° to 86°) and 29° (range, 19° to 37°) for both breasts. In prone position, these angles were 65°(range,62° to 76°) and 21° (range, 19° to 25°). In supine and prone position, respectively, 99% and 82% of women had at least one external breast limit in the increased dose zone. 14% of patients in supine position had their entire breasts in the increased dose zone. Increasing patient age was associated with increasing thoracic dimensions and with an increasingly lateral position of the breasts (r=0.198 to 0.334; P<0.05). In supine and in prone positions, respectively, 99% and 80% of women will have at least one breast in the zone of increased dose, as determined by OMBC.

CLINICAL RELEVANCE/APPLICATION
Because most breasts are at least in their external part exposed to higher tube current, OBTCM may increase rather than decrease the radiation dose to the breast.
appendicitis (74% and 83%, respectively), which increased with the addition of hyperemia to 81% and 89%, respectively. Statistical modeling showed a linear direct correlation between the number of secondary signs present and both positive predictive value and specificity (R² = 0.963 and R² = 0.949, respectively), values that increased to 100% in the presence of four secondary signs.

CONCLUSION
Hyperechoic fat and hyperemia increase the positive predictive value and specificity of sonography for appendicitis in patients with noncompressible appendices of diameters between 6 and 7 mm. Without secondary signs, a conservative approach should be followed as approximately half of such patients with borderline diameter appendices do not have appendicitis.

CLINICAL RELEVANCE/APPLICATION
Ultrasound reliably predicts appendicitis in borderline 6 to 7 mm diameter appendices when secondary characteristics are assessed.

SSQ05-02 • Does Inclusion of Imaging in the Work Up of Patients with Clinically Suspected Appendicitis Reduce the Rate of Unnecessary Surgical Procedures?
Max Layahy MD, PhD (Presenter) ; Doenja M Lambregts MD, PhD ; Eveline Mutsaers ; Alfons Kessels ; Stephanie Breukink ; Regina G Beets-Tan MD, PhD

PURPOSE
Since February 2010 new Dutch guidelines have been implemented recommending the use of US or CT to confirm or refute clinically suspected appendicitis before (laparoscopic) surgery. For equivocal cases with US additional imaging (CT/MRI) is recommended. This study aimed to see whether these new guidelines lowered the percentage appendix sana.

METHOD AND MATERIALS
This retrospective study included all consecutive patients operated for clinically suspected appendicitis at our hospital from 2006 until 2013. The use of imaging (none versus US, CT and/or MRI) and its findings were recorded. Surgical and histopathological findings - where available - were notified. The primary study endpoint was the number of appendix sana before and after the guideline implementation.

RESULTS
745 patients were included, of which 475 were collected before the implementation of the guidelines and 270 after. During the pre-implementation period, 22.3% (106/475) of the patients received imaging focused on the appendix. Post-implementation, 98.9% (267/270) of the patients received imaging before surgery. The average percentage of an ‘appendix sana’ before the guidelines was 25% (119/475). After implementation, this average percentage dropped significantly to 5.9% (16/270).

CONCLUSION
Preoperative imaging in all patients with suspected clinically appendicitis resulted in a significant reduction in the percentage of ‘appendix sana’. This suggests that the implementation of imaging in the work up of these patients could be an effective strategy to reduce the number of unnecessary surgeries.

SSQ05-03 • The Alvarado Score as a Method for Potentially Reducing the Number of Unnecessary CT Scans for Appendicitis When Appendiceal Ultrasound Fails to Visualize the Appendix
Robert Jones MD (Presenter) ; R. Brooke Jeffrey MD * ; Terry S Desser MD * ; Eric W Olcott MD

PURPOSE
To evaluate the Alvarado score as a means to reduce referrals to CT when ultrasound fails to visualize the appendix but is otherwise normal.

METHOD AND MATERIALS
With IRB and HIPAA compliance, 1241 consecutive appendiceal sonograms for suspected appendicitis were reviewed to yield 247 patients whose studies did not visualize the appendix but were otherwise normal and had CT within 48 hours. Of the 247 patients, 86 had Alvarado scores of 3 or less.

RESULTS
The incidence of appendicitis was 15.4% (38/247) for all 247 patients but less among the 86 with Alvarado scores of 3 or less, whether considering all 86 (0/86, 0% ; p = 0.001), females (0/59, 0%; p = 0). The Alvarado score was 2.9 ± 0.9.

CONCLUSION
Patients with non-visualization of the appendix and an Alvarado Score of 3 or less are at particularly low risk for acute appendicitis and low risk for disorders requiring emergent surgery. Active clinical observation should be considered for them rather than direct referral to CT.

CLINICAL RELEVANCE/APPLICATION
Preoperative imaging results in a significant reduction of unnecessary surgery and should thus be recommended for all patients clinically suspected for appendicitis.

SSQ05-04 • Diagnosing Acute Appendicitis Using a Non-oral Contrast CT Protocol in Patients with a BMI of Less than 25
Vijay Ramalingam MD (Presenter) ; Jennifer W Uyeda MD ; David D Bates MD ; Kathy Zhao ; Marisa Roberts ; Lindsey Storer ; Jorge A Soto MD * ; Stephan W Anderson MD

PURPOSE
Evaluate the diagnostic accuracy and repeat CT scan rate for the diagnosis of appendicitis after the implementation of a non-oral contrast protocol in the Emergency Department setting in patients with a BMI of less than 25.

METHOD AND MATERIALS
This IRB approved study included 736 adult patients with a BMI of less than 25 over two 6 month time periods (August 2012- January 2013 and June 2008- November 2008) presenting to the ED with acute abdominal pain and a clinical suspicion of acute appendicitis. The earlier cohort underwent CT imaging with oral and intravenous contrast, per departmental protocol. The later cohort was imaged solely with intravenous contrast, per a modified departmental protocol. The electronic medical record was reviewed, recording the results of imaging reports, clinical outcomes, and surgical pathology results.

RESULTS
A total of 364 patients received a CT scan with the use of oral and intravenous contrast; there were 40 true positive cases of appendicitis and 1 false positive case. The sensitivity, specificity, PPV, and NPV for the diagnosis of appendicitis with both oral and intravenous contrast was 100 %, 99.7 %, 99.6 %, and 100 %, respectively. A total of 372 patients received the non-oral contrast, positive intravenous contrast protocol; there were 39 true positive cases of appendicitis and 1 false negative case. The sensitivity, specificity, PPV, and NPV for the diagnosis of appendicitis with both oral and intravenous contrast was 100 %, 99.7 %, 99.6 %, and 100 %, respectively. The use of oral contrast significantly decreased the number of unnecessary surgical procedures.

CONCLUSION
Implementation of a non-oral contrast CT protocol in patients with a BMI of less than 25 demonstrates similar accuracy to a positive oral contrast protocol in patients with a BMI of less than 25 for the diagnosis of appendicitis.

CLINICAL RELEVANCE/APPLICATION
As ordering clinicians and emergency departments continue to seek ways to increase throughput, the continuing use of oral contrast due to inadequate visualization of the appendix which was subsequently found to be negative for appendicitis.

SSQ05-05 • Improving the Role of CT in Diagnosing Complicated Appendicitis: Are there Occult Signs?
Mustafa Al Sultan MD (Presenter) ; Tarek Hegazi MBBS ; Caroline Reinhold MD, MSc ; Lawrence A Stein MD

PURPOSE
Retrospectively evaluate the accuracy of focal appendiceal wall enhancing defect and intra-luminal gas in predicting gangrenous and/or perforated appendicitis when not apparent on imaging in relation to surgical and pathological results.

METHOD AND MATERIALS
Patients with surgically and pathology-proven appendicitis who underwent preoperative IV contrast CT within 24 hours of surgical intervention over a 4-year period (n=187) were retrospectively reviewed. Variable clinical data and length of admission for each patient were also assessed. Two radiologists who were blinded from the clinical data and final surgical / pathology results examined each scan for: diameter of appendix, intra- and extra-luminal appendicolith, intra- and extra-luminal gas, phlegmon, abscess, and focal enhancing wall defect. The results were compared against surgical and pathology findings and divided into 3 groups (perforated, gangrenous and simple). The perforated group was subsequently divided into 2 subgroups whether there was presence or absence of ‘classic CT’ findings of perforated hollow viscus (i.e either / or abscess, extra-luminal gas, or extra-luminal appendicolith). Statistical significance, sensitivity and specificity for each finding were calculated. Interobserver agreement using kappa index was used for focal enhancing wall defect.
RESULTS

Simple, gangrenous and perforated appendicitis were present in 65.8%, 16% and 18.2% of the study cohort respectively. There was a good interobserver agreement (kappa = 0.76) for focal wall enhancing defect. Sensitivity and specificity of focal wall defect for diagnosing perforated appendicitis was 81.8% and 92.8% respectively, PPV = 71.0%, NPV = 95.9%. Sensitivity and specificity for Intraluminal gas was 45.3 % and 91.1% respectively, PPV = 72.5%, NPV = 76.2%.

CONCLUSION

‘Classic CT signs’ have been well documented for diagnosis of perforated appendicitis, however, recognition of occult signs, as focal enhancing wall defect or intra-luminal gas is otherwise uncomplicated appendicitis at imaging suspicious of suggesting a perforated or gangrenous acute appendicitis.

CLINICAL RELEVANCE/APPLICATION

Focal wall defect and intra-luminal gas add more sensitive interpretation value in the diagnosis of image-occult complicated appendicitis and is recommended in routine evaluation of these cases.

SSQ05-06 • Low-tube-voltage High-pitch Dual-source Computed Tomography with Sonogram Affirmed Iterative Reconstruction Algorithm of the Abdomen and Pelvis: Initial Clinical Experience

Hao Sun MD (Presenter); Huadan Xue MD; Zhengyu Jin MD; Xuan Wang MD; Yu Chen MD; Yonglan He MD

PURPOSE

To investigate the image quality, radiation dose and diagnostic performance of the low-tube-voltage high-pitch dual-source computer tomography (DSCT) with sonogram affirmed iterative reconstruction (SAFIRE) for routine abdominal and pelvic scans.

METHOD AND MATERIALS

This institutional review board-approved prospective study included 64 patients who gave written informed consent for acquisition of additional abdominal and pelvic images on DSCT. The patients underwent standard CT scans (protocol 1) (tube voltage of 120kVp/pitch of 0.9) followed by high-pitch CT scans (protocol 2) (100kVp/3.0/SAFIRE). The total scan time, mean CT number, signal to noise ratio (SNR), image quality, lesion detectability and radiation dose were compared between two protocols.

RESULTS

The total scan time of protocol 2 was less than that of protocol 1 (P<0.05). SNR on images of protocol 2 was higher than that of protocol 1 (all P<0.05).

CONCLUSION

The high-pitch DSCT with SAFIRE can reduce scan time and radiation dose while preserving image quality in abdominal and pelvic scans.

SSQ05-07 • Simple or Solid? Prospective Clinical Evaluation of Iterative Reconstruction Using Dual-source Single-detector Reconstruction to Compare Renal Cyst Density on 50% Dose Images

Kristy Lee MD (Presenter); Patrick McLaughlin FFRCSI; Rekha Raju; Shamir Rai BSC; Sarah A Barrett MBCh; Charlotte J Yong-Hing MD, FRCP; Alison C Harris MBChB; John R Mayo MD*; Savvas Nicolaou MD

PURPOSE

Many studies now demonstrate the utility of iterative reconstruction (IR) algorithms to generate acceptable abdominal CT images at lower radiation exposures than filtered back projection (FBP). In comparison there is a clear deficiency robust clinical studies examining the changes in appearance, density and conspicuity of pathology on low dose CT reconstructed with FBP and IR. The purpose of this study was to determine if the internal characteristics of renal hypodensities differed between 100% and 50% dose images generated using a dual source imaging protocol using FBP and IR.

METHOD AND MATERIALS

81 consecutive patients underwent contrast enhanced CT abdomen using a dual source 128-slice CT system (Definition FLASH; Siemens Healthcare, Germany). RAW data from detector A of the dual source (A+B) datasets was reconstructed to yield half dose images (AP50) using a validated technique. All images were reconstructed using FBP and a raw data based IR algorithm (SAFIRE). The size and mean hounsfield unit (HU) of renal hypodensities measuring greater than 1 cm was recorded. AP100, AP50, IR, AP50IR, and AP100-IR datasets. Hypodensities >20 HU were classified as solid and those between -20 HU and 20 HU was considered simple. AP100-IR images were chosen as the reference standard for the purposes of sensitivity and specificity analysis.

RESULTS

When compared to our chosen reference standard, 50% dose images reconstructed with FBP showed superior sensitivity and specificity to those reconstructed with IR for the correct classification of renal hypodensities.

CONCLUSION

Approximately 20% of renal hypodensities are mischaracterized on the half dose images.

SSQ05-08 • Frequency of Previously Reported Ovarian Torsion Findings on Both Ultrasound and Computed Tomography

David W Swenson MD (Presenter); Ana P Lourenco MD; David J Grand MD

PURPOSE

To evaluate the frequency of imaging findings for ovarian torsion on ultrasound (US) and computed tomography (CT) studies performed in the emergency department (ED).

METHOD AND MATERIALS

20 adult females with surgically proven ovarian torsion underwent both pelvic US and CT between 3/1/2006 and 5/31/2010. Two radiologists reviewed all US and CT studies in consensus, measuring each torsed ovary in 3 axes, and grading each study for the presence or absence of the following previously described findings of torsion: (1) ovarian width >5 cm, (2) ovarian volume > 20 mL, (3) ovarian stromal edema or marked heterogeneity, (4) numerous small peripheral follicles, (5) a twisted vascular pedicle or “swirl sign”, (6) small free fluid in the pelvis, (7) abnormal Doppler waveforms (US only), (8) para-ovarian fatty stranding (CT only), and (9) uterine deviation toward the torsed ovary.

RESULTS

Of the 20 torsed ovaries, 55% were on the right and 45% on the left. An underlying mass was identified in 60%. Mean torsed ovarian diameter was 7.4 cm (range, 5.0-20.0 cm). Mean volume was 416 mL (range, 29-1842 mL). Thus 100% of torsed ovaries met previously published size criteria for concern, namely a single measurement >5 cm, and volume > 20 mL. Stromal edema/heterogeneity was identified in 40% of torsed ovaries by US (vs. 60% by CT), peripheral follicles in 40% by US (vs. 5% on CT), a twisted vascular pedicle in 10% by US (vs. 60% on CT), small free fluid in 55% by US (vs 45% on CT), and abnormal Doppler waveforms in 40% by US (vs. NA for CT). Para-ovarian fatty stranding and uterine deviation towards the torsed ovary were each present on 40% of CT studies.

CONCLUSION

An abnormally enlarged ovary is the most common finding of ovarian torsion on both US and CT. While US is often considered the optimal imaging modality for identifying torsion, in our series, CT was equal to or more successful than US in demonstrating most of the previously reported ancillary findings of torsion.

CLINICAL RELEVANCE/APPLICATION

Pelvic US is often described as the best imaging modality for evaluating ovarian torsion, however, CT may provide comparable diagnostic value and may be particularly useful in emergent patients.

SSQ05-09 • Diagnosing Acute Pancreatitis Using Attenuation Values in Patients with Unexplained Abdominal Pain, Apparently Normal CT Scans and Normal Serum Levels of Pancreatic Enzymes

Mahmood A Al Bahhar MD (Presenter); Soumia Senouci; Puskar Pattanayak MBBS, FRCR; Caroline Reinhold MD, MSc

PURPOSE

To evaluate the ability of pancreas CT attenuation values to diagnose acute pancreatitis in patients presenting with abdominal pain, normal serum levels of pancreatic enzymes, and no apparent CT scan finding to explain the patients’ pain.

METHOD AND MATERIALS

Out of 124 patients reviewed. 31 patients satisfied the inclusion criteria, including documented clinical suspicious of pancreatitis, three folds elevation of pancreatic enzymes and grade A or B pancreatitis by CT scan. Another 31 normal CT scans for trauma were included in the control group. The attenuation values, measured in Hounsfield Units (H.U), of the spleen, aorta, portal vein and head, body and tail of the pancreas were measured in both arterial and
portovenous phases for both cases and control groups. The threshold of the pancreatic attenuation and the pancreatic-spleen attenuation ratios for predicting acute pancreatitis were assessed with receiver operating characteristic curve analysis.

RESULTS

In both arterial and portovenous phases, there was statistically significant differences between the cases and control groups in regards to the attenuation values of the head and body of the pancreas. No such difference was seen in the tail. The mean HU of the pancreas was 76.04 HU in cases of pancreatitis, whereas in control cases it was 86.47 HU (p=0.05) ON PV phase. When considering the ratio between the pancreas and the spleen, the mean was 0.77 for patients and 0.88 for controls (p=0.02). A pancreatic-splenic ratio of 0.77 in the portovenous phase has a 76% positive predictive value (PPV) in diagnosing acute pancreatitis with a 85% specificity.

CONCLUSION

Our study demonstrates that when a patient presents with abdominal pain, normal pancreatic enzymes and no CT findings to explain the patient's pain, a pancreatic-splenic attenuation ratio in the portovenous phase of 0.77 has a 76% PPV with a 85% specificity for diagnosis acute pancreatitis. These findings may allow a diagnosis of acute pancreatitis to be made in cases were early clinical and morphological imaging findings are non-diagnostic. This will help explain the cause of abdominal pain in some of patients and reduce the number of negative emergency CT scans.

CLINICAL RELEVANCE/APPLICATION

This finding may allow a diagnosis of acute pancreatitis to be made where early clinical, laboratory and morphological imaging findings are non-diagnostic, which could explain patient's symptoms.

ISP: Gastrointestinal (Crohn's Disease)

Thursday, 10:30 AM - 12:00 PM • E353A
RESULTS
A total of 64 bowel segments (22 with ulcers, 14 with aphthoid lesions, 2 with erythema/edema, and 26 inactive) were included. DW-MRE sensitivity was 86.4% (19/22), 57.1% (8/14), and 0% (0/2) respectively, while the sensitivity of CE-MRE was 90.9% (20/22), 14.3% (3/21), and 0% (0/2), respectively, demonstrating no significant difference for ulcers albeit higher sensitivity in DW-MRE for all active lesions (71.1% vs. 57.9%). DW-MRE specificity (46.2% [12/26]) was significantly lower compared with CE-MRE (100% [26/26]). False-positive DW-MRE results mostly occurred in the colon ([13/14]) and was largely associated with undistended bowel ([11/14]).

CONCLUSION
DW-MRE was more sensitive than CE-MRE for non-ulcerative active bowel lesions but was less specific for excluding active inflammation, generating a high rate of false positives presumably related to undistended bowel.

CLINICAL RELEVANCE/APPLICATION
DW-MRE sensitivity shows the bowel inflammation of Crohn’s disease; however, its propensity for false positivity and the high accuracy of CE-MRE obscures the real clinical benefit of DW-MRE.

SSQ06-06 • Does Abdominal Ultrasound Show Equivalence to Computed Tomography and Magnetic Resonance Enterography in Predicting Active Crohn Disease and Complications?

Saima Batool MBBS ; Aman Wadhwani BSC (Presenter) ; Kerri Novak MD * ; Stephanie R Wilson MD *

PURPOSE
To show the equivalence of abdominal ultrasound (US) with computed tomography (CT) or magnetic resonance enterography (MRE) / CTE, as gold standard imaging (GSI), in predicting active disease and intestinal complications in patients with crohn disease (CD).

METHOD AND MATERIALS
This retrospective review of 210 patients with CD compares US with temporally performed CT (n=70) or CTE (n=75)/MRE (n=65). Two independent reviewers, blinded to the final pathology, reviewed image files of all modalities for active disease predicted on the basis of wall thickness, hyperemia, and presence of mesenteric inflammatory fat. Complications were predicted based on their familiar morphologic appearances. Sensitivity (SN), specificity (SP), positive predictive value (PPV), negative predictive value (NPV), and accuracy (ACC) for active disease and complications visualized with US were calculated. In each instance, the advantages and disadvantages afforded by US relative to other modalities were documented.

RESULTS
In this select population, a majority presented to Emergency with acute complications. A total of 138 patients had thick bowel, inflammatory fat, and hyperemia on GSI, with agreement on US in 134 (SN 97%, SP 95.8%, PPV 98.5%, NPV 92% and ACC 96.7%). Complications were present on GSI in 118/210 patients. (114). Current US although deep positioned abscess with large quantities of gas may be shown with superiority on CT scan. MR was superior for prediction of wall bowel edema and mucosal ulceration although the difference in determination of active disease between US and MR was inconsequential.

CONCLUSION
In our study US showed equivalent ability to predict active disease and a wide range of clinical complications, equal to and at times superior to that of either CT or CTE/MRE.

CLINICAL RELEVANCE/APPLICATION
US is a real-time method for diagnosis of CD and associated complications. Scanning patients for followup or at the time of acute clinical exacerbation is effective with this radiation free modality.

SSQ06-07 • Visualization of Bowel Motility Disorders in Patients with Inflammatory Bowel Disease by Development of an Automated Color-coding Algorithm in Cine MRI

Maria L Hahnemann MD (Presenter) ; Felix Nensa MD ; Sonja Kinner MD ; Guido Gerken ; Thomas C Lauenstein MD

PURPOSE
The aim of this study was to establish an automated algorithm for visualizing and quantifying bowel motion disorders in cine MRI.

METHOD AND MATERIALS
Thirty patients with suspected or diagnosed inflammatory bowel disease underwent MR examination on a 1.5T scanner (Avanto, Siemens). In addition to the standard MRI bowel protocol, coronal T2-weighted cine MR images were acquired with a temporal resolution of 4.5s continuously over a time span of 150s. After affine 2D respiratory motion correction, bowel motility was estimated from cine MRI using an optical flow algorithm and the resulting motion vector magnitudes were color-coded into bowel motility maps.

RESULTS
The acquisition of color-coded maps of bowel motility was feasible in all 30 patients. Increased or decreased bowel movement visualized by motility-mapping allowed for the detection of segments of abnormal bowel motility. Particularly, inflamed bowel segments exhibited a decreased motility.

CONCLUSION
Color-coded motility mapping in T2w cine MRI is a feasible and promising new approach for the assessment of bowel motility disorders. In future, this method may improve the detection of pathological conditions or abnormalities in bowel segments without or with only subtle signs of inflammation on morphologic images.

CLINICAL RELEVANCE/APPLICATION
This new technology may help to increase diagnostic accuracy for the depiction of inflamed bowel segments.

SSQ06-08 • Pre-obstructive Changes in Small Bowel Motility in Strictureing Crohn’s Disease Appear Reversible on Investigation with MRE

Alex Menys (Presenter) ; Emma Helbren MBCh, FRCSR ; Jessica Makanyanga ; David Atkinson * ; Alistair Forbes ; Al Windsor ; Steve Halligan MD ; Stuart A Taylor MBBS

PURPOSE
To examine whether abnormal motility in pre-obstructive, dilated bowel is reversible.

METHOD AND MATERIALS
21 patients with stricturing Crohn’s disease (9 Male, mean age 31) undergoing two 1.5T MR enterography (MRE) examinations (mean 14 months apart), were retrospectively identified. Multiple True FISP coronal motility sequences were acquired during 20 second breath holds (1 slice/0.8sec, TR 4ms, TE 1.7ms, slice thickness 10mm) to encompass the small bowel volume. On each of the two scans, a radiologist (5 years experience) placed an ROI in the dilated small bowel immediately upstream of the stricture, and in normal bowel remote from the diseased area. Using validated motility analysis software, measurements of small bowel motility ( s.d of the pixel Jacobean determinant) and maximum bowel diameter were made. The percent change in bowel diameter and motility between the two scans was calculated for each ROI position and analysed using Spearman’s Rho.

RESULTS
The mean percentage change in pre-stricture bowel diameter and motility was -7% (range -70 to +65%) and -58% (range -625 to +89%) respectively. There was a negative correlation between the percentage change in diameter and motility (Spearman’s Rho coefficient -0.6, P = 0.007) ie as the diameter decreased, motility increased. There was no such correlation between diameter (mean change 3%, range -35% to 36%) and motility (mean change 11%, range -85% and 28%) in normal bowel (Spearman’s Rho 0.8, P = 0.94).

CONCLUSION
Motility changes in pre-stricture dilated bowel are fluid over time and different from normal bowel. As the bowel diameter decreases, motility increases and vice versa.

CLINICAL RELEVANCE/APPLICATION
Medical management could be favourable over surgery in some instances. Loss of function in the small bowel is potentially reversible.

SSQ06-09 • Comparison of Bismuth, Tungsten, and Tantalum Enteric Contrast Agents to Complement Iodine for Double Contrast Dual-energy CT Enterography

Samira Rathnayake (Presenter) ; John Mongan MD, PhD * ; Yanjun Fu PhD ; Andrew S Torres PhD * ; Robert E Colborn PhD * ; Dongwei Gao MD ; Margaret J Wong MENG, BS ; Wilbur Wang BA ; Benjamin M Yeh MD *

PURPOSE
To investigate the effectiveness of double contrast DECT obtained with iodinated intravenous and non-iodinated enteric contrast for small bowel wall and vasculature visualization, compared with conventional CT.

**METHOD AND MATERIALS**

Thirteen rabbits were imaged on a rapid kVp switching CT scanner with intravenous iohexol and an experimental positive enteric contrast agent: bismuth subsalicylate (n=5), tungsten oxide (n=4), or tantalum oxide (n=4). These enteric agents can be separated from iodine at DECT due to their relative high and low x-ray attenuation coefficients. DECT “iodine-only” density maps and conventional CT images were obtained from the thirteen studies to generate 94 pairs of small bowel and 34 pairs of vasculature images comparison. Four sub-specialty trained abdominal imaging attending radiologists without prior DECT experience independently viewed each comparison to record relative clarity of small bowel wall and abdominopelvic vasculature and completeness of enteric contrast subtraction using a visual analog scale (0%=contrast materials not distinguished to 100%=perfect separation). Significance of differences was determined by t-tests.

**RESULTS**

Small bowel wall was observed to be 44% (95% CI: 34%-47%, p < 0.05). Double contrast DECT provides better simultaneous visualization of bowel wall and vasculature than conventional CT in vivo. DECT “iodine-only” maps obtained with a tungsten- or tantalum-based enteric contrast agent were clearer than with a bismuth-based enteric agent.

**CLINICAL RELEVANCE/APPLICATION**

Development of tantalum or tungsten enteric agents should enable clearer bowel wall and abdominopelvic vasculature visualization for double contrast DECT than conventional CT.
interreader variability was high for all three reconstructions (p = 0.89 and 0.88 respectively), than on CCI (0.81 and 0.69) and GI images (0.78 and 0.50). Pairwise comparison showed no significant differences (P>0.05).

CONCLUSION
1. DECT may be a promising method for detection of residual tumor within 24 h after RF ablation.
2. Our study suggests that no difference in accuracy exists between monochromatic 70 keV images, GI, and CCI.

CLINICAL RELEVANCE/APPLICATION
Detection of residual tumor after RF ablation is clinically important, and DECT may play a role in this setting.

SSQ07-04 • Clinical Implications of Negative and Inconclusive Percutaneous Ultrasound-guided Biopsy of Focal Liver Lesions

Jason A Pietryga MD (Presenter) ; Alison J Kim MD ; Rendon C Nelson MD *

PURPOSE
To describe our clinical experience with ultrasound-guided biopsies of focal liver lesions and to determine if small lesion size (=3cm), patient body habitus, or history of cirrhosis affect the rate of inconclusive/negative biopsy results.

METHOD AND MATERIALS
This is an IRB-approved HIPAA-compliant study. A retrospective search identified 283 consecutive adults who underwent US-guided biopsy of a focal liver lesion with pathology results from 1/1/2011 to 7/31/2012. Medical records/RAD/C5 were reviewed to identify the lesion sizes, patients’ BMI, history of cirrhosis and prior malignancy, and biopsy results. Rates of inconclusive/negative biopsy results were compared between patients with lesions =3 vs. >3cm, obesity vs. no obesity, and cirrhosis vs. noncirrhosis. Correlation of results with history of prior malignancy was also performed. Statistical analysis of the comparisons was performed using a Fisher’s exact test with a p-value < 0.05 deemed significant.

RESULTS
15.5% (44/283) of the biopsies had inconclusive/negative results. 25% (11/44) of these patients went on to rebiopsy or excision of which 45% (5/11) were diagnostic of malignancy. 19.0% (29/153) of lesions = 3cm had inconclusive/negative results vs. 9.4% (124/153) of lesions >3cm (p=0.02). 21.4% (18/84) of obese patients had inconclusive/negative results vs. 13.1% (23/176) of nonobese patients (p=0.063). 52.9% (9/17) of cirrhotic patients had inconclusive/negative results vs. 12.2% (35/266) of noncirrhotic patients. 10.7% (21/197) of patients with a known cancer were diagnosed with a new additional cancer (i.e. new primary).

CONCLUSION
A minority (15.5%) of patients who underwent US-guided biopsy of a focal liver lesion had inconclusive or negative results. Having a lesion =3cm or a history of cirrhosis increases the rate of inconclusive/non-diagnostic results. Obesity may increase the rate of inconclusive or negative results. A significant minority of liver lesions in a patient with a known cancer represent disease from a new primary.

CLINICAL RELEVANCE/APPLICATION
A negative or inconclusive biopsy of either a small liver lesion or a lesion in a patient with cirrhosis should undergo further work-up as it is associated with a significant false negative rate.

SSQ07-05 • Usefulness of a Second Biopsy after a First Inconclusive One for the Diagnosis of Small Hepatocellular Carcinoma in Cirrhotic Patients

Christophe Aube MD, PhD * ; Frederic Oberti MD ; Benoit P Gallix MD ; Olivier Seror ; Aurore Caumont-Prim MSc ; Valerie Vilgrain MD (Presenter)

PURPOSE
When radiological hallmarks of hepatocellular carcinoma (HCC) as defined by EASL–EORTC Clinical Practice Guidelines are not seen on imaging, biopsy of nodule larger than 1 cm is recommended. The goal of our study was to determine the usefulness of a second biopsy when the first one is inconclusive.

METHOD AND MATERIALS
In a multicenter prospective study of 430 cirrhotic patients with nodules < 3 cm detected during surveillance, 152 patients (mean age = 61.95 +/- 8.86 years) with 165 nodules had a percutaneous biopsy of a nodule and adjacent liver using 16G-cutting needles. When the first biopsy was inconclusive (no pathologic diagnosis of nodules), a second biopsy was proposed.

RESULTS
The mean diameter of the nodules was 19.4 +/- 5.7 mm. At first biopsy, the diagnosis was HCC, dysplastic nodule and regenerative nodule in 105 (63.6%), 6 (3.6%) and 10 (6.1%), respectively. No lesion was found at pathology in 43 (26.1%) nodules. 17 (39.5%) of the nodules underwent a second biopsy after a first negative one. The mean diameter of nodules was 18.3 +/- 4.4 mm. At second biopsy, the diagnosis was HCC and dysplastic nodule in 12 (70.6%), and 2 (11.8%), respectively.

CONCLUSION
When a first biopsy of a small nodule developed on cirrhosis is inconclusive, a second biopsy is useful and rules in a diagnosis of HCC in more than 70% of HCCs that have been missed at the first biopsy.

CLINICAL RELEVANCE/APPLICATION
When a biopsy is required to confirm the diagnosis of a small HCC in cirrhotic patients, a second biopsy should be performed when the first one is inconclusive.

SSQ07-06 • Coagulation Profiles: Can We Safely Relax the INR and Platelet Parameters for Image-guided Percutaneous Liver Biopsy?

Doug R Kitchin MD (Presenter) ; Lucas Ludeman MD ; J. Louis Hinshaw MD *

PURPOSE
METHOD AND MATERIALS
RESULTS
There was no significant difference in the laboratory profiles of the patients biopsied before guideline relaxation from those after (INR 1.08 +/- 0.18, plts 213K +/- 94K before; INR 1.07 +/- 0.16, plts 221K +/- 94K after), nor was there a change in hemorrhagic complication rate (1.9% vs 1.9%) or preprocedural platelet administration (0.8% before, 0.3% after; p=0.38). However, there was a significant decrease in preprocedural FFP administration (4.2% before vs 1.0% after; p=0.0015). When categorizing patients on the basis of INR and platelet level alone, there was a significant increase in hemorrhagic complications in patients with INR>1.5 (12% vs 1.9%; p=0.003) and platelets< 25,000/uL (13.3% vs 1.9%; p=0.008). However, patients with INR levels initially greater than 1.5 who received FFP and were corrected (INR 1.46 +/- 0.07) had a similar hemorrhagic complication rate (11.1%) as those whose INR levels were not corrected (INR 1.9 +/- 0.33, 15.4%).

CONCLUSION
Based upon a review of the literature, we changed our coagulation guidelines for percutaneous liver biopsy to INR<25.000/ul, which has resulted in decreased FFP transfusion while maintaining a low complication rate, and has had a positive impact on our overall workflow. Patients with INR>1.5 and platelets< 25,000/ul (13.3% vs 1.9%; p=0.008) have had a positive impact on our overall workflow. Patients with INR>1.5 and platelets< 25,000/ul (13.3% vs 1.9%; p=0.008) have had a positive impact on our overall workflow. Patients with INR>1.5 and platelets< 25,000/ul (13.3% vs 1.9%; p=0.008) have had a positive impact on our overall workflow.

CLINICAL RELEVANCE/APPLICATION
More relaxed coagulation guidelines result in decreased FFP administration and, while patients with INR>1.5 and platelets< 25,000/ul (13.3% vs 1.9%; p=0.008) have had a positive impact on our overall workflow. Patients with INR>1.5 and platelets< 25,000/ul (13.3% vs 1.9%; p=0.008) have had a positive impact on our overall workflow.

SSQ07-07 • CT-guided Percutaneous Drainage versus Surgical Repair of Gastrointestinal Anastomotic Leaks: Is There a Difference in Hospital Course or Overall Treatment Cost?

Lauren M Burke MD (Presenter) ; Mustafa R Bashir MD * ; Carly S Gardner MD ; Arthur A Parsee MD ; Daniele Marin MD ; David P Vermess MD ; Syamal D Bhattacharya ; Tracy A Jaffe MD

PURPOSE
To identify differences in hospital course and overall treatment cost when comparing CT-guided percutaneous drainage with open surgical repair for gastrointestinal anastomotic leaks.

METHOD AND MATERIALS
RESULTS
144 patients had radiographic evidence of a gastrointestinal anastomotic leak (esophageal, gastric, small or large bowel). 54 patients underwent surgical repair of their anastomotic leaks; 9 were excluded due to lack confidence scores

CONCLUSION
Gastrointestinal anastomotic leaks managed by percutaneous drainage are associated with lower overall cost and shorter hospital stays compared with open surgical management.

CLINICAL RELEVANCE/APPLICATION
**SSQ07-08** • Fluoroscopically-guided Jejunal Extension Tube Placement through an Existing Gastrostomy Tube in Patients Requiring Nutrition beyond the Ligament of Treitz: Analysis of 391 Procedures Performed over 3 Years

André Uflacker MD (Presenter); Yujie Qiao; Genevieve G Easley BS; James Patrie MS; Drew L Lambert MD; Eduard E De Lange MD

**PURPOSE**
To evaluate outcomes of fluoroscopic placement of a jejunal extension (J-arm) in patients with an already existing gastrostomy (G) tube.

**METHOD AND MATERIALS**
Retrospective review of 391 J-arm placements over a 3-year period was performed in 174 patients requiring nutrition post ligament of Treitz [M/F 94/80, age range 1-89 y (mean 55.9 y)]. IRB approval and HIPAA compliance were maintained. Indications for jejunal nutrition were aspiration risk (35%), pancreateatitis (17%), gastroparesis (13%), gastric outlet obstruction/mass/leak (12%) and other (23%). Technical success, procedure-related complications, tube malfunction rate and tube patency were assessed. G-tube location, J-arm course and fluoroscopy time were correlated for success/failure. Full and partial technical success were defined as J-arm tip placement at or beyond the ligament of Treitz, and between the pylorus and ligament, respectively. Failure was inability to advance the tip out of the stomach. Procedure-related complications were perioperative adverse events related to tube placement occurring within 7 days. Tube malfunction was defined as coating/kinking/occlusion and inadvertent removal requiring replacement.

**RESULTS**
Tube placement was successful in 303/391 (78%). Complications occurred in 3 (0.8%) [1 perforation (0.2%), 1 hematoma (0.2%), 1 hypotension (0.2%)]. Malfunction occurred in 197 (50%). Overall patency was 51 days (95%CI: [42, 58 days]) following placement. There was no association between successful J-arm placement and G-tube position in the stomach (p=0.677) or indication for jejunal nutrition (p=0.349); between J-arm trajectory in the stomach and incidence of tube malfunction (p=0.365); and between risk of coating/kinking in the stomach and G-tube position (p=0.173) or J-arm length (p=0.987). Fluoroscopy time placement was negatively associated with procedure success (p=0.08).

**CONCLUSION**
Fluoroscopically-guided J-arm placement was safe, with low procedural complication rate. Fluoroscopy time was the only predictor of technical success. Tubes replaced after 90 days had higher rates of tube malfunction.

**CLINICAL RELEVANCE/APPLICATION**
Fluoroscopic guided J-arm placement is safe for patients requiring jejunal nutrition. Tubes should be replaced within 90 days.

---

**SSQ07-09** • Biliary Drainage in 30 Patients with Undilated Bile Ducts Affected by Biliary Fistula due to Pancreatobiliary Surgical Treatment: Technique, Feasibility, Complications, and Clinical Outcome

Massimo Venturini MD (Presenter); Francesco A De Cobelli MD; Stefano Cappio MD; Marco Salvioni; Giulia Agostini; Alessandro Del Maschio MD

**PURPOSE**
To evaluate technique, feasibility, complications, and clinical outcome of percutaneous biliary drainage in 30 patients with undilated bile ducts and normal bilirubin levels affected by biliary fistula due to pancreatobiliary surgical treatment.

**METHOD AND MATERIALS**
From 2006 to 2012, Percutaneous Transhepatic Colangiography (PTC) and placement of a percutaneous biliary drainage (8-French) was attempted in 30 patients affected by biliary fistula, demonstrated by the presence of bile in abdominal surgical drainage, with bilirubin normal levels and ultrasonographic evidence of undilated biliary ducts. Under ultrasonographic (and fluoroscopic) guidance, the puncture attempt with Chiba needle (21G) was performed using a right approach puncturing along the course of the sixth segment portal vein branch, or a left approach in case of aerobilia and adequate volume of the left hepatic lobe.

**RESULTS**
PTC was successfully performed in 28/30 patients (21 cases with right approach, 7 with left approach) with radiological demonstration of biliary fistula (direct opacification of the fistula adjacent to the biliary-digestive anastomosis and fluoroscopic demonstration of contrast material in the surgical drainage). Biliary drainage was placed in 27/30 patients (90%) at first attempt, in 1/30 patients (3.3%) at second attempt two days later, placing in 23 patients an external-internal drainage, in 5 patients an external drainage. Of the 6 lesions demonstrated by the presence of bile in surgical abdominal drainage, 5 missed completely the fistula; in all cases, no periprocedural complications were recorded. In 2/30 patients, biliary drainage couldn't be placed: surgical resection was necessary in one case while in the other case biliary fistula spontaneously resolved.

**CONCLUSION**
Percutaneous biliary drainage under ultrasonographic/fluoroscopic guidance has proven to be a useful technique in patients with undilated bile ducts affected by biliary fistula feasible, effective, without significant peri-procedural complications and represents the first choice of treatment; furthermore PTC is an accurate tool to confirm the diagnosis of biliary fistula after pancreatobiliary surgical treatment.

**CLINICAL RELEVANCE/APPLICATION**
PTC and percutaneous biliary drainage represent the first therapeutic option in case of biliary fistula due to pancreatobiliary surgery.

---

**Gastrintestinal (Gallbladder and Biliary Imaging)**

Thursday, 10:30 AM - 12:00 PM • E353C

**SSQ08 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**

**Moderator**
Michael A Blake, MBCh *

**Moderator**
David J Lomas, MD

**SSQ08-01** • Early Gallbladder Cancer: CT and MR Findings with Pathologic Correlation

Charles H Mitchell MD (Presenter); Pamela T Johnson MD *; Elliot K Fishman MD *; Ralph H Hruban; Siva P Raman MD

**PURPOSE**
The majority of early gallbladder cancers are diagnosed incidentally following cholecystectomy. With the widespread use of CT, patients with unsuspected gallbladder cancer will undoubtedly be imaged for other indications. Radiologists should be aware of the subtle findings associated with smaller cancers, so as to detect lesions when still in resectable stages.

**METHOD AND MATERIALS**
Following IRB approval, 18 patients (10 female, 8 male) were identified in the pathology database with T1, T2, and T3 gallbladder cancers. Patient demographics were recorded, and the medical record was searched to determine if the tumor was correctly diagnosed on CT, MRI, or US. Each of the patients' Operative CT or MRI studies were retrospectively reviewed by a board-certified radiologist with regard to tumor morphology (focal thickening, diffuse thickening, polyploid mass), tumor size, presence of gallstones, lymphadenopathy, carcinomatosis, and liver invasion/metastases.

**RESULTS**
There were 2 T1 tumors, 6 T2 tumors, and 10 T3 tumors. 10 patients were found to have lymph node metastases at surgery, with 4 of these identified during retrospective CT/MRI review. 6 lesions presented as a discrete polyploid mass, 9 as focal wall thickening, and 3 as diffuse wall thickening. Of the 6 polyploid masses, the mean maximum diameter was 37 mm (range 15 - 61 mm). Of the 9 tumors with focal wall thickening, the average thickness was 9 mm (range 8 - 24 mm) over a length of 32 mm. CT correctly identified the malignancy prospectively in 12/18 cases, while ultrasound did not make the correct diagnosis prospectively in 2/3 cases. 5 cases demonstrated hepatic invasion and 4 cases demonstrated gallstones.

**CONCLUSION**
The cross-sectional imaging findings of early gallbladder cancer can be subtle: The most common appearance in this series was limited focal wall thickening, and even the polyploid masses were quite small. Not surprisingly, 1/3 of cases in this series were not correctly diagnosed prospectively on CT/MRI. Identification requires an understanding of the appearance of early gallbladder cancer and dedicated evaluation of the gallbladder in every case. Future investigations should evaluate the utility of MPRs for improving diagnostic accuracy.
Clinical Relevance/Application

The findings of gallbladder cancer in its earliest stages can be extremely subtle, requiring a careful evaluation of the gallbladder in both the axial plane and using multiplanar reformats.

SSQ08-02 • The Yield of Magnetic Resonance Cholangiopancreatography (MRCP) for the Investigation of Dilated Bile Ducts in Patients with Normal Liver Function Tests (LFTs)
Shlomit R Tamir MD (Presenter); Ofer Benjamino MD; Assaf Issachar MD; Marius Braun

Purpose
To evaluate the yield of MRCP for the investigation of incidental biliary duct dilatation in patients with normal as compared to those with elevated LFTs.

Method and Materials
This was a retrospective study conducted on MRCP scans of 113 consecutive patients referred to our tertiary medical center for the evaluation of biliary duct dilatation seen on previous imaging (CT, US). Biochemical data were collected from the medical records: ALT, AST, ALP, GGT and Bilirubin. Only patients with bile duct dilatation confirmed on MRCP were included in the study group. Pathology findings were compared between two groups of patients with bile duct dilatation: normal versus elevated LFTs.

Results
Complete data was available for 69 patients. MRCP confirmed bile duct dilatation in 53 patients who therefore consisted our study group; 28 pts. had normal and 25 pts had elevated LFTs. MRCP demonstrated the cause of bile duct dilatation in 34 pts. (64%), more commonly in pts with elevated (n=18, 72%) than normal (n=16, 57%) LFTs. Pathologies which did not require further evaluation or treatment (peripancreatic diverticula, benign asymptomatic stricture) were demonstrated in 17/34 (50%) with normal LFTs. Pathologies which required further evaluation or treatment (space occupying lesion, cholechocholithiasis, severe stricture) were more commonly seen in the elevated LFTs group (16/25, 64%) than in the normal LFTs group (9/28, 32%).

Conclusion
MRCP is a valuable tool in the workup of biliary duct dilatation even in the setting of normal LFTs, as the probability of an obstructing pathological finding is not negligible. However, it is less likely to find an obstructing pathology, or even a reasing benign etiogy, in patients with normal as compared to elevated LFTs.

Clinical Relevance/Application
Appropriate criteria should be set for MRCP in patients with incidental biliary dilatation and normal LFTs, weighing the low but significant prevalence of obstructing pathology in these patients.

SSQ08-03 • T1 Mapping on Gadoxetate Disodium Enhanced MRI in Patients with Primary Sclerosing Cholangitis (PSC)
Kristina I Ringe MD (Presenter); Marcel Gutberlet DiplPhys; Frank K Wacker MD *; Hans-Juergen Raatschen MD

Purpose
To assess the value of T1 mapping of the liver on gadoxetate disodium enhanced MRI in patients with PSC for evaluation of liver function and to determine a possible correlation with severity of disease.

Method and Materials
26 patients (17 males; mean age 43 years) with confirmed diagnosis of PSC who underwent gadodate disodium enhanced MRI on a 1.5T system were included in this prospective IRB-approved study. T1 mapping of the whole liver was performed using a 3D spoiled gradient echo sequence with flip angles (5° and 15°) before (T1) and approximately 17 minutes (T2) after i.v. contrast injection. T1 values were measured by placing ROIs in each liver segment on identical positions of the corresponding datasets and compared (T-Test). Mean T1 changes (T1-T2) were calculated and correlated with liver function tests (Pearson), which were obtained within 24 hours of the MRI scan.

Results
Significant changes of T1 relaxation times between non-enhanced and gadodate disodium enhanced MRI could be observed in all liver segments (p<0.05). On a segmental level, T1 relaxation times significantly decreased on gadodate disodium enhanced MRI in patients with PSC. Regarding the whole liver, the decrease of T1 relaxation times significantly correlated with bilirubin, alkaline phosphatase and cholinesterase levels, whereof fluctuations during the course of the disease are common.

Clinical Relevance/Application
T1 mapping of the liver in patients with PSC may serve as a useful method to assess liver function and probably indirectly severity of the disease on a global as well as on a segmental level.

SSQ08-04 • Relapsed Igg4-related Sclerosing Cholangitis after Steroid Therapy: Image Findings and Risk Factors
Myung-Won You (Presenter); Jin Hee Kim MD; Jae Ho Byun MD; Seung Soo Lee MD; Hyong Jung Kim MD; Myung-Hwan Kim; Moon-Gyu Lee MD

Purpose
To compare image findings of Igg4-related sclerosing cholangitis (Igg4-SC) between initial attack and relapse and to determine the risk factors associated with relapse of Igg4-SC.

Method and Materials
Of 99 patients with pathologically or clinically diagnosed Igg4-SC, 59 patients who had received steroid therapy and had been thoroughly followed up with imaging examinations were included. Among them, 23 were identified to have relapse of Igg4-SC. CT, MRCP, and ERCP at initial attack of all 59 patients and at the time of relapse of 23 patients were reviewed by two radiologists in consensus regarding the extent and degree of bile duct changes and extrabiliary organ involvement. The clinical data including patients’ age and gender, serology and pathology findings, if available, and steroid therapy regimen at initial attack and relapse were collected. The causes of relapse were divided into two categories: (1) steroid treatment withdrawal (4 cases) and (2) steroid treatment reduction or maintenance therapy (19 cases). The clinical data and imaging findings at initial attack and relapse were compared using chi-squared test.

Results
The relapsed Igg4-SC was characterized by more frequent extrapancreatic and multiple bile duct strictures, a greater number of involved bile duct segments, thicker bile duct wall, and a less frequent combination with autoimmune pancreatitis compared with initial attack (P<.016). On univariate analysis, relapse group was associated with a less frequent performance of maintenance steroid therapy, more frequent extrapancreatic and multiple bile duct strictures, a greater number of involved bile duct segment, and thicker bile duct wall at initial attack than in non-relapse group (P<.023). On multivariate analysis, no performance of maintenance steroid therapy and more severe bile duct wall thickening were independently associated with relapse, with odds ratio of 6.6 and 4.1, respectively (P=.041).

Conclusion
The image findings of Igg4-SC at relapse were more aggressive than those at initial attack. The severity of bile duct changes and the performance of maintenance steroid therapy were associated with relapse of Igg4-SC after steroid therapy.

Clinical Relevance/Application
When there are severe bile duct changes in patients with Igg4-SC, more aggressive steroid therapy than standard regimen and maintenance therapy may be necessary due to a high risk of relapse.

SSQ08-05 • Mucus Thread Sign of the Biliary Intraductal Papillary Mucinous Neoplasm on Magnetic Resonance Imaging Including Magnetic Resonance Cholangiography and Diffusion-weighted Imaging
Gil-Sun Hong MD (Presenter); Jae Ho Byun MD; Seung Soo Lee MD; Namkug Kim PhD; Jin Hee Kim MD; Hyong Jung Kim MD; Yedaun Lee MD; Moon-Gyu Lee MD

Purpose
To evaluate a mucus thread sign of biliary intraductal papillary mucinous neoplasm (IPMN) on magnetic resonance imaging (MRI) including MR cholangiography (MRc) and diffusion-weighted imaging (DWI).

Method and Materials
This retrospective study was approved by our institutional review board, and informed consent was waived. Forty-one patients with pathologically confirmed biliary IPMNs were included in this study. The definite mucus thread sign was defined as linear or curvilinear dark striations in the bile duct. The mucus thread sign was retrospectively analyzed on MRI including MRc (thin-section MRc, thick slab MRc, and 3D MRc) and DWI. For quantitative analysis in 18 patients with the definite mucus thread sign on DWI, apparent diffusion coefficient with b-factors of 150 (ADC150) and 1000 (ADC1000) of mucus thread sign were compared with those of normal bile. The prevalence of definite mucus thread sign was compared among the MRI and MRc sequences. The relationship between prevalence of definite mucus thread sign and the pathologic grade, the diameter of the dilated bile ducts or the maximum diameter of viable mass of biliary...
DWI with a b-value of 150 demonstrated the definite mucus thread sign better than HASTE or TSE T2-weighted images (70% [19/27], 50% [17/34] and 9.1% [3/33], respectively; \( P < 0.001 \)). At MRC, the definite mucus thread sign was present in 78.0% (32/41) patients with biliary IPMNs. There was no statistically significant difference in the prevalence of the definite mucus thread sign among the three MRC sequences (thin-slice MRC, thick slab MRC and 3D MRC; 67.6% [25/37], 46.2% [18/39] and 45.2% [14/31]; \( P = 0.093 \)). ADC500 and ADC1000 of the definite mucus thread sign \( (6.35 \pm 2.43 \text{ and } 3.02 \pm 0.42, \text{ respectively}) \) were significantly higher than those of normal bile \( (3.03 \pm 0.32 \text{ and } 2.72 \pm 0.23; \ P < 0.001 \text{ and } P = 0.01) \). The prevalence of definite mucus thread sign correlated well with only the diameter of the extrahepatic bile duct \( (P = 0.001) \).

CONCLUSION

The mucus thread sign, a characteristic finding of biliary IPMN, is well demonstrated on MRI including MRC and DWI.

### SSQ08-06 • Comparison between Fundamental and Harmonic Images with High Back Ground Noise for Detection of Microcrystals in Gall Bladder

**You Jin Ku** (Presenter) ; **Chul Soon Choi** MD ; **Dae Young Yoon** MD ; **Eun Joo Yun** ; **Young Lan Seo** ; **Kyoung Ja Lim** ; **Sora Baek** ; **Sang H Bae** MD, PhD

**PURPOSE**

To compare conspicuity of fundamental ultrasonographic (FUS) images and harmonic US images with high back ground noise (HUSN) for detection of microcrystals in the Gall Bladder.

**METHOD AND MATERIALS**

From November 30, 2012 to March 18, 2013, patients who showed microcrystals in the Gall bladder detected on US were included in this study. Exclusion criteria were gall stones, gall bladder sludge and acute calculous cholecystitis.

During observational period, we performed fundamental US images (FUS) and Harmonic US images with high back ground noise (HUSN). All ultrasonography examinations were performed by one radiologist, who had more than 20 years of experience in abdominal ultrasonound, with an IU 22 ultrasound unit (Philips Medical Systems, Bothell, WA, USA) using a 2- to 5-MHz convex array transducer.

After obtaining images, two radiologists who are a 3th year resident and a specialist having 20 years of US imaging, graded the conspicuity of each images with FUS and HUSN in consensus. The grades were G(1): absent microcrystal, G(2): equivocal, G(3): vague but present, G(4): clear and present. Grades of both images are statistically compared with Wilcoxon rank sum test. A p-value less than 0.05 was considered to be statistically significant.

**RESULTS**

There were 18 patients. Their average age was 55.3 years with standard deviation of 12.6 years. The male to female ratio was 11 versus 7. Six patients revealed symptoms and 12 patients were asymptomatic. FUS images were G1 in 7 patients, G2 in 5 patients, G3 in 4 patients, G4 in 2 patients. In contrast to FUS images, HUSN images were G1 in none, G2 in 1 patient, G3 in 2 patients, G4 in 15 patients. Wilcoxon rank sum test showed p-value of 0.0002 between two image grading.

**CONCLUSION**

HUSN images were superior to FUS images for detection of microcrystals in the gall bladder probably due to Rayleigh scattering.

### SSQ08-07 • Clinical Utility of MR Cholangiopancreatography in the Assessment of Acute Cholecystitis in the Emergency Setting

**Jennifer W Uyeda** MD (Presenter) ; **Vijay Ramalingam** MD ; **Amrita P Devalapalli** BS ; **Stephan W Anderson** MD ; **Jorge A Soto** MD *

**PURPOSE**

To assess the utility of MRCP in the assessment of acute cholecystitis in the emergency setting with emphasis on patients in whom US and MRCP results are discordant.

**METHOD AND MATERIALS**

The institutional review board approved this HIPAA-compliant retrospective study. Informed consent was waived. 371 consecutive adults (120 males, 251 females) who presented to the emergency department with abdominal pain between 4/1/2010 and 2/28/2013 who underwent US and MRCP within a 48-hour period were included. MRCP was performed for further assessment of bile duct dilatation. US and MRCP reports were reviewed and were classified as positive, negative or equivocal for the diagnosis of acute cholecystitis. Electronic medical records were reviewed to determine subsequent management and pathology findings.

**RESULTS**

In 275 (74.1%) of 371 patients, the results of US and MRCP were concordant. 73 (19.7%) patients had negative or equivocal results for acute cholecystitis but MRCP was positive. Of these 73 patients, 52 (71%) underwent cholecystectomy and 3 underwent percutaneous drainage. Of the 52 patients who underwent cholecystectomy with negative or equivocal US findings, but positive MRCP findings for acute cholecystitis, 22 (42%) were pathologically proven acute cholecystitis while the remaining 30 were pathologically proven chronic cholecystitis. Of the 371 US examinations, 23 (6.2%) were positive or suspicious for acute cholecystitis on US but negative on MRCP. 14 (61%) of these 23 patients underwent cholecystectomy and 2 (9%) were pathologically proven acute cholecystitis; 12 were pathologically proven chronic cholecystitis.

**CONCLUSION**

US is the study of choice in patients with acute right upper quadrant suspected to have acute cholecystitis. MRCP provides additional information in select cases. However, MRCP has limitations in discriminating between acute and chronic cholecystitis.

### SSQ08-08 • The Technologist-performed Sonographic Murphy’s Sign: Is It Really an Accurate Test?

**Ronald O Bude** MD (Presenter) ; **Richard K. J. Brown** MD * ; **Ehab H Youssef** MD, FRCR

**PURPOSE**

In our dept, the sonographic Murphy’s sign, performed by technologists who have not been physician-trained to elicit it, is generally considered the best ultrasound test for detecting acute cholecystitis. Technologist criteria for a positive test vary widely, from pain at probe contact of the RUQ skin to pain at probe palpation of the gallbladder in deep inspiration. We questioned the validity of this evaluation and performed a study to evaluate the test done this way.

**METHOD AND MATERIALS**

HIDA scan was the gold standard for detection of acute cholecystitis, due to the variability of our pathologists’ criteria (which varied from a few lymphocytes in the gallbladder wall to the need for transmural perforation) and the subjectivity and potential bias of the surgeons’ impressions at operation. All adults in a consecutive 3 year period fulfilling the following criteria were studied: unequivocal HIDA scan; US within one day of HIDA; recorded unequivocal sonographer’s Murphy sign evaluation. Timing of narcotic analgesia was noted. Sensitivities and specificities were calculated.

**RESULTS**

Study population: 383 patients. The Murphy’s sign is used in our dept. without taking narcotic analgesia or presence of gallstones into account. Used this way the sensitivity and specificity for detecting acute cholecystitis, respectively, were 45% (46/103) and 57% (159/280). Interestingly, 43% of patients (163/383) had narcotic analgesia within two hours before US, which probably influenced the results. However, even when considering patients with gallstones who did not have narcotic analgesia for at least 24 hours before US, the sensitivity and specificity were still only 63% (20/32) and 60% (36/60), respectively. Sensitivities and specificities for other combinations of stones/no stones and narcotic timings were similarly unimpressive, but space limits giving them here.

**CONCLUSION**

The sonographic Murphy’s sign, when performed by technologists not trained in its performance, is neither sensitive nor specific for the detection of acute cholecystitis. It remains to be proven whether this test is useful when performed by physicians, or by ancillary personnel specifically trained in its performance, given the prevalence of narcotic analgesia.

### SSQ08-09 • MR Signal Change of Hepatobiliary Imaging after Oral Ingestion of Manganese Chloride Tetrahydrate: Preliminary Examination

**Jennifer W Uyeda** MD (Presenter) ; **Ehab H Youssef** MD, FRCR

**PURPOSE**

To compare conspicuity of fundamental ultrasonographic (FUS) images and harmonic US imaging with high background noise (HUSN) for detection of microcrystals in the gallbladder.

**METHOD AND MATERIALS**

From November 30, 2012 to March 18, 2013, patients who showed microcrystals in the gallbladder detected on US were included in this study. Exclusion criteria were gallstones, gallbladder sludge and acute calculous cholecystitis.

During observational period, we performed fundamental US images (FUS) and Harmonic US images with high back ground noise (HUSN). All ultrasonography examinations were performed by one radiologist, who had more than 20 years of experience in abdominal ultrasound, with an IU 22 ultrasound unit (Philips Medical Systems, Bothell, WA, USA) using a 2- to 5-MHz convex array transducer.

After obtaining images, two radiologists who are a 3th year resident and a specialist having 20 years of US imaging, graded the conspicuity of each images with FUS and HUSN in consensus. The grades were G(1): absent microcrystal, G(2): equivocal, G(3): vague but present, G(4): clear and present. Grades of both images are statistically compared with Wilcoxon rank sum test. A p-value less than 0.05 was considered to be statistically significant.

**RESULTS**

There were 18 patients. Their average age was 55.3 years with standard deviation of 12.6 years. The male to female ratio was 11 versus 7. Six patients revealed symptoms and 12 patients were asymptomatic. FUS images were G1 in 7 patients, G2 in 5 patients, G3 in 4 patients, G4 in 2 patients. In contrast to FUS images, HUSN images were G1 in none, G2 in 1 patient, G3 in 2 patients, G4 in 15 patients. Wilcoxon rank sum test showed p-value of 0.0002 between two image grading.

**CONCLUSION**

HUSN images were superior to FUS images for detection of microcrystals in the gallbladder probably due to Rayleigh scattering.

**CLINICAL RELEVANCE/APPLICATION**

Harmonic images with high back ground noise could demonstrate microcrystals within gallbladder, which are not usually seen on routine fundamental ultrasonography.
Individual patients' creatinine (Cr) levels vary from day to day; the more severe a patient's background renal failure, the more severe the variations. If a patient who does not develop AKI (23% versus 5%, OR = 5.51 (95% CI 5.17-5.88), p < 0.001) who did not develop AKI (23% versus 5%, OR = 5.51 (95% CI 5.17-5.88), p < 0.001), we should stratify by baseline Cr variability. Patients who developed AKI post-scan had high pre-scan Cr variability compared to patients who did not develop AKI. The data suggests that a single Cr measurement does not adequately represent the Cr dynamics or renal function over an extended period of time. Pre-scan Cr variability may be an additional factor that affects post-scan Cr change.

CONCLUSION
The definition of the bile duct and increase of hepatic R2* value after oral ingestion of MCT may be obtained as additional benefits of contrast enhanced MRC and quantification of manganese uptake.
RESULTS

3953 patients were identified. The groups whose Cr rose to or beyond the nephropathy threshold increased as baseline Cr levels increased in both pre-contrast and post-contrast periods. There was no significant difference in nephropathy risk for Baseline Cr up to 0.9 mg/dl. For baseline Cr values between 1.0 and 2.8 mg/dl, creatinine rises to or beyond the threshold occurred significantly more frequently after contrast (61% vs. 39%; p<0.05).

CONCLUSION

Although most post-contrast acute rises in serum Cr are due to non-contrast-related natural variation, about 22% of these rises may be due to the contrast when baseline Cr levels are between 1.0 and 2.8 mg/dl.

CLINICAL RELEVANCE/APPLICATION

Intravenous contrast usually does not cause nephropathy, but slightly raises the risk in some patients with renal failure. This risk should be considered before giving contrast to such patients.

SSQ09-05 • Kidney Transplant: The Diagnosis of Chronic Allograft Nephropathy (CAN) with Real Time Elastography (RTE). Comparative Evaluation between RTE Data and Hystological Findings

Fabrizio Chegai MD (Presenter); Antonio Or lacchio MD; Costantino Del Giudice MD; Elena Di Caprera; Daniela Tosti; Giovanni Simonetti MD; Elisa Costanzo

PURPOSE

METHOD AND MATERIALS

45 patients clinically suspected of CAN (CAN group) and 18 patients with a stable graft function (control group) were enrolled in our study. RTE was performed and tissue mean elasticity (TME) was calculated by a single operator who was unaware of the renal function data of all patients. Kidney tissue elasticity measurements were performed using a Philips® IU 22 Ultrasound Machine equipped with the L12-5 linear probe (MHz). CAN group patients underwent biopsy after RTE and the findings were correlated to the histological Banff score. Furthermore ecocudoDoppler was performed and intrarenal resistance index (RI) and pulsatility index (PI) were measured.

RESULTS

CONCLUSION

CLINICAL RELEVANCE/APPLICATION

RTE can identify non-invasively the CAN with results comparable to biopsy, and could be recommended for the evaluation of fibrosis in these patients.

SSQ09-06 • Single Center Experience with 1,585 Injections of Gadoteridol in Patients with Renal Dysfunction

Rupan Sanyal MD (Presenter) ; Jonathon P Stidham MD; John V Thomas MD, MRCP; Desiree E Morgan MD *

PURPOSE

Evaluate incidence of nephrogenic systemic fibrosis in patients with renal dysfunction who undergo contrast enhanced MRI with Gadoteridol.

METHOD AND MATERIALS

IRB approved/HPAA compliant retrospective study of patients with Grade 3-5 renal dysfunction who underwent weight-based Gadoteridol enhanced MRI and had same day eGFR testing. Gadoteridol is a macrocyclic gadolinium contrast agent that has an extracellular biodistribution. The following variables were recorded: eGFR on the day of examination; volume of Gadoteridol injected; history of diabetes, dialysis or renal transplant; length of clinical follow up after MR examination; development of or biopsy of any skin lesion during follow up.

RESULTS

1585 weight-based Gadoteridol doses were administered to 1292 patients (893 females) with Grade 3-5 renal dysfunction. 204 patients had diabetes, 2 had renal transplant and 1 was on dialysis. 1266 doses were administered to patients with Grade 3A renal dysfunction (eGFR 45-59), 303 administrations to patients with Grade 3B renal dysfunction (eGFR 30-44) and 16 administrations to patients with Grade 4-5 renal dysfunction (eGFR <30).

CONCLUSION

No cases of nephrogenic systemic fibrosis developed after 1583 doses of Gadoteridol in 1292 patients with eGFR 2.

CLINICAL RELEVANCE/APPLICATION

This study suggests that Gadoteridol can be safely administered in patients with Grade 3 renal failure without causing nephrogenic systemic fibrosis.

SSQ09-07 • NISaFe Study: Observational Study on the Incidence of Nephrogenic Systemic Fibrosis in Renal Impaired Patients Following Gadoterate Meglumine Administration

Thomas Voigtlaender (Presenter)

PURPOSE

To prospectively estimate the incidence of NSF in patients with moderate to severe renal impairment after administration of gadoterate meglumine.

METHOD AND MATERIALS

An ongoing worldwide post-marketing study (PMS) is conducted to collect safety data in 1,000 patients (adults and children) with moderate to severe end stage renal impairment, scheduled to undergo a routine contrast-enhanced magnetic resonance (MR) imaging using gadoterate meglumine (Dotarem®). For each patient, risk factors at inclusion, indications for MR imaging, and occurrence of adverse events are recorded. Three follow up visits (between 3 months and 27 months after MRI) are performed in order to detect any suspicion or occurrence of NSF.

RESULTS

As of January 18, 2013, the cut-off date for the interim safety analysis, this ongoing PMS included data on 232 patients (mean age: 70.2 years (range: 21-92); male: 62.3%). The mean eGFR was 36.5 ±16.1 ml/min/1.73m² (range: 4.0-59.1) including 64.2% of moderate, 18.5% of severe, 14.2% of end stage renal impairment, scheduled to undergo a routine contrast-enhanced magnetic resonance (MR) imaging using gadoterate meglumine (Dotarem®). For each patient, risk factors at inclusion, indications for MR imaging, and occurrence of adverse events are recorded. Three follow up visits (between 3 months and 27 months after MRI) are performed in order to detect any suspicion or occurrence of NSF.

CONCLUSION

This interim safety analysis already confirms the very good safety profile of gadoterate meglumine in renal impaired patients.

CLINICAL RELEVANCE/APPLICATION

Interim analysis showed a good safety profile of gadoterate meglumine in renal impaired patients.

SSQ09-08 • Functional Assessment of Early Renal Allograft Dysfunction with Blood Oxygenation Level-dependent MR Imaging and Diffusion-weighted MR Imaging at 3T

Wooli Kim (Presenter); Chan Kyo Kim MD, PhD; Sung Yoon Park; Jungmin Bae; Byung Kwan Park MD; Wooseong Huh; Sung Ju Kim

PURPOSE

To evaluate the feasibility of blood oxygenation level-dependent (BOLD) MR imaging (MRI) and diffusion-weighted MR imaging (DWI) at 3T for functional assessment of early renal allograft dysfunction.

METHOD AND MATERIALS

This study was approved by the local ethics committee; written informed consent was obtained. Between April 2011 and December 2012, 46 patients with a renal allograft (early dysfunction, n = 36; normal, n = 10) were prospectively enrolled. BOLD MRI (multiple fast-field echo sequence with 8 and 16 gradient echoes) and DWI (single-shot echo planar imaging sequence with b values of 0, 500, and 800 sec/mm²) were performed at 3T. In patients with early renal allograft dysfunction, ultrasound-guided biopsies confirmed 21 acute rejections (AR), 7 acute tubulointerstitial necrosis (ATN), and 8 other pathologic conditions. R2* and apparent diffusion coefficient (ADC) were measured in the cortex and medulla of all renal allografts. The correlation between R2* or ADC values and estimated glomerular filtration rate (eGFR) was investigated in all the subjects using Spearman’s correlation coefficient. Both R2* and ADCs were compared among AR, ATN, and normal groups by using the Student t-test.

RESULTS

In renal allografts, the medullary R2* and cortical ADCs demonstrated a moderate correlation with eGFR (correlation coefficient, 0.487–0.538; p < 0.01) and the cortical R2* of 16 echoes and medullary ADCs had a weak correlation (correlation coefficient, 0.317–0.365; p < 0.05). The cortical R2* of 8 echoes did not give any correlation with eGFR. Although most post-contrast acute rises in serum Cr are due to non-contrast-related natural variation, about 22% of these rises may be due to the contrast when baseline Cr levels are between 1.0 and 2.8 mg/dl.

CLINICAL RELEVANCE/APPLICATION

Intravenous contrast usually does not cause nephropathy, but slightly raises the risk in some patients with renal failure. This risk should be considered before giving contrast to such patients.
show a correlation with eGFR (p = 0.111). In both cortex and medulla, AH had significantly lower R2* and ADCs than normal renal allografts (p < 0.01). In both cortex and medulla, the R2* of ATN were significantly lower than that of normal renal allografts (p < 0.05), while the ADCs of ATN were not significantly different from normal renal allografts (p > 0.05). Between AR and ATN, there was no significant difference in both R2* and ADCs (p > 0.05).

CONCLUSION
BOLD MRI and DWI at 3T, as noninvasive tools, may demonstrate early functional state of renal allografts. However, current these techniques appear to have the limited capability for characterizing a cause of renal allograft dysfunction.

CLINICAL RELEVANCE/APPLICATION
As unenhanced functional imaging techniques, BOLD MRI and DWI at 3T may help to noninvasively assess functional state of patients with renal allografts.

SSQ9-09 • Potential Role of MDCT Spectral Imaging by Using Material Density Analysis on Virtual Unenhanced Images in Renal Insufficiency

Catherine Roy MD (Presenter) ; Philippe Host MD ; Mickael Ohanna ; Isham Labani ; Gauthier Bazille MD ; Herve Lang MD

METHODS
We retrospectively identified 210 patients (no special recommendation for hydration) including 3 groups of 70 patients: a control group of normal patients, a group with moderate RI (GFR > 40 mL/min) and a group with severe RI (GFR < 40 mL/min) underwent an unenhanced acquisition using Helical CT (GE Discovery CT750HD 64-slice) scanner with Spectral Imaging single source fast switching. We used same helical pitch and detector collimation for all scans (1.375, 0.625mm). Among monochromatic CT images ranging from 40 to 140 KeV, three levels were then reconstructed at 75 KeV, 55 KeV, 45 KeV. An identical ROI was drawn in the medium part of renal parenchyma on both kidneys. A Gemstone Spectral Imaging (GSI) Viewer®, using material-density basis pairs provided values of water in mg/cc with standard deviation on unenhanced images and on virtual unenhanced images of the water-iodine pair for control group. Water values in mg/cc were correlated with GFR values using linear regression. Contrast-to-noise ratio graphs were also constructed for each patient to determine the optimum KeV for viewing. Statistical analysis was performed using SPSS software. Mean values and standard deviation of each group were calculated and compared using Student T-test.

RESULTS
Mean water content in control group was 1010 ±13 mg/cc (range: 997–1030), respectively for three levels of monochromatic images. There was no statistically significant difference in renal water content between virtual unenhanced images of the water-iodine MD pair and unenhanced acquisition for control group.

Mean water content in RI groups were 991±.25 mg/cc, 1032±38 mg/cc for severe and moderate for three levels of monochromatic images, respectively. There was no statistically significant difference in renal water content among the three groups. Noise index was higher for 45 KeV, but image quality was satisfactory.

CONCLUSION
The water content is not significantly different in impaired kidneys and normal kidneys parenchyma. It could not be used to assess renal impairment.

CLINICAL RELEVANCE/APPLICATION
There was no significant difference of water content inside kidney parenchyma in different forms of renal impairment.

Genitourinary (Novel Assessment of Native and Transplanted Kidneys)

Thursday, 10:30 AM - 12:00 PM • E450B

SSQ10 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

Moderator
Mindy M Horrow , MD *

Moderator
Dean A Nakamoto , MD *

SSQ10-01 • IgG4-Related Renal Disease: MR Findings with Emphasis on the Usefulness of Diffusion-Weighted Imaging

Bohyun Kim MD (Presenter) ; Jin Hee Kim MD ; Seong Ho Park MD * ; So Yeon Kim MD ; Jae Ho Byun MD ; Jeong Kon Kim MD

PURPOSE
To describe imaging characteristics of IgG4-related renal disease (IgG4-RD) on MR including diffusion-weighted imaging (DWI) and to evaluate the usefulness of DWI for lesion detection.

METHOD AND MATERIALS
We retrospectively identified 28 patients with pathologically or clinically diagnosed IgG4-RD who underwent MR covering the kidneys. Of 28 patients, 18 underwent DWI (b values of 0, 150, 500, and 1000 sec/mm2) and 19 underwent contrast-enhanced MR (CE-MR) with dynamic triple-phase including arterial, portal, and equilibrium phase (n=15) or single portal-phase (n=4) scanning. Two radiologists reviewed in consensus all MR images to assess the lesion location and number, and signal intensity (SI) of the lesions compared to the normal renal parenchyma on T1-weighted images (T1WI), T2WI, DWI, and CE-MR. The sensitivity of each sequence for lesion detection was obtained and the results were compared between T2WI, DWI, and dynamic CE-MR. The sensitivity of MR with DWI and MR without DWI was also compared. The ADC value of IgG4-RD (for the largest lesion, if multiple) and normal renal parenchyma was compared.

RESULTS
The most common findings of IgG4-RD on MR were bilateral (85.7%), multiple (92.9%), renal parenchymal (85.7%) lesions appearing iso-SI (96.4%) on T1WI, low SI (78.6%) on T2WI, high SI (100%) on DWI (b value of 1000 sec/mm2), and low SI (86.7%) in the arterial phase with progressive enhancement pattern on dynamic CE-MR. The sensitivity of DWI (100%) was higher than those of T2WI (78.6%) and dynamic CE-MR (86.7%) although there was no statistically significant difference between the sequences (P= 0.068). The sensitivity of MR with DWI was significantly higher than that of MR without DWI (100% vs. 70%, P=.037). The mean ADC value of IgG4-RD was significantly lower than that of the normal renal parenchyma (1.28x10^-3 mm^2/sec vs. 1.97x10^-3 mm^2/sec, P=.037). The mean ADC value of IgG4-RD was significantly lower than that of the normal renal parenchyma (1.28x10^-3 mm^2/sec vs. 1.97x10^-3 mm^2/sec, P=.037). The mean ADC value of IgG4-RD was significantly lower than that of the normal renal parenchyma (1.28x10^-3 mm^2/sec vs. 1.97x10^-3 mm^2/sec, P=.037). The mean ADC value of IgG4-RD was significantly lower than that of the normal renal parenchyma (1.28x10^-3 mm^2/sec vs. 1.97x10^-3 mm^2/sec, P=.037). The mean ADC value of IgG4-RD was significantly lower than that of the normal renal parenchyma (1.28x10^-3 mm^2/sec vs. 1.97x10^-3 mm^2/sec, P=.037).

CONCLUSION
The characteristic MR findings of IgG4-RD were bilateral, multiple, renal parenchymal lesions with T2 hypointensity, diffusion restriction, and progressive enhancement pattern. DWI was very useful to detect IgG4-RD and its sensitivity was higher than those of conventional MR sequences.

CLINICAL RELEVANCE/APPLICATION
It may be helpful to be aware of typical MR findings of IgG4-RD for the diagnosis of IgG4-related sclerosing disease in equivocal cases. The use of DWI may enhance the detection of IgG4-RD.

SSQ10-02 • 10% Tumor Diameter Shrinkage on the First Follow-up CT Predicts Clinical Outcome in Patients with Advanced Renal Cell Carcinoma Treated with Angiogenesi Inhibitors: A Follow-up Validation Study

Katherine M Krajewski MD (Presenter) ; Yoko Franchetti PhD ; Mizuki Nishino MD ; Nikhil H Ramaiya MD ; Annick D Van Den Abbeele MD ; Toni Choueiri MD

PURPOSE
Vascular Endothelial Growth Factor (VEGF)-targeted agents are standard therapies for metastatic renal cell carcinoma (mRCC), associated with variable tumor shrinkage. Response Evaluation Criteria In Solid Tumors (RECIST) is of limited utility in this setting, and other imaging changes are sought to reliably predict outcome early. We aim to validate 10% tumor shrinkage as the best early indicator of outcome.

METHOD AND MATERIALS
In this institutional review board-approved, HIPAA-compliant study, 66 mRCC patients with 165 lesions on clinical trials of VEGF-targeted agents underwent thoracic and abdominal CT at baseline and at first follow-up after therapy. Measurements were performed according to RECIST and Tumor Shrinkage of > 10% decrease in sum of the longest diameter (10%SCLD). Correlation with time-to-treatment failure (TTF) and overall survival (OS) were compared and stratified by response to the radiologic criteria. Receiver Operating Characteristics (ROC) analysis yielded the optimal threshold change in SCLD defining patients with prolonged survival.

RESULTS
More than -10%SCLD significantly differentiated “responders” from “non-responders” (median TTF 8.4 vs. 4.1 months, p = 0.001) while partial response by RECIST did not (median TTF 6.9 versus 5.5 months in responders vs. non-responders, p = 0.34). -10%SCLD was also significantly predictive of OS (median OS 35.1 vs. 15.0 months in responders vs. non-responders, p = 0.003). ROC curve analysis yielded -9.3% in SCLD as the optimal threshold for
CONCLUSION

The 3D T1w Dixon technique can replace standard fat suppression techniques.

CLINICAL RELEVANCE/APPLICATION

10% tumor shrinkage is validated as a reliable early predictor of outcome in mRCC patients receiving VEGF-targeted therapies and may provide a practical measure to guide therapeutic decisions.

SSQ10-03 • 3D Contrast Enhanced Ultrasound vs. Renal DTPA in the Detection of Perfusion Defects in Early Renal Transplants-Preliminary Findings

Ben Stenberg MSc (Presenter) ; Simon T Elliott MBChB, FRCR * ; Emma Tran BSC

PURPOSE

In the UK, technetium 99m renogam (DTPA) is the primary investigation for perfusion defects post-transplantation. It has high reported accuracy (up to 99% sensitivity), but time consuming, expensive and has the innate risks of an examination using ionising radiation. Contrast enhanced ultrasound (CEUS) is an emerging technology which may solve these issues, giving greater spatial and temporal resolution while having the potential to robustly quantify the degree of defect using 3D acquisition and stacked contour measurement system. However, little research has been done to investigate whether CEUS has the ability to maintain the high sensitivity rates to replace DTPA as the primary investigation, is achievable in this patient group and can be quantified using 3D data sets.

METHOD AND MATERIALS

This project used a blinded, cross over trial using 105 renal transplant patients examined with CEUS and compared to the DTPA within the immediate post-surgical phase. The examinations were reported independently of each other. Each CEUS was performed using a side by side, low MI technique, with a bolus injection of 2.4mL Sonovue (Bracco, Italy). 1 minute of 2D capture was acquired to manually assess the kidney perfusion and to allow for the medullary filling phase. A 3D volume of the whole kidney was then acquired in contrast specific mode.

RESULTS

All 105 patients underwent CEUS and imaging of the kidney was achieved in 100% of the cases (74/31 male/female) (34/71 live/deceased donor). 97 patients underwent both tests. DTPA detected 9 perfusion defects in these patients. CEUS detected all of these defects and a further 14 not detected by DTPA. Subsequent clinical correlation with operation records showed that in 5 of these cases polar arteries had been tied in surgery. 3D CEUS was used to quantify these defects (ranging from 0.2% to 100% of total renal volume (TRV)). The largest defect seen by CEUS but missed by DTPA was 17%TRV.

CONCLUSION

CEUS is more sensitive in the detection of perfusion defects in early renal transplants and the high resolution and 3D data acquisition techniques allow for robust quantification of the global renal perfusion. This technique is considered ‘off-label’ by the FDA.

CLINICAL RELEVANCE/APPLICATION

CEUS is achievable and more sensitive in the detection of perfusion defects than early kidney transplants than DTPA and has the ability to quantify defects accurately using 3D stacked contours.

SSQ10-04 • Assessment of Delayed Allograft Function by Diffusion Tensor Imaging and Arterial Spin Labeled Magnetic Resonance Imaging

Katja Hueper (Presenter) ; Marcel Gutberlet DiplPhys ; Frank Lehner MD ; Nicolas Richter MD ; Nils Hanke MD ; Jan Becker MD ; Matti Peperhoff MD ; Hermann Haller MD ; Frank K Wacker MD * ; Wilfried Gwinner MD ; Dagmar Hartung MD ; Antonia Zapf

PURPOSE

Delayed renal allograft function (DGF) is clinically defined as failure of serum creatinine to adequately decrease or need for dialysis during the first week after transplantation. DGF is associated with an increased risk for graft loss, acute rejection, and impaired long-term allograft function. In this study, we investigate whether diffusion tensor imaging (DTI) and arterial spin labeled (ASL) MRI allow assessment of DGF.

METHOD AND MATERIALS

The study was approved by the local ethics committee; written informed consent was obtained. Between July 2012 and February 2013 forty patients were examined between d4-d14 after kidney transplantation using a 1.5 T magnet. Echoplanar DTI (b=0,600 s/mm^2, 2D diffusion directions) and flow alternating inversion recovery (FAIR) trueFISP ASL sequences were acquired. Parameter maps of fractional anisotropy (FA) and renal perfusion were calculated. Serum creatinine was examined, and DGF was diagnosed by a nephrologist. Renal biopsy was available in 16/40 patients. Statistical analysis comprised unpaired t-tests for comparison of mean renal FA and perfusion values between patients with normal initial graft function and with DGF and correlation analysis of MRI parameters and serum creatinine.

RESULTS

DTI was and ASL by assessment of renal microstructure and perfusion enable detection of DGF and MRI parameters significantly correlate with renal allograft function. Thus, these techniques may be useful for risk stratification during the early post-transplantation period and may provide additional information to kidney biopsy.

CLINICAL RELEVANCE/APPLICATION

DTI and ASL can be used to non-invasively assess renal microstructure and perfusion and may help to early detect and characterize renal pathology associated with delayed renal allograft function.

SSQ10-05 • MR Renal Imaging Using a 3D T1-weighted Two-point Dixon Sequence at 3T : Is It an Efficient Alternative to Standard Fat Suppression Techniques?

Catherine Roy MD (Presenter) ; Philippe Host MD ; Guillaume Aleman MD ; Mickael Ohanna ; Herve Lang

PURPOSE

Standard fat suppression techniques such as 2D chemical shift (IP/OP) and spectral saturation sequences are a workhorse of renal MRI. However, they are vulnerable to field and RF inhomogeneities. A 3D two-point DIXON method delivers up to four contrasts in one measurement : IP/OP/water and fat images. The purpose was to assess whether DIXON can be an efficient alternative to standard techniques in terms of quality and examination time.

METHOD AND MATERIALS

158 patients referred for kidney MR examination (68 normal , 75 carcinomas, 15 angiomyolipomas) underwent on a 3T MR unit in addition to our routine protocol three axial T1w fat suppression techniques : Group A (spectral saturation FFE, 5 mm, 28 slices, 25 sec), Group B (2D chemical shift FFE, 5mm, 32 slices, two breathholds of 28 sec, IP/OP/Imágenes) and Group C (3D two-point Dixon, 1.8mm, 100 slices, 15s) with IP/OP/W/F images. Qualitative and quantitative analysis were performed by two readers independently. Criteria used for qualitative analysis were: fat suppression homogeneity and intensity, overall image quality and diagnosis confidence. For quantitative evaluation they used measurement of SNR between SI of kidney parenchyma and background noise by mean of an identical ROI. Tissue contrast was calculated between normal kidney and fat by using the equation [C=(A-B)/(A+B)].

RESULTS

On qualitative analysis, a statistically significant difference was found in overall image quality and fat suppression characteristics, with the DIXON (p=0.0009 for Group C against p=0.004 for Groups A and B). Both readers agreed that the degree of fat saturation was greater with Dixon without any displacement artifacts. Performances of the sole DIXON were excellent for the identification of tumoral process, fatty component as well as hemorrhetic part (sensitivity = 100%). For quantitative analysis, the SNR of kidney parenchyma was significantly superior with Dixon compared to corresponding information of Groups A and B. Calculated tissue contrast was significantly increased in Dixon for each corresponding image (0.85 vs 0.61 for Group A, 0.71 vs 0.55 and 0.48 vs 0.35 for Group B/OP, respectively).

CONCLUSION

The 3D Dixon achieved superior image quality and fat saturation in a shorter time with four informations. It can replace in daily routine standard fat suppression techniques.

CLINICAL RELEVANCE/APPLICATION

The 3D T1w Dixon technique can replace standard fat suppression techniques.

SSQ10-06 • ECG-triggered, Time-resolved Diffusion Weighted Imaging (DWI) of the Kidney: Assessment of Diffusion Parameters over the Entire Cardiac Cycle

Romet S Lanzman MD (Presenter) ; Philipp Heusch MD ; Julia Weller ; Anja Lutz ; Gerald Antoch MD * ; Hans-Joerg Wittsack PhD
PPURPOSE
The purpose of this study was to assess changes in renal diffusion properties over the entire cardiac cycle using ECG-gated, time-resolved diffusion-weighted imaging (DWI).

METHOD AND MATERIALS
Twenty-five cases were selected from the CRISP cohort. Ten each were Rapid Progressors (RP) or Slow Progressors (SP), measured by year 6 eGFR; the remaining five were Atypical Cases (AC) exhibiting large TKV but paradoxically slow progression. Analysis was conducted on T2-weighted SSFSE fat-suppressed data. TKV (via stereology) and expert manual tracings of kidneys and cysts were obtained using Analyze 11. Surfaces were calculated with marching cubes, and the CSA metric was obtained by removing cyst surface regions within a small tolerance of kidney surface. Both TKV and CSA metrics were log transformed (yielding lnTKV and lnCPSA) for correlation analysis.

RESULTS
Twelve nephrostomies in 10 patients (median age 64 yrs, range 29-91 yrs, 6 female and 4 male) were performed and reviewed. The causes of obstruction were ureteric calculus (n=3), ureteric stricture (n=2), malignancy (n=3), ureteric clot (n=1) and reflux (n=1). The renal pelvicalyceal system was visualized in both CEUS and fluoroscopic nephrostograms in 11/12 (92%) with one nephrostomy tube correctly identified by both methods as being misplaced. The entire renal pelvicalyceal system was visualized in 6/11 (55%) with a CEUS nephrostogram compared to 8/11 (73%) using traditional nephrostogram. Fluoroscopic nephrostogram showed drainage of contrast into the bladder in 10/11 (91%) cases compared to 9/11 (82%) using CEUS.

CONCLUSION
Preliminary results suggest that contrast enhanced ultrasound (CEUS) nephrostogram is a feasible method to confirm the correct positioning of the nephrostomy tube within the collecting system, to image the ureters and determine if there is satisfactory drainage into the bladder.

CLINICAL RELEVANCE/APPLICATION
CEUS nephrostogram is a suitable alternative for the traditional nephrostogram in children, patients with contraindication to iodinated contrast or if the procedure has to be performed at the bed side.
To address compliance requirements and ensure the quality and consistency of non-routine communication for critical results in our department, we sought to implemented, meets the regulatory requirements of the Joint Commission.

**CONCLUSION**

We developed a multimedia structured reporting system, called ViSion, which is capable of automatically translating radiology reports to any language and coding reports for billing and data mining.

**Evaluation**

We developed a multimedia structured reporting solution, called ViSion, which allows a radiologist to capture key images, tag those images with metadata describing anatomical locations and radiological observations/diagnoses, and assemble a multimedia structured report with image findings organized by anatomical categories. The metadata used to tag image findings has been developed and maintained with an integrated ontology authoring tool. The anatomical terms in the ViSion ontology are organized in a hierarchy for each body section, and each anatomical term in this structure is associated with a pathology tree containing radiologic observations and diagnoses for that anatomical site. The pairing of an anatomy location with a radiologic observation comprises a specific diagnosis. Each diagnosis can be further described with secondary characteristics that provide granular detail. This ViSion ontology and its tree structures were assembled in English, but the ontology has been translated to multiple foreign languages including Chinese and Arabic. Furthermore, all of the diagnoses contained in the ViSion ontology have been cross-referenced to other standardized medical ontologies (e.g., RadLex, SNOMED, ICD-10-CM) to facilitate data mining and electronic billing operations.

**Discussion**

The ViSion ontology has been created and is maintained by an authoring tool integrated with the system. The ontology currently consists of 918 anatomy terms and 1424 pathology terms that combined form 12,046 unique observations/diagnoses. Each of the terms has been translated to foreign languages and cross-referenced to other standardized ontologies.

**CONCLUSION**

Structured radiology reports are more complete and more effective than unstructured reports.

**Background**

Radiology report completeness and effectiveness are important aspects of quality. Unstructured reporting involves dictating in a free-text manner, customizing content to each case. Structured reporting aims to standardize format and lexicon, which may increase completeness and/or effectiveness. Structured reporting may improve the communication of findings made, and may also improve the nature of exam interpretation itself. The goal of this study was to compare unstructured and structured chest radiograph reports, in terms of their completeness and effectiveness.

**Evaluation**

This study was approved by the institutional review board. Following an educational lecture on the background of structured reporting, radiology trainees were provided with a chest radiograph structured reporting template. For each of the twelve trainees who completed the study, five randomly selected unstructured and five randomly selected structured chest radiograph reports were independently scored by four blinded physicians raters. Structured reports were rated to be more complete than unstructured reports, on a 5-point scale (mean 4.42, SD 0.24 versus 3.99, SD 0.35, p < 0.05).

**Discussion**

This study blindly compared 60 unstructured to 60 structured chest radiograph reports, in terms of their completeness and effectiveness. Structured reports were found to be more complete and more effective, as well of overall higher quality. The use of structured reports may improve the communication of findings perceived by the radiologist. The use of structured reporting templates may also improve exam interpretation, converting it from a largely intuitive process, to one that is cognitively more rational.

**CONCLUSION**

We have created and deployed a tool to integrate critical results auditing into the peer review efforts in our large, academic department. The process, as implemented, meets the regulatory requirements of the Joint Commission.

**Background**

To address compliance requirements and ensure the quality and consistency of non-routine communication for critical results in our department, we sought to integrate critical results auditing into our department’s on-going process of peer review. We created and deployed add-ons to the COGR software tool to seamlessly integrate routine critical results auditing.
Our departmental peer review process, known as consensus oriented group review (COGR), involves groups of radiologists regularly meeting to review randomly selected cases and record consensus on the acceptability of the issued report, supported by a software tool. The COGR software tool accesses data from the department's radiology information system (Centricity, GE Healthcare) and PACS workstations (Impax; AGFA Healthcare). We extended the COGR software tool to integrate additional case-specific questions regarding critical results reporting including, whether a critical result was present in the report and, if so, whether institutional guidelines for critical results communication were followed. Department administrators are able to generate automated reports to document compliance with critical results auditing requirements as needed.

SSQ11-06 • Application of ViSion Structured Reporting for C-RADS Reporting of CT Colonography Examinations

David J Vining MD (Presenter) *; Thomas Yang MD; Usama I Salem MBCh, MSC; Andreea Pitici *; Cristian Popovici *; Adrian Prisacariu *; Iulian Aghenitei *; Mihai Jurca; Radu Rosu *

CONCLUSION
The practice of radiology is undergoing a transition from narrative reporting to structured reporting. We have developed a unique structured reporting solution that has been modified for use in reporting CTC examinations. A benefit of structured data output is that it can facilitate data entry into national data registries such as the ACR’s CTC Data Registry.

BACKGROUND
Standardized reporting of CT Colonography (CTC) results is essential for the effective communication of diagnostic results and to support the American College of Radiology’s (ACR) CTC Data Registry. Various image display and manipulation systems exist for analyzing CTC image data, but apart from coding the results of these examinations with C-RADS criteria, no standardized reporting method exists today. We present a multimedia structured reporting solution, called ViSion, which it is applicable to CTC and can be used to facilitate data entry into the ACR’s CTC Data Registry.

EVALUATION
We developed a multimedia structured reporting solution, called ViSion, which performs screen captures from any CTC image processing and tags those key images with metadata describing anatomical locations, radiologic observations, and disease metrics. The ViSion software runs in parallel with the CTC program to perform screen captures of the 3D rendered images and to record the radiologist’s voice descriptions of the image findings. The screen capture and voice data are uploaded to a cloud database server where it was processed to extract metadata from the voice descriptions to tag the key images in a database. The ViSion system organizes the findings onto a graphic of a patient illustrating where particularly lesions were found in relation to the patient’s anatomy. We have modified the output of the ViSion reporting system to facilitate the automatic uploading of structured data into the ACR’s CTC Data Registry.

DISCUSSION
We applied the use of ViSion to 75 CTC cases performed at our institution to generate structured reports that were then used to upload data into the ACR’s CTC Data Registry.

SSQ11-07 • Measuring How Perceived Meanings of Uncertainty Cues Differ with and without Sentence-level Context in Radiology Reports

Brian E Chapman PhD (Presenter) ; James Y Chen MD *; Asako Miyakoshi MD; Wendy Chapman PhD; Amincare Gentili MD

CONCLUSION
Showing radiologists the cues in context did not significantly change their probability assignments, overall. However, assertion cues changed more than negation cues. Evaluating probability assignments for lexical assertion, negation, and uncertainty cues may not require displaying the cues in context.

BACKGROUND
Understanding how uncertainty is expressed in radiology reports is a critical task for natural language processing applications. pCyConTextNLP is a natural language processing (NLP) package that uses predefined cues to determine whether a finding is negated, asserted, or uncertain. We measured how radiologists understanding of these cues differed when presented without context and with sentence-level context.

EVALUATION
We created a set of 241 linguistic cues from pCyConTextNLP and from translations from a Swedish corpus. Sentences containing the cues were identified in a separate corpus of 4727 de-identified CTPA reports. Focusing on the Impression section, we randomly selected up to five sentences containing the cue, resulting in 321 sentences containing cues modifying findings. Three radiologist assigned the probability of the finding’s existence based on the sentence. The radiologists had previously provided probabilities (single-point and ranges) for each cue isolated from contextual information. We measured inter-radiologist discordance scores between contextual and non-contextual probability assignments and between single-point probabilities and probability ranges.

DISCUSSION
There was an insignificant positive shift of 0.024 in probabilities when viewed in context (paired t-test, p=0.35). Cues that showed high disagreement among radiologists had previously provided probabilities (single-point and ranges) for each cue isolated from contextual information. We measured inter-radiologist discordance scores between contextual and non-contextual probability assignments and between single-point probabilities and probability ranges.

SSQ11-08 • Rapid Creation of a Structured and Itemized Radiology Report from a Brief and Disorganized Dictation

John Stewart MD (Presenter)

PURPOSE
To automatically convert a brief, disorganized radiology report into a high quality structured and itemized radiology report. This reduces dictation time while allowing the radiologist to focus their attention on the images under review rather than on the text of the dictation.

METHOD AND MATERIALS
A very brief header is inserted at the top of the dictation. The radiologist then dictates a report which consists of only pertinent positive and pertinent negative findings. Each finding is placed on a line by itself to aid in report processing. The order of the findings is not important. The use of macros is allowed but not required. No negative findings are dictated unless they are pertinent negative findings. The radiologist uses two simple keywords while dictating. If no keyword is inserted at the end of a finding, the finding is considered incidental and not included in the impression. Otherwise the finding is either copied into the impression or new text is dictated for the impression which pertains to this finding. In this way, the finding section and impression section are created.

RESULTS
The ratio of dictated text to the text present in the final report (D/R ratio) is less than 50% for most reports. For reports with few or no pertinent findings the D/R ratio is less than 10%. This reduces dictation effort and increases report quality through the creation of standardized and itemized reports.

CONCLUSION
The software described significantly increases radiologist efficiency and report quality and is compatible with almost any speech recognition or word processing application.

CLINICAL RELEVANCE/APPLICATION
High quality standardized and itemized reports can be created without decreasing radiologist efficiency or distracting them from the review of images.

SSQ11-09 • Radiologic Measurement Dictation and Transcription Error Rates in RECIST (Response Evaluation Criteria In Solid Tumors) Clinical Trials: A Limitation of the Radiology Narrative Report to Accurately Communicate Quantitative Data

Merlijn Sevenster PhD *; Paul J Chang MD (Presenter) *; Jeffrey Bozeman BA; Andrea Cowhy BS; Joost Peters MD; Adam R Travis MD; Will Trotz BA; Lauren Wall MS

PURPOSE
Image-based tumor measurements are generally performed by radiologists and reported using dictation software into a narrative report. At many institutions, lesion measurements are then manually transcribed by oncology personnel into worksheets that are used to compute treatment response. We aim to quantify measurement dictation and transcription error rates and the extent to which such errors impact treatment response computation.
Neither cell viability nor activity were affected by TmDOTMA labeling. Fluorescence microscopy showed an intracellular uptake of the complex. MR spectroscopy (LA-ICP-MS) were performed for correlation with the MR data.

On day 8, PAG-pellets, livers and spleens were explanted. Selective macrophage staining (MAC 3) and laser ablation were used to induce inflammation. MR spectroscopy determined labeling efficiency. MR imaging and histological examination were used to confirm uptake of TmDOTMA labeled cells.

**RESULTS**

The aim was to determine metabolic activity of brown adipose tissue (BAT) with MRI at 7T using radioactively labeled superparamagnetic iron oxide nanoparticles (SPIO) embedded into the lipoprotein layer for visualization of lipoprotein distribution and BAT metabolism after intravenous (iv) and intraperitoneal (ip) injection.

The method and materials section described the experimental setup, including the use of radioactively labeled SPIOs for BAT imaging.

**CONCLUSION**

CEST imaging revealed alterations in finger cartilage of RA patients compared to healthy controls in the absence of cartilage thinning. The decreased CEST effect of the cartilage was measured with the glycosaminoglycan saturation transfer \[ST = CEST (+1.3 \text{ ppm}) – CEST (-1.3 \text{ ppm})/CEST (+1.3 \text{ ppm})\].

**CLINICAL RELEVANCE/APPLICATION**

Biochemical imaging with gagCEST of cartilage composition is feasible at finger joints in RA.

**RESULTS**

Cartilage ST values were significantly lower in patients compared to healthy volunteers (13.58 ± 6.11 vs. 27.38 ± 4.52; p=0.011). Cartilage CEST curves showed a decrease of CEST effect between 1.2 and 2.2 ppm, which corresponds to the resonance frequency of hydroxyl protons of glycosaminoglycans. There was no significant difference in JSW between healthy volunteers and RA patients.

**CONCLUSION**

CEST imaging revealed alterations in finger cartilage of RA patients compared to healthy controls in the absence of cartilage thinning. The decreased CEST effect in the spectral range of glycosaminoglycan resonances points towards depletion of glycosaminoglycans in RA.

**CLINICAL RELEVANCE/APPLICATION**

Biochemical imaging with gagCEST of cartilage composition is feasible at finger joints in RA.

**RESULTS**

The aim was to determine metabolic activity of brown adipose tissue (BAT) with MRI at 7T using radioactively labeled superparamagnetic iron oxide nanoparticles (SPIO) embedded into the lipoprotein layer for visualization of lipoprotein distribution and BAT metabolism after intravenous (iv) and intraperitoneal (ip) injection.

The method and materials section described the experimental setup, including the use of radioactively labeled SPIOs for BAT imaging.

**CONCLUSION**

CEST imaging revealed alterations in finger cartilage of RA patients compared to healthy controls in the absence of cartilage thinning. The decreased CEST effect of the cartilage was measured with the glycosaminoglycan saturation transfer \[ST = CEST (+1.3 \text{ ppm}) – CEST (-1.3 \text{ ppm})/CEST (+1.3 \text{ ppm})\].

**CLINICAL RELEVANCE/APPLICATION**

Biochemical imaging with gagCEST of cartilage composition is feasible at finger joints in RA.

**RESULTS**

Cartilage ST values were significantly lower in patients compared to healthy volunteers (13.58 ± 6.11 vs. 27.38 ± 4.52; p=0.011). Cartilage CEST curves showed a decrease of CEST effect between 1.2 and 2.2 ppm, which corresponds to the resonance frequency of hydroxyl protons of glycosaminoglycans. There was no significant difference in JSW between healthy volunteers and RA patients.

**CONCLUSION**

CEST imaging revealed alterations in finger cartilage of RA patients compared to healthy controls in the absence of cartilage thinning. The decreased CEST effect in the spectral range of glycosaminoglycan resonances points towards depletion of glycosaminoglycans in RA.

**CLINICAL RELEVANCE/APPLICATION**

Biochemical imaging with gagCEST of cartilage composition is feasible at finger joints in RA.
SSQ12-04 • In Vivo Ultrasound Imaging of Pancreatic Islets
Jose L Paredes MD (Presenter); George Gittes; Jiamjung Wang; Floriella Villanueva

**PURPOSE**
Imaging and quantifying pancreatic islets in vivo could revolutionize the treatment of diabetes mellitus. Currently, insulin levels and hemoglobin A1C are our main methods for determining beta cell mass in diabetic patients. These insensitive measures are grossly inadequate for proper guidance of therapy. An office-based, non-invasive method for determining islet mass serially in diabetics has long been sought-after, but with no success. Here we show that a sub-harmonic ultrasound probe, in conjunction with microbubble intravenous contrast, allows islets visualization in the mouse pancreas based on the increased blood flow compared to surrounding pancreatic tissue.

**METHOD AND MATERIALS**

**RESULTS**
The subharmonic ultrasound visualization rendered clearly delineated large blood vessels of the scanned region in the pancreas. We were also able to identify discrete, three-dimensional hyper-perfused areas that were of the size, number, and distribution of islets. To validate that these hyperperfused areas were indeed islets, we scanned the pancreas of transgenic mice that express GFP under the mouse insulin promoter

**CONCLUSION**
Using a mouse model, we now have strong evidence to show the potential feasibility of using ultrasound combined with intravenous administration of microbubbles to visualize and quantify islet mass.

**CLINICAL RELEVANCE/APPLICATION**
Imaging and quantifying pancreatic islets in vivo could revolutionize the treatment of diabetes mellitus.

SSQ12-05 • Automated Analysis of Metastatic Involvement in Bone Using Anatomical and Functional Information from FDG PET/CT Images
Omer Demirkaya (Presenter); Abdulaziz Alsugair MD; Mohied M Abouzied MD

**PURPOSE**
Although overall incidence of bone metastasis is not known, over half of people who die of cancer in the US each year are thought to have bone involvement. In this study we developed a method to quantify the metabolic and anatomic changes induced by bone metastases in cancer patients using PET/CT images. The quantitative parameters along with the structural changes seen by CT bone window may serve as a useful tool in assessing the response of bone metastases to therapy.

**METHOD AND MATERIALS**

**RESULTS**
Seventy three patients with no prior history of chemo or radiotherapy who had bone metastases documented by PET/CT (Discovery ST, GE) and other conventional imaging modalities were selected for the study. PET/CT images were resampled to the same pixel size. Then the bone structure was segmented using a threshold of 150 HU. After the segmentation, the 50% of the maximum SUV within the bone mask was used to identify bone lesions in each slice. Using the ROIs defined at 70% of the max, the lesion characteristics including the mean HUs were computed from the PET/CT images. The lesions were subjected to the visual confirmation by an experienced PETCT physician who also categorized them based on the appearances in the CT bone window as lytic, sclerotic, mixed, or no-change type. The lesion characteristics were compared using statistical methods.

**CONCLUSION**
The quantitative method for analysis of bone metastases may serve as a useful tool in monitoring and assessing therapy response.

**CLINICAL RELEVANCE/APPLICATION**
A quantitative method provides a convenient way to analyze the functional and structural characteristics of bone lesions and may serve as a useful tool for assessing the response to therapy.

SSQ12-06 • A Dual Isotope Hybrid ?CT-PET System Reveals Functional Heterogeneity of Bone Lining Cells and Longitudinal Changes in Marrow from Local Radiation and Chemotherapy
Masashi Yagi (Presenter); Luke Aretsen BS, ARRT; Yutaka Takahashi PhD; Leslie Sharkey; Masahiko Koizumi MD, PhD; Cory Xian; Clifford J Rosen; Douglas Yee MD; Jerry W Froelich MD; Susanta K Hui PhD

**PURPOSE**
We report the skeletal and marrow response to clinically relevant local radiation and chemotherapy using ?CT-PET and reveal a potentially important role for bone lining cells in mediating the skeletal response to local and systemic injury.

**METHOD AND MATERIALS**
Mice were given systemic methotrexate (MTX, 2.5mg/kg, 3 days) or 16Gy local radiation to legs. Longitudinal FDG (days -4, 2) and NaF (days -3, 3, 7, 14, 29) ?CT-PET scans were performed. Eight skeletal regions were monitored. Distal femora were harvested for cellular histology.

**RESULTS**
We observed significant functional heterogeneity throughout the skeleton for bone mineral remodeling as measured by NaF.

**CONCLUSION**
Dual isotope ?CT-PET revealed functional heterogeneity of the skeleton in response to local radiation or chemotherapy. These studies demonstrate an important role for bone lining cells in mediating the skeletal and possibly the marrow response to injury. This methodology also establishes a translational model for studying the skeletal health of cancer survivors.

**CLINICAL RELEVANCE/APPLICATION**
Dual isotope ?CT-PET revealed functional heterogeneity of the skeleton in response to radiation or chemotherapy and establishes a translational model to study the skeletal health of cancer survivors.

SSQ12-07 • Direct Water Proton Saturation (DWS) Imaging of Prostate Cancer
Guang Jia PhD (Presenter); Saba N Elias MSc; Wenbo Wei; Daniel J Clark MSC; Jinyuan Zhou PhD; Michael V Knopp MD, PhD

**PURPOSE**
Conventional magnetization transfer (MT) can be used to study the interaction of free water protons to macromolecular protons in the prostate. However, MT only shows weak contrast between prostate cancer and benign regions due to a large frequency offset. Direct water proton saturation (DWS) may provide a stronger contrast by applying a smaller frequency offset. This study is to evaluate DWS imaging for prostate cancer detection.

**METHOD AND MATERIALS**
A total of 20 patients with prostate cancer were prospectively enrolled in this sub-study. All patients were imaged on a 3 Tesla MR system (Achieva, Philips Healthcare). DWS imaging was based on single-slice single-shot TSE sequence. The saturation pre-pulse was composed of a train of sixteen block pulses, each with a pulse length of 31 ms and a flip angle of 720° to 1800°. The single slice image was acquired with saturation pre-pulse at 33 different frequencies (8 to -8 ppm with an interval of 0.5 ppm) and the scan time was 3 min. Magnetization transfer ratio (MTR) at 8 ppm was calculated on tumor regions, non-cancerous peripheral zone, and central gland at four different saturation pre-pulse powers (1.6, 2.4, 3.2, and 4.0 µT). Student t-test was used to compare MTR(8ppm) in the histology identified tumor region and non-cancerous regions.
RESULTS
The measured MTR at 8 ppm in prostate cancer was 10.2% ± 0.6% at 1.6 μT, 20.7% ± 1.9% at 2.4 μT, 29.0% ± 3.0% at 3.2 μT, and 37.2% ± 3.6% at 4 μT, indicating a linear relationship between MTR(8ppm) and the saturation pre-pulse power. Non-cancerous peripheral zone showed significantly smaller MTR(8ppm) at all four powers (7.3% ± 2.3% at 1.6 μT, 14.7% ± 2.9% at 2.4 μT, 21.4% ± 4.7% at 3.2 μT, and 28.2% ± 5.6% at 4 μT, P < 0.01).

Non-cancerous central gland exhibited similar MTR(8ppm) values to prostate cancer regions (11.1% ± 2.2% at 1.6 μT, 20.1% ± 2.0% at 2.4 μT, 28.9% ± 2.0% at 3.2 μT, and 37.1% ± 4.9% at 4 μT, P > 0.05).

CONCLUSION
Direct water proton saturation imaging can generate a contrast that is different from T1 or T2 contrast. Malignant tumors consistently reveal higher MTR(8ppm) due to increased magnetization transfer and direct water saturation effects. By optimizing the saturation pre-pulse power and frequency offset, image contrast in the prostate can be substantially enhanced.

CLINICAL RELEVANCE/APPLICATION
The DWS-MRI approach has the potential to improve imaging of cancerous tissue within organs such as the prostate by better tissue contrast.

SSQ12-08 • Enhanced Delineation of Primary Pancreatic Adenocarcinoma Following Neoadjuvant Therapy Using -Ferumoxytol: Preliminary Findings with Histopathologic Correlation
Sandeep S Hedgire MD (Presenter) ; Mari Mino Kenudson MD ; Carlos Fernandez-Del Castillo MD ; Sarah Thayer ; Ralph Weissleder MD, PhD ; Mukesh G Harisinghani MD

PURPOSE
To evaluate role of MRI with ferumoxytol in delineating primary tumor in pancreatic adenocarcinoma patients undergoing preoperative neoadjuvant therapy.

METHOD AND MATERIALS
In institutional review board approved, HIPPA compliant prospective study, 10 patients with biopsy proven pancreatic adenocarcinoma were enrolled with the primary intention of detecting lymph node metastasis following administration of ferumoxytol. MRI scans were performed at baseline, immediate post and at 48 hrs time points with quantitative T2* sequences using single shot, monopolar, multiecho gradient echo (TE = 4.8–24.8, TR = 169 ms, thickness = 4 mm).

The patients were categorized into those who received preoperative neoadjuvant therapy (group A) and those who did not (group B). The T2* of primary pancreatic tumor and adjacent parenchyma was recorded at 48 hrs time point in both groups and the difference between T2* values was calculated. After Whipple surgery, the primary tumors were assessed histopathologically for fibrosis and inflammation.

RESULTS
Five of the 10 (50%) patients had presurgical neoadjuvant therapy. The mean T2* of tumor and adjacent parenchyma was 48 hrs in group A were 22.11 ms and 16.34 ms respectively. In group B, these values were 23.96 ms for tumor and 23.26 ms for adjacent parenchyma. The T2* difference between the tumor and adjacent parenchyma in group A was more pronounced compared to group B. Histopathologic evaluation showed prominent fibrosis with scattered residual tumor glands with therapeutic effects, and a rim of dense fibrosis with atrophic acini at the periphery in the lesion in the group A. Conversely, intact tumor cells/glands were present at the periphery of the tumor in the group B.

CONCLUSION
Ferumoxytol may have potential application in depicting post neoadjuvant therapy induced fibrosis (especially at the periphery of the tumor) and thereby improving the ability for precise delineation of tumor margins.

CLINICAL RELEVANCE/APPLICATION
Indistinct tumor margin poses a challenge to the surgeon. MRI with ferumoxytol may be used for better delineation of the pancreatic cancer thereby affecting surgical planning and overall prognosis.

SSQ12-09 • Quantification of ADC and SUV Values in Tumors and Lymph Node Metastases of Patients with Cervical Carcinoma in a Simultaneous PET-MRI System
Philipp Brandmaier MD (Presenter) ; Sandra Purz MD ; Martin Reinhardt MD ; Henryk Barthel ; Osama Sabri MD ; Thomas K Kahn MD ; Patrick Stumpff MD, PhD

PURPOSE
Previous studies have shown discrepancies between standard uptake value (SUV) and apparent diffusion coefficient (ADC) parameters of different tumor entities with non simultaneous measurements on examination modalities such as PET-CT and MRI. The objective of this study was the quantitative evaluation of SUV and ADC values in patients with primary and recurrent cervical cancer and suspicious lymph nodes in a simultaneous PET-MRI system to exactly deteriorate an expectable correlation.

METHOD AND MATERIALS
We included 15 patients with histologically confirmed cervical carcinoma and lymph node metastases (total of 38 lesions; primary tumor n= 14; positive lymph nodes n=24) who all underwent a simultaneous whole body 18F-fluorodeoxyglucose (FDG) PET-MRI (T2-HASTE, TIRM, EPI-DWI with b values of 0 and 800 mm²/s) including a dedicated pelvic examination (EPI-DWI with b values of 0,50,400,800 mm²/s, T2 - TSE , T1-weighted TSE native and post-contrast ± fat suppression). Reader defined volume-of-interest (VOI; 0.2-0.5 mm³) for ADC and SUV were placed in suspicious tumor lesions and FDG-positive lymph nodes (short axis diameter > 5mm) in regions with maximum FDG-uptake. ADCmin, ADCmean, relative ADC value (ratio of ADCmean / ADCreference tissue) and SUVmean were calculated with the M.glutaeus maximus serving as reference tissue. Evaluation was performed by simultaneous analysis of specific lesions on a dedicated workstation (syngo.via, Siemens Medical Solutions ®, Erlangen, Germany). A value of 1.5 was defined as cut off in order to differentiate malignant from non-malignant lesions.

RESULTS
Local tumor lesions and lymph nodes showed average SUVmean values of 12.7 (SE ± 1.63), respectively 9.4 (SE ± 1.59); corresponding ADCmean averaged amounted to 1.020 x 10-3 mm²/s² (SE ± 0.104) and 1.094 x 10-3 mm²/s² (SE ± 0.12). A significant difference to reference tissue (SUV 0.72 ± 0.17, SE, ADC 1.58 ± 0.12 SE) was seen.

CONCLUSION
The present work demonstrates the ability of acquisition of quantitative parameters (ADC and SUV) in a simultaneous PET-MRI system. Values of ADC and SUV in tumor tissue apparently show an opposite behaviour to ADC and SUV values in non-tumor tissue.

CLINICAL RELEVANCE/APPLICATION
Simultaneous quantification of SUV and ADC parameters in PET-MRI show an opposite behaviour which might be useful for evaluation of therapy response and effective tumor grading.
RESULTS
There were 18 females and 32 males. Age range of the patients was 41 to 88 (average 61). In the MM group 6 patients had very prominent and 16 patients had moderately prominent bone marrow vascularity. Two MM patients had no appreciable marrow vascularity whereas 26 of patients had subtle vascularity. Four MM patients had completely fatty marrow and the remaining 46 had mild to moderate background of red marrow. In the control group, there were no patients with very prominent or moderately prominent bone marrow vascularity. Eight cases in the control group had no marrow vascularity visualized and 42 patients had subtle vascularity seen. Six patients in the control group had completely fatty marrow and the remaining 44 had mild areas of red marrow.

CONCLUSION
Prominent bone marrow vessels are evident on MRI in patients with known MM corresponding to this well known historically well established finding.

CLINICAL RELEVANCE/APPLICATION
In patients with an established diagnosis of MM, large marrow vessels should not be mistaken for lesions of myeloma. In the patient without known MM, the observation of large vessels in elderly patients

SSQ13-02 • Vertebral Body Enhancement in Patients with Central Venous Obstruction
Debbie L Bennett MD (Presenter) ; Frank J Simeone MD

PURPOSE
There have been isolated case reports of vertebral body marrow enhancement on contrast-enhanced CT imaging in patients with central venous obstruction. Recognition of this phenomenon is important as these regions of enhancement can be confused with sclerotic metastatic disease. The purpose of this project is to determine the incidence of marrow enhancement in patients with central venous obstruction, as we hypothesize that this is an under-recognized phenomenon. Additionally, this project identifies various patterns of enhancement that can be seen in central venous obstruction.

METHOD AND MATERIALS
Using a departmental radiology report searching program, all chest CTs performed between 1/1/2000 and 12/15/2012 which mentioned the terms 'SVC obstruction', 'SVC syndrome', 'superior vena cava obstruction', 'superior vena cava syndrome', 'venous obstruction', or 'central venous obstruction' were identified. Each CT was reviewed by consensus to determine whether central venous obstruction was present. Of the cases with central venous obstruction, the vertebral bodies were evaluated for the presence or absence of marrow enhancement. When vertebral marrow enhancement was present, the levels involved, portion of the vertebral body involved, and pattern of enhancement were recorded.

RESULTS
There were 357 chest CT reports which mentioned central venous obstruction; of these, 53 (15%) were found to have central venous obstruction. Of the 53 patients with central venous obstruction, 25 (47%) demonstrated vertebral body enhancement. The enhancement was classified as either linear (n=9, 17%), nodular (n=9, 17%) or both (n=7, 13%). Five cases (9%) of vertebral body enhancement were reported as metastasis or concerning for metastasis.

CONCLUSION
Vertebral body marrow enhancement can be seen in patients with central venous obstruction. Two distinct patterns of marrow enhancement were identified: linear and nodular. Nodular enhancement was at times confused with metastatic disease, a misinterpretation which could result in incorrect staging of known malignancies or unnecessary procedures in patients without known malignancy. Marrow enhancement should be considered when interpreting studies with central venous obstruction.

CLINICAL RELEVANCE/APPLICATION
Patients with central venous obstruction may demonstrate cervical and/or thoracic vertebral body enhancement in a pattern which can be confused for sclerotic osseous lesions.

SSQ13-03 • Single Bony Abnormality on Spine MRI of Cancer Patients during F-up: Metastasis or Not?
Seun Ah Lee MD (Presenter) ; Min Hee Lee MD ; Sang Hoon Lee ; Hye Won Chung MD ; Myung Jin Shin MD

PURPOSE
To evaluate single focal bony abnormalities found on spine MRI of cancer patients during F-up in order to establish diagnosis of metastasis.

METHOD AND MATERIALS
After scanning a database for patients who were diagnosed with primary cancer and received spine MRI for detecting metastasis during F-up from 2000 to 2013, 358 patients with bony lesions were identified. Those with more than two bony lesions and with unavailable pathological confirmation were excluded. Finally, 46 patients with a single, focal bony abnormality seen on spine MRI and pathologically proven, were included. The primary cancer was from lung (15), GI tract (8), HCC (4), kidney (4), bladder (3), cervix (2), lymphoma (1), osteosarcoma (1), MPNST (1), and bile duct (1), thyroid (1), osteosarcoma (1), MPNST (1), and bile duct (1), thyroid (1). Most common lesions were lung (15), liver (8), kidney (4), bladder (3), cervix (2), lymphoma (1), osteosarcoma (1), MPNST (1), and bile duct (1), thyroid (1), osteosarcoma (1), MPNST (1), and bile duct (1), thyroid (1).

RESULTS
Of 46 bony lesions, metastasis (mets) was 27 (58.7%) cases. Non-metastasis was 19 (41.3%) including no tumor present, suggesting non-metastasis, 12, hematopoietic bone marrow (4), infection (1), radiation osteitis (1), inadequate tissue (1). On MR, margin was ill-defined in 6 (mets:1, non-mets:5), well-defined in 25 (mets:26, non-mets:14). Compared with hematopoietic marrow, ill-defined margin was found in all (4/4) hematopoietic marrow and only one (1/27) in mets, showing significant difference (p < 0.05).

CONCLUSION
When a single, focal bony abnormality was detected on spine MRI of cancer patients during F-up, incidence of metastasis was greater than half, but not as high as expected. Although most MR findings may not be characteristic, margin of lesions can aid in differentiating metastasis from focal hematopoietic bone marrow.

CLINICAL RELEVANCE/APPLICATION
When a single, focal bony abnormality was detected on spine MRI of cancer patients during F-up, incidence of metastasis was greater than half, but not as high as had been expected.

SSQ13-04 • Evaluation of Lumbar Vertebral Body Using IDEAL MRI and Micro CT
Won C Bae PhD (Presenter) ; Reni Biswas ; Mark Bydder PhD * ; Koichi Masuda MD * ; Jiang Du PhD ; Christine B Chung MD ; Eric Y Chang MD ; Prema S Karunanithi

PURPOSE
To perform quantitative IDEAL MR imaging of fat content in cadaveric vertebral body of the lumbar spine and to compare the measures against reference standards of fat content as well as trabecular bone structures using micro CT analysis.

METHOD AND MATERIALS
Cadaveric lumbar spines (Fig.A) of 17 donors (14 male 3 female, 29 yr and female 20 yr) were imaged using General Electric IDEAL 3D spoiled gradient echo sequence (TR 19-22,2 cm, slice thickness 5 mm, TR = 11.08 ms, TR=1.23 to 6.07 ms, ETL=3, matrix=256x256, scan time=5 min). Fat fraction maps (Fig.B) were obtained after console-based reconstruction. Axial slices of vertebral body (Fig.C) were divided and analyzed using histology and biochemistry for fat content, and micro CT (Fig.D; 18 um isotropic) for trabecular structure using BoneJ. Correlation analyses were performed.

RESULTS
IDEAL fat fractions correlated significantly with histologic fat content (R²=0.30, P=0.0005) and strongly with biochemical fat content (R²=0.59, P=6x10^-8). In addition, fat fraction correlated significantly with (Fig.E) connectivity density (number of trabeculae per volume; R²=0.38, P=0.0001) as well as (Fig.F) trabecular spacing (R²=0.14, P=0.046), but not with trabecular thickness or bone volume fraction (Fig.G). These results were evident in representative 3D models (Fig.D), the sample with higher fat fraction (right) exhibited lower connectivity and higher spacing between trabeculae than the sample with lower fat fraction.

CONCLUSION
While evaluation of fat content in bone marrow has obvious applications in the field of radiation oncology, its utility for musculoskeletal diseases such as degenerative disc disease is less realized. The present results suggests that (chronic) changes in fat content in the marrow may be associated with changes in structure of trabecular bone, even without obvious bone loss. Better understanding of relationship between marrow fat and trabecular structure, as well as adjacent disc changes, may shed a light on pathogenesis of disc degeneration.

CLINICAL RELEVANCE/APPLICATION
The IDEAL MR technique provides an accurate means of evaluating fat content in vivo. In addition, vertebral body fatty changes may provide additional information for trabecular changes.

SSQ13-05 • Ultrashort Time-to-Echo MRI of Cartilaginous Endplates of Human Lumbar Spines In Vivo: A Feasibility Study
Won C Bae PhD (Presenter) ; Prema S Karunanithi ; Richard Znamirovski ; Sheronda Statum ; Jiang Du PhD ; Christine B Chung MD

PAGE 62 OF 171
RESULTS

In conventional T2-weighted FSE images, the nucleus pulposus (NP; Figure A, square) was seen with homogeneous high signal intensity as expected in healthy human subjects. However, the region of the CEP (Figure A, arrows) exhibited low signal intensity and could not be evaluated directly. In contrast, UTE MR image clearly showed the region with high linear signal intensity (Figure B, arrows). Our previous study on cadaveric spines (Figure C), comparing conventional MRI (Figure C-I) and histology (Figure C-II to -v), suggested that this UTE MR signal intensity is due to the presence of the CEP (thick uncalcified and thin calcified layers), but not the disc proper or subchondral bone. In addition, UTE MRI is able to show abnormal morphology of the CEP (Figure D-II), invisible in conventional images (Figure D-I).

CONCLUSION

Abnormal changes in histologic morphology and composition of the CEP have been found in ageing IVD and certain pathology such as scoliosis. It has been difficult to evaluate the CEP adequately using MRI, due to intrinsically short T2 value of the tissue. Along with recent validation study, the present study suggests clinical feasibility of UTE MR evaluation of the CEP in vivo. Additional studies may elucidate relationship between CEP changes and disc degeneration, and back pain.

CLINICAL RELEVANCE/APPLICATION

The UTE MR technique provides sensitive and direct means of evaluating the CEP in vivo. It may be useful for early detection of CEP pathology, and understanding of pathogenesis of disc degeneration.

SSQ13-06 • Standing MRI Exaggerates the Degree of Lumbar Stenosis but Does Not Improve Correlation with Patient Symptoms

Ka Lok Lee MBChB (Presenter); James Griffith; Yvonne Lau; Defeng Wang; Shi Lin L; Alex Ng

Purpose

Only modest correlation exists between patient symptoms and supine MRI findings in lumbar degenerative disease. This study investigates whether upright MRI in the standing position improves correlation with patient symptomatology.

Method and Materials

Prospective study performed between January 2012 and March 2013. 49 patients (M:F=35:14, mean age of 58.2±9.2) with clinically diagnosed lumbar spinal stenosis were examined by low field 0.25T MRI (G-Sscan, Esaote, Italy) in the supine and standing positions. Morphological changes including dural sac cross-sectional area (DSCA), grading (0-4) of lateral recess and foraminal stenosis at L3/4, L4/5 and L5/S1 levels were measured in the two positions and compared. Severity of clinical symptoms (including symptom duration, walking tolerance, walking distance, Visual Analogue Score of lumbar and lower limb pain, Oswestry Disability Index and SF-16) was assessed and correlated with MRI findings.

Results

Dural sac cross-sectional area (mm2) was significantly lower in the standing (L3/4: 101.7 vs 142.2, p = 0.04; L4/5: 72.3: vs 108.2, p = 0.04; L5/S1: 54.6 vs 79.4, p=0.04). The degree of lateral recess and foraminal stenosis was greater in the standing in supine (p: 0.23 to 0.42). Inter- and intra-rater agreement for dural sac cross-sectional area and grading stenosis were substantial (r: 0.61 – 0.73). Overall there was still only poor to mild correlation (r: 0.12 – 0.38) between clinical symptoms and MRI morphological changes.

Conclusion

MRI in the standing position increases central canal, lateral recess and foraminal stenosis. Standing MRI, did not however, increase the correlation between patient’s symptoms and MR morphological changes, which remained low to modest.

Clinical Relevance/Application

Open system 0.25T MRI allows scanning of the lumbar spine in standing position; standing MRI, did not however, increase the correlation between patient’s symptoms and MR morphological changes.

SSQ13-07 • Image Quality Optimization after Spinal Fusion Surgery Using Iteratively Reconstructed Dual Energy CT High keV Monoenergetic Datasets

Holger Haubenreisser (Presenter); Miriam Hahn; Rene Schmidt; Paul Apfaltrer MD; Martin U Sedlmair MS *; Bernhard Schmidt PhD *; Stefan O Schoenberg MD, PhD *; Thomas Henzler MD

Purpose

To prospectively evaluate the effectiveness of high keV dual-energy CT (DECT) in combination with sinogram-affirmed iterative reconstruction in the raw data space (IR) for metal artifact reduction after spinal fusion surgery.

Method and Materials

10 consecutive patients underwent spinal fusion surgery and were consequently examined using a non-contrast enhanced DECT protocol for postoperative evaluation of metal implants. DECT raw data was reconstructed with traditional filtered back projection (FBP) and IR. Both FBP and IR image datasets were then post-processed on a separate offline workstation. Monoenergetic datasets were generated from 60keV to 190keV in 10keV intervals. Objective image quality evaluation of metal implants. UTE echo subtraction image was obtained by subtracting the 2nd echo image from the 1st echo image. Morphology and composition of the CEP were evaluated by a board-certified radiologist.

Results

A total of 28 datasets were reconstructed for each patient (14 FBP, 14 IR). Image noise was significantly lower in all IR datasets when compared to the corresponding FBP datasets (p<0.05). IR of DECT raw data leads to improved objective and subjective image quality of high keV monoenergetic datasets that allow valuable metal artifact reduction in patients after spinal fusion surgery.

Clinical Relevance/Application

Iteratively reconstructed DECT raw data improves image quality of calculated high keV monoenergetic CT image data potentially leading to a more accurate assessment of the postoperative spine.

SSQ13-08 • Dual-energy CT in Detecting Bone Marrow Edema of Vertebral Compression Fractures

Aina O Venkatadasamy (Presenter); Jean-Claude Dosch; Stephane Kremer MD, PhD; Jean-Louis Dietemann MD; Guillaume Bierry MD, PhD

Purpose

To prospectively evaluate the performance of virtual non-calcium (VNC) dual-energy CT (DECT) images for the demonstration of trauma-related abnormal marrow attenuation in vertebral compression fractures (VCF).

Method and Materials

Twenty patients (16 females, 4 males; age=69±14 years) presenting with benign VCF on radiographs were consecutively and prospectively included in this IR-approvals study, and underwent MRI and DECT of the spine. MR examination, evaluated by an independent reader, served as reference standard for edema (acute nature of fracture) assessment.

Two other independent readers visually evaluated all vertebrea for abnormal marrow attenuation (“CT edema”) on VNC DECT images using a binary scale; specificity, sensitivity, predictive values, intra and inter-observer agreements were calculated. A last reader performed a quantitative evaluation of CT numbers, and cut-off values for “CT edema” were calculated using ROC analysis.

Results

In the visual detection of “CT edema”, VNC DECT images had a sensitivity of 84%, a specificity of 97%, a PPV of 81% and a NPV of 97% compared to MR as a reference standard; intra- and inter-observer agreements were good to excellent, ranging from k=0.74 to k=0.90. CT numbers were significantly different between vertebrea with edema on MR and those without (p<0.05).

Conclusion

VNC DECT images allowed an accurate demonstration of trauma-related abnormal attenuation in VCF, revealing the acute nature of the fracture.

Clinical Relevance/Application

...
SSQ14-02 • A Longitudinal CT Study of Lenalidomide and Bortezomib Treatment for Multiple Myeloma: Trabecular Microarchitecture and Biomechanics Assessed by a CT-based Finite Element Model

Miyuki Takesu MD (Presenter); Yoko Kachi; Mio Ishikawa MD; Shuji Date; Masao Kiguchi RT; Kazuo Awai MD *; Yoshiaki Kuroda; Akira Sakai

PURPOSE
Lenalidomide and bortezomib have been successfully used in the treatment of multiple myeloma (MM), of which bone disease is a key feature. Bortezomib has been linked to increased bone formation and osteoblastic activity; however, the effect of lenalidomide on bones remains unknown. Therefore, in this study, trabecular microstructural analysis and biomechanics assessed by a clinical CT-based finite element model (CT/FEM) were used to investigate whether lenalidomide affects the microarchitecture of bones.

METHOD AND MATERIALS
Sixty-seven MM patients (male, n=37; mean age, 67.14±10 years; female, n=30; mean age, 68.6±10 years) were examined by 64-detector CT after a mean period of six months of either therapy with bortezomib- (n=33) or lenalidomide (n=19), or follow-up without treatment (n=15). Using a bone mineral calibration phantom and a 3D image analysis system, bone mineral content per tissue volume (BMC/TV), trabecular parameters, and mechanical properties of the third lumbar vertebrae were calculated. The statistical significance of the change with respect to baseline over time was assessed using a two-way analysis of variance with repeated measures. To investigate whether baseline geometric or biomechanical indices predict the subsequent response to treatment, the Spearman rank correlation test was performed for each baseline index with respect to post-treatment changes.

RESULTS
At the second CT examination, trabecular number, failure load and stiffness increased in the lenalidomide group (P<0.05). Lenalidomide treatment resulted in significant increases in BMC/TV, trabecular number and CT/FEM-derived estimates of bone strength, while failure load and stiffness decreased in the bortezomib group. Baseline BMC/TV and trabecular spacing predicted lenalidomide-induced bone changes.

CLINICAL RELEVANCE/APPLICATION
Lenalidomide treatment promoted significant increases in bone strength. Mechanical properties, assessed by a CT/FEM, provided useful information about treatment response in multiple myeloma.
METHOD AND MATERIALS

Attenuation value and contrast-to-noise ratio (CNR) were determined in a head phantom with 70 and 120 kVp. Forty-two volunteers were randomly assigned to three cerebral CTA protocols. Of 30 volunteers, 64 mL CM was administered at 4.0 mL/s. 15 were scanned with 70 kVp and the other 15 with 120 kVp. The rest of the 12 volunteers were scanned with 70 kVp after administration of 40 mL CM at 2.5 mL/s. The Hounsfield unit (HU) of the internal carotid artery T junctions and CNR were assessed, and the volume CT dose index (CTDIvol) and effective dose were compared. Subjective arterial enhancement, sharpness of the arterial boundary and overall image quality were assessed by two radiologists using 5-point scale.

RESULTS

The mean arterial attenuation and CNR of 70 kVp protocol (718.4 ± 102.5 HU and 31.7 ± 7.9, respectively) were significantly higher than those of 120 kVp protocol (384.4 ± 76.1 HU and 24.7 ± 6.2, respectively) when 64 mL CM was administered. 70 kVp protocol using 40 mL CM had significantly higher arterial attenuation (586.3 ± 98.2 HU) and no difference in CNR (24.1 ± 5.2), compared to 120 kVp protocol using 64 mL CM. The CTDIvol and effective dose of 70 kVp (15.27 ± 0.67 mGy and 0.69 ± 0.06 mSv), respectively. Both 70 kVp protocols using 64 or 40 mL CM resulted in significantly higher score in arterial enhancement, sharpness of arterial boundary and overall image quality, compared to 120 kVp protocol.

CONCLUSION

The use of 70 kVp significantly improved arterial enhancement and CNR, and provided superior quality images using lower radiation dose, compared to conventional 120 kVp protocol. The 70 kVp protocol allowed 38% volume reduction of CM, while improving arterial enhancement and maintaining CNR with a lower radiation dose.

CLINICAL RELEVANCE/APPLICATION

The use of 70 kVp in cerebral CT angiography significantly improves arterial enhancement, CNR, and image quality. Also, the volume of contrast medium could be reduced to 38% while maintaining CNR.

SSQ14-04 • Improved Image Quality for Improved Diagnostic Accuracy of Cranial Computed Tomography Using Sinogram-affirmed Iterative Image Reconstruction

Holger Haubenreisser (Presenter); Christian Fink MD; Paul Apfaltrer MD; Martin U Sedlmaier MS *; Bernhard Schmidt PhD *; Stefan O Schoenberg MD, PhD *; Thomas Henzl MD

PURPOSE

To prospectively compare image quality of contrast and non-contrast enhanced cranial computed tomography (cCT) with thin slice widths using traditional filtered back projection (FBP) and sinogram-affirmed iterative image reconstruction in the raw data space (IR).

METHOD AND MATERIALS

29 consecutive patients (19 men; 71.6 ± 16.6 years) referred for native cCT were prospectively included. 11 (38%) patients also received contrast-enhanced studies and were also included. Each cranial CT raw data set was reconstructed with FBP and sinogram-affirmed IR in the raw data space with decreasing slice widths (5 mm – 1 mm). Objective image quality was assessed by measuring image noise in three predefined brain regions (white matter, thalamus, cerebellum) using identical regions of interests (ROIs). Subjective image quality was assessed by 2 experienced radiologists by scoring the reconstructed data sets with respect to subjective image noise, subjective image sharpness, diagnostic acceptability and the presence of artifacts.

RESULTS

Image noise was significantly lower in all IR images at identical slice widths when compared to images reconstructed with FBP (4.25 ± 0.49 HU vs. 7.56 ± 1.10 HU non-contrast enhanced, 4.30 ± 0.26 HU vs. 7.97 ± 1.43 HU contrast-enhanced, 1mm slice width; p<0.5). Subjective image quality of IR images especially at thinner slice widths of 1-3 mm were consistently higher than those of FBP reconstructions (p < 0.001).

CONCLUSION

Sinogram-affirmed IR significantly reduces image noise in contrast enhanced and non-contrast enhanced studies, while increasing objective and subjective image quality. In cCT this may be used to decrease slice width and thus reduce partial volume effects, which may lead to increased diagnostic accuracy of small lesions.

CLINICAL RELEVANCE/APPLICATION

IR techniques should be used routinely in cCT if thin slice reconstructions are required in order to improve image quality and potentially diagnostic accuracy of small lesions.

SSQ14-05 • CT Angiography of Head with Dual-source Ct: Comparison of Image Quality and Radiation Dose between Prospetive ECG-triggered and Conventional Protocols

Nong Qian (Presenter); Yuejin Xue BEng, MD; Changjie Pan

PURPOSE

Experiments were carried out to test the hypothesis that using prospective ECG-triggering acquisition, also called "step-and-shoot" (SAS) mode on head can reduce radiation dose without compromising image quality compared with using conventional dual energy CTA scan.

METHOD AND MATERIALS

Eighty-four patients with clinically suspected or confirmed cerebrovascular disease were randomly divided into 2 groups: Group A (43 patients underwent prospective ECG-triggering combined with "step-and-shoot" acquisition) and Group B (41 patients, underwent conventional dual-energy scanning). Images were reconstructed at 60% R-R interval. All images were processed on workstation and the image qualities of these images were scored by two experienced radiologists. These image scores and radiation doses used in each group were subjected to statistical analysis using the paired-sample t-test.

RESULTS

The image quality score for group A was 4.72 ± 0.50 with a good rate of 97.7% (42/43) and 4.71±0.51 for group B with a rate of 97.6% (40/41). The difference in the scores of image quality, between two groups was not statistically significant (P = 0.903). The average effective dose was (0.216 ± 0.01) mSv in group A and (0.291 ± 0.04) mSv in group B. T-test results showed that the effective dose for the two groups are statistical different (P=0.000).

CONCLUSION

Compared with conventional mode, SAS mode with a narrow R-R interval can be applied to perform cerebral CTA with a dose reduction by 60.01% and produced similar image quality.

CLINICAL RELEVANCE/APPLICATION

When applying SAS mode and conventional model with a narrow R-R interval to perform cerebral CTA, SAS mode results in radiation dose reduction of approximately 60% without compromising image quality.

SSQ14-06 • Application of a Novel Metal Artifact Correction Algorithm in Flat-panel CT after Coil-embolization of Brain Aneurysms: Intraindividual Comparison

Jan-Hendrik Bühk MD (Presenter) *; Michael Groth; Susanne Sehner; Jens Fiehler; Nils O Schmidt; Ulrich Gryszka MD

PURPOSE

To evaluate a novel algorithm to correct for beam hardening artifacts caused by metal implants in computed tomography performed on a flat panel equipped c-arm angiography system (FP-CT).

METHOD AND MATERIALS

16 datasets of cerebral FP-CT acquisitions after coil-embolization of brain aneurysms in the context of acute subarachnoid hemorrhage have been reconstructed applying a soft tissue kernel with and without a novel reconstruction filter for metal artifact correction, resulting in high-resolution isotropic datasets. Image reading was performed in multiplanar reformations (MPR) in average mode on a dedicated radiological workplace in comparison to the preinterventional native multissection CT (MS-CT) scan serving as anatomic Gold standard. Two independent radiologists performed image scoring following a defined scale in direct comparison of the image data with and without artifact correction. For statistic analysis, a random intercept model was calculated.

RESULTS

Inter-rater agreement was very high (ICC = 86%). Soft tissue image quality at the level of the implants was substantially improved. The additional metal artifact correction algorithm did not induce impairment of the subjective image quality in all other brain regions.

CONCLUSION

Adding metal artifact correction to FP-CT in an acute postinterventional setting helps visualizing the close vicinity of the aneurysm at consistent over all image quality.

CLINICAL RELEVANCE/APPLICATION

Further development of reconstruction filters for perinterventional brain FP-CT will help spreading the applicability of this still relatively new technique into more clinical settings.
Purpose

Conventional digital subtraction angiography (DSA) helps to evaluate the severity of vascular spasm after subarachnoid hemorrhage (SAH). Being equipped with flat detector (FD), DSA is able to provide in-room assessment of peri-therapeutic cerebral hemodynamics and help tailoring endovascular treatments. The aim of current study is to compare the cerebral circulation time (CCT) that derived color-coded quantitative FD-DSA and CT perfusion (CTP) in SAH patients.

Methods and Materials

Nineteen SAH patients entered our neurovascular service in 8 months interval and with available CCT derived from diagnostic FD-DSA and MDCT, were retrospectively recruited. The mean time interval between two examinations was 19 (4-36) hours. The CCT derived from FD-DSA was defined as the difference of Tmax (Time of maximum intensity) between the region-of-interest (ROI) of selected arteries and superior sagittal sinus (SSS). Four CCT were defined accordingly, namely, RA-CCT and LA-CCT (arterial ROI placed on the second portion of right and left anterior cerebral arteries), RM-CCT and LM-CCT (arterial ROI placed on the second portion of right and left middle cerebral artery). The CCT from MDCT was defined as the difference of time-to-peak between corresponding arterial (RM, LM) and SSS ROI. For CCT of anterior cerebral artery, only the dominant was defined due to limited spatial resolution.

Results

The mean of RA-CCT, LA-CCT, RM-CCT and LM-CCT defined by FD-DSA were 5.6±1.5, 6.0±1.8, 5.9±1.9, 6.0±2.3 seconds respectively. The mean of RA-CCT, LA-CCT, RM-CCT and LM-CCT defined by MDCT were 6.0±2.3, 5.9±2.3, 6.0±2.3 seconds respectively. The intraclass classification of CCT merited from FD-DSA between two observers ranged from 0.86-0.99, and those from MDCT between two observers ranged from 0.72-0.98. The correlations of RA-CCT, LA-CCT, RM-CCT, and LM-CCT between two modalities were 0.70, 0.76, 0.70, 0.80, respectively. The correlation got worse when the CCT became longer.

Conclusion

With no extra radiation dose, FD-DSA provides CCT of SAH patients with comparable results as CTP. It facilitates the feasibility of both in-room peri-therapeutic hemodynamic monitoring and tailoring endovascular treatments.

Clinical Relevance/Application

The CCT measured by QDSA provides additional hemodynamic information in SAH patients in addition to vascular morphology. It confirms the reproducibility of intra-arterial hemodynamic models.

SSQ14-08 • Noise and Radiation Dose Reduction Using a Partial Temporal Profile Non-local Means (PATEN) Filter in CT Brain Perfusion

Zhoubo Li (Presenter); Lifeng Yu PhD; Shuai Leng PhD; Armando Manduca PhD *; Amy L Kotsenas MD; David R De Lone MD; Cynthia H McCollough PhD

Purpose

To develop a 4 dimensional (3D spatial + 1D temporal) noise reduction filter that is not sensitive to patient motion and to perform a retrospective clinical evaluation on its performance in CT brain perfusion.

Methods and Materials

A partial temporal profile non-local means (PATEN) filter was developed in our lab that uses redundant information to reduce image noise, in which the pixel value in the filtered image is a weighted average of similar pixels and the weight is calculated by comparing their partial temporal profiles. This approach can reduce noise in a time series of perfusion images, even when there is significant motion during the time-series scans. A feasibility test was performed using 5 brain perfusion cases acquired with our routine protocol (CTDIvol = 300 mGy). We intentionally selected those cases in which the patient moved substantially during the scan, making the data difficult to process with the commercial perfusion software, despite the fact that it already incorporates anatomic registration to compensate for patient motion. A validated noise insertion technique was used to simulate images at a low-dose level (25% of full dose). PATEN was applied to the low dose images. Image quality and perfusion parameter maps were compared among low-dose, low-dose+PATEN filter, and full dose images.

Results

The PATEN filter achieved a 76.2 to 85.3% decrease in image noise. Radiologist evaluation revealed no spatial or motion blurring in the PATEN images. The mean percent error parameters calculated from the PATEN images closely matched those determined from full dose data: Root mean square errors between the PATEN filtered data and full dose data for CBF, CBV and MTT were 6.32, 4.94 and 14.67% for healthy tissue, respectively. For tissues with pathology, the mean percent error between the PATEN and full dose data was 6.32, 4.94 and 14.67% for healthy tissue, respectively. The correlation got worse when the CCT became longer.

Conclusion

A newly developed PATEN filter can reduce radiation dose by 75% in CT brain perfusion while maintaining image quality without causing spatial or temporal blurring of anatomy, even when significant patient motion occurs during the scan.

Clinical Relevance/Application

Dramatic radiation dose reduction can be achieved in CT brain perfusion by applying the PATEN filter, which is insensitive to patient motion.

SSQ14-09 • CT Image Quality Improvement and Dose Reduction Potential with Model-based Iterative Reconstruction Using Autopsy Imaging in the Brain: Evaluation of Image Noise and DOSE Estimation with Different Noise Index

Takashi Takahata RT; Yue Dong (Presenter); Tomokatsu Tsukamoto; Ye Ju; Keisuke Nishihara MD; Hiroki Mori MD; Kazunari Mesaki MD; Katsuhide Ito MD

Purpose

To assess the dose reduction potential and image quality improvement with model-based iterative reconstruction algorithm (Veo) by comparing image noise and DOSE (DLP mGy-cm) with the adaptive statistical iterative reconstruction (ASiR) and the filtered back projection (FBP) reconstruction, using autopsy imaging.

Methods and Materials

With institutional review board approval, 8 brain CT autopsy imaging (AI) cases with different noise index (NI: 2.8, 3.2, 4.5, 6.0, 8.5) were performed on Discovery CT750 HD. For comparison, 3 sets of 0.625mm slice thickness CT images were reconstructed with FBP, 50% ASiR and Veo. The image noise (SD) was measured with the same size of regions of interest at the same slice in 3 locations. The image noise reduction ratio was defined by SD (at NI 5.5)/SD (at NI 2.8). Using a 5-point score (1: poor; 3: diagnosis, 5 excellent), 3 radiologist independently and graded overall noise and delineation of the head image.

Results

For the comparison with same image slice thickness, the image noise reduction with Veo compared with FBP and 50%ASiR for the NI2.8, 3.2, 4.5, 6.0, 8.5 and the average were (15.0%, 22.2%, 35.4%, 42.9%, 50.5% and 33.2±14.6%) and (-2.6%, 5.7%, 19.7%, 27.5%, 34.8% and 17.0±14.5%), respectively. The noise reduction ratio (NI1.5/NI2.8) for the Veo, 50%ASiR and FBP were 1.7, 2.7 and 2.9, respectively. The average scoring for the Veo, 50%ASiR and FBP at NI3.2 were 3.7±0.7, 3.3±0.7, and 2.8±0.6, respectively. All the differences were statistically significant (p < 0.05).

Conclusion

Veo advanced reconstruction algorithms greatly reduced image noise over FBP and ASiR. With Veo reconstruction, it was possible to reduce dose (DLP) by 71.7% if the noise of the current FBP images was acceptable.

Clinical Relevance/Application

Veo reconstruction technique has the ability to reduce radiation dose through their improvement in image quality compared with the current algorithms such as FBP and ASiR.
The ability to link a cerebellar infarct with a particular perfusion territory may yield information on infarct pathogenesis and may refine treatment planning.

**SSQ15-05 • 4D Flow MRI Indicates Changes in Intracranial Hemodynamics in Arteries Supplying Arteriovenous Malformations**

**Amir R Honarmand** MD (Presenter); **Biraj M Patel** MD; **Can Wu**; **Susanne Schnell**; **Pegah Entezari** MD; **Parmede Vakil** PhD; **Michael C Hurley** MBChB; **Bernard Bendok** MD; **Ali Shalbani** MD; **Timothy J Carroll** PhD; **Michael Markl** PhD; **Sameer A Ansari** MD, PhD

**PURPOSE**

To evaluate peak velocity (PV) and net flow (NF) in arteries supplying intracranial arteriovenous malformations (AVMs) using 4D flow MRI.

**METHOD AND MATERIALS**

With IRB approval, baseline 4D flow MRI was performed at 1.5T or 2T MR systems for a prospective study. Flow quantification was performed using ECG gated three-directional velocity encoding with full 3D coverage of the AVM nidus, feeding and draining vessels, and contralateral equivalent normal arteries. 4D flow MRI was acquired in an axial oblique 3D volume using flip angle of 15°, VENC: 100 cm/s, spatial resolution = (1.2-1.6) mm3, and temporal resolution: 44 ms. Data were analyzed using 4D flow visualization of the velocity data and flow quantification using time integrated 3D pathlines positioned orthogonal to the vessel by a commercially available software (Ensight, CEI, Inc. Apex, NC). AVM Spetzler-Martin (SM) grade and nidus volume (7/6 · X · Y · Z dimensions) were obtained. Paired sample t test, one-way ANOVA, univariable, and stepwise multiple regression analysis were performed to build predictive models.

**RESULTS**

Ten patients (7M/3F) with mean age of 40.7 (10-66) years were studied. Hemodynamic parameters of 17 arteries (5 ICAs, 9 MCAs, 2 PCAs, and 1 ACA) supplying the AVM nidus, normal contralateral equivalent arteries, and corresponding sinuses draining the AVM were quantified. PV and NF were significantly higher in AVM feeder arteries (AFs) compared with normal contralateral equivalent arteries (EA) (mean: 0.96 Vs. 0.66 m/s, P = 0.001; 5.2 Vs. 3.0 ml/cycle, P = 0.004, respectively). No significant difference was observed between AFs PV, NF, and sinus PV based on AVM SM classification. (P = 0.8, P = 0.1, P = 0.4, respectively). Stepwise multiple regression and univariable models identified nidus volume and EA's PV to be positively correlated with PV in AFs (P = 0.01, r = 0.6; P = 0.003, r = 0.7, respectively). NF was the significant factor for predicting PV in EAs (P = 0.001, R = 0.7). Positive direct correlation was observed between AFs' PV and sinus PV (P = 0.01, R = 0.6).

**CONCLUSION**

4D flow MRI is feasible for monitoring of cerebral AVM hemodynamic parameters and illustrates subtle, but distinct hemodynamic changes in arterial feeders compared to a normal equivalent arteries.

**CLINICAL RELEVANCE/APPLICATION**

These findings may have implications in novel characterization schemes for risk stratification based on quantitative flow analysis.

**SSQ15-06 • Diagnosis of Carotid Artery Dissection with CT: Does the Contrast Material Really Help?**

**Luca Saba** MD (Presenter); **Eytan Raz** MD; **Mario Piga**; **Roberto Montisci** MD; **Eugenio A Genovese** MD

**PURPOSE**

The purpose of this work was to evaluate if the use of contrast material in the MDCTA study of carotid artery dissection (CAD) modify the diagnostic performance.

**METHOD AND MATERIALS**

One hundred patients (61 men, 39 women; mean age, 51 years; range, 25 – 78 years) 40 with and 60 without CAD, that underwent MDCTA for suspected CAD formed the study cohort. In this study patients from three different groups were included (patients with MR confirmation of CAD, n = 40; patients with MR confirmation of CAD absence, n = 20; patients that underwent MDCTA of carotid arteries for atherosclerosis analysis, n = 40). Three blinded observers with different level of expertise analyzed the randomized basal scan and after 3 months the observers evaluated the same datasets by using basal scans (BS) and after administration of contrast material (CM). Statistical analysis included Receiver Operating Characteristics (ROC) curve analysis and the Cohen weighted test.

**RESULTS**

The ROC curve analysis showed that for the 3 observers the use of BS versus BS and CM produced an improvement of the diagnostic confidence with AUC values from 0.894 to 0.926 (p value = 0.91); from 0.856 to 0.879 (p value = 0.365); and from 0.819 to 0.982 (p value = 0.01). The Cohen kappa analysis showed no significant difference in concordance with the use of BS versus BS and CM. The prevalence of uncertain findings was in 16%, 20.5% and 33% in the BS and 15%, 17.5% and 29% in BS and CM for observer 1, 2 and 3 respectively.

**CONCLUSION**

Results of our study suggest that the use of BS instead the classic BS and CM determines a small reduction in the diagnostic confidence of the readers, that is statistically significant only in the junior one. Therefore the use of the only BS in the suspect of CAD may help in reducing cost and risk related to the administration of contrast material.

**CLINICAL RELEVANCE/APPLICATION**

Results of our study suggest that the use of the only basal in the suspect of CAD can be used and this approach may help in reducing cost and risk related to the administration of contrast material.

**SSQ15-07 • Carotid Artery Stenosis: Comparison of 3D-Time-of-Flight MR Angiography and Contrast-enhanced MR Angiography at 3.0T**

**Ivan Platzeck** MD (Presenter); **Dominik A Sieron** MD; **Philip Wiggermann**; **Michael Laniado** MD

**PURPOSE**

To compare 3D time-of-flight MR angiography (TOF MRA) and contrast-enhanced MR angiography (CEMRA) for quantification of carotid artery stenosis at 3.0T.

**METHOD AND MATERIALS**

Twenty-three patients (5 f, 18 m; mean age 61 y, age range 45-78 y) with external carotid artery stenosis detected with Doppler ultrasonography were examined on a 3.0T MR system. The MR examination included both 3D TOF MRA and CEMRA of the carotid arteries. MR images were evaluated independently by two radiologists. Stenosis evaluation was based on a four-point scale: 0 = normal, 1 = mild stenosis, less than 50%; 2 = moderate stenosis, 50-69%, 3 = severe stenosis, more than 70% but less than full occlusion, 4 = occlusion). TOF MRA and CEMRA were evaluated separately, with a four-week time interval between evaluation sessions. While evaluating TOF MRA, the readers were blinded for CEMRA images and vice versa. Furthermore, the readers were blinded for other imaging or clinical data. In cases of interrater differences concerning the same MR angiography type, stenosis grade was determined by the readers in consensus. Stenosis grades determined by TOF and CEMRA were compared using the Wilcoxon test. Cohen’s kappa was used to evaluate interrater reliability.

**RESULTS**

At 3.0T, 3D TOF MRA should not be used as replacement for contrast-enhanced MRA of the carotid arteries, as it results in significantly higher stenosis grades, and may lead to inadequate therapy.

**CLINICAL RELEVANCE/APPLICATION**

The current results imply that TOF MRA at 3.0T should not be used as a replacement for CEMRA, which itself is well validated by comparison with digital subtraction angiography in previous studies.

**SSQ15-08 • Intraplaque Hemorrhage on Routine 3D-Time-of-Flight MR Angiography Is Strongly Associated with Symptomatic Status in Carotid Artery Stenosis**

**Hediyeh Baradaran** MD (Presenter); **Hooman Kamel** MD; **Atul Mangla** MD; **Ankur Pandya** PhD, MPH; **Allison Dunning**; **Vito Fodera** MD; **Pina C Sanelli** MD; **Ajay Gupta** MD

**PURPOSE**

Intraplaque hemorrhage (IPH) in carotid artery atherosclerosis is strongly associated with previous and future stroke. Carotid plaque imaging has previously relied on high-resolution imaging using dedicated surface coils or MRI sequences not routinely obtained to measure stenosis. Recent reports suggest 3D-time-of-flight (TOF) imaging can accurately predict IPH compared to histopathology. We investigated the association between IPH determined on routinely acquired, 3D-TOF MRA neck images and prior stroke or TIA in patients with high-grade carotid stenosis.

**METHOD AND MATERIALS**

CONCLUSION
We postulate that a selective labeling of each vertebral artery (VA) allows distinguishing the cerebellar territories that are exclusively fed by one VA (PICA in subjects with normal vascular anatomy) from those territories supplied by the basilar artery (ALCA and SCA).

**CLINICAL RELEVANCE/APPLICATION**

Intraplaque hemorrhage (IPH) in carotid artery atherosclerosis is strongly associated with previous and future stroke. Carotid plaque imaging has previously relied on high-resolution imaging using dedicated surface coils or MRI sequences not routinely obtained to measure stenosis. Recent reports suggest 3D-time-of-flight (TOF) imaging can accurately predict IPH compared to histopathology. We investigated the association between IPH determined on routinely acquired, 3D-TOF MRA neck images and prior stroke or TIA in patients with high-grade carotid stenosis.
Subjects were screened after review of consecutive MRA neck exams performed from 8/2009 through 8/2012. Patients were included if they had high-grade carotid artery stenosis (70-99%) on non-contrast 3D-TOF MRA and documentation of prior stroke/TIA and vascular risk factors. IPH was determined by a validated technique assessing carotid plaque signal 50% more hyperintense than adjacent muscle. Assessments were made by two independent, blinded neuroradiologists with a third used as a tie-breaker. Clinical data was determined by consensus of two stroke neurologists. Statistical analysis was performed using univariate and multivariable logistic regression analysis with adjustment of statistically significant covariate risk factors.

RESULTS

After reviewing 4895 consecutive neck MRAs, 51 subjects with 53 carotid arteries met inclusion criteria. Vascular risk factors were not significantly different between groups. IPH was present in 24 carotid arteries. Of patients with IPH-positive exams, 15 had prior events (10 strokes, 5 TIA). Of those with negative exams, 4 had prior events (3 strokes, 1 TIA). In the univariate logistic regression analysis, the OR of the association of IPH to any prior ischemic event was 14.5 (95% CI 3.6-57.6) and the age- and sex-adjusted OR was 14.2 (95% CI 3.3-60.5). The association was preserved across magnet field strengths.

CONCLUSION

Our study demonstrates a strong association between ischemic events and IPH as determined on widely available, standard, large field-of-view neck coils using a 4-minute MRA sequence which is commonly used for screening exams.

CLINICAL RELEVANCE/APPLICATION

With prospective validation of our findings, regular reporting of IPH on neck MRA studies can be used as a risk stratification tool to complement measures of luminal diameter stenosis.

SSQ15-09 • CTA vs. 3T Black-Blood MRI for Identification of Symptomatic Carotid Plaques: A Comparative Study

Jochen M Grimm MD (Presenter); Andreas Schindler; Florian Schwarz MD; Clemens C Cyran MD *; Martin Dichtgans MD; Tobias Saam MD *; Tobias Freilinger; Maximilian F Reiser MD; Konstantin Nikolau MD *; Fabian Bamberg MD, MPH *; Chun Yuan PhD *

PURPOSE

The purpose of this prospective comparative study was to evaluate CT angiography (CTA) and black-blood 3T-MRI (bb-MRI) regarding their respective ability to identify symptomatic carotid plaques.

METHOD AND MATERIALS

20 patients with unilateral symptomatic carotid disease who underwent extensive clinical workup at our stroke unit to exclude other causes of ischemic stroke underwent standard CTA and bb-MRI with TOF, pre- and post-contrast fsT1w-, fsT2w- and fsPDw- sequences within 7 days of symptom onset. Both symptomatic and contralateral asymptomatic sides were evaluated. By bb-MRI, plaque morphology and composition and prevalence of complicated type VI lesions (AHA-LT6) with haemorrhage, thrombus and/or ruptured fibrous cap were evaluated. By CTA, plaque type (soft, mixed, hard), plaque density in HU and presence of ulceration and thrombus were evaluated. Sensitivity (SE), specificity (SP), positive and negative predictive value (PPV, NPV) were calculated using a two-by-two table.

RESULTS

For identifying the symptomatic side AHA-LT6 was the best bb-MRI variable and presence of plaque ulceration was the best CTA variable, resulting in a SE, SP, PPV and NPV of 80%, 80%, 80% and 80% for AHA-LT6 as assessed by bb-MRI, 40%, 95%, 65% and 71% for plaque ulceration as assessed by CTA. The SE, SP, PPV and NPV for the combination of AHA-LT6 as determined by bb-MRI and ulceration as determined by CTA was 85%, 75%, 77% and 83%, respectively.

CONCLUSION

Bb-MRI delivered a better sensitivity, NPV and PPV compared to CTA at identifying the symptomatic side, while CTA offered an excellent specificity at the cost of low sensitivity and moderate PPV and NPV. Results were only slightly improved over bb-MRI when combining both techniques.

CLINICAL RELEVANCE/APPLICATION

This study shows that bb-MRI is better suited to detect symptomatic carotid plaques than CTA. A combination of both techniques is only marginally superior to bb-MRI alone.

ISP: Nuclear Medicine (Neurologic Imaging)

Thursday, 10:30 AM - 12:00 PM • SS05SAB

SSQ16 • AMA: 15:5 • ARRT:1:5

Moderator
Satoshi Minoshima, MD, PhD *

Moderator
Alexander Drzezga, MD *

SSQ16-01 • Nuclear Medicine Keynote Speaker: State-of-the-Art Molecular Neuroimaging

Alexander Drzezga MD (Presenter) *

SSQ16-03 • Does Computer Aided Diagnostic (CAD) Software Decrease Inter-reader Variability of Florbetapir PET Brain Scan Interpretation?

Ameya Nayate MD (Presenter) *; Jacob G Dubroff, MD, PhD *; James E Schmitt MD, PhD; Rekha I Kishore MD *; Ilya M Nasrallah MD, PhD; David A Mankoff MD, PhD; Daniel Pryma MD *

PURPOSE

METHOD AND MATERIALS

29 patients enrolled in the Alzheimer’s disease neuroimaging initiative (ADNI 2) were included. Readers classified each case using a binary system, positive or negative for significant beta amyloid deposition. Each case was interpreted twice by each reader, once qualitatively and once with the aid of SUVr measurements generated by Scenium software (Siemens Medical). Cases were randomly assigned to 4 reading sessions separated by a washout period and interpreted by 2 blinded, board certified and Florbetapir-interpretation trained readers. No case was repeated within an individual session. To quantify inter-rater agreement, a kappa coefficient was calculated for the raters with and without the use of Scenium.

RESULTS

When Florbetapir PET brain studies were read qualitatively, there was inter-reader disagreement in 8/29 cases. When the same Florbetapir PET studies were read with SUVr, there was inter-reader disagreement for only 1 case. The kappa coefficient for the studies read with SUVr (0.94) was statistically significantly higher compared to the qualitatively only read studies (0.71), p < 0.005.

CONCLUSION

The use of semi-quantitative indices (SUVr) to aid the interpretation of Florbetapir images improves inter-reader agreement. Further study is needed to confirm the impact on the accuracy of interpretation.

CLINICAL RELEVANCE/APPLICATION

Computer aided diagnostic software can decrease inter-reader variability of F-18 Florbetapir PET brain scan interpretation.

SSQ16-04 • A Novel Metric of Volumetric Statistical Amyloid Burden by Comparison to a Database of Health Controls

Jon W Piper BEng (Presenter) *; Aaron S Nelson MD *; Sara Pirozzi BS *; Zhidei Shen

PURPOSE

METHOD AND MATERIALS

Consensus reads among three readers for 130 Florbetapir scans, as described in Fleisher et. al (2011), were classified as either amyloid+ or amyloid-. MNI-neuro 5.1 was used without intervention to deformably register each scan to a common atlas space with reference to 3 florbetapir PET templates. Z-scores were computed for every voxel in each Florbetapir scan, as compared to 74 young healthy controls. A ‘gray matter mask’, defined as the VOI encompassing the high uptake voxels of an average of many amyloid+ patients and excluding the high uptake voxels of an average of many amyloid- patients, was used to only consider gray matter burden. In computing the final VSAB metric. Z-score thresholds from 3 to 7 were considered for the computation of VSAB, defined as the percentage of voxels within the gray matter mask that exceeded the z-score threshold.
Prior to widespread implementation of PET/MR for dementia evaluation; PET results obtained by PET/MR need to be validated and compared to PET/CT.

**CLINICAL RELEVANCE/APPLICATION**

Incorporation of quantitative and statistical analysis of functional neuroimaging has been shown to increase the accuracy and confidence of visual interpretation of these studies.

**SSQ16-05 • High Resolution PET Scanner Optimized for Neurological Imaging**

**David Beylin**, MS, MBA (Presenter) *; **Pavel Y Stepanov** MS *; **Stephen Schaefeer** BS *; **Irving N Weinberg** MD, PhD *; **Valera Zavarzin** MS *

**PURPOSE**

Dementias and motion disorders such as Alzheimer’s disease (AD) and Parkinson’s disease (PD) present a huge societal and economic burden. Accurate, early diagnosis of these disorders using biomarkers is a research and clinical priority. Recent development of Position Emission Tomography (PET) radiopharmaceuticals for evaluation of Alzheimer’s disease, and other dementias – such as F18 -Florbetapir, F18-FDDNP, F18 -Florobetaben, F18 -Flutematomol, and F18 – Litocam, and others - position PET as a key diagnostic modality in evaluation of dementia and other brain disorders. Currently available PET scanning infrastructure relies on bulky Whole Body PET (WB PET) machines developed for oncology applications. While WB PET machines can acquire acceptable brain images, large-scale deployment of WB PET scanners to accommodate estimated volume of brain imaging procedures will be inefficient and costly. There is a clear need for a high-resolution, small-footprint, inexpensive PET scanner focusing on neurological applications.

**METHOD AND MATERIALS**

We constructed a dedicated brain PET scanner with a bore diameter of 25 cm and a 20 cm axial field of view. The intrinsic spatial resolution of the detector block is 1.9 mm. The bore and the head-support system are constructed to ensure that the scanner gantry does not obstruct the patient’s line of sight, which is important for claustrophobic patients and patients with neurological or psychiatric conditions, who may need to be in visual contact with the caregiver or healthcare staff at all times. The scanner was evaluated using various phantoms, including point sources, uniformity phantom, and Hoffman brain phantom.

**RESULTS**

The measurements demonstrated spatial resolution of 2-3 mm across the field of view, energy resolution of less than 13% for all detector blocks, image uniformity of better than 15%. Quantitative accuracy is better than 10% after calculated attenuation correction as benchmarked against the whole-body PET scanner.

**CONCLUSION**

Novel dedicated brain PET imaging device provides an acceptable alternative to whole-body PET machines at reduced cost to the healthcare facility. The device does not obstruct patient line of sight and could, potentially, eliminate claustrophobia.

**CLINICAL RELEVANCE/APPLICATION**

New PET imaging device could be used for F18-FDG and F18-florbetapir imaging in evaluation of Alzheimer’s disease, and clinical neuroscience research with novel CNS radiotracers.

**SSQ16-06 • Quantitative Analysis of FDG PET Hypometabolism in Pre-operative Identification of Seizure Foci Not Detected on Routine MR and Qualitative PET**

**Bhawana Rathore** MD (Presenter) ; **Vina Ravichandran BA** ; **Pearce Korb** MD ; **James R Galt** PhD ; **Robert E Gross** ; **David M Schuster** MD ; **Bruce J Barron** MD *; **Larry Olson** ; **Jonathon Nyo** PhD *; **Hamilton E Reavey** MD

**PURPOSE**

Approximately 30% of patients with epilepsy are refractory to medications and may require resective brain surgery. Identification of candidate regions of seizure onset is crucial to successfully guide resection or placement of surgically implanted electrodes for intracranial electroencephalography (iEEG). However, many patients do not have visually identifiable lesions on brain MRI or PET making it a challenge for surgical planning. The primary aim of this proof of concept study is to determine whether most hypometabolic regions of the interictal brain PET using quantitative analysis software correlates with the seizure onset zone determined by subsequent iEEG.

**METHOD AND MATERIALS**

Eighteen interictal PET-CT scans of brain in patients who had undergone iEEG were retrospectively reviewed. All patients originally had MR and qualitative PET interpreted as negative. The studies were then processed with quantitative analysis software (MimNeuro 5.6; Cleveland, Ohio) which compares PET images to a normal database. The 10 most hypometabolic foci were recorded on a scale of 1-10 with 1 being most hypometabolic. Foci which corresponded to white matter or cerebellum on co-registered CT were eliminated from analysis since these are rare locations for origin of seizures. Candidate foci based on rank order of hypometabolism were then compared to the actual location of the seizure onset zone as identified on iEEG.

**RESULTS**

Mean (±SD) age was 43.6 (±11.7); range 24-60 years. Ten patients were male and 8 female. For all 18 patients the seizure onset zone from the iEEG correlated with one of the hypometabolic foci on the quantitative PET analysis. Mean (±SD) rank order of hypometabolism for the seizure onset zone was 1.7 (±1.1); range 1-5. In 10 out of 18 patients (56%) the most hypometabolic focus correlated with the proven seizure onset zone on iEEG.

**CONCLUSION**

Quantitative analysis of PET hypometabolism may be useful in identifying candidate seizure onset zones and guiding placement of intracranial electroencephalography electrodes even in patients with negative MR and unrevealing qualitative PET. Further analyses with a larger sample size and co-registration of PET and MR is warranted to determine diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative analysis of PET hypometabolism may bring added value to pre-operative identification of seizure foci not detected on routine MR and qualitatively interpreted PET thereby improving outcomes.

**SSQ16-07 • PET/CT versus PET/MR for the Clinical Evaluation of Patients with Dementia: Comparison of Visual Interpretation by Two Experienced Readers**

**Kent P Friedman** MD (Presenter) ; **Rajan Rakheja** ; **Timothy M Shepherd** MD, PhD ; **Rachel Bartlett** PhD ; **Yu-Shin Ding** PhD ; **Fernando Boada**

**PURPOSE**

Simultaneous PET/MR is a new technology that may be used in the evaluation of dementia patients. There are few data in the literature regarding quantitative differences between PET data obtained at PET/CT versus PET/MR and how this may impact image interpretation. This study compared the PET interpretation of PET/CT versus PET/MR by two independent experienced nuclear medicine physicians.

**METHOD AND MATERIALS**

Forty-five minutes following injection of 10 mCi of FDG, 19 patients with clinically-suspected dementia underwent a 15-minute clinical brain PET/CT. Simultaneous PET/MR scanning was subsequently performed (60 minute list-mode) at approximately 90 minutes post-injection. Two experienced nuclear medicine physicians blindly interpreted the PET portion of all PET/CT scans, attributing a specific diagnosis (normal, AD, FTD, LBD, other dementia, mixed phenotype or unspecified disease) and severity scale (mild, moderate or severe abnormality). The readers then blindly interpreted the PET data obtained from PET/MR. Concordance between PET/CT (reference standard) and PET/MR with respect to diagnosis and disease severity was assessed for each reader.

**RESULTS**

Reader A classified 12 PET/CT scans as AD, 5 as unspecified dementia, 1 as LBD and 1 as normal with a mean severity score of 2.0. Reader B classified 10 PET/CT scans as AD, 3 as unspecified, 1 as LBD and 5 as normal with mean severity score of 2.1. PET/MR interpretations with comparison to PET/CT yielded an 84% (16/19) intra-reader concordance of diagnosis, with 95% (18/19) of severity scores varying by one point or less. Reader B exhibited 84% intra-reader concordance of dementia pattern diagnosis, with 89% (17/19) of all scores varying by one point or less.

**CONCLUSION**

Our preliminary analysis in clinically-suspected dementia patients showed a relatively high concordance of intra-reader assignment of diagnosis and severity of findings between PET/CT and PET/MR when evaluated by two blinded experienced nuclear medicine physicians. These results suggest PET/MR brain scans acquired on hybrid PET/MR are of diagnostic quality and interpretation results compare favourably to PET/CT.

**CLINICAL RELEVANCE/APPLICATION**

Prior to widespread implementation of PET/MR for dementia evaluation; PET results obtained by PET/MR need to be validated and compared to PET/CT.

**SSQ16-08 • A Novel MR Atlas-based Method Outperforms the Silver-standard CT Segmentation-based Method in PET Attenuation Correction**

The Kappa statistics for agreement with consensus reads for VSAB were 0.90, 0.90, 0.92, 0.94, and 0.97, respectively. The VSAB used were 30.0%, 12.8%, 4.0%, 1.4%, and 0.7%, respectively.

**CONCLUSION**

Volumetric Statistical Amyloid Burden shows promise as an additional metric for distinguishing amyloid+ from amyloid-. Additionally, the agreement of this metric with visual assessment suggests that there may be value in computing voxel-level z-scores for amyloid images. Further work will investigate even more robust methods for gray matter mask definition and will compare VSAB with updated visual assessment methods.

**CLINICAL RELEVANCE/APPLICATION**

New PET imaging device could be used for F18-FDG and F18-florbetapir imaging in evaluation of Alzheimer’s disease, and clinical neuroscience research with novel CNS radiotracers.
Functional Connectivity in Children with Sickle Cell Anemia and Normal Brain MRI

Kathleen J Helton MD (Presenter); Diana Fridlyand BS; Matthew Scoggins PhD; Ping Zou PhD; Jane Hankins MD; Banu Aygun MD; Jane Schreiber PhD; Robert J Ogg PhD

PURPOSE
Children with sickle cell anemia (SCA) are at risk for cognitive impairment, but the etiology of cognitive dysfunction in patients without visible evidence of brain injury remains unknown. We have shown that intelligence quotient in children with SCA is associated with altered blood-oxygenation level dependent (BOLD) functional MRI (fMRI) response to visual stimulation, findings that suggest chronic anemia alters the neural-hemodynamic coupling that supports healthy brain function. We used BOLD fMRI to test the hypothesis that cognitive dysfunction in SCA is associated with altered brain network connectivity.

METHOD AND MATERIALS
We have developed an atlas-based MR method for PET AC and have evaluated its accuracy using simulations.

RESULTS
The MRAC method resulted in a lower average whole-brain absolute percent-error (WBAE) across patients of 1.84% compared to the 4.57% achieved by the CTSEG method (p < 0.0001). We have developed a MR T1w-based AC method that outperforms the silver standard. In addition, the presence of a focal lesion does not affect the accuracy of the proposed method.

CLINICAL RELEVANCE/APPLICATION
An accurate MR-based AC method allows the MR/PEI to become quantitatively reliable and opens the door for simultaneous quantitative-PET and MR applications.
Biotin-responsive Basal Ganglia Disease (BBGD): Neuroimaging Features before and after Treatment

Hassan Kassem MD; Sari s Alsuhibani MBBS, MD (Presenter); Sherif Abdelfattah MD, PhD; Fahad Alsheikh; Ayman H Gaballah MD, FRCR

PURPOSE
The purpose is to assess the clinical and neuroimaging features of a biotin-responsive basal ganglia disease before and after treatment of a subacute encephalopathy and to compare the disease with the other basal ganglia diseases of childhood

METHOD AND MATERIALS
We retrospectively reviewed the clinical, laboratory and neuroimaging features of fifteen (15) genetically proven cases of biotin-responsive basal ganglia. All patients were of arab ancestry and have consanguineous parents. Recessive genetic defect was detected in all cases. The chemical tests for organic and inorganic toxic compounds were normal in all cases. All patients were treated with frequent subacute encephalopathy leading to seizures, extrapyramidal symptoms and coma. MRI of the brain were done in all cases at the onset of symptoms and within a few days after the administration of high doses of biotin (5-10 mg/kg/d).

RESULTS
The brain MRI showed bilateral lesions in the caudate heads in all cases with complete or partial involvement of the putamen. The globus pallidum and cerebellum were spared in all patients. In 12 cases, discrete abnormal signal changes were observed in the mesencephalon, cortical-subcortical regions and thalami. In 8 cases when the disease was advanced, patchy white matter disease was found. The high signal abnormality of the mesencephalon and cortical-subcortical areas were disappeared after treatment with biotin and thiamine while the caudate and putamen necrosis remained unchanged in all patients including those who became asymptomatic.

CONCLUSION
The neurological features, control of the disease with biotin and the distinctive MRI features should lead to the diagnosis of BBGD. It is important to check for the presence of this disease in children with acute onset extrapyramidal symptoms as therapeutic trial of biotin and thiamine can be lifesaving.

CLINICAL RELEVANCE/APPLICATION
It is important to check for the presence of this disease in children with acute extrapyramidal symptoms or subacute encephalopathy as it can be managed without further neurological deterioration.
### SSQ17-06 • Does Ultrasound Texture Analysis of Periventricular White Matter Predict the Periventricular White Matter Injury in Preterm Infants?

**Sun Kyoung You** MD (Presenter) ; **Young-Hun Choi** ; **Sang-Joon Park** BA ; **Jung-Eun Cheon** MD ; **Woo Sun Kim** MD ; **In-One Kim** MD

**PURPOSE**
Periventricular leukomalacia (PVL) is the major cause of neurodevelopmental problems encountered in survivors of premature birth. The aim of this study was to evaluate the ultrasound texture analysis as a potential imaging tool for quantitative assessment of periventricular white matter (PVWM) injury in preterm infants.

**METHOD AND MATERIALS**
73 preterm infants (median gestational age; 28wks, median birth weight; 905.2g) who were treated in the neonatal intensive care unit and had serial cranial US and brain MR obtained at near term period (38.0 ± 3.7wks) were included in our study. Periventricular echogenicity (PVE) on serial cranial US were evaluated qualitatively by visual grading as grade 1, 2, and 3 compared to echochogenicity of the choroid plexus and quantitatively using Gray Level Co-occurrence Matrix (GLCM) method; a second order statistical method of texture analysis. These features were selected based on empirical observation that the normal PVWM exhibits homogeneous echotexture, whereas the ischemic PVWM often exhibits heterogeneous echotexture. Four GLCM textural features which represent homogeneity of an image were measured: (1) angular second moment (ASM), (2) inverse differential moment (IDM), (3)contrast, and (4) entropy. Quantitative and qualitative US features of PVE were compared between two groups (group 1: PVL on MRI(10), group 2; no PVWM abnormality on MRI(63)).

**RESULTS**
All GLCM features did not show statistically significant difference between two groups, although mean value of ASM and IDM were higher in group 1 than those of group 2 (ASM p-value; 0.176, IDM p-value; 0.52). Contrast (degree of heterogeneity) and entropy (degree of randomness) were lower in group 1 than those of group 2 (contrast p-value; 0.68, entropy p-value; 0.221). IDM and entropy values of PVE grade 1 (less than choroid plexus) showed statistically significant difference between two groups. (IDM p-value; 0.006, entropy p-value; 0.003).

**CONCLUSION**
Texture analysis using GLCM method may serve as a complementary tool for quantitative assessment of PVE in selected cases of increased PVE. It is still questionable whether US screening of PVWM in premature infants can be a sensitive predictor of the PVWM injury in preterm infants.

**CLINICAL RELEVANCE/APPLICATION**
Off-line texture analysis of PVE utilizing GLCM matrix might be a complementary tool for quantitative approach to vulnerable brain structures in preterm infants.

### SSQ17-07 • Amide Proton Transfer MR Imaging of the Brain in Children at 3T: A Preliminary Study

**Hong Zhang** MD (Presenter) ; **Jinyuan Zhou** PhD ; **Na X Zhao** PhD ; **Yun Peng** MD

**PURPOSE**
APT imaging is able to extend the achievable magnetic resonance imaging (MRI) contrast to the protein level. The aim of this study was to investigate APT effect in healthy children.

**METHOD AND MATERIALS**
Nineteen healthy children were investigated. All subjects were scanned on a Philips 3T MRI scanner (Achieva 3.0T TX). Single-slice APT imaging was acquired. All data processing and analyses were performed using the interactive data language (IDL). The MTR asymmetry (3.5 ppm) image was calculated. Regions of interest were carefully chosen by experienced radiologists. The regions of interest were drawn on relatively homogeneous white and gray matters of bilateral cerebral hemispheres with a homogeneous texture. The mean signal intensity was measured at the left and right side of the brain in volunteers. So, the values from both sides were combined. The units of APT are percentage points in the water signal intensity, the values are -0.62±0.20 (white matter) and 0.25±0.34 (gray matter). There was statistically significant difference of APT signal intensities between white and gray matters. (t=-12.24, p=0.000).

**RESULTS**
Fig 1 shows an example of APT images for a volunteer. As shown in Fig 1, the APT signal intensities were greater in gray matter compared to white matter in voluntary 3.5 ppm difference by visual grading. The statistical difference was significant between the left and the right side of the brain in volunteers. So, the values from both sides were combined. The units of APT are percentage points in the water signal intensity, the values are -0.62±0.20 (white matter) and 0.25±0.34 (gray matter). There was statistically significant difference of APT signal intensities between white and gray matters. (t=-12.24, p=0.000).

**CONCLUSION**
We have demonstrated the feasibility of APT imaging of normal brain in healthy children on a clinical 3T scanner. APT imaging at 3T revealed significant contrast between white and gray matters, with a higher APT signal apparent within the gray matter. These preliminary results show that the APT is a unique contrast that can provide complementary information to standard clinical MRI measures.

**CLINICAL RELEVANCE/APPLICATION**
APT imaging is able to extend the achievable MRI contrast to the protein level. We believe that APT imaging at 3T has the potential to become a noninvasive biomarker for some pediatric diseases.

### SSQ17-08 • A Novel MRI Sequence (aCaeBlack Bone(½γ)) Offering an Alternative to Ionising Radiation in the Investigation of Craniosynostosis

**Karen A Eley** MBCh, DPhil (Presenter) ; **Fintan Sheerin** MBChB ; **Stephen R Watt-Smith** MD, MBBS ; **Stephen J Golding** MD

**PURPOSE**
"Black Bone" MRI is a novel gradient echo sequence providing improved definition of the bone-soft tissue margin by minimising soft tissue contrast. We sought to determine the potential of "Black Bone" MRI as a non-ionising alternative to CT in the identification of cranial sutures and diagnosis of craniosynostosis.

**METHOD AND MATERIALS**
A prospective study of 4 children with normal cranial sutures and 13 children with a clinical diagnosis of craniosynostosis was conducted following initial investigation with SSQ 15.5 for Wire” sequence in an animal model. Normal cranial sutures were assessed by measurement of suture widths with reference to normative data. "Black Bone" datasets in the 13 children with craniosynostosis were compared to CT and clinical findings. Blinded review of 12 "Black Bone" datasets from children was completed by 3 assessors, grading each cranial suture on a scale of 0 to 2. To provide comparable imaging to CT and enhance visualisation of the cranial sutures, techniques were developed to produce three-dimensional rendered images of the craniofacial skeleton.

**RESULTS**
Patent cranial sutures were consistently identified on the "Black Bone" datasets as areas of increased signal distinguished from the signal void of the cranial bone. In children with craniosynostosis the affected suture was absent, whilst the remaining patent sutures could be visualised. These findings were consistent with those on CT. On independent review, synostosed sutures received the lowest mean scores. Three-dimensional rendered images permitted visualisation of the cranial sutures throughout their course.

**CONCLUSION**
Patent cranial sutures appear as areas of increased signal on “Black Bone” MRI clearly distinguished from the cranial bone. The sequence accurately differentiates the normal suture from the prematurely fused, demonstrating considerable clinical potential as a non-ionising alternative to CT in the diagnosis of craniosynostosis.

**CLINICAL RELEVANCE/APPLICATION**
"Black Bone" MRI offers a non-ionising alternative to CT in the investigation of craniosynostosis, with the ability to produce three-dimensionally rendered images to enhance diagnostic capabilities.

### SSQ17-09 • Low-dose Temporal Bone CT in Children: Feasibility and Image Quality

**Hui Zheng** (Presenter) ; **Yuhua Li** ; **Wenjun Cao** ; **Ming Liu** ; **Dengbin Wang** MD, PhD

**PURPOSE**
To evaluate the visualization of the temporal bone using low-dose 256-slice CT, we scanned one exsomatized cadaveric head at multiple levels of mAs and kV. This optimized protocol was used to examine pediatric patients. We analyzed the feasibility of low dose temporal bone CT in children and evaluate the image quality and radiation dose of a low-dose versus.

**METHOD AND MATERIALS**
One exsomatized cadaveric head was scanned repeatedly at three levels tube tensions from 120 to 80kV. And at every kV, multiple mAs were used from 250mAs until the image quality was insufficient. Noise was measured as the standard deviation in HU within the region of brain stem. All databases were subjectively evaluated by 2 experienced radiologists. The visibility of 16 anatomical landmarks was scored using a five point scale. The noise and effective dose were compared with each other. The optimized low dose protocol was used to examine 27 consecutive children. We retrospectively analyzed 36 examinations underwent a standard temporal bone CT acquired with 120kV,250mAs. The image quality and the effective dose were analyzed. Image quality score frequencies were calculated for each group. The children were then divided into 5 groups according to age-specific effective dose conversion coefficient. The effective dose of different age groups were compared in both high and low protocols. And then we compared the effective dose between the two protocols at the same age.

---

Page 73 of 171
RESULTS
CT radiation dose was significantly reduced when the parameters were selected 100kV, 70mAs. Most of the anatomical landmarks were delineated no significantly difference though the increased noise. The frequency of score 5 was significantly lower for the low-dose scans versus high, however the frequency of 4 was significantly higher. The frequency of the scores 1 and 2 was none for both protocols.

CONCLUSION
Low-dose temporal bone CT scans allow an accurate evaluation of middle and inner ear structures in children though reduced image quality compared with high-dose scans. The radiation dose was 5~6 times below standard protocol used in daily work. The effective dose for infants is higher than the older children underwent the same protocol.

CLINICAL RELEVANCE/APPLICATION
Postoperative CT of cochlear implants should provide information on the precise localization of the implant and its individual electrode.

Pediatrics (Radiation Dose Reduction)

Thursday, 10:30 AM - 12:00 PM • S102C

SSQ18-01 • Patient-Specific CT Dose Maps (CTDM) and Patient-Specific Dose Estimates (PSDE) for Pediatric CT: Preliminary Results in Comparison with the CTDIvol and Size Specific Dose Estimate (SSDE)

Dianna M Bardo MD (Presenter) *; Jeffrey H Yanof PhD; Donna M Stevens MS; Efrat Shefer PhD *; Galit Kafri PhD *; Jens Wiegert PhD *

PURPOSE
This study aims to investigate PSDE which considers individual body habitus, attenuation/absorption characteristics of tissue and material included in pediatric CT using a Monte-Carlo simulation tool. Another aim is to devise a method to determine CT dose from scatter radiation and the proportion of scatter to displayed CTDIvol. Measures of all components of CT radiation; direct beam, over-ranging, and scatter are made with improved accuracy to produce a PDSE dose profile and compared to SSDE and CTDIvol.

METHOD AND MATERIALS
IRB approval was granted to review 15 pediatric CT and CTA exams, 8 male, 7 female, ages 6 days to 15 years. HU of each image voxel was used to categorize tissues into 6 material classes based on physical composition and chemical stoichiometry. PSDEs were computed from voxelized CTDMs using the Monte-Carlo method, integrating dose or energy in individual patients, taking into account tissue density. A Student’s paired T-test was used to compare the mean values of CTDIvol-normalized PSDE and SSDE for chest and abdomen regions. Display of radiation dose in CTDMs is designed to visually indicate areas of greater and lesser dose on a color scale, with scatter dose displayed separately and in total.

RESULTS
CTDMs show that dose generally increases with decreasing patient size. The general trend of average normalized dose vs. patient size tends to agree with the SSDE. The calculated PSDE dose profile is greater in smaller diameters compared to SSDE. Patient specific dose profiles of PSDE vary along the z-axis indicating variation of dose throughout the irradiated volume which depends on effective diameter, tissue type and position within the irradiation field. PSDE values for infant chest/cardiac CTA exams were greater than CTDI-normalized SSDE. In older/larger patients, increased diameter, which increases attenuation of x-rays, skews the PSDE less than the SSDE.

CONCLUSION
PSDE provides an accurate and individualized measure of radiation dose imparted during CT scan. CTDMs depict dose distribution within each slice. CTDMs and PSDE enable understanding of dose in different tissues, using varied scan protocols and are especially important in understanding imparted CT dose in infants.

CLINICAL RELEVANCE/APPLICATION
The importance of accurate, patient specific dose estimation and reporting in the youngest and smallest patients is most vital. In children, the accurate estimation and calculation of dose in clinic...

SSQ18-02 • Reduction of Radiation Exposure, Effective Dose and Organ Dose in Pediatric Body CT Using BMI-based kVp Adjustment

Vana M Derderian BS (Presenter); Jenifer W Siegelman MD, MPH; Choonsik Lee PhD; Elizabeth C Jones MD; Mahadevappa Mahesh MS, PhD *; Les R Folio DO, MPH *

PURPOSE
Understanding organ dose from CT in the context of age and body size is evolving. As part of efforts to balance CT radiation risk and its diagnostic benefit, we assessed the effectiveness of a BMI-based (Body Mass Index) kVp adjustment on dose in a pediatric cohort over time. We compared exposure and calculated patient-specific organ and effective dose from long-2 z-axis exams in children before and after kVp reduction.

METHOD AND MATERIALS
To evaluate the effectiveness of BMI-based kVp adjustment, we retrospectively reviewed all kVp-adjusted CT scans in children (2012; n=358). Scans with kVp-adjusted chest, abdomen and pelvis (CAP) or CAP with neck with one or more scans covering the same region prior to 2011 (program implementation) were included (n=13). Technical parameters (kVp, mAs, automatic exposure control (AEC) use) as well as exposure data (CTDIvol, DLP) from four CT units extracted from Radiance/PACS were compared with SSDE (Size Specific Dose Estimate) effective diameter at the middle slice, organ and effective doses at two time points (2010 and 2012). Computational phantoms representing six different age groups (newborn to adult) and two genders were used for Monte Carlo simulation of organ dose. Radiologists and ordering physicians monitored studies for clinically relevant (subjective) reductions in quality. Repeat rate due to inadequate quality was collected.

RESULTS
Comparing 2012 with 2010 as baseline, CTDIvol, DLP, and SSDE in 2012 were 22% (p=0.082), 20% (p=0.2982), and 26% (p=0.012) lower on average. Organ doses in 2012 were on average 26% (p=0.012) lower than baseline, similar to the reduction seen in SSDE. Urinary bladder and active marrow showed the maximum (28%) and minimum reduction (25%), respectively. No studies were repeated; no additional costs were incurred.

CONCLUSION
SSDE and average organ doses were, on average, 26% reduced after BMI-dependent kVp adjusted scans in 13 children. Use of BMI-based kVp adjustment is an economical dose reduction method that can maintain quality.

CLINICAL RELEVANCE/APPLICATION
Economical radiation dose reduction and organ dose estimation methods should help pediatric dose optimization efforts in hospitals and clinics without additional capital or infrastructure investment.

SSQ18-03 • High-pitch Dual Source Computed Tomography of Pediatric Abdomen

Eray Atli MD (Presenter); Erhan Akpinar MD; Berna Sayan Oguz MD; Mithat Haliloglu MD

PURPOSE
To assess radiation dose reduction and image quality with high-pitch dual-source CT (DSCT) in comparison with standard pitch with conventional pediatric abdominal CT.

METHOD AND MATERIALS
A total of 48 patients (median age, 51.8 months) underwent high-pitch abdominal CT in this institutional review board-approved HIPAA-compliant prospective study. High-pitch (value: 3) mode CT was performed with 64-slice DSCT. This was compared to a group of 37 patients (median age, 60.7 months) who underwent conventional pediatric abdominal CT (pitch: 1).

RESULTS
Both patient groups were similar with respect to age, APD, LD, ED and SL. Mean ST of high-pitch abdomen CT was 1.57 sec, while it was 9.94 sec in standard pitch mode CT. In comparison with conventional pitch mode, high pitch mode of DSCT reduced radiation exposure by 67% (5.18 vs. 1.7 mGy, SSDE according to ED); CTDIvol, DLE and SSDE parameters were significantly lower in high pitch mode (p<0.05).

CONCLUSION
The use of high pitch DSCT significantly decreases scan times and radiation exposure when compared to conventional CT. Image quality and diagnostic confidence, however, is still similar in both imaging techniques.
In pediatric abdominal imaging, high pitch DSCT provides fast scanning, less motion artifacts and significant reductions in radiation exposure without adversely affecting image quality.

**SSQ18-04 • Dose Reduction in Pediatric Body-CT due to Fully-integrated-Digital 'Stellar' Detector**

Jennifer L Cullmann (Presenter); Khoschay Schawkat MD; Daniel Ott MD; Stefan Puig MD, MSc.

**PURPOSE**
To evaluate the potential reduction of radiation dose in pediatric body CTs after implementation of a new fully-integrated-digital detector (Stellar®, Siemens Healthcare, Germany) compared with a conventional “Ultra-Fast-Ceramic” (UFC) solid-state-detector.

**METHOD AND MATERIALS**
152 routine CT examinations (112 thoracic, 8 abdominal and 32 thoracoabdominal) of 114 children (58 male, 56 female) between 1 day and 16 years of age were included in the analysis. The following parameters were recorded: age, scan length, maximum body diameter, and CTDIvol, dose-length-product (DLP). The effective radiation dose (EED) was estimated from the DLP (EED = k × DLP) and body weight. Size-Specific Dose Estimates (SSDE) were calculated for each study. Image noise was used as a proxy for image quality. Three 1.0 cm round regions of interest (ROI) were created, two in the right paraspinal muscles at the levels of the right pulmonary artery and the right kidney and one in the right gluteus maximus muscle. The standard deviation of 1000 single-slice images was calculated for each ROI.

**RESULTS**
Age and body diameter did not show significant differences in both groups. The mean CTDIvol was about 16% lower after detector change (1.77 vs. 1.52 mSv). However, standard deviation was statistically not significant (p<.30). The mean ED was significantly lower with the digital Stellar detector (0.74 mSv ± .6) compared with the previous UFC solid-state-detector (1.09 mSv ± 1.3) (p<.002). This was obviously mainly achieved due to a significantly lower mean scan-length of 270 mm ± 123.6 vs. 231 mm ± 89.5 (p<.3) resulting in a significantly lower DLP: 70.2 mGy·cm ± 88.4 vs. 45.2 mGy·cm ± 41.6 (p<.02).

**CONCLUSION**
Fully digital Stellar® detector may achieve a mild reduction of radiation in pediatric patients. However, the main difference of the DLP was due to differences of the scan length before and after exchange of the detector unit.

**CLINICAL RELEVANCE/APPLICATION**
There may be some radiation dose reduction due to fully digital detectors. However, other factors such as scan length still have a major influence on radiation dose.

**SSQ18-05 • Pediatric CT Radiation Dose Variability: Affecting Factors at a Large Academic Institute**

Ranish D Khawaja MBBS, MD (Presenter); Sarabjeet Singh MD; Beth Vettiyil MBBS; Sarvenaz Pourjabbar MD; Atul Padole MD; Mannudeep K Kalra MD *; Diego A Lira MD

**PURPOSE**
Children are more susceptible to radiation-induced carcinogenesis because of greater organ radiosensitivity and a longer life-span. Since children have a wide variability in their body sizes and expected variations in radiation doses, we aimed to compare pediatric CT radiation doses across different body weight groups and across scanners, operators and body regions in pediatric CT.

**METHOD AND MATERIALS**
In an IRB-approved study, 544 consecutive pediatric (=18years) chest (c) and abdomen-pelvis (α) CT (NC=204; Nα=340; Mf=309:235) were assessed with a web based dose monitoring software (Exposure, Radiometrics) from 1/2011 to 1/2013. Demographics of patient (age, sex, body weight, and body diameter); body regions; age, sex, training experience of CT technologist, scanner type (availability of Iterative Reconstruction ‘IR’), off-centering, and estimated effective dose (EED) were recorded. Corresponding EED values were also recorded for adult CT (n=14,000; €=6,000; Nα=8,000) for comparison. Analysis of variance (ANOVA) was used to evaluate differences in ED across above variables.

**RESULTS**
Analysis of variance (ANOVA) was used to evaluate differences in ED across above variables. P < .05 were considered significant.

In pediatric chest CT, for example, the difference was statistically not significant (p=.30). The mean ED was significantly lower with the digital Stellar detector (0.74 mSv ± .6) compared with the previous UFC solid-state-detector (1.09 mSv ± 1.3) (p<.002). This was obviously mainly achieved due to a significantly lower mean scan-length of 270 mm ± 123.6 vs. 231 mm ± 89.5 (p<.3) resulting in a significantly lower DLP: 70.2 mGy·cm ± 88.4 vs. 45.2 mGy·cm ± 41.6 (p<.02).

**CONCLUSION**
Fully digital Stellar® detector may achieve a mild reduction of radiation in pediatric patients. However, the main difference of the DLP was due to differences of the scan length before and after exchange of the detector unit.

**CLINICAL RELEVANCE/APPLICATION**
There may be some radiation dose reduction due to fully digital detectors. However, other factors such as scan length still have a major influence on radiation dose.

**SSQ18-06 • Is Wide-detector Better than Helical Acquisition in Children Undergoing Torso CT Imaging?**

Robert F Buchmann DO (Presenter); S. Bruce Greenberg MD

**PURPOSE**
We have shown a 45% reduction in radiation exposure with no loss in image quality for torso CT imaging of children by shifting from filtered back projection to Adaptive Iterative Dose Reduction (AIDR 3D). Our purpose was to evaluate if additional dose reduction or improved image quality could be obtained by changing from helical to wide-detector technique.

**METHOD AND MATERIALS**
The study groups include 100 children who had undergone helical torso CT and 50 who had undergone wide-detector torso CT. Wide-detector technique is a step and shoot technique that allows for up to 16cm of coverage per rotation with stitching of multiple rotation acquisitions. The helical group average age was 9.4 years (SD 5.7) and the wide-detector group 10.0 years (SD 5.9) which was not significantly different (p = .54). Size-Specific Dose Estimates (SSDE) were calculated for each protocol. Image noise was used as a proxy for image quality. 3.0 cm < round regions of interest (ROI) were created, two in the right paraspinal muscles at the levels of the right pulmonary artery and the right kidney and one in the right gluteus maximus muscle. The standard deviation in each ROI constituted the measure of image noise. Unpaired t tests compared the SSDE and image noise for each group.

**RESULTS**
The results are summarized in the table. No significant difference in the SSDE was present between the two study groups (p = .58). Children less than 7 years old undergoing wide-detector acquisition had a mean SSDE of 2.8 mGy (SD 0.5) while those undergoing helical acquisition had a mean SSDE of 3.2 mGy (SD 0.9). This difference was not significant (p = .09) but showed a trend towards reduced dose in younger children. Image noise in the abdomen was improved by wide-detector technique, but the difference was not significant (p = .18). A 7% reduction in pelvis image noise by wide-detector technique was significant (p = .04).

**CONCLUSION**
Radiation exposure was not significantly improved by the use of wide-detector scanning, but a trend towards modest improvement in younger, smaller children was observed. Pelvis image quality was significantly improved and a trend towards improvement in the abdomen was observed. Helical images are likely to have increased noise compared to wide-detector technique due to inherent smearing associated with helical technique.

**CLINICAL RELEVANCE/APPLICATION**
The information acquired allows for optimization of computed tomography in children.

**SSQ18-07 • Usefulness of Large Beam-shaping Filters at Different Tube Voltages of Pediatric CT**

Takanori Masuda (Presenter); Yoshinori Funama PhD; Naoyuki Imada; Takayuki Oku; Satoshi Inada; Kazuo Awai MD *

**PURPOSE**
As children are more susceptible to radiation-induced damage than adults it is necessary to use a lower radiation dose at pediatric CT. An effective reduction methods is the selection of large beam-shaping filters. We compared the radiation dose with small and large beam-shaping filters at different tube voltages and document the usefulness of large beam-shaping filters at pediatric CT.

**METHOD AND MATERIALS**
We used a 15-cm diameter cylindrical water phantom and inserted a 10-cm long pencil ionization chamber into the phantom center. Helical CT acquisitions were performed on a pediatric CT scanner (VCT, GE Healthcare). The tube voltage was 80-, 100-, or 120 kVp; the beam pitch and gantry rotation time were 1.375 and 0.4 sec. The tube current was automatically set with automatic exposure control (noise index: 10 HU). The field-of-view (FOV) was 15- and 50 cm with small and large beam-shaping filters, respectively. Scans with a 50-cm FOV were reconstructed at a 15-cm display FOV. The radiation dose and image noise (SD of the CT number) were compared on all reconstructed images.

**RESULTS**
...
The proposed thermometry method allows susceptibility-induced temperature errors to be detected and corrected for. As a result, improved MR guidance may be performed even near air-tissue interfaces, with potential benefits in prostate, uterus, and brain MR-guidance applications.

**METHOD AND MATERIALS**

Two anthropomorphic phantoms simulating a 1-year-old and a 5-year-old that had inserted thermoluminescent dosimeters (TLDs) were scanned using a dual-source 128-slice CT system operated with conventional SECT at low tube potential and also DECT at 80/140 kVp with tin filtration. The scan range included both abdomen and pelvis. For the SECT scans, the tube potential and corresponding tube current were selected by using an automated tube potential selection tool (CARE kv), using 120 kVp and 150 mAs as reference, with optimization for CT angiography. The scanner output, as measured by the volume CT dose index (CTDVol), was recorded and used to adjust the mAs in the DECT scans such that CTDVol was the same as the SECT scan. Organ doses in mGy were measured and the effective dose in mSv was calculated by summing the absorbed doses (mGy) of individual organs considering ICRP103 weighting factors.

**RESULTS**

The resulting CTDVol values were 0.67 mGy and 2.73 mGy for the 1-year-old and 5-year-old phantoms, respectively. The calculated effective doses were 1 and 1 mSv (1-year-old), and 3 and 3 mSv (5-year-old) for the 80 kVp and 80/140 kVp scans, respectively. In the 1-year-old phantom, organ doses were statistically the same with average difference of 0.11 mGy (P=0.07) between 80 kVp and 80/140 kVp. In the 5-year-old phantom, organ doses were also statistically the same with average difference of 0.35 mGy (P=0.15) between 80 kVp and 80/140 kVp.

**CONCLUSION**

At matched radiation scanner output, organ and effective doses of DECT scans are comparable to those from conventional SECT at a low tube potential of 80 kVp.

**CLINICAL RELEVANCE/APPLICATION**

The use of DECT to achieve comparable organ and effective doses relative to optimized low-tube potential CT angiography in pediatrics, is a pre-requisite for consideration of its use clinically.

**SSQ19-08 • The Optimal Dose Reduction Level in Chest CT with 640-slice CT Volume Scan Mode Using Iterative Reconstruction (AIDR 3D) in Little Swine Model**

Qin Liu MA, BA (Presenter) ; Yang Hou MD ; Pengfei Zhao ; Qiyong Guo MD

**PURPOSE**

To evaluate the radiation dose and image quality (IQ) of an iterative reconstruction (AIDR 3D) in combination with SureExposure3D on a 640-slice CT and determine the optimal dose reduction using AIDR 3D for neonates and children chest CT that can provide IQ comparable to filtered back projection (FBP).

**METHOD AND MATERIALS**

29 normal swines whose weight ranged 3-12kg (7.62±2.67) underwent 640-slice MDCT chest CT(Aquilion one ,Toshiba) for 5 times with 80kvp and different mAs. SureExposure3D technique were used and the index of noise were set to SD10 (Group A, routine dose), SD12.5, SD15, SD17.5, SD20 (Group B-E) to reduce dose successively. Group A were reconstructed with FBP, Group B-E were reconstructed using AIDR 3D (strong level). Two radiologists graded subjective image quality in both lung and mediastinal images using a 5-point scale in a blinded manner. Object IQ parameters of image noise, signal-to-noise (SNR) were measured in each group. A receiver-operating characteristic (ROC) analysis was performed to establish a radiation reduction threshold up to which comparable IQ (score=4) was maintained.

**RESULTS**

Group B, C, D has significantly lower noise , better SNR than Group A(P<0.05). Using AIDR 3D technique, 80kvp with SureExposure3D (SD17.5) can provide comparable or even better IQ compared with routine dose with FBP reconstruction which is 43% dose reduction in little swine model.

**CLINICAL RELEVANCE/APPLICATION**

The results of little swine model may be applied to reducing radiation dose of chest CT in neonates and children with serious lung infections.
SSQ19-02 • Improving Reconstruction Speed for Dynamic MRI Using Parallel Imaging with Combined Coil Compression and Direct Virtual Coil

Kang Wang PhD (Presenter) *; Scott K Nagle MD, PhD *; Harald Kramer MD; Tao Zhang; Philip Beatty; Mahdi Rahimi; Courtney K Morrison; Frank Korosec PhD *; Scott B Reeder MD, PhD; Dan W Rettman BNS *; Ersin Bayram PhD *; James H Holmes PhD *

PURPOSE
Coil-by-coil (CBC) data-driven auto-calibrating parallel imaging has become more widely used for dynamic MR applications, such as dynamic contrast-enhanced (DCE) MR angiography (MRA). However, for high spatial resolution, high parallel imaging factors and high channel count coil array protocols, the image reconstruction time can be clinically unacceptably long. This work demonstrates an initial comparison of combining Coil Compression and Direct Virtual Coil (CCDVC) to significantly reduce reconstruction times vs. the currently used conventional method of CBC in the setting of dynamic contrast enhanced peripheral runoff MR angiography.

METHOD AND MATERIALS
Twenty-four volunteers (7 healthy, 17 with pathology) were imaged and informed consent was obtained prior to all scanning. All scans were conducted on a clinical scanner (3.0T MR750, GE Healthcare), with 48cm FOV, 1.0mm isotropic resolution, 32-channel coil array and parallel imaging factor of 3 (phase) × 2 (slice) = 6. Temporal view-sharing was used to generate raw data for each time frame. The same raw data sets were then reconstructed twice: once with CBC and once with CCDVC. Time-resolved images reconstructed using CBC and CCDVC were randomized and blindly scored by two radiologists using a 5-point scale: image 1 much better (clinically significant); image 1 slightly better (not clinically significant); equivalent; image 2 slightly better (not clinically significant); image 2 much better (clinically significant).

RESULTS
The reconstruction times for CCDVC were about 18× faster than the conventional CBC method (17 sec vs. 311 sec per phase on an offline computer) in the parallel imaging synthesis/FFT/coroll combination module. One radiologist scored 18 cases as "equivalent", 3 cases as CCDVC "slightly better", and 3 cases as CBC "slightly better"; the second radiologist scored 17 cases as "equivalent", and 7 cases as CCDVC "slightly better".

CONCLUSION
The combined CCDVC technique was shown to significantly reduce the reconstruction time for high spatial and temporal resolution peripheral MRA, with no significant loss in image quality.

CLINICAL RELEVANCE/APPLICATION
The reconstruction speed for a DCE peripheral MRA scan can be significantly improved by using CCDVC to enable more aggressive clinical protocols or improve clinical workflow.

SSQ19-03 • Exercise System for Using 31-phosphorus MR Spectroscopy to Monitor Phosphocreatine Recovery from Exercise as Index for Mitochondrial Metabolism

Floyd Settles (Presenter); Geoffrey D Clarke PhD

PURPOSE
Measurement of mitochondrial function is relevant to aging, diabetes and sports medicine. Phosphorus-31 magnetic resonance spectroscopy (31P-MRS) can be used to evaluate the rate of phosphocreatine (PCr) recovery following exercise as a noninvasive index of the rate of ATP synthesis. The project's aim is to develop a reproducible measurement technique using an exercise apparatus to quantify PCr recovery in the vastus lateralis muscle (VL).

METHOD AND MATERIALS
The apparatus was designed to exercise the VL with subjects in supine position with a dual-tuned 1H-31P TX/RX surface coil strapped to the thigh. PCr depletion levels and recovery times were measured for 8 minutes following a 5 min period of exercise. Slice-selective 31P-MRS was performed on 5 subjects (4 male, 15-56 y.o.) with TR=3000 ms, NSA=2, BW=2200 Hz. The time for return of PCr values to their half-maximum (T-half) was used as an index for the rate of ATP synthesis. PCr recovery data were fit to the function PCr(t) = PCr(0)+[D1-exp(-bt)] using the Marquart-Levenberg algorithm (nlsLM function) in the R statistical package, where D and b were the fitted variables.

RESULTS
The prototyped apparatus is a compact, single-piece PVC assembly with little mass.

CONCLUSION
The exercise apparatus works, supporting and immobilizing the thigh and surface coil during baseline, dynamic flexion exercise and recovery phases of the protocol. Spectral data acquired consistently demonstrated PCr depletion and recovery in VL across all subjects. Predictable extension of the lower leg is obtained with a constant resistance without the use of large weights.

CLINICAL RELEVANCE/APPLICATION
Noninvasive, reproducible measurements of mitochondrial function by a well-characterized in-vivo biomarker can provide insights for the characterization and treatment of metabolic diseases.

SSQ19-04 • Transcranial Magnetic Stimulation-Induced Heating of Deep Brain Stimulation Implants: An Empirical Specific Absorption Rate Evaluation Using a Tissue Equivalent Phantom

Goldie R Boone MS (Presenter); Geoffrey D Clarke PhD

PURPOSE
Transcranial magnetic stimulation (TMS) uses electromagnetic induction to generate weak electric currents by application of rapidly changing magnetic fields to depolarize or hyperpolarize neurons in the brain. The potential for induced heating of brain tissues located near bilaterally implanted deep brain stimulation (DBS) electrodes during application of single pulse and repetitively pulsed TMS was investigated. This study provides empirical evidence for the "reasonable assurance of safety" in the FDA's classification of TMS as a Class II (special controls) device.

METHOD AND MATERIALS
TMS was conducted using the MagPro R30 system (MagVenture, Denmark) with a liquid cooled butterfly coil (model Cool-B65). TMS-induced heating was measured using a proprietary phantom and a clinical/research stimulation protocol. Fiber optic thermometry probes acquired real-time temperature measurements of the induced heating at the surface of the metallic DBS electrodes during TMS. The three specific aims of this study were to evaluate the 1) spatially localized temperature increase, 2) spatially localized time-averaged temperature increase, and 3) the average head SAR in the phantom in the absence and presence of the DBS implant over a 6 minute averaging period in saline and gelled-saline solutions at stimulation frequencies of 1 and 5 Hz. The differences in the average temperatures in the presence and absence of bilateral DBS implants were analyzed by ANOVA (p = 0.05, power = 0.80) with Bonferroni correction.

RESULTS
In the clinical/research stimulation orientation, no evidence of induced heating effects was observed above the thermal noise. However, stimulation of the lead loops at 5 Hz in gelled saline at a distance of 0.5 cm from the coil's surface and peak intensity region resulted in temperatures that tripled the spatially localized temperature limit and SAR values that doubled the spatially localized SAR limit. TMS-induced heating effects of this nature may result in localized tissue damage.

CONCLUSION
The observations in this research study support the use of repetitive TMS of patients with a bilateral DBS device implant provided prior knowledge is used to guide surgical lead configuration and careful coil placement during stimulation.

CLINICAL RELEVANCE/APPLICATION
The data support the use of repetitive TMS as a safe adjuvant therapy to surgery and pharmaceuticals in the treatment of neurological movement and major depressive disorders.

SSQ19-05 • How to Improve the Quality and Speed of 3T MR Imaging in Cervical and Lumbar Spine by Multiple RF Transmission?

Chuan Shuai Tian (Presenter); Bing Zhang PhD; Fei Chen MS; Bin Zhu; Haiping Yu; Ming Li; Danyan Li; Huiting Wang MS; Weibo Chen MSC; Queenie Chan PhD

PURPOSE
We aimed to study how to improve the quality and speed of cervical and lumbar imaging by TX technology compared with single transmission (without TX).

METHOD AND MATERIALS
Thirty-seven healthy volunteers (seventeen (5 male and 12 female), aged 21-55y (mean 38.47±13.02y) for cervical; twenty (8 male and 12 female), aged 20-64y (mean 25.48±4.8y) for lumbar) were scanned at 3.0T scanner (Achieva TX, Best, the Netherlands), acquiring the T2WI and T1WI images of the cervical and lumbar with and without TX. We compared the parameters, as well as the average signal intensity in different region of interest (ROIs) between the cervical and lumbar MRI with and without TX (Fig.a,b). P values less than 0.05 were considered statistically significant by Paired t-test.
RESULTS
TR was shortened by 1224ms (26.67%) on T2WI, and 97ms (17.64%) on T1WI in lumbar MRI. Packages reduced by 1.5±1 (37.5%), scanning time is shortened by 97.24±31.15s (44.02%). On T2WI of the cervical, the average signal intensity of ROIs 3/4/9 for vertebrae, ROIs 10/11 for fat were increased, ROIs 6/7 for the spinal cord, ROI 12 for the pons were decreased (P 0.05 have no statistical significance. On T1WI, the average signal intensity of ROIs 1/2 for vertebrae, ROIs 5-8 as the spinal cord, ROI 12 for the pons, ROI 13 for the cerebellum were reduced, ROIs 10/11 for fat were increased (P0.05 have no statistical significance. On T2WI of the Lumbar, the average signal intensity of ROIs 1-6/10 for vertebrae, ROI 9(on the same level of lumbar 1) for fat was increased (P 0.05, no statistical significance. On T1WI, the average signal intensity of ROIs 2-6/10 for vertebral, ROI 7 for the spinal cord were reduced; ROI 8 for fat was increased (P 0.05 have no statistical significance.

CONCLUSION
In the cervical and lumbar MRI, multiple-transmit parallel RF transmission can improve B1 homogeneity, shorten TR, reduce local SAR value and scanning packages, thereby improve the image quality and reduce scanning time.

CLINICAL RELEVANCE/APPLICATION
Multiple-transmit parallel RF transmission can improve the image quality and reduce scanning time.

SSQ19-06 • High B-value Diffusion Weighted Imaging in Defining the Infiltration Zone of Cerebral Glioma
Chunhui Jiang BMEdSc, MMEdSc; Jian Wang (Presenter)

CONCLUSION
It is demonstrated in this study that DWI may be useful in defining the infiltration zone of glioma, especially with high B-values. Larger studies are needed to prospectively validate the utility of ADC from high B-values DWI scan as a noninvasive imaging biomarker for quantitatively measuring the infiltration zone of glioma.

METHOD AND MATERIALS
This study determines the performance degradation in the RF coil due to orientation.

RESULTS
The areas of the MDP peaks were plotted with respect to position. For both orientations, the signal from right to left was symmetric about the center of the coil with the highest signal at ±8 cm. The signals across the coil R/L were reduced by 30% (p=0.015) at 38.9° compared to 0°. Along the z axis, with the phantom flat on the table parallel to B₀, results were similar with a maximum signal at ±8 cm and no signal below -5 cm, an overall -36% average difference.

CONCLUSION
Signal intensity changes from the acquired phantom data suggest that over 60% of the total signal is lost at the 38.9° angle compared to acquisitions with the coil parallel to B₀. Also, most of the signal will come from the portion of the VL muscle that is near the knee-end of the coil.

CLINICAL RELEVANCE/APPLICATION
Signal sensitivity profiles that take into account position and coil orientation must be considered for 31P metabolite quantification in exercise studies.

SSQ19-08 • Cerebrospinal Fluid Fluctuation in the Ventricular System in Idiopathic Normal Pressure Hydrocephalus
Naoki Ohno MS (Presenter); Tosiaki Miyati PhD; Mitsuhito Mase MD; Noam Alperin PhD*; Harumasa Kasai MSc; Shinnosuke Hiratsuka; Makoto Kawano; Yuta Shibamoto MD, PhD; Toshifumi Gabata MD; Osamu Matsui MD

PURPOSE
MRI-compatible exercise studies are reported in the literature for measuring phosphorus-31 (31P) metabolites in the vastus lateralis muscle (VL). For these studies the thigh is positioned at an angle with respect to the main magnetic field to allow leg movement, which is a non-optimal orientation for the MRS coil. This study determines the performance degradation in the RF coil due to orientation.

METHOD AND MATERIALS
A dual-tuned rigid TX/RX surface coil (Rapid Biomedical, Rimpar, Germany) was used on a 3T MRI system (TIM Trio, Siemens, Malvern, PA) to collect 31P spectra from a leg phantom (15 cm diameter, 4 L plastic cylindrical jug with 10 mL H₃PO₄) and a small standard (6 mL plastic vial with a 850 mM concentration of methylenediphosphonic acid (MDP)). The standard was positioned on the surface coil and a 1-pulse 31P sequence was performed (TR 8000 ms, 4 NSA, 4 prep scans, BW=3000 Hz). Spectra were taken with the MDP vial at the center of the coil, 5 cm, 8 cm and 10 cm away from the center in the R/L and H/F directions. Measurements were repeated with the leg phantom flat on the table parallel to B₀ (0°) and secured to the exercise device at an angle of 38.9° with respect to B₀. Spectra were analyzed using jMRUI software to determine the area under each peak. Paired t-tests were used to evaluate the statistical significance (p).

RESULTS
The areas of the MDP peaks were plotted with respect to position. For both orientations, the signal from right to left was symmetric about the center of the coil with the highest signal at ±8 cm. The signals across the coil R/L were reduced by 30% (p=0.015) at 38.9° compared to 0°. Along the z axis, with the phantom flat on the table parallel to B₀, the signal was almost symmetric, but spectra obtained at an angle were skewed with the maximum signal at ±8 cm and no signal below -5 cm, an overall -36% average difference.

CONCLUSION
Signal intensity changes from the acquired phantom data suggest that over 60% of the total signal is lost at the 38.9° angle compared to acquisitions with the coil parallel to B₀. Also, most of the signal will come from the portion of the VL muscle that is near the knee-end of the coil.

CLINICAL RELEVANCE/APPLICATION
Signal sensitivity profiles that take into account position and coil orientation must be considered for 31P metabolite quantification in exercise studies.

SSQ19-09 • Accurate T1 Relaxivities (r1) of Gadolinium-based Magnetic Resonance Contrast Agents (GBCAs) in Human Whole Blood at 1.5T and 3T
Yaqi Shen PhD, MD; Christopher G Snyder BS; Frank L Goerner PhD (Presenter) *; Regina Moritz; Val M Runge MD *

PURPOSE
The current available values for T1 relaxivity (r1) of Gadolinium based MR contrast agents (GBCAs) at 1.5T and 3T are either provided for non-clinically relevant scenarios or in only a portion of the available GBCAs. This is likely due to the complex nature of obtaining these values. This study determines and compares the r1 values of eight commercially available GBCAs in human whole blood at 1.5T and 3T.

METHOD AND MATERIALS
Pools of whole blood were obtained from healthy volunteer donors. They were allowed to age after collection. Colony-stimulating factor (CSF) was added to the aged blood to stimulate stem cells to generate CD34+ mononuclear cells. The blood was centrifuged to remove red blood cells and platelets. The supernatant was collected and used as the starting material for the study.

RESULTS
The current available values for T1 relaxivity (r1) of Gadolinium based MR contrast agents (GBCAs) at 1.5T and 3T are either provided for non-clinically relevant scenarios or in only a portion of the available GBCAs. This is likely due to the complex nature of obtaining these values. This study determines and compares the r1 values of eight commercially available GBCAs in human whole blood at 1.5T and 3T.

CONCLUSION
Multiple-transmit parallel RF transmission can improve the image quality and reduce scanning time.

CLINICAL RELEVANCE/APPLICATION
Multiple-transmit parallel RF transmission can improve the image quality and reduce scanning time.

SSQ19-07 • Comparison of Signal as a Function of Position for a 1H/31P Surface Coil Used in Exercise Studies
Erika Ripley (Presenter); Geoffrey D Clarke PhD

PURPOSE
We have reported that temporal changes in the brain parenchyma's apparent diffusion coefficient (ADC) during the cardiac cycle (7ADC) reveal the degree of fluctuation of water molecules likely resulting from arterial inflow (volume loading) during systole, and this information potentially facilitates the diagnosis of idiopathic normal pressure hydrocephalus (iNPH). However, we assessed the ADC change only in white matter. Moreover, several studies have shown that analysis of intraventricular CSF flow can provide the intracranial condition in iNPH. We therefore determined the temporal change in ADC over the cardiac cycle in the ventricular system of iNPH.

METHOD AND MATERIALS
On a 1.5-T MRI, ECG-triggered single-shot diffusion echo planar imaging (b = 0 and 1000 s/mm2) was used with sensitivity encoding and half-scan techniques to minimize the bulk motion. Then ADC image of each cardiac phase were made. Next, a normalized-7ADC image was calculated from all cardiac phase ADC images (20 phases) on a pixel-by-pixel basis using the following equation: Normalized-7ADC = (ADCmax - ADCmin)/(ADCmax + ADCmin), where ADCmax and ADCmin represent the maximum and minimum ADC during the cardiac cycle, respectively. We assessed normalized-7ADC and ADC values in the three ventricular regions: i.e., the anterior and posterior horns of the lateral ventricles and the third ventricle, and compared those values among the iNPH (n=14), atrophic ventricular dilatation (atrophic VD group; n=9), and healthy volunteers (control group; n=8).

RESULTS
Normalized-7ADC of the third ventricle was significantly higher in INPH compared with the control and atrophic VD groups, whereas there were no significant differences for normalized-7ADC in the other regions among the groups. This result can be explained by the fact that large compression on the ventricular system increases the fluctuation of the water molecules. However, there were no significant differences in ADC of all ventricular regions among the groups.

CONCLUSION
Normalized-7ADC analysis as a fluctuation MRI in the ventricular system makes it possible to noninvasively obtain more detailed information on the intracranial condition in INPH and thereby possibly assist in the diagnosis.

CLINICAL RELEVANCE/APPLICATION
Fluctuation analysis of the intraventricular CSF makes it possible to noninvasively obtain more detailed information on the intracranial condition in INPH and thereby possibly assist in the diagnosis.
To improve image quality in x-ray computed tomography (CT) in cases of missing or corrupt data.

**PURPOSE**

Thorsten Heuser

IR could be used to improve performance or reduce dose, with the amount of dose reduction dependent on lesion size and contrast, as well as the diagnostic task.

**CLINICAL RELEVANCE/APPLICATION**

Image quality and performance improvement of IR depends on diagnostic tasks. A previously validated CHO predicted that there is a significant improvement of observed for 3 mm lesion at 360 mAs, from 96±2% to 98±1% (p < 0.05).

**RESULTS**

- Simulation studies revealed that for a realistic thoracic morphology, CT numbers in slices at the edge of the axial field of view (from large cone-angles) vary by 30 HU as a function of the center view angle of the PS acquisition. Scatter alone causes variations of ~6 HU at different view angles. PS's from porcine studies confirmed HU variations in soft-tissue regions of 29 HU as view angle varied. In simulations, the application of the PSAR algorithm reduced the RMSE in the myocardial region from 14.5 HU to 6.3 HU across all slices and view angles.

**CONCLUSION**

New image reconstruction methods indicate that repeatable quantitative imaging is possible for CT acquisitions with a large cone angle.

**METHOD AND MATERIALS**

- Simulation studies were conducted with a monoenergetic simulation of an anthropomorphic phantom (i.e. the XCAT phantom). The central view angle of the image reconstruction was sampled in 15 deg intervals over 360 deg.

**METHOD AND MATERIALS**

- The cone-angle issues are mitigated with an error term derived from the error-reduction-based algorithm (ERB, Zeng et al., 2004). In addition, the scatter contributions are estimated based on the convolution of pencil-beam scatter distributions and a forward scatter model. These two components are iteratively estimated through successive cone-beam forward projections and Feldkamp reconstructions of the original artifact-present images. The proposed PSAR algorithm was tested with simulations of a 64-slice CT acquisition of a thoracic phantom. The view-angle dependent error was evaluated in simulations and verified with measured images from DCE-CT porcine studies.

**RESULTS**

- Simulation studies revealed that for a realistic thoracic morphology, CT numbers in slices at the edge of the axial field of view (from large cone-angles) vary by 30 HU as a function of the center view angle of the PS acquisition. Scatter alone causes variations of ~6 HU at different view angles. PS's from porcine studies confirmed HU variations in soft-tissue regions of 29 HU as view angle varied. In simulations, the application of the PSAR algorithm reduced the RMSE in the myocardial region from 14.5 HU to 6.3 HU across all slices and view angles.

**CONCLUSION**

New image reconstruction methods indicate that repeatable quantitative imaging is possible for CT acquisitions with a large cone angle.

**METHOD AND MATERIALS**

- Simulation studies were conducted with a monoenergetic simulation of an anthropomorphic phantom (i.e. the XCAT phantom). The central view angle of the image reconstruction was sampled in 15 deg intervals over 360 deg.

**RESULTS**

- Simulation studies revealed that for a realistic thoracic morphology, CT numbers in slices at the edge of the axial field of view (from large cone-angles) vary by 30 HU as a function of the center view angle of the PS acquisition. Scatter alone causes variations of ~6 HU at different view angles. PS's from porcine studies confirmed HU variations in soft-tissue regions of 29 HU as view angle varied. In simulations, the application of the PSAR algorithm reduced the RMSE in the myocardial region from 14.5 HU to 6.3 HU across all slices and view angles.

**CONCLUSION**

New image reconstruction methods indicate that repeatable quantitative imaging is possible for CT acquisitions with a large cone angle.

**METHOD AND MATERIALS**

- Simulation studies were conducted with a monoenergetic simulation of an anthropomorphic phantom (i.e. the XCAT phantom). The central view angle of the image reconstruction was sampled in 15 deg intervals over 360 deg.
METHOD AND MATERIALS
CT image quality often suffers from artifacts due to missing or corrupt data. Numerous approaches to reduce these artifacts have been published. These approaches include filter-based or extrapolation techniques specific for the kind of artifact investigated and in many cases tend to introduce new artifacts. Often, however, prior data are available which can, potentially, be used to better compensate for the missing or corrupt data and thereby to help reduce artifacts without introducing new artifacts. These prior data may be images from a different scan of the same patient, e.g. a planning CT, or images of a similar patient taken from a different patient database. We propose a prior-based artifact correction (PBAC) algorithm, a generalized correction method for prominent artifacts in CT resulting from missing or corrupt data. To compensate for differences in patient shape and position PBAC performs a non-rigid registration to match the prior with the patient, and it accounts for differences in the CT values by histogram matching. The registered prior is forward projected and its projections are used to smoothly inpaint the missing data. We evaluate all cases during reconstruction data results in the corrected image. PBAC is evaluated using several data sets measured with a clinical spiral cone-beam CT device (Somatom Definition Flash, Siemens Healthcare, Forchheim, Germany).

RESULTS
Compared to the uncorrected CT images PBAC reduces the artifacts by 79% in case of metal pedicle screws in a thorax scan, by 99% for a hip patient with 12.2 cm truncation, and by 67% in case of a head scan with a limited scan angle of 150°. In all cases PBAC significantly outperforms the conventional correction methods which achieve artifact reduction values of only 42%, 90%, and 5%, respectively.

CONCLUSION
PBAC is a highly effective method to correct artifacts from resulting in missing or corrupt data by making use of prior knowledge. It significantly increases the image quality and preserves the patient-specific anatomy to allow for reliable medical diagnosis.

CLINICAL RELEVANCE/APPLICATION
PBAC is relevant for clinical CT which often suffers from metal artifacts, and it is relevant for flat detector CT which additionally suffers from truncation or limited angle artifacts.

SSQ20-05 • Clinical Evaluation of Coronary Artery Image Quality with Second Generation Iterative Model Reconstruction

Ethan J Halpern MD (Presenter) ; Eric L Gingold PhD ; Hugh White MD ; Katrina M Read MS *

PURPOSE
Iterative Model Reconstruction (IMR), as implemented in the second generation Philips software for multislice CT, is a knowledge-based reconstruction with marked reduction in image noise. The purpose of this study was to evaluate image quality with the application of IMR to coronary CT angiography (CCA).

METHOD AND MATERIALS
We evaluated 20 consecutive CCA cases acquired with a 256-slice ICT scanner, following reconstruction with traditional filtered back projection (FBP), first generation iterative reconstruction (iDose) and second generation IMR (Philips Medical Systems; Cleveland, OH). Each case was reconstructed in a diastolic phase (75% of the R-R interval) and evaluated by two independent reviewers. The mean and standard deviation (sd) of pixel values were computed in a standardized region of interest (ROI) and in left to right overimaged left coronary artery. Subjective rating scores were obtained from each reviewer (1-5 scale for poor-excellent) for definition of 1) contours of small coronary arteries, 2) vessel caliber and 3) signal-to-noise ratio.

RESULTS
Second generation IMR reduces intravascular noise on CTA by 86% compared with FBP, allowing better definition of smaller coronary arteries, better discrimination of coronary calcification, better definition of non-calcified plaque, and improved overall diagnostic confidence in the presence or absence of coronary stenosis.

CONCLUSION
IMR provides images with decreased noise and improved definition of fine anatomical details in the coronary circulation without requiring additional radiation exposure.

SSQ20-06 • Iterative Metal Artifact Reduction in Computed Tomography

Andreas Krauss PhD (Presenter) * ; Rainer Raupach PhD * ; Bernhard Schmidt PhD * ; Thomas G Flohr PhD *

PURPOSE
To quantitatively evaluate the performance of a novel algorithm for metal artifact reduction in computed tomography (CT).

METHOD AND MATERIALS
The proposed iterative metal artifact reduction algorithm starts with standard CT reconstruction. Metal pixels are then identified through HU thresholding and a metal score is calculated from the input image by assigning soft tissue pixels (identified by upper and lower HU thresholds) to 0 HU. Then normalized sinogram interpolation is performed: The prior image is forward projected and the original rawdata is normalized pixelwise with the prior sinogram. In the normalized sinogram, pixels within the metal trace are replaced by linear interpolation from the edges of the metal with a priori known HU at localization. The interpolated sinogram is de-normalized and standard reconstruction of the corrected sinogram is performed. The procedure is repeated iteratively with the output of the previous iteration used as input for prior image calculation. Finally, a frequency split is performed to preserve valid edge information of the non-corrected images: The high frequency part of non-corrected images is merged with the low frequency part of MAR-corrected images. The algorithm was applied to 10 hip replacement cases.

RESULTS
Streak artifacts from hip prostheses as well as the typical dark band between bilateral hip prostheses were almost completely eliminated. Pelvic soft tissue and organ structure was restored. Typical drawbacks of previous MAR algorithms such as introduction of new artifacts or compromised bone structure close to the prostheses were minimal due to iterative normal interpolation and frequency split, respectively. Between bilateral hip prostheses, mean HU values within regions of interest located inside the bladder (expected to be water, i.e. 0 HU) were improved from -3.2 ± 2.52 HU to -7 ± 38 HU.

CONCLUSION
The proposed algorithm substantially reduces artifacts from hip prostheses.

CLINICAL RELEVANCE/APPLICATION
MAR provides images with decreased noise and improved definition of fine anatomical details in the coronary circulation without requiring additional radiation exposure.

SSQ20-07 • Optimization-based Image Reconstruction with Variable Resolution in Diagnostic CT

Zheng Zhang MA, BS (Presenter) ; Junguo Bian PhD ; Xiaohua Pan PhD ; Xiaohua Pan PhD * ; Alexander Zamyatin PhD * ; Emil Y Sidky PhD *

PURPOSE
In diagnostic computed tomography (CT) imaging, it is often of interest to obtain detailed information within a region of interest (ROI), while rough knowledge outside the ROI may be sufficient. This novel imaging approach leads to an image reconstruction problem that requires voxels of different sizes within and outside the ROI. In this work, we develop and investigate an optimization-based algorithm to reconstruct images with variable spatial resolution, that is, images with non-uniform voxel sizes.

METHOD AND MATERIALS
We used a Toshiba 320-slice diagnostic CT scanner to collect data from a patient and a swine using a circular geometry. Both data sets were acquired at 1200 views over 27°. We performed image reconstruction by using a modified adaptive-steepest-descent-projection-onto-convex-sets (ASD-POCS) algorithm, which is specifically adapted to accommodate image arrays with variable resolution. Using this modified algorithm, we performed reconstruction on a variable-resolution domain, which consists of voxels of size 0.06 cm within a selected ROI, and voxels of size 0.12 cm outside the ROI. We then carried out additional reconstructions by further increasing the voxel size outside the ROI to 0.24 and 0.48 cm. As references, we also applied ASD-POCS algorithm to reconstructing images on uniform-resolution arrays, consisting of voxels of sizes ranging from 0.06 cm to 0.48 cm.

RESULTS
By visual comparison, we observed that in the variable-resolution images, as the ratio of voxel size outside the ROI to that within the ROI increased from 1 to 6, although the region outside the ROI becomes progressively coarser, the image quality within the ROI remains virtually identical to that of the reference image reconstructed with uniform voxels of size 0.06 cm.

CONCLUSION
The results demonstrate that by employing an optimization-based algorithm tailored to variable-resolution images, we are able to reconstruct images within ROI of quality comparable to that obtained with uniform, high-resolution arrays.
Mitigation of Windmill Artifacts at Large Cone Angles

Hye Sun Na (Presenter) ; Akira Hagiwara * ; Brian E Nett PhD *

PURPOSE
To assess windmill artifact mitigation performance for a new reconstruction algorithm at large cone angles

METHOD AND MATERIALS
Numerical simulations of an anthropomorphic phantom (i.e. XCAT) were performed with a total coverage of 14.6 deg. Images were reconstructed by both the traditional FDK algorithm and the improved algorithm for both full-scan and cardiac modes. Then three types of tissue: cardiac muscle, soft tissue, and lung, were segmented and separately analyzed for the effect of cone beam artifacts. The severity of cone beam artifacts for a certain type of tissue in different slices is evaluated using the metric of mean CT# deviation from the ground truth.

RESULTS
For both full-scan and cardiac acquisitions, the mean CT# deviation in the images reconstructed with the improved algorithm remains significantly lower than the FDK type algorithm for all slices and all tissues. For a full-scan acquisition the images reconstructed with the improved algorithm, compared with the FDK reconstruction, show a reduction of the mean CT# deviation of 52%±16%, 39%±21%, and 53%±19%, for cardiac muscles, soft tissues, and lungs, respectively, over the studied cone angle coverage. For a cardiac acquisition, the reductions of the mean CT# deviation from FDK to WC reconstructed images for the three tissue types are 79%±24%, 77%±20%, and 79%±17%, respectively.

CONCLUSION
Compared to the traditional FDK-type algorithm, the newly developed Wide-Cone algorithm substantially reduces the cone-beam artifacts without degrading z-resolution.

Performance Evaluation of a New Analytic Reconstruction Algorithm for Axial CT with Large Cone-angle Coverage

Zhihu Qi PhD (Presenter) ; Brian E Nett PhD *

PURPOSE
To prospectively compare SIRT and Drug Eluting Bead-TACE (DEB-TACE) for the treatment of intermediate stage HCC.

METHOD AND MATERIALS
From 04/2010 – 04/2013, a total 24 patients with histology proven irresectable intermediate stage N0, M0 HCCs were randomized to receive SIRT or DEB-TACE. Randomization was stratified according to tumor load < or =25%. SIRT was performed in a bilobar approach and could be repeated once for each patient. Follow-up was carried out by MRI in 3 month intervals.

RESULTS
The SIRT group had a lower rate of tumor progression (22% vs. 45%) and higher median survival (422 vs. 275 days). The median survival for intermediate stage HCC patients was 325 days. The difference in median survival between the two groups (p=0.18). A SIRT patients died of liver failure, 3x due to decompensation of esophageal varices, 1x to cardiac arrest, 1x to carotid artery stenosis, and 1x to pseudoaneurysm of the common femoral artery.

CONCLUSION
The new reconstruction algorithm reduces windmill artifacts without significantly degrading z-resolution.

Prospective Randomized Comparison of Selective Internal Radiation Therapy (SIRT) versus Transarterial Chemoembolisation (TACE)

for the Treatment of Hepatocellular Carcinoma (HCC)

Roman Kloeckner MD (Presenter) ; Waltraud Eichhorn ; Gerd Otto MD ; Marcus A Worns ; Christoph Dueber MD ; Michael B Pitton MD

PURPOSE
To prospectively compare SIRT and Drug Eluting Bead-TACE (DEB-TACE) for the treatment of intermediate stage HCC.

METHOD AND MATERIALS
From 04/2010 – 04/2013, a total 24 patients with history proven irresectable intermediate stage N0, M0 HCCs were randomized to receive SIRT or DEB-TACE. Randomization was stratified according to tumor load < or =25%. SIRT was performed in a bilobar approach and could be repeated once for each patient. Follow-up was carried out by MRI in 3 month intervals.

RESULTS
Each group consisted of 12 patients. Demographic data were not considerably different between both groups (SIRT: 8 male / 4 female, mean age 72 ± 7 years; TACE: 10 male / 2 female, mean age 71 ± 9 years). 1 patient in each group had an initial tumor load =25%. Mean follow up period in the SIRT group was 394 ± 311 days, compared to 385 ± 292 days. Overall median survival was 392 days. There was no significant difference in median survival between both groups (p=0.81). 4 SIRT patients died of liver failure, 3x due to decompensation of esophageal varices, 1x to cardiac arrest, 1x to pseudoaneurysm of the common femoral artery. 6 TACE patients died (3x tumor progress, 1x liver failure, 1x bleeding of esophageal varices, 1x deterioration of general condition after coronary bypass surgery).

CONCLUSION
No significant difference was found in median survival between SIRT and TACE in intermediate stage HCC-patients. The lower rate of tumor progression in the SIRT group was nullified by a greater incidence of liver failure.

PET/MRI of Hepatic 90Y Microsphere Uptake: Correlation of Angiographic and Radiologic Findings with Microsphere Deposition

Kathryn J Fowler MD (Presenter) ; Nael E Saad MBChB ; Akash Sharma MD ; Christina K Speirs MD, PhD ; Jeffrey R Olsen MD * ; Jose
Y90 radioembolization provides preferential delivery of radioactive microspheres allowing higher doses delivered over a limited range. Pre-embolization work-up with angiography +/- coil embolization, and Tc-99m MAA SPECT is done to assess suitability. Despite importance of optimal technique, there is limited literature on imaging the biodistribution of microsphere delivery. The purpose of this prospective study was to evaluate the post-radioembolization distribution of particles with PET/MR (Siemens Biograph, Erlangen, Germany).

METHOD AND MATERIALS
PET/MRI was performed within 48 hours (range 3.5-24 hours) of radioembolization for 4 patients with HCC and 7 patients with metastases (5 colorectal, 1 anal squamous cell carcinoma, and 1 neuroendocrine). Microsphere type included resin (n=8) and glass (n=3) with delivery to the right (n=8), left (n=2), and proper hepatic artery (n=1). Biodistribution was qualitatively assessed as discrete within the tumor, ill-defined, and assigned as whole liver, lobar or sectional distribution. Comparison with pre-treatment angiography, Tc-99m MAA, and gadoxetic acid enhanced MRI with diffusion weighted imaging was performed to analyze distribution, non-target uptake, and tumor coverage.

RESULTS
PET/MRI demonstrated intrahepatic Y90 microsphere distribution in all patients following radioembolization (n=11). PET biodistribution localized to tumor for 9 patients. Peripheral uptake was observed in metastatic lesions, correlating with enhancement and diffusion restriction. Uptake in HCC was more uniform and was observed within tumor thrombus as well. Heterogeneous microsphere distribution within a treatment region was observed in 2 cases of colorectal cancer metastases, which correlated with differentiated perfusion on pre-treatment work-up.

CONCLUSION
PET/MRI allows localization of 90Y microsphere biodistribution following radioembolization. The pattern of distribution correlates with pre-treatment angiography, Tc-99m MAA SPECT, enhancement and diffusion imaging. Future work will focus on correlating biodistribution of particles with tumor response and outcomes with possible validation of 90Y PET/MRI as an indicator of adequate tumor coverage and early predictor of treatment response/potentiating adaptive treatment regimens.

CLINICAL RELEVANCE/APPLICATION
PET/MRI imaging of Y90 distribution provides confirmation of delivery to the expected region, tumor coverage, and validation of pre-treatment planning results.

SSQ21-03 • Yttrium-90 Radioembolization for Neuroendocrine Tumor Liver Metastases
Katherine Y Fan BS (Presenter) ; Aaron T Wild BA ; Vivek Gowdra Halappa MD ; Rachit Kumar MD ; Susannah Yovino MD ; Timothy Pawlik MD * ; David O Cosgrove MBChB, FRCR * ; Ibah R Kamel MD, PhD * ; Joseph M Herman MD, MSc ; Jean-Francois H Geschwind MD *

PURPOSE
Surgical resection remains the only curative option for neuroendocrine tumor liver metastases (NETLM). However, 90% of patients have unresectable disease. Limited data currently exists for yttrium-90 (Y-90) radioembolization, an emerging treatment option for unresectable NETLM. This study evaluates the efficacy, tolerability, and prognostic factors of Y-90 radioembolization in NETLM patients.

METHOD AND MATERIALS
Thirty-eight patients underwent glass-based Y-90 radioembolization for NETLM at a single institution between April 2004 and February 2012. Patients were assessed radiographically (using magnetic resonance imaging), serologically, and clinically at 1 month and then every 3 months post-treatment for tumor response, toxicity, and survival outcomes.

RESULTS
Median length of follow-up was 17 months (IQR, 9-37). Median survival was 29 months. On imaging follow-up, 3 patients (9%) had a complete response (CR) to treatment, 6 (17%) had a partial response (PR), 21 (60%) had stable disease (SD), and 5 (14%) developed progressive disease (PD). Multivariate analysis with backward elimination revealed 2 factors to be independently associated with good tumor response (CR/PR): histological subtype (p=0.037) and hepatic LSF (p=0.038). Median overall survival (OS) was observed in patients requiring more than one Y-90 treatment (HR 7.384, p=0.003) and in patients with = 1 ECOG performance status (HR 3.539, p=0.04) on multivariate proportional hazards regression models for OS. Development of grade 3 serologic toxicities was observed in only 2 patients (one with elevated bilirubin, the other elevated alkaline phosphatase) after treatment. Grade 3 non-serologic toxicities experienced included abdominal pain (11%), fatigue (11%), nausea/vomiting (5%), ascites (5%), dyspnea (3%), diarrhea (3%), and peripheral edema (3%).

CONCLUSION
Our institutional experience demonstrates Y90 radioembolization can be an efficacious, safe, and tolerable treatment for NETLM.

CLINICAL RELEVANCE/APPLICATION
Y-90 radioembolization can safely and effectively target liver metastases from neuroendocrine tumors and is recommended for patients with unresectable liver metastases.

SSQ21-04 • Intratumoral Vascular Shunting: The Missing Link between Circulating Tumor Cells and Metastasis?
Amy R Deipolyi MD, PhD (Presenter) ; Patrick D Suthpin MD, PhD ; Siddharth Govindan MD ; Suvaranu Ganguli MD * ; Rahmi Oklu MD, PhD

PURPOSE
Colorectal carcinoma is a leading cause of cancer mortality mostly due to metastasis. It is unclear how large circulating tumor cells (CTCs) shed from the tumor traverse capillary beds to establish distant lesions. Intratumoral vascular shunting, however, may provide a conduit for CTCs to access distant sites. To determine whether intratumoral shunting is associated with metastasis, we assessed how tumor shunting related to the presence of disseminated disease and to clinical outcome.

METHOD AND MATERIALS
61 colorectal cancer patients with liver metastases (30 F, 31 M; mean age 63 yr) were evaluated for selective internal radiation therapy (SIRT) from 5/07 to 8/12. Following transcatheter injection of radioactive particles (99mTc-MAA), lung shunt fractions (LSF) were calculated reflecting the amount of intratumoral shunting of MAA particles, which can measure up to 150 microns. Medical records were reviewed for other metastases and the size of liver lesions before and after SIRT, the time between SIRT and disease progression, and patient survival after SIRT. Liver tumor size was estimated using the largest dimension of the largest lesion. The relationship of LSF and estimated tumor size to outcomes was assessed using linear regression and student’s t test.

RESULTS
Patients with lung metastases at the time of SIRT had significantly higher LSF (mean 9.2%) than patients without lung metastases (mean 6.1%) (p<0.05).

CONCLUSION
LSF may be a more robust marker of metastatic potential than tumor size. Increased LSF due to vascular shunting within liver metastasis is an indicator of distant metastasis and is associated with more rapid disease progression after SIRT. Intratumoral shunting may provide a conduit for CTCs to access more remote organs, bypassing filtration by liver parenchyma and may be an important factor in metastatic potential of colorectal cancer.

CLINICAL RELEVANCE/APPLICATION
Vascular shunting in liver metastases from colorectal cancer is a robust indicator of more distant metastases and future disease progression, and may be a more useful clinical marker than tumor size.

SSQ21-06 • Boosted Selective Internal Radiation Therapy (B-SIRT) Using 90Y-loaded Glass Microspheres Induces Prolonged Overall Survival for PVT Patients
Etienne Garin MD (Presenter) * ; Laurence Lenoir ; Julien Edeline ; Eveline Boucher ; Yan Rolland MD, PhD *

PURPOSE
Evaluation of the response rate and survival of hepatocellular carcinoma PVT patients treated with Therasphere® using the boost concept.

METHOD AND MATERIALS
Therasphere® was administered in 40 PVT hepatocellular carcinoma patients (main= 11, lobar = 23, segmental= 6). MAA SPECT/CT quantitative analysis was used for the calculation of the tumour dose (TD), the healthy injected liver dose (HLD) and the injected liver dose (LD). Response was evaluated at 3 months using EASL criteria. OS was evaluated using Kaplan and Meyer tests.

RESULTS
Mean 90Y-loaded microspheres injected activity was 3.1±1.5 GBq. Mean LD was 143±49Gy. Median TD was 316Gy for responding lesions versus 133Gy for non responding lesion (p ≤0.001). OS was 12m [3-8] for patients with main PVT versus 21.5m [12-28.7] for patients segmental or lobar PVT (ns). Finally Os was 23.2m for patients with a TD>205Gy and a good PVT targeting (n= 34).

CONCLUSION
Boosted selective internal radiation therapy using 90Y-loaded glass microspheres induces prolonged overall survival for PVT patients without increasing liver toxicity.
CLINICAL RELEVANCE/APPLICATION
Boost selective internal radiation therapy using 90Y loaded glass microsphere allows a fully customized oncological treatment for PVT patients inducing prolonged survival.

SSQ21-07 • Sorafenib versus Y90-radioembolization in Cirrhotic Patients with Hepatocellular Carcinoma (HCC): Cohort and Nested Control-case Study with Propensity Analysis

Alberta Cappelli MD (Presenter) ; Cristina Mosconi ; Annagiuilia Gramenzi ; Sara Marinelli ; Alessandro Granito ; Virginia Erro ; Silvia Fiumana ; Mauro Bernardi ; Luigi Bolondi ; Franco Trevisani ; Rita Golferi MD

PURPOSE
Sorafenib and Transarterial Y90-radioembolization (TARE) are treatments currently available for advanced (BCLC stage C) HCC not amenable or resistant to curative options and transarterial chemoembolization (TACE). No study comparing the outcome of these treatments (pts) is yet available. We performed a case-control, retrospective study to compare the survival in both groups comparing the two treatments after patients’ matching for the independent prognostic factors.

METHOD AND MATERIALS
RESULTS
67 Sorafenib pts and 63 TARE pts were selected. The two groups did not significantly differ for gender, aetiology, previous HCC treatments, portal vein thrombosis, Child-Pugh class, MELD score, BCLC stage, alpha-fetoprotein levels, ascites, creatinine, platelet count. Median survival did not differ between Sorafenib (13.1 months; 95% CI: 3.1-23.2) and TARE (13.2; 6.1-20.2; P=0.854) and mortality rate at 1, 2 and 3 years was respectively 48%, 70% and 86% vs 48%, 73% and 80%. Propensity model matched 34 pts for independent non-co-axial prognostic factors: PS, MELD, portal thrombosis, tumour gross pathology. Median survival was 13.1 months (1.3-25.0) for Sorafenib and 9.0 months (3.7-14.3) for TARE (P=0.214).

CONCLUSION
In advanced HCC not otherwise treatable, Sorafenib provides, after adjustment for the confounding factors, a not statistically significantly better survival than TARE.

CLINICAL RELEVANCE/APPLICATION
In advanced HCC treated with Sorafenib or TARE, the propensity analysis demonstrates that median survival is better after Sorafenib but not statistically different (13.1 vs 9.0 months: p=0.214).

SSQ21-08 • A New Model to Estimate Prognosis after Yttrium-90 Radioembolization in Patients with Hepatocellular Carcinoma

Thomas C Launenstein MD (Presenter) ; Judith Ertle ; Stefan P Mueller MD * ; Andreas Bockisch ; Guido Gerken ; Joerg Schlaak

PURPOSE
A prognostic model to estimate the survival in hepatocellular carcinoma (HCC) patients treated with transarterial hepatic selective internal radiotherapy (SIRT) is not fully characterized. We aimed to establish a new scoring model including assessment of both tumor responses and therapy-induced systemic changes in HCC patients to predict survival at an early time point post-SIRT.

METHOD AND MATERIALS
149 HCC patients treated with SIRT (TheraSphere, MS Nordion, Canada) were included into this study. CT images and biomarkers in blood tested at one month post-SIRT were analyzed and correlated with clinical outcome. Tumor responses were assessed by RECIST 1.1, mRECIST, and Choi criteria. Kaplan-Meier methods were used to estimate survival curves. Cox regression was used in uni- and multivariable survival analyses and in the establishment of a prognostic model.

RESULTS
CONCLUSION
A new model including imaging and non-imaging parameters may predict survival of HCC patients at an early time point after SIRT. In this model, Choi criteria should be applied rather than RECIST or mRECIST.

CLINICAL RELEVANCE/APPLICATION
Efficacy of SIRT can be predicted one month after therapy.

ASRT®RSNA 2013: Elbow and Forearm Trauma: Mechanisms of Injury and Patterns of Fractures

Thursday, 10:40 AM - 11:40 AM • N230

LEARNING OBJECTIVES
1) Review the anatomy of the elbow joint in three dimensions. 2) Demonstrate the standard radiographic views of the elbow. 3) Discuss techniques for performing CT of the elbow. 4) Illustrate that the forearm is a ring, and show how specific mechanism of injuries yield specific fracture patterns. 5) Teach the four keys to looking at elbow radiographs.

ABSTRACT
Designed for non-radiologists and radiologists alike, this course explores elbow and forearm trauma, using multicolored 3-D images as well as dynamic illustrations. After reviewing the anatomy of the elbow joint, the presentation will show how this anatomy can be optimally imaged, both radiographically and with CT. Using a model of the forearm as a ring, the lecture will demonstrate how one common mechanism, the "Fall on Palm Heel" (FOPH), can cause a variety of fracture patterns, depending on how the forces travel up the forearm. This model will be used to illustrate and differentiate the classic forearm fractures, including both bone forearm fracture, Monteggia, Galeazzi and Essex-Lopresti. The presentation also will focus on the elbow joint, illustrating the radiographic appearance of common elbow injuries in adults and children, including non-displaced radial head supracondylar, lateral condylar, and medial epicondylar fractures. The "4 Keys" to assessing elbow radiographs are emphasized throughout the talk:
1) The radial head always points to the capitellum. 2) Fat pads are your friends. 3) The anterior humeral line passes through the middle third of the capitellum. 4) When in doubt, get the other side.

Characterization of Breast Cancer Using PET Molecular Imaging: A Clinical Perspective

Thursday, 12:15 PM - 12:45 PM • SS503AB

CL-MIE-TH5A
Amir Imanzadeh , MD
Pedram Heidari , MD
Sarvenaz Pourjabbar , MD

PURPOSE
18F-FDG, despite its widespread use in oncologic assessment, has limited application in breast cancer (BrCa) characterization; a broad range of PET tracers has been developed for BrCa to address this unmet need. We will discuss i) the major classes of targeted compounds that have been used for imaging of BrCa; ii) detail the most promising tracers in each class.

CONTENT ORGANIZATION
1. Importance of PET imaging in BrCa 2. Limitations of 18F-FDG in characterization of BrCa 3. Various classes of receptor PET tracers including small molecules, peptides, antibody fragments 4. A detailed description (including advantages and limitations) of tracers in each class with potentially higher clinical impact in BrCa 5. Future directions in development of novel PET tracers for BrCa.

SUMMARY
PET has become a powerful tool in diagnosis and follow up of cancer patients including BrCa. Since 18F-FDG has a number of limitations in characterization of BrCa phenotype, a wide variety of PET tracers have been developed that range from small molecules to intact antibodies. This overview encompasses limitations of FDG PET in BrCa, groups of compounds that can be used as probes for BrCa PET imaging, and detailed examples of more promising tracers in each class.
CL-MIS-TH1A • Simplified Two-timepoint FDG-PET/CT for Diagnosis of Pancreatic Lesions. Is It Helpful in Determining Pancreatic Lesions?

Freimut Juengling MD, PhD (Presenter) *; Christian Bieg MD; Ralph Peterli MD; Markus Von Flue MD; Markus Gass MD

PURPOSE
Predicting the dignity of pancreatic lesions is still a diagnostic challenge. Fusion of FDG-PET/CT with diagnostic computed tomography offers new possibilities, nevertheless the differentiation between benign changes in chronic pancreatitis from pancreatic cancer remains difficult. Therefore the aim of this study was to evaluate, whether early two-timepoint kinetics of pancreatic lesions in FDG PET may be helpful to differentiate pancreatic lesions

METHOD AND MATERIALS
We prospectively analyzed 64 patients (pancreatic cancer n=45, chronic pancreatitis n=19) scheduled for two-timepoint FDG-PET/CT scan for pancreatic lesions in our hospital between 2005-2011. Studies were performed 60 and 90 minutes after application of the radioactive substance. Histological samples were collected for all patients, either by resection or by biopsy. Semi-quantitative analysis was performed using the minimal, maximal and the average standardized uptake value (SUV) from the two different sets of images and a SUV change was calculated as difference between the two measurements. SUV changes of patients with pancreatic cancer and chronic pancreatitis were compared using the student t-test.

RESULTS
Mean change of SUVmin. was 12.04 % for pancreatic cancer vs. -4.66 % for chronic pancreatitis respectively (p=0.00012). Mean change of SUVavg. was 12.13 % for pancreatic cancer vs. -5.65 % for chronic pancreatitis respectively (p

CONCLUSION
The present analysis shows a statistically highly significant difference comparing the changes in SUVmin, SUVavg and SUVmax in early two-timepoint PET/CT images of patients with pancreatic cancer and chronic pancreatitis. This is the first analysis of two-timepoint PET/CT performed as early as 30 minutes after the first images. The additional time and effort is minimal and fits perfectly into the existing, clinical and diagnostic workflow. Therefore, in patients with suspicious pancreatic lesions the simplified two-timepoint FDG-PET/CT represents an excellent diagnostic option and is helpful in characterizing pancreatic lesions.

CLINICAL RELEVANCE/APPLICATION
In patients with pancreatic lesions simplified two-timepoint FDG-PET/CT can help to differentiate between malignant and chronic inflammatory disease and is recommended in initial diagnostic evaluation.

CL-MIS-TH2A • Functional Diffusion Map, a Preferable Biomarker versus Mean ADC Value for Early Evaluation of TACE Treatment Response in Patients with Liver Carcinoma

Yong-Bo Yang (Presenter) ; Yu-Fang Chen ; He Wang PhD ; Dong Chen ; Xing-An Long ; Hong-Yan Cheng

PURPOSE
To compare the efficacy of Functional Diffusion Map (FDM) and mean ADC in the early evaluation of Transarterial Chemoembolization (TACE) treatment response in patients with liver carcinoma, as it was typically evaluated by traditional imaging methods several months later.

METHOD AND MATERIALS
A total of 45 patients with liver carcinoma were enrolled and treated with TACE. T1-weight and DWI (b=600) were performed before treatment and 4 weeks later. The three-color FDM was obtained from the registration of DWI images to their own pre-treatment T1-weighted images and a 12-degree of freedom transformation using FSL (FMRIB, Oxford, UK). Red voxels (VR) for which the ADC increased significantly, blue voxels (VB) for which the ADC decreased significantly, and green voxels (VG) for which the ADC did not change significantly, where total voxels (VT= VR+VB) for which the ADC changed significantly. The mean ADC values were measured on the diffusion MRI images in one week ahead of TACE and one month after the treatment. Each patient was examined by dynamic contrast-enhanced CT or MRI every 3 months during the follow-up.

RESULTS

CONCLUSION
FDM showed better efficacy than the mean ADC value in the early evaluation of therapeutic response in patients with liver carcinoma after TACE, and a fairly close association with those by the long-term conventional means of imaging. It will be a powerful and promising biomarker and could provide an early and important reference for the clinical protocols.

CL-MIS-TH3A • Hybrid 18F-FDG PET-MRI of the Hand in Rheumatoid Arthritis

Falk R Miese MD (Presenter) ; Hubertus Hautzel MD ; Benedikt Ostendorf ; Gerald Antoch MD * ; Axel Scherer MD ; Hans Herzog

PURPOSE
18F-FDG-PET is highly sensitive to inflammatory activity in Rheumatoid Arthritis (RA). However, it is MRI that is the imaging method of choice for the visualization of joint damage in RA due to its high soft tissue contrast and superior spatial resolution. The purpose of the present study was to test the feasibility of true hybrid PET-MRI of the hand in RA and to compare the assessment of synovitis in PET and MRI.

METHOD AND MATERIALS
True hybrid 18F-FDG-PET-MRI was acquired in four patients. All patients were female with an average age of 48 years, range 24-58 years. Two presented with early therapy-naive RA, two presented prior to therapy escalation. PET-MRI were acquired on a APD-based magnetoinsensitive BrainPET Detector (Siemens Healthcare, Erlangen, Germany) in a 3 T MRI scanner (Magnetom Trio, Siemens). The MRI data were evaluated according to the RAMRIS synovitis criteria. The PET of the same joints was categorized semiquantitatively. Additional findings, not included in the RAMRIS criteria, such as tenovaginitis or synovitis of joints not applicable for the RAMRIS were recorded.

RESULTS
All patients were positive for synovitis in MRI and PET. On a joint base, 21/26 (81%) of joints were MRI-positive, and 18/26 (69%) were positive on PET. In three patients that demonstrated synovitis on MRI, normal gluocis utilization was noted (14%). Synovitis severity as measured in PET and MRI correlated significantly (r = 0.672; P < 0.001). In 6/10 additional abnormal findings there was concordance between MRI and PET.

CONCLUSION
The results of this feasibility study point towards the validity of 18F-FDG PET-MRI of the hand in RA. 18F-FDG PET-MRI may possibly be a tool for further research on inflammatory activity, therapy control and joint destruction in RA.

CL-MIS-TH4A • Ultra-high Relaxivity Gd Nanoparticles for Molecular Imaging

Ananth Annapragada PhD * ; Eric Tanifum PhD ; Ketan B Ghagada PhD (Presenter) *

PURPOSE
T1 based Magnetic Resonance (MR) molecular imaging requires molecularly targeted, high relaxivity contrast agents. The Solomon-Bloembergen-Morgan equations predict that the T1 relaxivity of Gd-based agents at clinically relevant field strengths can be increased by increasing the rotational correlation time of the Gd. The purpose of this work was therefore to design Gd-presenting nanoparticles that increased the rotational correlation time, and to test them in vitro and in vivo.

METHOD AND MATERIALS
Gd-presenting liposomal nanoparticles were designed with Gd chelates either on, or off hydrophilic tethers that modulated the in-membrane flipping of the Gd. Lipid anchors were varied to modulate the in-membrane rotation. Relaxivity measurements were made at field strengths from 1.4T to 9.4T. MR angiography was performed in C57BL/6 mice to study signal intensity as a function of gadolinium dose in the vasculature, and immobilized in tissue.
**RESULTS**

The liposomal nanoparticle enabled association of 25,000-100,000 gadolinium chelates per nanoparticle. Inhibiting Gd chelate rotation resulted in at least a 5 fold increase in T1 relaxivity compared to conventional contrast agents. MRA studies demonstrated a long blood half-life (~24 hours) of the nanoparticle contrast agent compared to the conventional agents. The high T1 relaxivity of the nanoparticle agent resulted in a substantially higher signal-to-noise ratio and improved feature conspicuity.

**CONCLUSION**

This study demonstrates an ultrahigh T1 relaxivity Gadolinium-based nanoparticle contrast agent for use in MR molecular imaging. Combined with the multiplex ability of the particle encapsulating a large number of Gd atoms, a signal enhancement of at least 125,000 over traditional Gd chelates is achieved. This could facilitate the use of such a particle in MR molecular imaging.

**CLINICAL RELEVANCE/APPLICATION**

The development of a high T1 relaxivity Gadolinium-based nanoparticle contrast agent will enable MRI-based interrogation of molecular targets.

---

**18F-FAMT PET/CT for Accurate Tumor Volume Prediction in Oral Squamous Cell Carcinoma: Correlation with Immunohistological Findings and Comparison with 18F-FDG**

**Mu Kim (Presenter) ; Tetsuya Higuchi MD, PhD ; Yukiko Arisaka MD ; Azusa Tokue MD ; Shigeyasu Sugawara ; Arifudin Achmad MD ; Yoshito Tsushima MD ; Satoshi Yokoo**

**PURPOSE**

L-3-[18F]-fluoro-?-methyl tyrosine (18F-FAMT) is an amino acid tracer for positon emission tomography/computed tomography (PET/CT) which evidenced additional usefulness to the 2-[fluorine-18]-fluoro-2-deoxy-D-glucose (18F-FDG) PET/CT for diagnosis of malignancies. In this study, both modalities were tested for their accuracy in tumor volume prediction of oral squamous cell carcinoma using PET-VCAR software. Relationship between the radiotracers uptake, expression of cell proliferative marker and pathological prognostic marker were elucidated by immunohistochemical study.

**METHOD AND MATERIALS**

Fourteen OSCC patients were enrolled in PET/CT studies using 18F-FDG and 18F-FAMT before surgery. The functional tumor volumes (cm3) were calculated from volume of interest (VOI) generated by the PET-VCAR using the pre-determined cut-off values. Semi quantitative analyses were performed using a representative maximal standardized uptake value (SUVmax) of both radiotracers. Post-surgical pathological examination results were used as the reference to determine the final diagnoses and the actual tumor size. Immunohistochemical studies were performed to evaluate the clinicopathological variables.

**RESULTS**

18F-FAMT uptake correlates with tumor viability. Tumor volumes derived from 18F-FDG PET were significantly bigger that than derived from 18F-FAMT images, and the actual tumor size (P < 0.05).

**CONCLUSION**

Tumor volumes obtained from 18F-FAMT PET/CT uptakes correlates with cellular proliferative and prognostic markers in OSCC.

**CLINICAL RELEVANCE/APPLICATION**

18F-FAMT PET/CT for accurate tumor volume prediction in oral squamous cell carcinoma

---

**Prognostic Utility of FDG PET Metabolic Tumor Volume in HPV Positive, Stage III and IV Oropharyngeal Squamous Cell Carcinoma**

**Krishna Alluri MD (Presenter) ; Abdel K Tahari MD, PhD ; Christine Chung MD ; Harry Quon MD ; Wayne Koch MD ; Richard L Wahl MD * ; Rathan M Subramaniam MD, PhD +**

**PURPOSE**

To establish the prognostic utility of (18)F-fluorodeoxyglucose (FDG) positron emission tomography/ computed tomography (PET/CT) parameters SUVmax, SUVmean, SUVpeak, metabolic tumor volume (MTV) and total lesion glycolysis (TLG) in human papilloma virus (HPV) positive stage III and IV oropharyngeal squamous cell carcinoma (OPSCC).

**METHOD AND MATERIALS**

We included 70 patients who had a biopsy-proven, HPV positive (in situ hybridization), stage III and IV oropharyngeal SCC and had a baseline PET/CT examination at our institution in the study. Outcome endpoint was event free survival (EFS). An event can be either either recurrence or death. Cox proportional hazards univariate and multivariate regression analyses were performed, creating two multivariate models. Imaging and clinical parameters were included in the models. Survival analysis was performed using Kaplan Meir survival curves.

**RESULTS**

In Cox regression proportional hazard univariate analysis, total MTV (MTV-T) (HR, 1.019; P = 0.008), primary tumor MTV (MTV-P) (HR, 1.021; P = 0.024), neck nodal MTV (MTV-N) (HR, 1.03; P = 0.006) and nodal TLG (TLG-N) (HR, 1.005; P = 0.006) showed a statistically significant association with EFS. There was no statistically significant association of EFS with SUVmax, SUVmean, SUVpeak and total TLG. In Cox regression proportional hazard multivariate analysis model I, primary MTV remained as independent prognostic marker for EFS when adjusted for every other variable in the model and in model II, the primary tumor MTV remained an independent prognostic marker for EFS when adjusted for other variables, except for neck lymph node status and SUVpeak. The Kaplan Meir survival curves, using median cut point of 23.3ml for total MTV were not statistically different (log rank p = 0.86).

**CONCLUSION**

Total MTV and primary tumor MTV have superior prognostic utility in patients with HPV positive stage stage III and IV oropharyngeal squamous cell carcinoma than other FDG PET parameters.

**CLINICAL RELEVANCE/APPLICATION**

Identification of PET/CT related prognostic factors that predict long-term survival would enable the detection of patients who can undergo therapy de-intensification among HPV positive OPSCC patients.

---

**18F-FDG PET/CT for Detection and Localization of Residual or Recurrent Disease in Patients with Multiple Myeloma after Stem Cell Transplantation**

**Christoph Weber MD (Presenter) ; Christian R Habermann MD ; Susanne Klutmann ; Gerhard B Adam MD ; Thorsten Derien**

**PURPOSE**

To determine the diagnostic performance of (18)F-fluorodeoxyglucose (FDG) positron emission tomography (PET)/CT for the detection and localization of residual or recurrent disease in patients with multiple myeloma (MM) after stem cell transplantation (SCT).

**METHOD AND MATERIALS**

A total of 197 whole-body (18)F-FDG PET/CT scans were performed in 99 patients with MM at different time points in the course of disease after autologous or allogeneic stem cell transplantation. Post-transplant PET/CT scans and clinical remission status as determined by the clinical gold standard (Uniform Response Criteria) were analysed and compared.

**RESULTS**

A total of 576 focal osseous and extramedullary lesions were detected in 79 scans. Additional diffuse bone marrow involvement was detected in 17 patients. (18)F-FDG PET/CT had a sensitivity of 54.6%, a specificity of 82.1%, a positive predictive value of 82.3%, a negative predictive value of 54.2% and an overall accuracy of 65.5%. The sensitivity of (18)F-FDG PET/CT was shown to depend on the disease category according to the Uniform Response Criteria for myeloma.

**CONCLUSION**

In patients with MM in the post-transplant setting, (18)F-FDG PET/CT may contribute to the detection and localization of disease, provide information about the extent of distinct myeloma manifestations and the total disease burden and add information about the metabolic activity of disease, but has substantially lower sensitivity for this purpose compared to the pretreatment setting.

**CLINICAL RELEVANCE/APPLICATION**

(18)F-FDG PET/CT allows a more comprehensive evaluation of persisting or recurrent myeloma, therefore it might be suitable as method of choice for an
Shanker Raja MD (Presenter) ; K. M. Das MD

PURPOSE
A strong association between pericardial fat (PAT) estimated by diagnostic CT (diagCT), and CAD, especially vulnerable plaques, has been documented. Recently PAT has been touted as an independent risk factor for CAD. However, significant variability in PAT estimates have been reported, including ethnic, technical factors (CT acquisition parameters) etc. Currently low dose CT (lowCT) is routinely obtained as part of SPECT/PET-CT. We sought to explore the feasibility of estimating PAT on lowCT in comparison to PAT estimated on diagCT.

METHOD AND MATERIALS
A subset of 16 pts (male =11, female =5; mean age = 27 yrs (range=6-70)) referred to PET-CT, and with history of prior diag CT, were randomly selected for further analysis. All lowCT were acquired on GE STE 960 PET-CT scanner (General Electric, Wausauk, Milwaukee, USA), at 50-80 miliamp, based on vendor specifications. To estimate PAT, axial CT slices were post processed utilizing the volume analysis toolbox on a AW-4. & GE workstation. To exclude extra-vascular thoracic fat, the heart and pericardium were manually contoured and extracted. The extracted datasets were thresholded semiautomatically (-190 to -30 Hounsfield units), to obtain the voxels containing PAT.

RESULTS
The PAT estimates were statistically analyzed using Excel and medcalc (statistical analysis suite). The mean and standard deviation for lowCT=36.47 +/- 26.6, while for diagCT =21.84 +/- 19.5ml. The correlation coefficient 'r' value was 0.9174, p-value =0.0005,95% CI for r = 0.7645 to 0.9726. While Bland Altman differences versus averages plots of PAT estimates of diagCT and lowCT, revealed good agreement between the techniques.

CONCLUSION
We have demonstrated the feasibility of estimating PAT on lowCT. To the best of our knowledge this is the first report of estimating PAT on lowCT. Our pilot study demonstrates a tight correlation between the two techniques, and Bland Altman analysis suggests PAT estimated via low dose CT may be clinically acceptable. However, significant differences observed in the estimated means and reasons for the wider standard deviation of PAT estimates by lowCT, needs further exploration.

CLINICAL RELEVANCE/APPLICATION
Recent trends in CT technology is leaning towards ever lower radiation exposures and lowCT, our small series has demonstrated that PAT can be estimated by lowCT.

CL-NMS-TH5A • Myocardial Perfusion Positive Rates Based on Reader Specialty

Aaron S McAllister MD (Presenter) ; Kenneth A Veselicky DDS, MD

PURPOSE
The purpose of this study was to analyze the percentage of abnormal myocardial perfusion studies for each interpreting specialty to see if a measureable difference exists.

METHOD AND MATERIALS
Depending on the day of the week, myocardial perfusion SPECT/CT studies at a tertiary referral center were read by either cardiologists or radiologists. From 2008-2010, studies performed on Tuesday and Thursday were read by cardiologists, while the remaining days of the week were read by radiologists. All studies were otherwise similar. They were performed on patients from the same referral base by the same technologists on the same equipment at the same hospital with the same radiotracers. This natural randomization was utilized in a retrospective review to determine whether a difference exists between the rate of abnormal myocardial perfusion scans read by cardiologists and radiologists.

The impression and reading physician were extracted from the imaging database for all 2744 myocardial perfusion studies performed between 2008 and 2010. Reviewers were blinded to the identity and specialty of the reading physician and assigned each impression to one of three categories, normal (no ischemia), abnormal (demonstrated ischemia), or indeterminate. Incomplete studies such as rest only studies were not included in the analysis. The proportion of normal, abnormal, and indeterminate scans was then tabulated based on interpreting specialty. Subsequent patient treatment was not included in this analysis.

RESULTS
A total of 981 studies were interpreted by cardiologists and 1735 were interpreted by radiologists. There were a total of 18 readers, including 2 cardiologists and 3 radiologists who each read more than 400 studies over this time period. Collectively radiologists interpreted 21% positive for ischemia, 78% normal, and 1% indeterminate. The cardiologists interpreted 34% positive for ischemia, 57% normal, and 9% indeterminate.

CONCLUSION
There is a significant difference between the rates of positive myocardial perfusion scans depending on the interpreting physician’s specialty.

CLINICAL RELEVANCE/APPLICATION
This study raises concern for variability in the interpretation of myocardial perfusion scans based on the specialty of the interpreting physician.

CL-NME-TH6A • Yttrium-90 Radioembolization Therapy: A Systematic Pictorial Review Using SPECT-CT Integrated with Angiographic Images

Hamilton E Reavey MD (Presenter) ; Bhawana Rathore MD ; Valeria Moncayo MD ; Vina Ravichandran BA ; Hyun S Kim MD ; David M Schuster MD

PURPOSE/AIM
The purpose of this study is to provide a pictorial review of Yttrium-90 therapy centered on correlative vascular anatomy as validated with SPECT-CT. We demonstrate examples of target and non-target embolization and correlate angiographic images to radiotracer distribution. We demonstrate the value that pre-therapy MAA SPECT-CT and post-therapy Bremsstrahlung SPECT-CT adds to the clinical management of these patients. We include examples of both target and non-target embolization including gastric, duodenal and mesenteric deposition of radionuclide. Our goal is to familiarize radiologists with expected and unexpected pre and post therapy findings and to provide them with the tools to more effectively interpret and perform these exams.

CONTENT ORGANIZATION
A. Anatomy: Liver anatomy and vascular anatomy B. Pathophysiology of Y-90 therapy C. Indications/contraindications for Y90 therapy D. Outcomes: MAA and Bremsstrahlung images from selected cases that demonstrate examples of both target and non-target embolization with review of corresponding angiographic images.

SUMMARY
After reviewing our exhibit, the reader should know hepatic anatomy and vascular supply including common variants, be familiar with indications for Y-90 therapy and understand the value of obtaining pre and post-therapy planning SPECT-CT to guide clinical management.

Pediatric Radiology -Thursday Posters and Exhibits (12:15pm - 12:45pm)

CL-PDS-THA • AMA PRA Category 1 Credit ™:0.5
Host
Maresh M Thapa , MD

CL-PDS-TH1A • Osteochondritis Dissecans of the Knee; MRI Guided Retrograde Drilling at 1.5 T and Clinical Outcomes in Pediatric Patients

Matti Vahakari MD (Presenter) ; Peeka Kerimaa MD ; Osmo Tervonen MD, PhD ; Jussi Korhonen MD ; Juha Jaakko Sinkukumpu MD ; Risto Ojala MD, PhD ; Roberto Blanco Sequeiros MD

PURPOSE
The purpose of this study was to evaluate the feasibility and clinical results of percutaneous high field MRI-guided retrograde drilling for the treatment of juvenile osteochondritis dissecans (JODC) of the femur.

METHOD AND MATERIALS
8 JODC lesions of the femur in seven patients (figure 1A and 1C), unresponsive to prolonged conservative management (6 months), were treated with MRI-guided percutaneous retrograde drilling (figure 1B) to reduce symptoms and to promote osseousification of the subchondral lesion. All lesions were of juvenile type OCD (mean age 13 y). Four lesions were located on the lateral condyle and four lesions were located on the lateral condyle. All the patients had severe limitation of activity due to the OCD related pain. The mean size of the lesion was 15mm x 7mm x 15 mm. An 1.5 T wide bore MRI scanner (Siemens
ACL attachments were localized with high and similar reliability on 3D MEDIC GRE sequences and multi-planar routine 2D PD sequences. For the follow up of spinal deformities, a novel biplanar slot scanning system has been shown to allow significant dose reduction. Further dose reduction can be obtained with recent technical advances (copper filtration and dedicated image processing) and with the optimization of the acquisition parameters (kV, mA and scan speed).

Our aim was to assess the image quality as well as the reproducibility of clinical parameter measurements using an optimized ultra low dose protocol for scoliosis examinations

METHOD AND MATERIALS
23 patients (mean age: 12.4 ± 3.3, range 5-18yo) with mild or moderate idiopathic scoliosis were imaged with an ultra low dose protocol optimized according to the body mass index (BMI) following the ALARA concept.

Dose Area product (DAP) and entrance dose (kerma) were quantified for each examination. Image quality was rated on a 5-point scale based on the visibility of the edges of the vertebrae of 5 different anatomical areas (cervical, superior and inferior thoracic and lumbar). Image quality was graded 1 in 5/23 (22%) cases, 2 in 9/23 (39%) cases, 3 in 7/23 (30%) cases, 4 in 1/23 (4%) cases and 5 in 1/23 (4%) case.

Interoberver agreement was very high for Cobb angle (ICC 0.92), T1-T12 kyphosis (ICC 0.90) and L1-S1 lordosis (ICC 0.90) and high for cervical lordosis (ICC 0.89), T4-T12 kyphosis (ICC 0.89), pelvic incidence (ICC 0.88) and sacral slope (ICC 0.83).

CONCLUSION
Ultra low dose imaging is achievable for the follow up of idiopathic scoliosis, with acceptable image quality and high reproducibility of the measurements.
CL-PDS-TH6A ● Estimated Radiation Exposure from Routine Pediatric Radiographs Comparing Computed and Direct Digital Radiography
Christopher Smith MD (Presenter) ;  Kathy McKay  ;  Benvon C Cramer MBChB

PURPOSE
Digital radiography (DR) has been widely adopted because of its workflow benefits and has also been marketed as having a benefit in terms of dose reduction. The purpose of this study is to determine the estimated radiation dosages to patients associated with pediatric radiographs, comparing computed and digital radiographic systems.

METHOD AND MATERIALS
This is a retrospective and prospective case series of pediatric radiographs performed over a period of two years during a renovation from a CR to a DR digital system. Parameters measured were kVp, mAs and patient weight, sex and age. Estimates of dose were derived from published pediatric conversion factors.

RESULTS
The mean estimated doses associated with a sample of (n=2515) pediatric chest and sinus radiographs taken using CR vs DR systems were .18 vs .09 and .16 vs .07 mSv, respectively (p <.05)

CONCLUSION
‘Plain film’ radiography accounts for the majority of pediatric imaging and there has been a considerable increase in pediatric radiographic volume performed in North America over the past decade. Monitoring and optimization of radiation dose in the pediatric setting is therefore essential. Adoption of DR systems is one way this can be achieved. The type of digital system only explains part of the overall dose variability. Although it was not systematically assessed in this study, a review of dose outliers suggests technique is also an important contributor to dose variability. This study provides important information towards meeting the ALARA principle in the pediatric setting where the risks associated with radiation dose are the greatest.

CLINICAL RELEVANCE/APPLICATION
Radiographic doses are non-trivial and variable across pediatric patients imaged at a single institution. Dose reduction can be achieved is through the adoption of digital direct radiographic systems.

CL-PDE-TH7A ● Placenta Evaluation: Normal and Abnormal Findings by Obstetric Ultrasound and Magnetic Resonance Imaging
Taisa D Gasparetto MD (Presenter) ;  Heron Werner MD ;  Lorena Arrieta ;  Pedro Daltro MD ;  Romeu C Domingues MD

PURPOSE/AIM
The placenta serves as the organ providing oxygen and nutrition to the fetus. In cases of placenta pathologies, disturbances in the exchange may lead to intrauterine growth restriction, prematurity and intrauterine fetal death. Although ultrasound and Doppler flow sonography are the gold standard techniques to evaluate the placenta, MRI has become an important tool in the assessment of unclear diagnosis with ultrasound.

CONTENT ORGANIZATION
- Anatomy of the placenta (basal plate, placenta lobule, cotyledon) - Placenta maturation (Grannum-Classification in ultrasound and adaptation to MRI) - Calcification of the placenta - Placental shape - Placental shape abnormalities- circumvalata, bilobata. - Pathologies of the placenta: septal cysts, infarction, trombi, placental lakes, retroplacental hematoma, chorangioma, molar pregnancy, placenta previa, abnormal plancetal invasion - Umbilical cord: single umbilical artery, hypercoiling umbilical cord, umbilical cord knots, umbilical cord cyst, velamentous cord insertion

SUMMARY
Although US remains the method of choice for fetal evaluation, MRI plays an important role as imaging adjunct in the placenta evaluation, specially due to the large field of view and multplanar capabilities.

CL-PDE3030-THA ● Demystifying Pediatric Neurometabolic Disorders
Tushar Chandra MD (Presenter) ;  Teresa G Kelly MD ;  Saurabh Guleria MD ;  Suyash Mohan MD ;  Hervey D Segall MD ;  Mohit Maheshwari MD

PURPOSE/AIM
The aim of this exhibit is to provide a succinct review of the spectrum of various metabolism disorders that affect the CNS in pediatric age group. We will elucidate a pattern based approach and describe specific pointers to formulate a diagnosis.

CONTENT ORGANIZATION

SUMMARY
A myriad of metabolic conditions involve the brain in pediatric age group. These include abnormalities of lipid and glycogen storage, mitochondrial disorders, urea cycle disorders and some other rare enzyme deficiencies. Proper diagnosis of these conditions can be very challenging, even for the astute radiologist. Magnetic resonance imaging including spectroscopy is a powerful tool in the study of normal and abnormal brain structure, function and biochemistry. This exhibit attempts to simplify the diagnostic approach to these disorders with a pattern based approach to formulate a differential diagnosis and pointers to a specific diagnosis, whenever possible.

Breast - Thursday Posters and Exhibits (12:15pm - 12:45pm)
Thursday, 12:15 PM - 12:45 PM ● Lakeside Learning Center
RESULTS
In our series the no drainage rate on images has been 4% (57/1406 consecutive patients).
Intraoperative gamma probe has detected SLN in 13/57 patients (23%), obtaining 23 SLN (8 positive) in 4/13 patients (31%). Nine patients underwent intraoperative blue dye, getting drainage in 5/9 (56%), with only 1/5 positive SLN (same SLN found by gamma probe).
23/57 patients had not been submitted to lymphadenectomy: 10 patients due to negative SLN, 13 patients due to previous lymphadenectomy. 34/57 patients (60%) underwent lymphadenectomy: 30 patients without drainage, 4 patients with positive SLN. 557 nodes have been excised, 107/557 positive in 12/314 patients. 4 patients with positive SLN had more positive nodes in 2 cases and the SLN were the only one positive node in the other 2 patients. In 50% of the patients without drainage (17/34), all the nodes excised during lymphadenectomy were negative.
17/57 of the patients (30%) had previous breast surgery: 13 lymphomectomy and lymphadenectomy (all of them submitted to a new lymphomectomy, lymphadenectomy performed before), and 4 lymphomectomy with SLN biopsy (all of them submitted to a new lymphomectomy and lymphadenectomy, 1 positive).

CONCLUSION
A high rate of (50%) of lymphatic spread has been found in patients with lack of SLN drainage in planar and SPECT-CT images.
The intraoperative use of the gamma probe allows the identification of SLN in 13/57 patients (23%), avoiding lymphadenectomy in 10 patients (17.5% of the series) due to negative SLN.

CLINICAL RELEVANCE/APPLICATION
Even in case of no drainage in lymphoscintigraphy imaging, the use of intraoperative gamma probe allows the detection of SLN in nearly a quarter of the series, avoiding lymphadenectomy in 17.5% of the

LL-BRS-TH2A • Fluorodeoxyglucose Uptake in Breast Cancer Can Be Influenced by Physiological Estrogen Fluctuations during the Menstrual Cycle
Kanae K Miyake MD (Presenter) ; Yuji Nakamoto MD, PhD ; Shigeira Saji ; Tomoharu Sugie ; Kensuke Kurihara ; Yoko Nakatani MD, PhD * ; Shotaro Kanao MD ; Masakazu Toi ; Kaoi Togashi MD, PhD *

PURPOSE
The physiological plasma estrogen concentration is consistently maintained in lower range such as 10 to 30 pM in postmenopausal women. However in premenopausal women, it changes more widely due to menstruation cycle and ranges around 0.01 nM to 10 nM. The purpose of this study was to evaluate whether the physiological fluctuation of estrogen level affects fluorodeoxyglucose (FDG) uptake in breast cancers of premenopausal patients.

METHOD AND MATERIALS
Thirty-three premenopausal females (age 42±5 y) with solid mass-type invasive breast cancer, who underwent positron emission tomography/computed tomography with FDG before therapy, were retrospectively analyzed. The maximal standardized uptake values (SUVmax) in primary breast cancer were compared among the patients, according to the menstruation cycle, in each clinicopathological subtype. In in vitro study, ER-positive T47D human breast cancer cells were previously incubated under different concentrations of 17?estradiol (E2) level, and FDG uptake was evaluated after exposure to various doses of E2.

RESULTS
In patients with 'Luminal A' breast cancer, FDG uptake was significantly higher during the late menstrual period (after day10: 6.2±2.2, n=8) than during the early menstrual period (day 1-9: 3.5±2.0, n=7) (p=0.026). There was no significant difference between the two periods in other subtypes, i.e. 'Luminal B (HER2-negative)'(n=10), 'Luminal B (HER2-positive)'(n=3), and 'Triple-negative'(n=5). In the in vitro study, E2 augmented FDG uptake in T47D cells in a dose- and time-dependent manner, which was inhibited by ER-agonists, such as tamoxifen and fulvestrant. With exposure with 0.01 nM, 0.1 nM, 1 nM and 10 nM E2 after incubation in E2-free medium, mean FDG uptake reached 114%, 121%, 150% and 147%, respectively, by 24 hr, and 153%, 173%, 174% and 176%, respectively, by 48hr. With the baseline E2 level of 0.01 nM, FDG uptake was significantly increased when E2 level was elevated to >1 nM. However, when the baseline E2 level was 0.1 nM, no significant elevation of uptake was observed when E2 level increased up to 1 to 10 nM.

CONCLUSION
Our preliminary data suggest that, in premenopausal patients with possibly lower baseline E2 level, FDG uptake in 'Luminal'-type cancer could be elevated after E2 surges during the menstrual cycle.

CLINICAL RELEVANCE/APPLICATION
Fluorodeoxyglucose uptake in breast cancer can be influenced by physiological estrogen fluctuations during the menstrual cycle.

LL-BRS-TH3A • Dynamic Contrast-enhanced MR Imaging: A Potential Predictor to Pathologic Complete Response of Breast Cancer after Neoadjuvant Chemotherapy
Yuan Jiang (Presenter) ; Xiaoying Wang MD ; Naishan Qin ; Li Guo

PURPOSE
To retrospectively evaluate the feasibility of time intensity curve (TIC) in dynamic contrast-enhanced MR imaging (DCE-MRI) in prediction of pathologic complete response (pCR) after neoadjuvant chemotherapy (NAC) in breast cancer.

METHOD AND MATERIALS
RESULTS
CONCLUSION
TIC in DCE-MRI has the potential capability in predicting pCR after NAC in breast cancer.

CLINICAL RELEVANCE/APPLICATION
DCE-MRI can be used in breast cancer-response evaluation after NAC and can help predict pCR.

LL-BRS-TH4A • The State of Screening Mammography from 2004 to 2011: Screening Rates are Down Nationwide as USPSTF Guidelines are Ignored
Maraty S Dodoo PhD (Presenter) ; Richard DuszaK MD ; Danny Hughes PhD ; Geraldine B McGinty MD

PURPOSE
To estimate rates and intervals between repeated screening mammography examinations for elderly Medicare beneficiaries, using recently published “repeat imaging” classification criteria.

METHOD AND MATERIALS
A 5% national random sample of Medicare beneficiary physician office and outpatient hospital claims data for female elderly beneficiaries, 66 years and above was used. From that data we selected beneficiaries enrolled continuously in Medicare and alive throughout each of 2 periods five years apart: 2004-2006, and 2009-2011. These periods are essentially pre- and post- publication of the revised 2009 US Preventive Services Task Force (USPSTF) recommended changes. Administrative claims for screening mammography were identified using the appropriate CPT/HCPCS/ICD-9 codes. From the dates of service for those claims, we computed screening rates and intervals between repeated screenings. The rates and intervals were compared for the 2 periods, by age group, and by state of beneficiary residence. Denominators were defined using the Neiman Health Policy Institute classification system.

RESULTS
There were 1,081,981 elderly females in our 2004-2006 beneficiary group, and 866,792 in our 2009-2011 group. Average screening rates were 53.3% in 2004-2006 but dropped to 48.2% in 2009-2011. Far fewer (29.1%) of the 2004-2006 group underwent repeated screening, and even fewer (22.8%) in the 2009-2011 period. Screening rates were down for every elderly age group and in every state. Screening intervals were centered around 12, not 24 months. After the revised USPSTF guidelines fewer Medicare women are undergoing screening mammography. Women who underwent repeated screening seem to have maintained the 12-month interval between screenings (average 14.5 months in 2004-2006, and 13.9 months in 2009-2011).

CONCLUSION
Only 48% of Medicare elderly beneficiaries underwent any screening mammography in a recent 3-year window, and only 22% underwent any repeated screening. Those who underwent repeated screenings overwhelmingly did so at 1-year (not 2-year) intervals.

CLINICAL RELEVANCE/APPLICATION
Screening mammography intervals have remained static despite 2009 USPSTF recommendations, but overall screening rates have declined. Increasing compliance and patient access merits attention.

LL-BRS-TH5A • Does Background Enhancement Influence Diagnostic Accuracy of Breast MRI?
Nienke L Hansen MD (Presenter) ; Simone Schrading MD ; Alexandra Barabasch ; Kevin Strobel PhD ; Christiane K Kuhl MD *
PurposE
Purpose of our study was to determine the influence of the degree of background enhancement on sensitivity, specificity and positive predictive value (PPV) of breast MRI.

mEThOD aNd MATEriALS
335 women with 494 breasts underwent dynamic contrast-enhanced breast MRI in our institution (median age 55, 25-86 years) from May 2010 to November 2012. Background enhancement in MRI was scored on a 4-point-scale from absent to strong. BI-RADS diagnoses were assigned per breast. BI-RADS6 lesions were excluded from analysis. Diagnoses were validated either by biopsy (BI-RADS 4/5) or MRI follow-up (BI-RADS 1-3) (average 14 months, 12-27 months).

SUMMaRY
Sensitivity, specificity and PPV were calculated and compared for all classes of background enhancement. Fisher’s exact test was used for statistical analysis.

RESULTS
A total 378 (77%) benign and 116 (23%) malignant diagnoses were validated in the 494 breasts. 9% (45/494) of lesions were classified as DCIS (mean size 28 mm, range 7-100 mm), 14% (71/494) as invasive carcinoma (mean size 17 mm, range 0.5-11 mm). The distribution of MR-ACR categories in the 335 patients was as follows: MR-ACR1 in 187/335 (56%), 2 in 92/335 (27%), 3 in 41/335 (12%), and MR-ACR4 in 15/335 (4%). Sensitivity of MRI in breasts categorized as MR-ACR1, 2, 3, and 4 was 98% (64/65), 100% (31/31), 68% (15/22), and 100% (5/5), respectively (p<1). Specificity of breast MRI in breasts categorized as MR-ACR1, 2, 3, and 4 was 83% (175/211), 72% (76/105), 57% (26/46) and 38% (6/16) (p=0.000019). PPV was 64% (64/100), 52% (31/60), 43% (15/35) and 33% (5/15).

CONCLUSION
Background enhancement does not seem to interfere with our ability to identify invasive breast cancers and DCIS in MRI. This, however, is achieved at the expense of specificity and PPV, which decreases significantly with stronger background enhancement.

CLINIcAl RELEVANCE/APPLIcATION
The accuracy of breast MRI decreases with increasing background enhancement; a compromise on specificity appears unavoidable. However, PPV levels appear still acceptable in women with MR-ACR 3 and 4.

LL-BRS-TH6A • Diffusion Tensor Imaging for Prediction of Pathologic Response to Neoadjuvant Chemotherapy in Patients with Breast Cancer

Hee Jung Shin MD (Presenter) ; Nola M Hylton PhD ; Lisa Wilmes PhD ; David Newitt PhD ; Ella F Jones PhD ; Rebekah McLaughlin PhD

PURPorse
To investigate tumor apparent diffusion coefficient (ADC) and fractional anisotropy (FA) measured by diffusion tensor imaging (DTI) as predictors of pathologic complete response (pCR) in patients with locally advanced breast cancer (LABC) after neoadjuvant chemotherapy (NAC).

METHOD AND MATERIALS
In this HIPAA-compliant institutional review board-approved study, forty patients with LABC (mean tumor size, 4.0 cm; range, 0.6–9.9 cm) were enrolled between September 2010 and November 2012. MRI imaging including DTI was performed on a 1.5T scanner before NAC (MR1) and after one cycle of taxane-based treatment (MR2). ADC and FA prior to treatment and after one cycle of NAC were measured from DTI data. Pretreatment values (MR1), early treatment values (MR2), and early percent change of these variables (between MR1 and MR2) were compared between pCR and non-pCR groups using the Mann-Whitney U test. Receiver operating characteristic (ROC) curve analysis was performed to assess the diagnostic performance of each parameter and the area under the ROC curve (AUC) was compared.

RESULTS
After one cycle of treatment, 9 patients (22.5%) showed pCR and 31 patients (77.5%) showed non-pCR. Prior to pretreatment, only tumor ADC showed a statistically significant difference between pCR and non-pCR groups (1.07 ± 0.20 X 10-3 vs. 1.12 ± 0.10 X 10-3 mm2/sec, respectively) (P<0.029). After one cycle of treatment, patients with pCR had statistically significantly higher percent changes of tumor ADC (P<0.029). Patients with pCR showed significantly lower pretreatment ADCs than those with non-pCR. Early percent change in both ADC and FA was associated with pCR. These results suggest that both diffusion related parameters provide information that can be used for early assessment of response to NAC in patients with LABC.

CLINIcAl RELEVANCE/APPLIcATION
The prediction of pCR using DTI-based quantitative measurements of fractional anisotropy could help determine surgical planning and predict long-term outcome.

LL-BRE-TH7A • The Density Dilemma

Julie Bykowski MD ; Christian S Welch MD (Presenter) ; Jade Quijano De Guzman MD ; Haydee Ojeda-Fournier MD

PURPorse/AIM
Advocacy organizations have been successful in enacting legislation in 5 states and endorsed or proposed bills in 17 additional states requiring breast imagers to directly notify the patient if her breasts are dense. This exhibit will outline the variability in the state law requirements and implications for patient counseling regarding options for surveillance in an effort to reduce confusion and misinformation.

CONTENT ORGANIZATION
Overview of BI-RADS breast density categories, with image examples. Review of enacted and proposed state laws for breast density reporting, and variability of mandates for insurance coverage. Summary of possible benefits, pitfalls and costs of alternative or adjunct screening modalities. Review of Connecticut experience with whole breast ultrasound. Our institution’s recommendations for patients and clinicians.

SUMMaRY
The growing trend of state mandates for notification regarding breast density may result in confusion and misinformation. Review of current enacted and proposed laws, the reliability of breast density assessment, and adjunctive screening options is required in an effort to accurately address these concerns with patients and referring providers.

LL-BRE-TH8A • Revisiting High Risk Breast Lesions: Radiopathologic Correlation and Management through Clinical Vignettes?

Mona M El Khoury MD (Presenter) ; Lucie Lalonde MD ; Maude Labelle MD ; Julie David MD ; Isabelle Trop MD, MPH

PURPorse/AIM
The purpose of this exhibit will be to:
1- Review the range of high risk lesions that might be encountered at percutaneous imaging guided biopsies, including atypical ductal hyperplasia (ADH), lobular neoplasia (Atypical lobular hyperplasia (ALH) and Lobular carcinoma in situ (LCIS)), flat epithelial atypia (FEA), papilloma, mucocoele-like lesions, radial scar and phyllodes.
2- Illustrate the imaging presentation of these high risk lesions
3- Discuss the importance of radio-pathologic correlation
4- Propose the optimal management for each of these lesions based on the most recent literature.

CONTENT ORGANIZATION
1- Through clinical cases, each high risk entity will be discussed in terms of its:
   a. Pathophysiology
   b. Imaging presentation (mammography, sonography, MRI)
   c. Radiopathologic correlation
d. Management approaches

SUMMaRY
To this day, high-risk lesions remain challenging in terms of diagnosis and management. Through clinical and radiologic examples, the different high-risk lesions of the breast will be described, with an emphasis on radiopathologic correlation with the goal that the clinical team can propose a plan for subsequent optimal management.
1. To describe the spectrum of echocardiographic, CT and MRI findings of apical ventricular aneurysms and other pathology.

2. To outline an approach to the differential diagnosis of ventricular apical pathology based on imaging findings combined with clinical and biochemical data.

PURPOSE/AIM

1. To describe the spectrum of echocardiographic, CT and MRI findings of apical ventricular aneurysms and other pathology.

2. To outline an approach to the differential diagnosis of ventricular apical pathology based on imaging findings combined with clinical and biochemical data.

CONTENT ORGANIZATION

1. To describe the spectrum of echocardiographic, CT and MRI findings of apical ventricular aneurysms and other pathology.

2. To outline an approach to the differential diagnosis of ventricular apical pathology based on imaging findings combined with clinical and biochemical data.

SUMMARY

While the majority of pathologic conditions at the ventricular apices involve apical aneurysms secondary to myocardial infarction, other etiologies should be considered, especially when there is no documented coronary atherosclerosis. We recommend taking into account imaging findings and clinical data as presented in our algorithm outlining an approach to the differential diagnosis.
A retrospective review of ECG-gated cardiac CT studies identified studies performed for pre-operative evaluation of ASD, PFO and VSD defects. Ten cases of ASD, 5 cases of PFO and 2 cases of VSD were identified. Each defect was evaluated in multiple projections using a CT workstation. CT results were compared to transthoracic/transesophageal echocardiography and with subsequent operative findings/decisions to determine whether CT imaging was helpful in these cases.

RESULTS

Areas of DE were found in all 28 included scans (100%). RP imaging however showed scarcely any deficits, even in patients with evident scarring on DE imaging. Only 2 RP deficits (7.1%) were found with locations matching the reported area of DE. Analysis of the revision by both radiologists resulted in a very weak correlation between the two imaging modalities ($\rho=0.06$), even when comparing only the transmural ($>50\%$) areas of DE with RP deficits ($\rho=0.10$).

CONCLUSION

The two methods which AP-CMRI provides for the detection of MI, do not correspond as well as previously reported. This could be attributed to RP imaging not being as reliable as we thought for the detection of MI (3), or to the idea that (even transmural) myocardial scars can, after some time, become reperfused. We are currently planning a prospective trial in which all future patients with proven MI on DE imaging will also undergo first-pass RP imaging series.

CLINICAL RELEVANCE/APPLICATION

In the assessment of previous MI with AP-CMRi, deficits on RP imaging do not correlate well with areas of DE. RP imaging alone might not be a reliable test for the detection of previous MI.

LL-CAS-TH6A • Pre-operative Evaluation of Intracardiac Septal Defects by ECG-gated Cardiac CT: Comparison with Echocardiography and Operative Findings

Ethann J Halpern MD (Presenter)

PURPOSE

Percutaneous therapies for closure of atrial septal defects (ASD’s), patent foramen ovales (PFO’s) and ventricular septal defects (VSD’s) require careful pre-operative planning. Although transesophageal echocardiography is routinely used, ECG-gated cardiac CT can provide additional 3D detail. We review our experience with ECG-gated CT of intracardiac septal defects prior to attempted repair, with echocardiographic and surgical correlation.

METHOD AND MATERIALS

A retrospective review of ECG-gated cardiac CT studies identified studies performed for pre-operative evaluation of ASD, PFO and VSD defects. Ten cases of ASD, 5 cases of PFO and 2 cases of VSD were identified. Each defect was evaluated in multiple projections using a CT workstation. CT results were compared to transthoracic/transesophageal echocardiography and with subsequent operative findings/decisions to determine whether CT imaging was helpful in these cases.

RESULTS

Septal defects were identified in all cases by the presence of shunting of contrast between the more densely opacified left heart and less densely opacified right heart. Definite enlargement of the right heart was identified in 7 patients. CT measurements of ASD size correlated well with echocardiography and operative reports. CT was most useful for measuring the tissue rim around an ASD to determine whether a sufficient rim was present for percutaneous closure. In three patients CT identified findings that were not suggested by transesophageal echocardiography and that changed the operative approach: one patient with an additional (2nd) septal defect (2 ASD’s), one patient with an absent tissue rim along the antero-superior aspect of an ASD adjacent to the aortic root, and one patient with tricuspid chordal structures along a VSD. CT clearly defined the length of the interatrial tunnel in patients with PFO’s. In one patient with a PFO, the CT demonstrated a right to left shunt.

CONCLUSION

Defects in the atrial or ventricular septum are clearly defined by ECG-gated cardiac CT, and the defect location is defined relative to adjacent structures (SVC, IVC, aortic root, chordal structures). The size of the defect and its associated tissue rim are easily quantified by 3-dimensional analysis of CT data. The presence and direction of intracardiac shunts may also be demonstrated.

CLINICAL RELEVANCE/APPLICATION

Cardiac CTA is a useful adjunct to echocardiography in the pre-operative assessment of intracardiac septal defects.

LL-CAS-TH7A • CT-derived Hyperaemic Myocardial Blood Flow: Does It Predict Functionally Significant Coronary Lesions?

Alexia Rossi MD (Presenter); Anoeshka S Dharampal MD; Steffen E Petersen; Gabriel P Krestin MD, PhD *; Pim J De Feyter MD, PhD; Francesca Pugliese MD, PhD

PURPOSE

CT coronary angiography (CTCA) is an anatomical modality and it is often insufficient to predict functional significance of coronary stenosis. According to the current guidelines the treatment of patients with coronary artery disease should be based on the combination of anatomical and functional significance of coronary lesions. The aim of our study was to evaluate the diagnostic performance of hyperaemic myocardial blood flow (MBF) derived from stress computed tomography perfusion (CTP) imaging compared to visual CTCA and semi-automatic quantitative computed tomography (QCT) in the detection of functionally significant coronary lesions in patients with stable angina.
To investigate the cardiac computed tomography (CT) findings and clinical features in patients with subprosthetic soft tissue after aortic valve replacement.

METHOD AND MATERIALS

Eighty-eight patients (mean age, 63 years; 45 males) with prosthetic aortic valve (mechanical valve, 55) who underwent cardiac CT during 1 year were consecutively enrolled in this retrospective study. Multiphase cardiac CT data were retrospectively reconstructed at every 10% interval and analyzed using multiplanar reformatted images by two readers in consensus manner. The presence or absence of subprosthetic tissue and the circular angle of subvalvular tissue were evaluated at cardiac CT. By using customized software, the geometric orifice area (GOA) of each prosthetic valve was measured to analyze the encroachment ratio by subprosthetic soft tissue. The parameters for echocardiography such as mean transaortic pressure gradient (MTPG) and peak transaortic velocity were also reviewed.

RESULTS

Seventeen patients (19%) showed subprosthetic soft tissue on cardiac CT. In patients with subprosthetic soft tissue, MTPG, peak pressure gradient, AV peak velocity and LV ejection fraction were significantly higher than in patients without subprosthetic soft tissue ($p<0.05$) noted in four patients on echocardiography and subprosthetic soft tissue were identified at CT in all of them. In patients with increased MTPG, the encroachment ratio of GOA by subprosthetic soft tissue, AV peak velocity, peak pressure gradient were significantly higher in patients with MTPG less than 40 ($p=0.04$).

CONCLUSION

Subprosthetic soft tissue is not uncommon in patients with aortic valve replacement and can lead to flow limitation through the prostheses. Cardiac CT may serve as a useful tool for evaluating subprosthetic soft tissue which otherwise would not be able to be assessed with conventional echocardiography.

CLINICAL RELEVANCE/APPLICATION

MDCT can also help to differentiate subprosthetic soft tissue causing flow limitation from subclinical lesions by analyzing the encroachment ratio on CT.
Comparison of 120 kV and 100 kV Scan Parameters for CT-guided Transthoracic Biopsy

Aysegul Solmaz Tuncer MD (Presenter); Ersilia Devicienti; Anna Rita Larici; Riccardo Inchingolo; Maria Rosaria Calve; Lorenzo Bonomo MD

PURPOSE

To evaluate the reliability of multidetector computed tomography (MDCT)-virtual lobectomy in predicting post-operative forced expiratory volume in one second (ppoFEV1).

METHOD AND MATERIALS

To determine the impact of CT Scanner capabilities on excess Z-axis scan length and radiation dose.

Noncontrast chest CTs performed between February and July 2012 were evaluated for excess Z-axis scan length (ES). ES was defined as the scanned distance superior or inferior to the superior or inferior margin of the lung parenchyma and was compared across different CT scanners. Analysis was performed with ANOVA, F-test, and t-tests.

Technologists were instructed to use the minimum scan length needed to include the entire lung during chest CT. These exams were performed with 4 different CT scanners: Siemens Somatom 40 slice (CT1); GE Light Speed 8 slice (CT2); GE VCT 64 slice (CT3); and GE HD750 64 slice (CT4). CT1 provides real-time visualization of the scan and a keyboard-driven scan stop capability. CT2 provides real-time visualization of the scan and a mouse-driven scan stop capability. CT3 and CT4 do not allow real-time visualization or scan stop capability.

RESULTS

1287 consecutive noncontrast CT scans were evaluated: 475 on CT1, 237 on CT2, 279 on CT3, and 296 on CT4. Mean total excess Z-axis scan length (EST) was 47 mm. CT scanner was a significant predictor EST (p < 0.001). There was a trend of underestimation than HRCT of RET (-2.8%, -4.1%, and -5.3% in FBP, ASIR, and MBIR, respectively). There was a trend of underestimation than HRCT of RET (-2.8%, -4.1%, and -5.3% in FBP, ASIR, and MBIR, respectively). There was a trend of underestimation than HRCT of RET (-2.8%, -4.1%, and -5.3% in FBP, ASIR, and MBIR, respectively). There was a trend of underestimation than HRCT of RET (-2.8%, -4.1%, and -5.3% in FBP, ASIR, and MBIR, respectively).

CONCLUSION

Real-time visualization of CT scans with mouse-driven scan stop capability significantly reduces ES (p < 0.001). Real-time visualization of CT scans with mouse-driven scan stop capability should be an essential feature of CT scanners to minimize Z-axis scan length and to reduce patient dose.
Surgical and Pathological Findings

**LL-ERS-THA • AMA PRA Category 1 Credit™️ • 0.5**

**Host**

Jamilk-Onari Johnson, MD

**LL-ERS-TH1A • Timelines in Diagnosis and Management of Acute Ovarian Torsion: Can We Do Better?**

Hournaz Ghandehari MD (Presenter); Phyllis Glanc MD

**PURPOSE**

The analysis of timelines in the diagnosis and management of surgically treated ovarian torsion may result in information leading to optimization of the timelines. This may help identify the points in the timeline where a shorter time interval would ultimately result in improved ovarian preservation rates.

**METHOD AND MATERIALS**

Charts of patients with surgically proven adnexal torsion over 12 years were retrospectively reviewed. Timelines for the following points were obtained: Triage in Emergency Room (ER); assessment by ER physician; performance of the imaging study and time to Operating Room (OR). Descriptive statistics for each of waiting times were computed including mean, median and 95% confidence interval for the mean and median. We computed the cumulative distributions of waiting and the percentage of each patient’s waiting time in each interval.

**RESULTS**

Of 86 surgically proven adnexal torsion cases, 63 (73%) had documentation of all timelines and were included in the study. The mean patient age was 33.7 years (15 years to 63 years, ± 1.5 SEM). Pathology was overwhelmingly benign (98%). In 34 cases (54%) the adnexa was detorsed successfully and the remaining 29 cases (46%) underwent adnexal removal due to non-viability.

The interobserver agreement for detection of mural defects on CEUS, using the kappas statistics.

Sonographic diagnosis was compared with the pathologic analysis of the adnexal specimen. Sensitivity, specificity, positive and negative predictive values, and accuracy were calculated, retrospectively, two experienced radiologists reviewed the sonographic findings prospectively evaluated were: wall thickness, biliary sludge, lithiasis, Murphy sign, wall striations, intraluminal membranes, wall interruption, pericholecystic fluid, or mural hyperemia. In the analysis we included only patients who underwent cholecystectomy within 24 hours after CEUS.

B-mode sonographic findings prospectively evaluated were: wall thickness, biliary sludge, lithiasis, Murphy sign, wall striations, intraluminal membranes, wall interruption, pericholecystic fluid, or mural hyperemia. In the analysis we included only patients who underwent cholecystectomy within 24 hours after CEUS.

**CONCLUSION**

In patients presenting with clinical signs and imaging features suspicious for adnexal torsion, longer overall time of the journey from ER to OR leads to lower rates of adnexal salvage. The longest individual time interval in our study is the time from imaging to OR. Optimizing this step would likely lead to increased ovarian salvage rates.

**CLINICAL RELEVANCE/APPLICATION**

Although it is known that the effect of time is directly related to the outcome in the torsed ovary, the results of this study identify delaying step/step for optimization of timelines for this gynecological condition.

**LL-ERS-TH2A • Usefulness of Contrast-enhanced Ultrasound (CEUS) in the Diagnosis of Acute Gangrenous Cholecystitis: A Comparative Study with Surgical and Pathological Findings**

Tomas Ripolles MD (Presenter); Maria Jesus Martinez Perez; Jordi Blay Beltran MD; Lida J Navarro MD; Rosario Martinez-Garcia MD; Encarna Marti-Ibor; Gregorio Martin Benitez; Jose Vizuete

**PURPOSE**

To determine the usefulness of contrast-enhanced US (CEUS) for the diagnostic assessment of acute gangrenous cholecystitis, compared with pathologic specimens as gold standard.

**METHOD AND MATERIALS**

From December 2011 to March 2013, all patients with a clinical and sonographic diagnosis of acute cholecystitis subsequently underwent a CEUS examination. An original CEUS diagnosis of gangrenous cholecystitis was made when discontinuity of gallbladder wall enhancement was seen after contrast agent injection. B-mode and color Doppler were used to evaluate wall thickness, biliary sludge, lithiasis, Murphy sign, wall striations, intraluminal membranes, wall interruption, pericholecystic fluid, or mural hyperemia. In the analysis we included only patients who underwent cholecystectomy within 24 hours after CEUS.

**RESULTS**

64 patients were included in the study (32 women, mean age of 71 years). The final pathological diagnoses were 6 chronic cholecystitis, 10 acute cholecystitis and 48 acute gangrenous cholecystitis. Local or widespread absence of gallbladder wall enhancement on the preoperative CEUS image was accurately associated with the presence of pathologically confirmed gangrenous acute cholecystitis (sensitivity, specificity and accuracy of 79.2%, 81.3% and 79.7%, respectively). The interobserver agreement for detection of mural defects of enhancement was good (k value: 0.719). The radiologic criteria with the highest sensitivity and specificity to gangrenous form were defects of enhancement, wall striations and biliary sludge. Presence of intraluminal membranes had high sensitivity (92.8%) but low specificity (22.9%) for detection of gangrenous cholecystitis.

**CONCLUSION**

Local or widespread absence of gallbladder wall enhancement on CEUS is associated with the presence of gangrenous acute cholecystitis.

**CLINICAL RELEVANCE/APPLICATION**

Preoperative diagnosis of gangrenous cholecystitis is difficult. However, early diagnosis and emergent intervention are critical because it is associated with an increased morbidity and mortality.

**LL-ERS-TH3A • Intraluminal Gas in Non-perforated Acute Appendicitis: A Predictor of Gangrenous Appendicitis**

Diana M Plata Ariza (Presenter); Elena Martinez Chamorro; Daphne Castano; Marta Arroyo; Esteban Peghini; Susana Borruel MD

**PURPOSE**

- To determine if the presence of gas within the appendix at CT in the context of proven appendicitis correlates with a gangrenous appendix by using pathologic/surgical examination as the reference standard.
- To compare the differences in length of hospital stay between the groups of phlegmonous and gangrenous appendicitis as an indicator of hospital costs

**METHOD AND MATERIALS**

We retrospectively reviewed the charts of 1249 adults patients with pathologically proven appendicitis (January 2009 to September 2012). From this group 197 patients had been examined by MDCT before surgery. 93 patients with findings of perforated appendicitis were excluded.

A 16-detector CT scanner was performed. Intravenous non-ionic contrast media was administered to 88 patients, oral contrast to 8 and rectal contrast to 1. 104 MDCT-scans were reviewed and classified in two groups depending on the presence of air in the appendix after a consensus by 2 senior radiologists and 1 resident. Results were compared to surgical/pathologic reports looking for a gangrenous or phlegmonous appendix.
Then we reviewed the length of hospital stay by groups and the results were analyzed by comparing the mean hospital stay with the pathology outcome. Odds ratios sensitivity, specificity and predictive values with 95% confidence intervals for intraluminal gas as sign of gangrenous appendicitis were determined. Statistical analysis used Fisher’s exact test.

RESULTS
Gangrenous appendicitis was present in 21 of the 25 patients with non-perforated appendicitis that contained gas, whereas such finding was present in 7 patients of the 79 without intraluminal gas (84% vs 9%, p < 0.0001). The presence of intraluminal gas showed an odds ratio for gangrenous appendicitis of 54 (12-262), a 75% (60-84%) sensitivity, a 94% (89-98%) specificity and a positive likelihood ratio of 14.2 (5.5-42.8).

The mean hospital stays were 2,5 and 5 days for phlegmonous and gangrenous appendicitis, respectively.

CONCLUSION
In patients with CT signs of non-perforated appendicitis the presence of gas within the appendix strongly suggests gangrenous appendicitis. Length of hospital stay is longer in gangrenous appendicitis and may generate higher hospital costs.

CLINICAL RELEVANCE/APPLICATION
Gangrene is a step prior to perforation, with higher morbidity and longer hospitalization time. CT signs of gangrene help surgeons to avoid delays in surgery, complications and a longer hospital stay

LL-ERS-TH3A • Noncontrast MRI versus Contrast Enhanced CT for Evaluation of Suspected Acute Appendicitis in Patients â‰¤ 40 Years: Cost Considerations and Impact on Emergency Department Patient Throughout

Matthew Covington MD (Presenter) ; Shannon Urbina ; Elizabeth A Krupinski PhD ; Lori Stolz MD ; Diego R Martin MD, PhD ; Surya Chundru MD ; James R Costello MD, PhD ; Bobby T Kalb MD

PURPOSE
To compare the effects of noncontrast MRI vs contrast-enhanced CT utilization for ED patients with right lower quadrant pain, with attention on patient throughput and comparative total abdominal imaging costs during the same ED visit.

METHOD AND MATERIALS
This study was IRB-approved and HIPPA compliant. Inclusion criteria included all patients at our institution â‰¥ 40 years presenting to the ED during daytime hours, who underwent noncontrast MRI or IV contrast-enhanced CT as the primary imaging method for evaluation of acute appendicitis between 2-2012 and 3-2013. Exclusion criteria included patients > 40 years, patients presenting after daytime hours and patients without clinical concern for acute appendicitis. MRIs utilized a fast, no oral/no intravenous contrast protocol, including a combination of multiplanar non-breath-hold, Half Fourier Acquisition Single Shot Turbo Spin Echo (HASTE) sequences +/- fat saturation utilizing a spectral adiabatic inversion recovery (SPAIR) technique. CTs were performed on a 64 slice scanner with IV contrast but no oral contrast. Data collected included time from ED triage to disposition (admit or discharge) and total number of imaging examinations performed during the ED stay. Cost-figures for each imaging modality and ancillary imaging tests were determined utilizing regional Medicare rates. A t-test was used to compare results between CT and MRI (p = 0.05 considered significant).

RESULTS
There were 33 patients in the MRI cohort and 42 patients in the CT cohort. Noncontrast MRI was associated with a significant reduction in ED length of stay compared to IV contrast-enhanced CT (560 min vs. 685 min, p=0.04). MRI patients had fewer ancillary imaging exams compared to CT (0.42 and 0.79 per patient, respectively, p

CONCLUSION
Evaluation of acute appendicitis with noncontrast MRI resulted in a significant reduction in the number of imaging tests performed and length of stay in the ED, compared to IV contrast-enhanced CT.

CLINICAL RELEVANCE/APPLICATION
Improved ED throughput and reduced number of imaging tests may offset additional MR imaging costs for patients with suspected appendicitis undergoing noncontrast MRI compared with contrast-enhanced CT

LL-ERE-TH4A • Globe and Orbital Trauma. A Quiz Case Based Review of Patterns of Injury

Eleni Testempassi MD (Presenter) ; Vasiliki Vantali MD ; Stylianos V Benakis MD ; Ioannis Matsiras ; Andreas Simopoulos MD, MSc ; Dimitrios Chondros

PURPOSE/AIM
Eye and orbital trauma is not an uncommon situation in the emergency room and in multi-trauma patients. The purpose of this exhibit is to illustrate the ocular and orbital traumatic lesions and review the roles of computed tomography, magnetic resonance imaging ultrasound and plain radiography in the evaluation of eye and orbital trauma.

CONTENT ORGANIZATION
A brief review of normal eye and orbit anatomy is presented. Common and uncommon traumatic ocular and orbital pathology, blunt and penetrating trauma and orbital traumatic lesions and review the roles of computed tomography, magnetic resonance imaging ultrasound and plain radiography in the evaluation of eye and orbital trauma.

SUMMARY
Rapid assessment and examination following trauma to the eye is crucial. A thorough knowledge of potential injuries is imperative to ensure rapid diagnosis, to prevent further damage to the eye and to preserve visual capacity. Imaging, in combination with ophthalmologic examination, can be powerful tool to the evaluation of traumatic injury of the eye.

Gastrointestinal - Thursday Posters and Exhibit (12:15pm - 12:45pm)

Thursday, 12:15 PM - 12:45 PM • Lakeside Learning Center

LL-GIS-THA • AMA PRA Category 1 Credit ™: 0.5

Host
Doug R Kitchen , MD

LL-GIE-TH10A • Utilization of Ancillary Features in Adjusting LI-RADS Category

Amal Shah BS (Presenter) ; Marilia P Ferreira MD ; Kevin A Zand MD ; Abdullah T Alturki MD, MBBS ; Elhamy R Heba BMBS; Eduardo A Costa MD ; Masahiro Tanabe MD ; Cynthia S Santillan MD ; Claude B Sirlin MD *

PURPOSE/AIM
The purpose of this exhibit is to:

1. Define ancillary features that may favor HCC.
2. Define ancillary features that may favor benignity.
3. Review when to apply ancillary features to adjust LI-RADS category.

CONTENT ORGANIZATION
• Introduction to LI-RADS; LI-RADS is an ACR-endorsed system of standardized terminology and criteria to interpret and report imaging examinations of the liver. LI-RADS assigns an ordinal score (1 to 5) to liver observations indicating likelihood of HCC
• Ancillary features definition: imaging features that modify likelihood of HCC
• Examples of ancillary features favoring HCC
• Examples of ancillary features favoring benignity
• How to apply ancillary features to adjust LI-RADS category
• Sample CT/MR images and schematics of select ancillary features

SUMMARY
The teaching points of this exhibit are:

1. Ancillary features that may favor HCC may be used to upgrade LI-RADS category by one or more categories (up to but not beyond LR4).
2. Ancillary features that may favor benignity may be used to downgrade LI-RADS category by one or more categories.
3. Absence of ancillary features should not be used to adjust LI-RADS category.
4. Ancillary features may be applied if there is uncertainty in the LI-RADS category.

LL-GIS-TH11A • Non Occlusive Mesenteric Ischemia (NOMI): What Do We Know?
Maria A Mazzel MD (Presenter); Francesco Giuseppe Mazzel; Giusi Imbiroco; Susanna Guerrini MD; Nevada Cioffi Squitieri; Alfredo Cirigliano; Dalila D'ascoli; Daniela Berritto MD; Francesca Iacobellis MD; Luca Voltterani

PURPOSE/AIM
1. To gain awareness about clinical, laboratoristic and imaging features of NOMI. 2. To describe the CT findings of NOMI with and without reperfusion event and to correlate these with pathological features.

CONTENT ORGANIZATION
1. A retrospective analysis of CT findings and anatopathological features of 30 patients (22 males, mean age 73.7 years), with a dismissal summary of NOMI. 2. Imaging/ pathological correlation in NOMI with and without reperfusion event.

SUMMARY
1. NOMI are increasingly common due to the ageing of society. 2. The prognosis of NOMI is extremely poor because many NOMI patients may not have been diagnosed correctly. 3. Owing to the possibility of the reperfusion event, NOMI can be a dynamic condition and its appearance at imaging could be significantly different depending on these reasons and on the time in which the CT examination is performed. 4. Awareness of CT findings of NOMI with and without reperfusion may bring the benefit of a prompt diagnosis and subsequent early and efficient initiation of therapy, which may improve the mortality.

LL-GIS-TH1A • Dual-Energy Computed Tomography for the Evaluation of Hypovascular Hepatic Metastases? Associations of the Optimal Monochromatic Level with Regard to the Metastasis-to-Liver Contrast Noise Ratio to Patient Size?
Mitsuhiro Matsuishi MD (Presenter); Takamichi Murakami MD, PhD *; Tomoko Hyodo MD; Masahiro Okada MD; Masakatsu Tsurusaki MD, PhD

PURPOSE
To examine the optimal monochromatic levels to acquire a highest metastasis-to-liver contrast-to-noise ratio (CNR) on virtual monochromatic spectral (VMS) imaging by dual-energy CT (DECT) and the associations of the optimal monochromatic levels to patient body size

METHOD AND MATERIALS
46 hypovascular hepatic metastases of twenty five patients were scanned by DECT in the portal venous phase. The scan was performed with fast kilovoltage switching between 80 and 140 kVp, detector collimation, 0.625 × 64 mm and helical pitch, 1.375. The tube current and rotation speed were adjusted to the computed tomography dose index-volume in a single energy CT acquisition at 120 kVp and Z-axis automatic tube current modulation technique (Noise Index=11.5). The highest metastasis-to-liver CNRs and the optimal monochromatic levels to acquire the highest metastasis-to-liver CNR on VMS imaging were measured, and their associations to patient body weight and body mass index (BMI) were examined.

RESULTS
The highest metastasis-to-liver CNRs were 6.83±1.6 (range, 3.18-10.83). The optimal monochromatic levels to acquire the highest metastasis-to-liver CNR were 67.9±2.9 (range, 65-74 keV). There was significant positive correlation of the highest metastasis-to-liver CNR to the body weight (r=0.320, p <0.05). A significant positive correlation was observed between the body size and the optimal monochromatic level with regard to the metastasis-to-liver CNR on VMS imaging. Therefore, we consider that it is necessary to adjust an optimal monochromatic level according to the patient size for the evaluation of hepatic metastases on VMS imaging.

CLINICAL RELEVANCE/APPLICATION
This is the first study demonstrating the associations of the optimal monochromatic level to acquire a highest metastasis-to-liver CNR on virtual monochromatic spectral imaging to patient body size.

LL-GIS-TH2A • Radiation Dose and Image Quality Comparison between Spectral CT and Conventional Multi-slice CT Liver Angiography
Guisheng Wang MD (Presenter); Jianhua Gao

PURPOSE
To compare the radiation dose and image quality including image noise of liver parenchyma and contrast-noise-ratio (CNR) for the veins between spectral CT and conventional multi-slice CT (MSCT) angiography in the liver.

METHOD AND MATERIALS
Thirty patients (group A) underwent conventional enhanced portal venous phase (PP) CT and 30 patients in group B underwent dual energy spectral enhanced CT in PP were retrospectively compared. Patients in group A were scanned in a 64-row MSCT with 120kVp and automatic tube current modulation (ATCM) with noise index=5.5 SAD=65cm. Patients in group B were scanned on the Discovery CT750 HD with spectral imaging mode. 101 sets of monochromatic images were reconstructed from a single spectral CT scan. CNR for the veins was calculated using liver parenchyma as background. The optimal energy level for obtaining the highest CNR was automatically determined on the GSI-viewer software. Image noise (at 70keV), CNR (at the optimal keV level) for the vein and radiation dose to the patient were obtained for spectral images and statistically compared with those in group A with the conventional MSCT using SPSS13.

RESULTS
Patient BMI values for the two groups were 24.5±5.31 and 24.9±4.69 with no difference. The radiation dose for spectral CT was 15.6±4.9 Gy, 30% lower than the 22.44±4.6 Gy for the conventional MSCT (p<0.05). On the other hand, CNR for the vein at the optimal energy level in spectral CT was 6.20±4.32, significantly higher than the 2.76±1.34 for MSCT with conventional polychromatic 120kV images (p <0.05). Compared with conventional standard-dose MSCT liver angiography, spectral CT imaging provides a set of monochromatic images for much improved CNR for vessels, comparable image noise for liver parenchyma with 30% dose reduction for standard sized patients.

CLINICAL RELEVANCE/APPLICATION
Spectral CT imaging provides a set of monochromatic images at lower radiation dose for additional information and optimized image noise and contrast-noise-ratio in liver angiography.

LL-GIS-TH3A • Expensive Stones: Ultrasound and MRCP Utilization in the Setting of Acute Biliary Colic. When Does MRCP Add Clinical Value?
Miriam Romero MD (Presenter); Frank K Chen MD; Jonas Castaneda; Phil Wu; Joel Ornelas MD; Phillip M Cheng MD, MS; Steven Cen PhD; Margaret Fleming MD; Suzanne L Palmer MD *

PURPOSE
To correlate the incidence of positive and negative findings on MRCP with laboratory values and findings on preceding abdominal US in patients with acute biliary colic.

METHOD AND MATERIALS
This is a retrospective case series in which we reviewed US and MRCP findings in 100 patients presenting with acute biliary colic to a single institution's Emergency Department over 7 months. Laboratory values, including total bilirubin (T Bil), alkaline phosphatase (AlkP), lipase, amylase and white blood cell (WBC) were obtained. The presence or absence of gallstones and intrahepatic and extrahepatic biliary dilatation on abdominal US and MRCP were recorded. CBD size was measured on both imaging modalities. Results were recorded for patients that went on to ERCP.

RESULTS
MRCP revealed cholecodolithiasis in 23 patients, 12 of which were confirmed on ERCP. Eighteen of these stones were not seen on US. Of the remaining 5 patients with stones on MRCP, 2 had CBD sludge and 3 had CBD stones identified on US. MRCP did not provide additional information in these patients. Three patients had positive US that were not visualized on MRCP. No CBD stones were identified on either imaging modality in the remaining 74 patients. CBD size was variable in patients with CBD stones on MRCP, but all had IHDD. However, IHDD on US only had a sensitivity of 65.2% (95% CI: 45.2%, 84.7%) and specificity of 59.7% (95% CI: 48.8%, 70.7%) in predicting a CBD stone on MRCP. Lab abnormalities were present in all patients with MRCP CBD stones, most commonly elevated T Bil (n=14) and elevated AlkP (n=16). Patients with ERCP confirmed CBD stones had borderline significantly elevated T Bil (4.3±4.9 vs. 2.4±4.4, p=0.05). However, no statistically significant difference was observed in the laboratory measurements between positive vs. negative stone finding on ERCP, MRCP or US.

CONCLUSION
ACK appropriateness criteria state that MRCP in acute biliary colic may be inappropriate in the setting of equivocal or negative US to assess for CBD stones and other etiologies of pain. However, the indications for MRCP in this setting are not precisely defined and MRCP utilization contributes to escalating costs. In the absence of abnormal labs or IHDD on US, MRCP may be of limited value though our study did not reveal definitive statistical correlation.

CLINICAL RELEVANCE/APPLICATION
Image Quality on Liver CT Based on Sinogram Affirmed Iterative Reconstruction Algorithm

Brian S Pugmire MD (Presenter); Jess Kaplan MD; Mayureewan Taphey; Peter F Hahn MD, PhD *; Daniel Doody MD; Debra A Gervais MD *; Michael S Gee MD, PhD

PURPOSE
Abdominal abscesses are well-known complications of Crohn's disease (CD) and frequently occur in the pediatric population. Percutaneous drainage has been shown to be a safe and effective method for treatment of CD-related abscesses in adults, frequently obviating the need for surgical drainage or providing a bridging procedure to a more controlled elective bowel resection following abscess resolution. Few studies have evaluated the success of this procedure in the pediatric population specifically. We present data from a retrospective review of 26 cases of pediatric patients who underwent percutaneous drainage for CD-related abscesses.

METHOD AND MATERIALS
26 cases of young patients (age < 21 years) with proven CD who underwent percutaneous drainage at an urban general hospital between 1995 and 2012 were retrospectively reviewed. Success of percutaneous drainage was defined as (1) no surgery within one year of drainage with resumption of IBD-related medical therapy (apart from antibiotics) within 8 weeks of the time of drainage or (2) surgical bowel resection following drainage with no evidence of residual abscess on imaging or at surgery. Various characteristics (patient gender and age, abscess size and volume, affected bowel segment, and need for repeat percutaneous drainage) were analyzed using the Fisher exact test to assess for factors associated with treatment success or failure.

RESULTS
The average age of the patients at the time of treatment was 17.5 years (range 10-20 years) with a male to female ratio of 15:11. Using the criteria listed above, 19 of 26 patients were classified as having undergone successful drainage, six were classified as treatment failures, and one patient could not be classified, giving a treatment success rate of 73%. Among the multiple factors analyzed, abscess volume >100cc was the most strongly associated with treatment success.

CONCLUSION
Percutaneous image-guided drainage is an effective treatment for CD-related abscesses in pediatric patients, based upon a combination of medical and surgical criteria for treatment success.

CLINICAL RELEVANCE/APPLICATION
Percutaneous drainage should be considered for treatment of pediatric patients with CD-related abscesses, thereby avoiding surgical drainage and allowing resumption of anti-inflammatory medications.

Evaluation of Diffusion Weighted Imaging without Bowel Preparation for Detecting Ulcerative Colitis

Huiyao Zhang (Presenter); Lili Yu; Haishan Yang MD; Furong Wang; Zhongwen Lv; Butian Zhang

PURPOSE
To evaluate the value of diffusion-weighted imaging (DWI) in ulcerative colitis without bowel preparation at 3T.

METHOD AND MATERIALS
Twenty patients who underwent magnetic resonance colonography including DWI for ulcerative colitis without bowel preparation, followed by colonoscopy within 24 hours were recruited. DWI was examined under different b values (b=0, 400, 600,800, 1000 s/mm²). Two radiologists reviewed conventional MR images, contrast enhanced MR images, DWI and ADC maps to evaluate each intestinal segment (rectum, sigmoid, left colon, transverse colon, right colon). Receiver operating characteristic (ROC) and binary logistic regression analysis was used to determine their diagnostic performance.

RESULTS
A total of 100 segments (71 with endoscopic colonic inflammation, 29 normal) were included. The proposed total magnetic resonance score (MR-score-T) correlated with the total modified Baron score (Baron-T) (r=0.875, p 1 detected endoscopic colonic inflammation with a sensitivity of 85.9% and specificity of 82.8%, with an area under the curve (AUC) of 0.929 (p < 0.05). DWI hyperintensity from b =800 s/mm² detected endoscopic colonic inflammation with a sensitivity of 79.3%, with an AUC of 0.867 (p=0.02) was 0.932 (95% confidence interval, 0.881–0.983) for detection of endoscopic inflammation. The threshold ADC value, 2.18×10⁻³ mm²/s, provided differentiation of endoscopic inflammation from normal intestinal segment with a sensitivity of 99.1% and specificity of 80.3%.

CONCLUSION
DWI without bowel preparation is a helpful method for detecting colonic inflammation in ulcerative colitis.

Interobserver Variability in MaRIA Score Calculation for Assessing Severity of Crohn’s Disease (CD) Using a Dedicated IBD Workstation

Benjamin D Spilseth MD (Presenter); Jeff L Fried MD *; David Bruining MD *; Stephanie Hansel MD *. William S Harmsen; Jordi Rimola MD *; Alan Larson; David R Holmes PhD; Joel G Fletcher MD *

PURPOSE
The MaRIA (MR Index of Activity) score is an image-based scoring system that describes the severity of Crohn's inflammation, but multi-institutional validation is limited and prior studies used an MR enterography (MRE) protocol after rectal enema. This study evaluates the interobserver variability for MaRIA Crohn’s severity assessment using standard clinical MR enterography exams with only per oral enteric contrast and a dedicated IBD computer workstation.

METHOD AND MATERIALS
30 pts with suspected CD had MRE performed with per oral but not rectal contrast. Multiphase gd-enhanced images were acquired and evaluated at 3 time points (45, 75, 115 seconds) in 26/30 pts. 3 colorectal segments and 3 small bowel segments were evaluated by 2 GI radiologists using a dedicated IBD computer workstation for all MaRIA measurements and MaRIA calculation (1.5*wall thickness + 0.02* relative contrast enhancement +5*edema + 0.5*ulceration). When no inflammation was identified, a per segment score of 4.0 was used. Inter-class correlation coefficients (ICC's) were calculated for phases of enhancement, between readers, and for different components of the MaRIA score.

RESULTS
There was near perfect agreement in MaRIA scores at the 3 phases of enhancement for each reader (ICC's = 0.994, 0.995). Median MaRIA scores for the readers were similar (17.8 and 18.1), and the median difference between readers was not significant (1.2, p = 0.12). In 51 inflamed segments, there was substantial agreement in calculating the MaRIA score to assess disease severity in CD patients who undergo routine MRE exams. MaRIA score is not significantly affected by the timing of the post contrast images. A dedicated IBD workstation facilitates semi-automated MaRIA measurement and automatic calculation.

CONCLUSION
There is substantial Interobserver agreement in calculating the MaRIA score to assess disease severity in CD patients who undergo routine MRE exams. MaRIA score is not significantly affected by the timing of the post contrast images. A dedicated IBD computer workstation facilitates semi-automated MaRIA measurement and automatic calculation.

Image Quality on Liver CT Based on Sinogram Affirmed Iterative Reconstruction Algorithm

Boris Schulz MD (Presenter); Boris Bodelle MD; Petra Siebenhandl; Martin Beeres MD; Firas Al-Batmeh; Claudia Frellesen; Thomas J Vogl MD, PhD

PURPOSE
To evaluate efficiency of sinogram affirmed iterative reconstruction technique, regarding noise and image quality on contrast enhanced computed tomography (CT) of the liver.

METHOD AND MATERIALS
CT examinations were performed upon 32 patients (128 slice CT, 120kV, 180mAas, activated tube current modulation, 0.6mm collimation). Each examination was reconstructed at standard filtered back projection (FBP) and 5 different SAFIRE strengths in 5mm images in transversal direction with soft tissue kernel. Image noise was defined as standard deviation (SD) of Hounsfield units (HU) in air, and signal to noise ratio (SNR) of the liver was defined as mean liver HU per liver SD. Subjective image quality was evaluated by three raters using a 5-point scale (1=non-diagnostic image quality, 5=excellent image quality).
RESULTS
Average image noise was 6.2HU (FBP), vs. 5.7HU (SAFIRE 1), vs. 5.0 (SAFIRE 2) 4.4HU (SAFIRE 3), 3.8HU (SAFIRE 4), 3.1HU (SAFIRE 5). SNR of the liver consecutively increased when using the iterative reconstruction algorithms from 8.4 (FBP) to 9.3 (SAFIRE 1) to 10.4 (SAFIRE 2) to 12.2 (SAFIRE 3) to 15.1 (SAFIRE 4) to 17.5 (SAFIRE 5). The differences in image noise and SNR of each SAFIRE-strength to FBP was statistically significant (p < 0.05).

CONCLUSION
Sinogram affirmed based iterative reconstruction technique significantly reduces image noise and increases SNR for examinations of the liver. However subjective image quality decreases with strong iterative strengths.

CLINICAL RELEVANCE/APPLICATION
Since subjective image quality decreased slightly with iterative reconstructive techniques, mild iterations are recommended to enhance image quality on liver CT.

LL-GIE-TH9A • Imaging Patterns of IPMN. An Illustrated Discussion of the International Consensus Guidelines 2012 for the Management of IPMN
Naomi M Campbell MBChB (Presenter); Seth S Katz MD, PhD; Richard Kinh Gian Do MD, PhD

PURPOSE/AIM
The increasing frequency of the diagnosis of intraductal papillary mucinous neoplasm (IPMN) necessitates stratification of IPMN patients into low and high risk groups, for which follow-up or surgical evaluation will be recommended. New evidence concerning the natural history of this entity has emerged since the publication of the 2006 International consensus guidelines for the management of IPMN, prompting release of new guidelines in 2012. We aim to illustrate the imaging patterns of IPMN with emphasis on features that influence patient management.

CONTENT ORGANIZATION
We reviewed the imaging of patients at our institution with surgically resected IPMN, of varying histologic grade, from low grade dysplasia to invasive carcinoma. IPMN cases will illustrate the spectrum of imaging features of this entity on CT and MRI, as well as the 'worrisome features' and 'high risk stigmata' that influence risk stratification.

We review the follow up recommendations, both pre- and postoperatively. Emerging evidence concerning the risk of concomitant pancreatic ductal adenocarcinoma remote from the IPMN is discussed, with reference to the impact on follow up.

SUMMARY
The viewer of the exhibit will be able to 1. Recognize the distinguishing imaging characteristics of IPMN. 2. Identify the 'worrisome features' and 'high risk stigmata' that should prompt additional work-up.

LL-GIE1244-THA • MR/PET vs. PET/CT in Rectal Cancer: A Potential Indication
Sasan Partovi BS (Presenter) *; Andres Kohan MD *; Karin A Herrmann MD; Jose L Vercher-Conejero MD *; Christian Rubbert MD *; Peter F Faullabner MD *; Raj M Paspulati MD; Pablo R Ros MD, PhD *

PURPOSE/AIM
MR/PET is a hybrid imaging technology which was recently introduced in the clinical arena. The MR component has a high soft-tissue contrast and reveals biological information when performing functional sequences like diffusion-weighed imaging (DWI). The PET component enables to visualize metabolism with a high sensitivity. The aim of this educational exhibit is to compare MR/PET vs. PET/CT for rectal cancer staging and to demonstrate MR/PET as a one stop approach for this clinical indication.

CONTENT ORGANIZATION
Current standard for rectal cancer staging: T staging with MRI. N and M staging with PET/CT. MR/PET in rectal cancer staging 3T. N staging with PET/CT. Role of DWI for discordant cases when comparing MR/PET vs. PET/CT.

SUMMARY
MR/PET is feasible and promising in rectal cancer patients. Originally proper staging in rectal cancer required two different imaging techniques, namely MRI and PET/CT. MR/PET offers an evolving one solution for staging, allowing local tumor assessment as well as adenopathy and distant metastasis. When discordance is observed between the findings of MR/PET vs. PET/CT DWI might be of help for clarification purposes. Rectal cancer could be one of the future killer applications of MR/PET. Multicenter trials in a large rectal cancer patient population are warranted.
cortical and medullary RBF in two groups were compared, and the correlation between serum creatinine and RBF were analyzed. One patient was performed ASL MR imaging 1 month after therapy.

RESULTS

CONCLUSION

ASL, a noninvasive functional MR imaging, is feasible in quantitative assessment of RBF, with the potential capability in the diagnosis and early evaluation to therapy in AKI.

CLINICAL RELEVANCE/APPLICATION
(dealing with ASL perfusion MRI): Quantitative assessment of RBF is feasible, and ASL MRI demonstrates potential capability in the diagnosis and early evaluation to therapy in AKI patients.

LL-GUS-TH3A • Value of Contrast Enhanced Sonography in Acute Pelvic Pain in Women and Children: Initial Experience

Sandrine Chapuy (Presenter); Philippe Manzoni MD; Adrian I Kastler MD, MSc.; Sebastien L Aubry MD, PhD; Bruno A Kastler MD, PhD

PURPOSE

To study the feasibility and value of contrast enhanced ultrasound (ECUS) in acute pelvic pain in women and children.

METHOD AND MATERIALS

Seventeen adnexal torsion were included in this retrospective study (12 patients from 21 days to 58 years, including 3 pregnant women) after local ethics committee approval between 2008 and 2012. ECUS imaging findings were compared to regular non enhanced US and to either pathological findings in case of surgery and to follow up imaging in the remaining cases.

RESULTS

Thirteen adnexal torsion were confirmed, 9 of which occurred on a pathological ovary. ECUS sensitivity and positive predictive value were 84.6%. We report two cases of false negative and two cases of false positive. Ovary Vascularization assessment was possible in all 13 cases as opposed to 30.8% in Doppler mode . In the three cases of ECUS performed pregnant women, imaging findings showed no transplacental passage. No adverse events were noted in all cases.

CONCLUSION

Our study showed that ECUS allowed accurate diagnosis of adnexal torsion in 84.6% of cases. ECUS is a feasible, safe and useful tool in the assessment of acute pelvic pain in women and children.

CLINICAL RELEVANCE/APPLICATION

Contrast enhanced US is a useful tool in the early diagnosis of adnexal and provides crucial information on ovary perfusion which may help conservative surgical management.

LL-GUS-TH4A • Does Serum Creatinine Based Criteria Overestimate Renal Dysfunction in Cancer Outpatients Submitted to Contrast-enhanced CT after Administration of Low-osmolality Nonionic Iodinated Contrast Media?

Joao I Melo; Rubens Chojniak MD, PhD (Presenter); Almir Bitencourt MD; Marcos D Guimaeraes MD

PURPOSE

To assess renal function estimated by serum creatinine and cystatin C based criteria before and after administration of low-osmolality nonionic iodinated contrast media in cancer patients submitted to contrast-enhanced computed tomography (CT).

METHOD AND MATERIALS

Prospective study that included 239 outpatients at a cancer reference center. Most included patients were female (57.7%) and mean age was 53.4 years (range: 14-82). Serum creatine and cystatin C were assessed in all patients before and after contrast administration. The glomerular filtration rate (GFR) was estimated by serum creatinine based formulas (MDRD and Cockcroft-Gault) and cystatin C based Larsson formula.

RESULTS

Serum creatinine mean values were significantly higher after contrast administration (p=0.004). There was also a statistically significant reduction in the GFR estimated with MORD and Cockcroft-Gault formulas (p=0.002). There was no statistically significant difference on Cystatin C levels (p=0.522) or in the GFR estimated by Larsson formula (p=0.629) before and after contrast administration. None of the patients presented clinically significant nephropathy. However, there was an increase higher than 25% in serum creatinine in 22 patients (9,9%), suggesting contrast-induced nephropathy. None of the patients had a significant increase on Cystatin C levels after contrast administration. There were no statistically significant differences in the results of patients with a solitary kidney, diabetes, metastatic disease or who underwent chemotherapy.

CONCLUSION

Many studies have shown that serum cystatin C is superior to serum creatinine as a marker of renal function. The results of this study showed that serum creatinine based criteria indicated renal dysfunction after administration of low-osmolality nonionic iodinated contrast media, which was not observed when clinical data and cystatin C based criteria were evaluated. Thus, we believe that serum creatinine based criteria may overestimate renal injury in cancer outpatients submitted to contrast-enhanced CT.

CLINICAL RELEVANCE/APPLICATION

Our results showed that low-osmolality nonionic iodinated contrast media are associated with low risk of contrast-induced nephropathy in cancer outpatients submitted to contrast-enhanced CT.

LL-URE-TH5A • CT and MR Urography in Routine Clinical Practice: Pearls and Pitfalls for the Beginners

Rammohan Vadapalli MD (Presenter); Abhijit Roychowdhury MD; Mgp Murthy MD; Krishna Mohan Pottal MD; Shanta Hettiarchichhi FRCR; Abhinav Srijam S Vadapalli; Piyush Saxena MBBS, MD

PURPOSE/AIM

AIM AND LEARNING OBJECTIVES: 1. To highlight the basic concepts of CT and MR Urographic Techniques with outlines of the protocol and discuss the precise Clinical indications of each or Combined (Combo Urography) in Clinical Uroradiological Imaging practice. 2. Discuss the Pearls and Pitfalls of these techniques in calculus disease, Obstructive uropathy, Painless haematuria evaluation as well as in Renal mass lesions and Urothelial neoplasms. 3. Surgeon friendly Visualization techniques like 3D Mip. Volume rendering, shaded Surface Display (SSD) and Virtual Ureterocystoscopy and their role are showcased with examples in Common and Uncommon pathologies including variants and anomalies.

CONTENT ORGANIZATION

1. Outline of CT and MR Urography protocols with advanced visualization techniques in the following areas. 2. Normal Variants and Congenital anomalies - clinical examples 3. Renal calculus disease- detailed description with examples. 4. Renal and Urothelial neoplasms - features on CT and MR Urography. 5. Obstructive uropathy: Role of Combo urography - case examples. 6. Common Pitfalls in Interpretation with CT and MR urography- shown with Clinical examples and Tips on how they could have been avoided.

SUMMARY

This Exhibit offers the Reader an overview of Pearls and Pitfalls of CT and MR Urography in Clinical Uroradiology practice.

Health Services - Thursday Posters and Exhibits (12:15pm-12:45pm)

Thursday, 12:15 PM - 12:45 PM • Lakeside Learning Center

LL-HPG-THA • AMA PRA Category 1 Credit ™: 0.5

Host

David C Levin, MD *

Host

David V Rawson, MD

LL-HPS-TH1A • Minimizing Z-Axis Scan Length during Chest CT: Guidelines for Dose Reduction

Stuart L Cohen MD; Thomas J Ward MD (Presenter); Claudia I Henschke MD, PhD; Matthew D Cham MD; David F Yankelevitz MD *

PURPOSE

To understand the relationship between the scout image and the CT scan; To develop guidelines that minimize the z-axis scan length during chest CT, thereby
LL-HPS-TH2A • Impact of a Radiology Utilization Management Program on the Performance of Expensive Outpatient Imaging Studies: Effectiveness of Collaboration and the Sentinel Effect

David P Friedman MD (Presenter); Nancy Smith; Ashish R Gandhe MD, MBBS

PURPOSE
To assess the impact of a collaborative radiology utilization management (UM) program on the performance of expensive outpatient imaging studies.

METHOD AND MATERIALS
Using evidence based guidelines, a radiology benefit management (RBM) company (HealthHelp, LLC) provides real time decision support for clinicians ordering expensive outpatient imaging studies (CT, MRI, PET, nuclear medicine). After initial consultation between RBM personnel (level 1, customer service representative; level 2, nurse) and the provider's staff, studies not meeting appropriateness criteria are referred to a subspecialty academic radiologist (level 3) for review. The radiologist can approve the study based upon an electronic chart evaluation, or call the provider for further information. If a suitable person cannot take the call, there is a subsequent 'no callback' from the provider's office within 48 hours, the study is administratively closed. Studies are not denied by the radiologist. We analyzed the rate of withdrawals (procedure withdrawn or changed by consensus with the provider) as a measure of the effectiveness of collaboration between the provider and radiologist. The rate of 'no callback' was a measure of the effectiveness of the sentinel effect; we also determined how often a study was reordered within 30 days after being closed due to 'no callback'. Withdrawal rates, as well as administrative closures at 30 days due to 'no callback', were aggregated to assess the overall impact of the UM program. The study interval was one year (January - December 2012).

RESULTS
A total of 12,758 studies were reviewed. There were 1,644 studies (12.9%) not performed by consensus and 643 studies (5.0%) changed by consensus; hence, 2,287 studies (17.9%) were withdrawn after radiologist collaboration. There were 'no callbacks' for 2,761 studies (21.6%); of these, 811 were reordered within 30 days; hence, 1,950 studies (15.3%) were not performed due to 'no callback'. In aggregate, this UM program impacted the performance of 4,237 studies (33.2%).

CONCLUSION
Our data demonstrate the striking impact of provider-radiologist collaboration, together with the sentinel effect, in reducing utilization of inappropriate or unnecessary, expensive outpatient imaging studies; these results were achieved without the use of denials.

CLINICAL RELEVANCE/APPLICATION
A collaborative RBM is highly effective in reducing the utilization of outpatient imaging studies.

LL-HPS-TH3A • Radiologist Error Rate When Interpreting Adult Computed Tomography: Systematic Review and Meta-analysis

Mark Z Wu MSc (Presenter); Matthew D McInnes MD, FRCP; Blair MacDonald; Ania Z Kielar MD; Shauna Duigenan MD

PURPOSE
To use meta-analysis to determine the radiologist error rate when interpreting computed tomography (CT) performed on adult patients. Secondary objectives include determination of whether error rate differs based on body region or level of training.

METHOD AND MATERIALS
Medline and Embase were searched through June 2012. Two reviewers independently selected studies that met the inclusion criteria and extracted study data. The error rates were investigated with a random-effects meta-analysis. Subgroup analyses: level of training of the initial reader, definition of major error; body system and risk of bias.

RESULTS
Fifty-eight studies met the inclusion criteria (388,123 CT examinations). Pooled total error rate was 7.7%, 95% CI[5.6,10.3] and major error rate was 2.4%, 95% CI[1.7,3.2]. The pooled major error rate was comparable for staff (2.9%, 95% CI[1.2,6.7]) and residents (2.2%, 95% CI[1.7,2.9]), Q = 0.92, p = 0.63. The pooled major error rate for head (0.8%, 95% CI[0.4,1.6]) and spine (0.7%, 95% CI[0.2,2.7]) was lower than for chest (2.8%, 95% CI[1.3,5.4]) and abdomen (2.6%, 95% CI[1.0,6.7]), Q = 8.28, p = 0.001. Lack of bending of the reference reader to the initial report was associated with a lower major error rate (2.0%, 95% CI[1.4,2.8]) than when bending was present (12.1%, 95% CI[4.4,29.4]), Q = 10.64, p = 0.0011.

CONCLUSION
This study documents the total and major error rates in interpretation of adult CT; these may be useful as reference standards for quality assurance programs aimed at error reduction. Cautious application of this data is suggested since numerous sources of heterogeneity are present.

CLINICAL RELEVANCE/APPLICATION
This study documents total (7.7%, 95% CI[5.6,10.3]) and major (2.4%, 95% CI[1.7,3.2]) error rates in interpretation of adult CT; these may be useful as reference standards for quality assurance programs.

LL-HPE-TH4A • What the Patients Prefer during the MRI Examination: The Answers

Lliana G Sanchez Da Rocha Msc (Presenter); Elaine Goncalves Guerra; Ronaldo H Baroni MD; Marcelo B Funari MD

PURPOSE
The magnetic resonance (MR) examination is a procedure that can be seen in a bad way by the patient. The restriction inside the magnet, the need to stay still for a period of time or weight limit of the table may prevent the realization of the exam. As a result, we have increased procedures with anesthesia (1) and / or loss of the income generated by these patients. In any imaging service, these issues may have great impact. Thinking of solutions, some alternatives have emerged, as shorter and wider bore equipment's, with greater weight tolerate, exam rooms with specific surroundings and optionally resources as music and blindfold. These actions have a cost / benefit. This abstract aims to demonstrate the perception of patients who schedule their MRI exams about these alternatives, collecting their opinions in a specific questionnaire.

METHODS
A short and wide bore MR equipment (Magnetom Espree, Siemens, Germany) was installed in the hospital satellite unit in March 2007. The room is designed so that one wall was replaced with window overlooking the outdoors area. 919 patients were asked to answer a questionnaire voluntarily after his MR procedure (regardless of type of examination) in the period from 07/20/2007 to 11/30/2007. The questionnaire contained seven direct questions (answers yes / no / do not know) and comments field. Data were compiled and presented at results.

RESULTS
Of the 919 patients who answered the questionnaire, 27% had never performed MRI. With respect to impression of the device, 60% found the device more comfortable (Graph 1). Among the comments pointed out, the key issue was the width of the magnet: the possibility to better accommodate the upper limbs and larger distance between the machine and face. Among those questioned, 89 (10%) had failed to perform MRI because of claustrophobia and 10 due to weight limits (Graph 2). During the study period, 6 patients (0.6%) failed the exam. Was asked if the use of blindfold was a preference. 71% answered no. In the comments field, the presence of light and the window was attributed as a factor that made this unnecessary accessory. It was also asked if listening to music during the exam was a preference. 75% answered yes.

CONCLUSION
It’s known that anxiety about MRI is a multi- faceted problem that involves fear not just from the machine, but also others like from being hurt, or feel pain, or even about the examination result. In this abstract we try to find alternatives to help, not only the claustrophobic, but also anyone who has to perform a MR exam.
RESULT

- The time needed to complete 2D reading of every CTA study was significantly shorter using the iPad™ than the workstation (153±101 vs 202±87 seconds, respectively; p=0.0203).
- Agreement on arterial blush detection occurred in 21/25 cases (84%), whereas out of the remaining 4 cases, 2 were iPad™ false negatives and 2 iPad™ false positives.
- Agreement on bleeding site and suspected feeding artery was 89.5% and 73.7%, respectively.

CONCLUSION

The iPad with Retina Display™ is effective for 2D reading of CT angiography studies of patients with suspected acute gastrointestinal bleeding.

CLINICAL RELEVANCE/APPLICATION

The iPad™ with Retina Display could be used by on-call interventional radiologists for immediate decision on percutaneous embolization in patients with suspected acute gastrointestinal bleeding.

LL-INS-TH2A • Verify and Development of Practical Applications in the Cloud-based Real-time 3D Workstation

Hironobu Tomita MD (Presenter); Hitoshi Yazawa BS; Masakazu Shito; Yosuke Kidokoro; Natsuki Toyota

CONCLUSION

The results of development of this system and its usage in clinical practice suggest that practical usage is fully possible and that this system may be very useful in the medical field.

Background

In recent years, information technology (IT) in medicine is progressing remarkably. But we do not have any good tools for access to medical images from outside hospital. Therefore we set up 3D cloud server for provide real-time diagnostic imaging for their patients. I report demonstration test for practical use in December 2011 to March 2012.

Evaluation

We set up 3D cloud server with virtualization application system for create 3D images. Image transfer speed testing involved measuring the image transfer speed in-hospital to the cloud-based server and transmitting 250–5000 images worth of 3D image data (computed tomography [CT]) to the cloud-based server and varying the number of images, parallel load, and other aspects to analyze the actual time required. For including the actual usage assumptions, we used frames per second (FPS) measurements, wireless LAN, and WiMAX (Worldwide Interoperability for Microwave Access) for ordinary 3D creation processes to investigate the feasibility of processing in terms of the differences in operability.

Discussion

The speed was equivalent to when the server system was installed inside the hospital (11.4 images/s in-hospital, 10.2 images/s with the server). The FPS was the highest in-hospital, at 17.8 frames/s and 16.5 frames/s with the server. Thus, we confirmed that FPS was within ranges that allowed for practical use in terms of operability.

LL-INS-TH3A • Comparison of the Organ Dose to the Lens of the Eye to ICRP Threshold Values for Cataract Formation in the Sinus MDCT Protocol Optimization Process

Jennifer W Siegelman MD, MPH (Presenter); Holly Lincoln MA; Dustin A Gress MS; Choonsik Lee PhD; Daniel Valentino PhD *; Alphonso Magri PhD; Mark P Supanich PhD *

CONCLUSION

Definition of quantifiable effect on lens dose in low CTDIvol range, can inform priority setting in the protocol optimization process, and aid risk communication in medical decision making.

Background

Definition of quantifiable effects on organ dose can inform decision in the protocol optimization process. Nearly optimized sinuses CT protocols, in a multi-vendor environment, with and without iterative reconstruction, resulted in an average CTDIvol value that was one-fifth of the 50th percentile of ACR Dose Index Registry. This work aims to quantify how sinus CT protocol optimization efforts impact organ dose to the eye lens, through direct measurement and Monte Carlo simulation, while considering ICRP threshold.

Evaluation

Scan parameters and average CTDIvol from the three scanners in one community health system were compiled using commercial software (Radmetrics Inc, Toronto, ON) (Scanner A: 100 kVp, 50 mAs; Scanner B: 120 kVp, 70 mAs; Scanner C: 100 kVp 70 mAs: no gantry tilt, length 13 cm). Lens dose was calculated via Monte Carlo radiation transport coupled with an adult computational human phantom with a realistic eye model including globe, lens, and orbit assessing direct dose as well as scatter. Direct measurement of air kerma was performed for each protocol using dosimeters including commercially available digital and software-calculable CR strips (Landauer) calibrated at a mean energy of 65 kVp as well as a 0.6 cc ion chamber (Radcal) calibrated for diagnostic scanning placed on the eyelid of the Rando phantom (Alderson, Stamford, CT). With these diagnostic scans, performed at CTDIvol = 5.3-12.1 mGy, the estimated absorbed dose to the lens of the eye based on phantom simulation ranged from 4.2 - 9.6 mGy. The measured air kerma to the "lens" surrogate 0.6cc ion chamber more closely paralleled the CTDIvol for the scanner with values from 5.2 - 12.2 mGy. Strip dosimeters resulted in a measured peak dose of 5.4 to 17.6 mGy.

Discussion

Diagnostic quality Sinus CT, performed at techniques less than 1/5 of the median CTDIvol reported in the ACR Dose Index Registry result in lens doses which are well below the threshold for tissue damage according to the ICRP.

LL-INS-TH4A • A Robust Pathological Lung Segmentation Platform Using Fuzzy-Connectedness with Patient-specific Modeling

Awais Mansoor PhD (Presenter); Ulas Bagci PhD, MSc; Brent Foster; Ziyue Xu PhD; Jayaram K Udupa PhD; Daniel J Mollura MD
We have presented an MS eFolder system to integrate patient's clinical data with MRI and quantitative data from CAD. CAD data has been converted to DICOM-SR format for long-term storage in PACS and data query and display in a DICOM-compliant clinical setting, in accordance with IHE profiles. The eFolder integrates patient's clinical data with MRI studies and a computer-aided detection algorithm for MS lesions. The methodology including conversion of CAD data from native MATLAB format or any other CAD-specific software to DICOM-SR, and developed based on IHE workflow profiles. The eFolder integrates patient's clinical data with MRI studies and a computer-aided detection algorithm for MS lesions.

RESULTS
An average Dice Similarity Coefficient of >90% was obtained—100% indicates the reference standard provided by the expert radiologists. A user interface was designed for radiologists to use the proposed quantification and evaluation system in their daily tasks. To the best of our knowledge, this is the first fully automated, robust, and accurate method using patient specific shape model within the pathological lung segmentation literature.

CONCLUSION
We developed a novel fully automated segmentation technique for lung segmentation, the initial analysis show promising scope for the technique in accurately segmenting pathological and normal lungs in routine clinical environment.

CLINICAL RELEVANCE/APPLICATION
Our proposed method is an automated system with applications that can be used in clinics and provide accurate quantification of lung diseases for early diagnosis or pre-op assessments.

Web-based DICOM-SR Viewer for CAD Data of Multiple Sclerosis Lesions in an Imaging Informatics-based eFolder

Kevin C Ma BS (Presenter); Jeffrey Zhang; Heng Gao Zhong; Brent J Liu PhD

BACKGROUND
Last year, we have demonstrated an imaging informatics multiple sclerosis eFolder with data storage, data analysis, and data mining solution designed and developed based on IHE workflow profiles. The eFolder integrates patient’s clinical data with MRI studies and a computer-aided detection algorithm for quantifying MS lesion characteristics (including lesion volume, lesion contour, locations, and sizes) in brain MRI studies. Quantitative CAD results need to be converted to DICOM-SR format for long-term storage in PACS and data query and display in a DICOM-compliant clinical setting, in accordance with IHE integration protocols. In order to display CAD results in DICOM-SR format on the web GUI, we have designed a web-based DICOM-SR viewer based on our existing DICOM viewer. The methodology including conversion of CAD data from native MATLAB format or any other CAD-specific software to DICOM-SR, and displaying the IHE results in a tabulated format along with the referenced images in the viewer will be shown. The viewer also displays lesion segmentation results in the DICOM format.

EVALUATION
72 MRI studies have been analyzed by the CAD. All of the CAD results have been converted to DICOM-SR via dcmcopy and customized XML templates. The generated XML-SR was integrated along with the eFolder GUI to allow users to view DICOM images, perform window/level/zooming tasks, and to view tabulated CAD results in the viewer. Users will also be able to select individual lesions for a more detailed lesion characteristic summary.

DISCUSSION
We will present an effective way to convert quantitative imaging data into DICOM-SR, a web-based GUI to display DICOM-SR, and provide an example of how to utilize the DICOM standard and IHE integration profiles in a research setting.

CONCLUSION
We have presented an MS eFolder system to integrate patient’s clinical data with MRI and quantitative data from CAD. CAD data has been converted to DICOM-SR format for long-term storage in PACS and data query and display in a DICOM-compliant clinical setting, in accordance with IHE profiles.
LL-INE3186-THA • Conventional and Unconventional CT Post-processing Software to Analyze Gunshot Injuries and Bullet’s Ballistic in Firefights

Marco Matteoli MD (Presenter); Claudia Scaringi; Antonio Cremona; Anna Macioce; Lara Cristiano MD; Marco Di Girolamo MD; Vincenzo David MD

PURPOSE/AIM
The purpose of this exhibit is to review the ‘in vivo’ applications of CT conventional and unconventional post processing softwares to evaluate injuries and terminal ballistic of bullets in wildfires and to identify the most useful application in clinical and forensic practice.

CONTENT ORGANIZATION
- Utility of ballistic analysis in wildfires - CT morphology of bullets and gunshot injuries - Application of CT conventional and unconventional post processing techniques: 1) Two-dimensional Reformation
  - Multiplanar Reconstruction
  - Minimum Intensity Projection.
  - Maximum Intensity Projection
- Three-dimensional Reformation
  - Volume Intensity Projection
- Three-dimensional VR.
- Radiation therapy planning software - Head injuries: clinical cases and review of literature
- Trunk injuries: clinical cases and review of literature
- Limb injuries: clinical cases and review of literature

SUMMARY
The major teaching points of this exhibit are: - CT scan may guide ‘in vivo’ or ‘post mortem’ forensic analysis
- Gunshot tissues injuries are better identify in axial view and through conventional CT post-processing algorithms (MIP, MPR, VR)
- Bullet’s ballistic is more clear after unconventional radiation therapy planning software

LL-INE3227-THA • Automatic Multi-organ Localizations on 3D CT Images by Using Machine-learning Approach Based on a Large Dataset

Xiangrong Zhou PhD (Presenter); Huayue Chen; Takeshi Hara PhD; Ryujiro Yokoyama; Masayuki Kanematsu MD; Hiroshi Fujita PhD

Background
Accurately and efficiently detecting the location of an object of interest (an organ, a lesion, etc.) plays an important role in medical image analysis. Machine-learning has demonstrated potentials for solving object detection problems in 3D CT image analysis. However, machine-learning requires a large number of samples for training and testing to show the real performance. As far as we know, few previous works reported performances on more than 1,000 CT scans and showed the possibility of the proposed algorithm for the localization of all the major organs on 3D CT images.

Evaluation
We proposed a machine-learning approach to accomplish the fast and automatic localization of the major organ regions on 3D CT scans. This approach combines object detections and the majority voting technique to achieve the robust and quick organ localization. We applied this approach to localizing 12 kinds of major organ regions independently on 1,300 torso CT scans. In our experiments, we randomly selected 300 CT scans for training, and then, applied the trained system to localize each of the target regions on the other 1,000 CT scans for the performance testing. The detection results were evaluated subjectively and quantitatively based on the ground truth from the human operators.

Discussion
Our evaluation based on 1,000 test CT cases showed that the heart location in 983 cases, liver location in 978 cases, stomach location in 952 cases, pancreas location in 943 cases, spleen location in 932 cases, left kidney location in 963 cases, right kidney location in 969 cases, left lung location in 992 cases, right lung location in 988 cases, bladder location in 984 cases, right femur head location in 578 cases, and left femur head location in 551 cases were correct. These results showed that our approach can accomplish the localization tasks in over 94% CT cases except the femur heads. The failure of the femur head locations was due to the poor performance of the trained results.

CONCLUSION
An universal approach was demonstrated to localize 12 major organs automatically on 3D CT scans and its efficiency and accuracy were validated by using 1,300 clinical CT scans.

LL-INE3233-THA • Retrieval of Reference Cases: For Which Cases Can Similar Cases be Useful?

Chisako Muramatsu PhD (Presenter); Tokiko Endo MD; Mikinao Ooiwa; Misaki Shiraiwa MD; Kunio Doi; Hiroshi Fujita PhD

Background
As digital mammography and monitor reading are becoming common practice, process for storing and retrieving images is much easier and faster. The vast data including diagnostic and pathologic images, clinical data, and treatment data can be effectively used as a reference and teaching materials. We have investigated an automatic retrieval of similar mammographic mass images and their effect on observers’ differential diagnosis.

Evaluation
Observers’ confidence ratings on a mass being malignant were recorded before and after the retrieval of reference images. The study included 48 benign and 50 malignant masses that were visible on two views. The majority of the benign cases were cysts and fibroadenomas, whereas the majority of the malignant cases were invasive ductal carcinomas. For each view, 5 most similar images were retrieved and a similarity map showing the distribution of the database was provided. Observers had to review both views before making their confidence ratings. Eleven physicians who are routinely reading mammograms and eleven radiological technologists who were trained to read mammograms participated.

Discussion
Overall, the number of cases that were affected beneficially by the retrieval of reference images was larger than that were affected detrimentally for both groups of observers. There was no trend in pathologies of the beneficially affected cases, although it is difficult to draw a strong conclusion based on the small number of cases. When majorities of the reference images were from the same pathologic group, i.e., benign or malignant, as the inquiry on both views, they were likely to be beneficial. When discrepancy occurred between the views, the observers, especially the technologists, had tendency to follow the suspicious ones and increased their ratings.

CONCLUSION
It is important to understand how reference images can affect observers’ confidence in order to improve an image retrieval system. Radiologists may effectively use such retrieval systems by understanding the system’s behavior and the characteristics of retrieved images.

LL-INE3186-THA • A DSC Digital Brain Phantom for Assessment of Leakage Correction Methods

Panagiotis Korfiatis PhD (Presenter); Leland S Hu MD; Zachary S Kelm BS; Bradley J Erickson MD, PhD *

Background
Cerebral blood volume (CBV) is an emerging magnetic resonance imaging biomarker used to differentiate between progression and pseudo progression in patients with glioblastomas (GBM), a challenging task even for experts. Dynamic susceptibility-weighted contrast (DSC) imaging is the most commonly used clinical technique for measuring CBV in brain tumors. However, accurate CBV quantification is difficult especially in cases of GBM, where the blood-brain barrier has been interrupted and contrast leakage occurs. Several software tools exist, allowing for semi-automatic calculation of relative CBV. Some of these software tools incorporate mathematical techniques to deal with contrast agent leakage. Assessing the accuracy and reliability of leakage correction methods can be achieved by using the lesion of an appropriate phantom. However, the development of digital phantoms that simulate contrast extravasation is an open research issue. The purpose of the current study is the development of a DSC-MRI digital phantom containing regions with a known amount of simulated contrast leakage, allowing evaluation of software tools.

Evaluation
The created phantom was successfully able to simulate contrast leakage effects on the time-concentration curves.

Discussion
An algorithm was developed, capable of producing a 4D digital phantom containing areas simulating white matter, gray matter, cerebrospinal fluid, and 4 regions with varying levels of contrast leakage. The time-concentration curves for each pixel were simulated based on the signal proposed by Liu et al.1. The model utilized can describe the combined T1 and T2* effects from contrast agent leakage in the measured signal. The algorithm can produce datasets simulating various image acquisition parameters, such as TE, relaxation rate, and mean transit time, while also allowing addition of Gaussian noise.
LL-INE3190-THA • mQC: A Centralized Platform for Automated Mammography Quality Control

Stephen Smithbower; Rasika Rajapakse PhD (Presenter); Janette Sam RT; Nancy Aldoff; Teresa Wight; Christine M Wilson MD

Background
Many of the required daily and weekly quality assurance procedures tend to be simple tests that involve a fair bit of manual work, such as selecting and measuring regions of interest and recording results in Excel. Such work can easily be automated by software, and the results of the tests stored in a centralized database in order to facilitate region-wide tracking of mammography unit performance. We propose a software platform, mQC, that utilizes British Columbia’s province-wide PACS network to provide automated quality control measurement and recording. This report summarizes our development and implementation process.

Evaluation
The original mQC implementation was a local, stand-alone software package deployed on a workstation at each mammography center. This approach proved unmanageable, due to IT issues (firewalls, administrative privileges on workstations, difficulties in performing software updates). As a result, mQC was retrofitted as a centralized server residing in one location that would poll the BC Transfer Grid and automatically process incoming images for all connected centers.

Discussion
mQC is currently servicing 19 different centers across British Columbia. Additional development is being done to expand the number of tests the platform provides, and to improve mQC’s reporting capabilities. Work is also being done on the platform to allow deployment by third-parties, as there has been both commercial and provincial interest in mQC outside of British Columbia.

CONCLUSION
Our centralized, PACS-network aware automated quality control platform has been able to reduce the time spent by technologists to perform quality assurance tests on mammography units, while simultaneously improving the accuracy and reporting of QA test results across the province by providing a centralized database. A website accompanies the platform, allowing technologists at any center to log in and view the results of their tests in real-time.
RESULTS
Change of torn gap width was showed in increase, in change, and in decrease as follows: in 2, 8, 7 tendons at 1 month FU, and in 3, 3, 4 tendons at 3 months FU, respectively. Comparing with initial US and 3 months FU US, torn gap width was increased in 2 tendons, decreased in 5 tendons, and not changed in 3 tendons. But statistically there were not significant in any intervals. Tendon echogenicity was improved in 2 tendons and aggravated in 1 tendon at 1 month FU, and improved in 1 tendon and aggravated in 4 tendons at 3 months FU. Intratendinous or intrabursal crystal formation was seen in 1 tendon at a month FU, and in 2 tendons at 3 months FU. Postinjection bursal effusion was seen in 13 tendons at 1 month FU. Thickened bursa was partially improved in 4 tendons and was not changed in 4 tendons at 3 months FU.

CONCLUSION
PRP injection therapy of partial thickness tear of the rotator cuff tendon was not so effective in short term follow up with ultrasound.

CLINICAL RELEVANCE/APPLICATION
Serial follow ultrasonography was useful to evaluate the effect of PRP injection therapy rotator cuff pathology.

LL-MKS-TH3A ● Four-year Experience Follow-up in the Treatment of Degenerative Disease of the Supraspinatus Tendon by Ultrasound Guided Injections of PRP. Clinical and Radiological Evidence

Lorenzo Maria Gregori (Presenter); Alice La Marra MD; Francesco Arrigoni; Luigi Zugaro; Antonio Barile; Carlo Masiocchi

PURPOSE
To evaluate with ultrasound and MRI the role of ultrasound-guided Platelet Rich Plasma (PRP) treatment in tendinopathy of the supraspinatus tendon of the shoulder.

METHOD AND MATERIALS
In a 4-year-period 198 patients with tendinopathy of the supraspinatus tendon were controlled. 82 patients were submitted to physiotherapy and 116 patients were submitted to US-guided infiltrations at a distance of 21 days between each other. All the patients were evaluated with US and MRI and from both the clinical and radiological points of view by VAS and Constant Scale. Both evaluations were performed at first diagnosis and after 3, 6, 12, 24, 36 and 48 months. The pathological pattern of the tendon and the possible morphological recovery in both groups were assessed by US and MR independent review by two musculoskeletal radiologists.

RESULTS
In the first group of 82 patients submitted to physiotherapy, an improvement of mean VAS (from 7.75 to 3.15) and Constant scale (from 53.1 to 79.8) was observed at 6 months; afterwards, a progressive worsening of mean VAS and Constant Scale was observed (mean VAS= 7.20 and mean Constant= 57.1 at 48 months). US and MRI controls at 3, 6, and 12 months showed no significant variations (no supraspinatus tears); at 48 months the controls documented 22 partial and 31 complete tears of supraspinatus tendon. In the second group (116 patients treated with PRP) the mean VAS at 3 months after the treatment improved from 7.25 to 1.75, the Constant scale from 54.7 to 86.5. Afterwards a progressive worsening of mean VAS and Constant Scale was observed (mean VAS= 4.70 and mean Constant= 65.1 at 48 months). US and MRI controls at 3, 6, and 12 months showed a progressive recovery of tendon morphology in 12/116 cases and no significant variations in 104/116 cases; no tears of supraspinatus were observed. At 48 months controls, we observed partial or complete morphological recovery at US and MRI at 116 (18.1%) and partial or complete tears of the supraspinatus in 36/116 (31%).

CONCLUSION
The use of PRP in patients with supraspinatus tendinopathy with respect to patients treated with physiotherapy, proved to give considerable results in terms of symptomatology and functionality, but only discrete morphological improvement.

CLINICAL RELEVANCE/APPLICATION
US-guided treatment may improve long-term symptomatology and life quality in patients affected by supraspinatus tendinopathy and may reduce proneness to tendon tear.

LL-MKS-TH4A ● MR Imaging of Adhesive Capsulitis of the Hip: Relevance of Capsular Thickness and Associated Pathologies

Jung Hyo Rhim MD, PhD; Jung-Ah Choi MD; Eugene Lee (Presenter); Eugene Joe; Sung Hwan Hong MD; Heung S Kang MD

PURPOSE
To evaluate the relevance of capsular thickness of the hip with respect to associated pathologies on magnetic resonance (MR) images for the diagnosis of adhesive capsulitis of the hip.

METHOD AND MATERIALS
Institutional review board (IRB) approval was obtained. MR images of 21 consecutive patients with clinical diagnosis of adhesive capsulitis of the hip joint were retrospectively evaluated. Capsular thickness of the hip joints was measured and compared with that of control subjects. Difference of the capsular thickness of hip joints was analyzed with generalized estimated equation (GEE). Inter- and intraobserver variabilities were analyzed with intraclass correlation coefficient (ICC). Diagnostic performance of the capsular thickness was evaluated with receiver operating characteristic curve (ROC). MR images were also evaluated for findings suggestive of associated pathologies.

RESULTS
Capsular thickness of the hip joint was significantly thicker in patients with adhesive capsulitis compared with that of control subjects (estimated mean thickness: patients: 4.39±0.26mm, controls: 2.70±0.17mm). Patients’ age, sex and laterality (right or left) of the lesion did not affect the capsular thickness. Inter- and intraobserver variabilities were excellent. Area under the receiver operating characteristic curve (AUC) showed moderately accurate diagnostic performance. Associated pathologies such as labral lesions, degenerative changes, synovitis, ligamentum teres abnormality, and FAI were found in 15 of 21 patients (24 of 36 hips).

CONCLUSION
In conclusion, MR imaging, particularly measuring the capsular thickness, may be helpful for diagnosis of adhesive capsulitis of the hip. Furthermore, MR imaging may offer additional information for the various associated pathologies of adhesive capsulitis of the hip.

CLINICAL RELEVANCE/APPLICATION
MR imaging showing capsular thickness-measurement may be helpful for diagnosis of adhesive capsulitis of the hip and offer additional information about associated pathologies.

LL-MKS-TH5A ● Hip Capsule Thickness in Femoroacetabular Impingement (FAI)

Andrew A Bonura MBBS (Presenter); Robert J Nairn MBBS; Mark E Schweitzer MD; Paul E Beaule MD*; Nicholas M Kolanko MD; Kawan S Raikhrad MD

PURPOSE
To determine the hip capsule thickness in patients with cam-FAI and non-FAI hip pathology using preoperative magnetic resonance imaging (MRI). The hypothesis was that in cam-FAI the capsule would be thicker related to chronic impingement of the cam deformity against the capsule.

METHOD AND MATERIALS
Research ethics board approval was obtained. Forty-one hips (40 patients) were included, 16 with surgically proven cam-FAI (9M,7F; age 22-58 yrs) and 25 patients with non-FAI chondrolabral pathology (4M,21F; age 18-63 yrs). All subjects had undergone preoperative 3T MRI including oblique axial and oblique coronal, FSE proton density weighted sequences, with parameters: FOV 180mm, Matrix 320 x 256, Slice thickness 3.5mm, TE 30ms, TR 2310ms, ETL 7, Nex=2. The hip morphology was analyzed using axial and coronal images. Capsular thickness was measured at two locations, anteriorly (3 o’clock) and superiorly (12 o’clock) on single oblique axial and oblique coronal images, retrospectively, at the thickest portion of the visualized capsule on the given slices. Comparison of the maximal hip capsule thickness between the two groups and gender analysis (two-tailed paired t-test for both), and correlation of capsule thickness with the alpha angle (Pearson correlation coefficient) were performed.

RESULTS
The mean maximal hip capsule thicknesses(mm) at the anterior and superior locations were: cam-FAI 4.99, 6.97; Non-FAI 4.94, 6.68, respectively. There was no significant difference between the cam-FAI and non-FAI groups at either location.

The mean maximal capsule thicknesses (mm) anteriorly for males, females were: cam-FAI 5.02, 4.96, respectively, and non-FAI 5.03, 4.93, respectively.

There was no significant gender difference in capsule thickness within each subject group.

The mean alpha angle measurements were 57.3 degrees in the cam-FAI group and 46.5 degrees in the non-FAI group (p
CONCLUSION
The hip capsule thickness is no different in cam-FAI patients compared to those with non-FAI hip pathology. There is no gender difference in hip capsule thickness with either cam-FAI or non-FAI hip pathology. In cam-FAI subjects, there is no correlation between the alpha angle and hip capsule thickness.

CLINICAL RELEVANCE/APPLICATION
Hip capsule thickness cannot be used as a specific marker or sign of cam-FAI.

LL-MKX-TH6A • Large-scale Population Imaging to Investigate the Genetic Epidemiology of Radiographic Scheuermann's Disease: The Rotterdam Study

Ling Oei MD, MA (Presenter); Salih El Saddry; Ater A Makurthou; Martha Castano-Betancourt; Karol Estrada; Carolina Medina-Gomez; Albert Hofman MD, PhD; Joyce B Van Meurs; Andre G Uitterlinden PhD; Edwin H Oei MD, PhD; Fernando Rivadeneira MD, PhD

PURPOSE
Scheuermann's disease is a form of osteochondrosis of the spine, characterized by increased posterior rounding of the thoracic spine in association with structural deformity of the vertebral elements. Although the etiology remains largely unknown, there is evidence that genetic factors play a role. A Danish twin study has found a heritability estimate of 74%. Nevertheless, no associated genes have been found to date. Our aim was to find genetic susceptibility factors for Scheuermann's disease.

METHOD AND MATERIALS
The radiographic criteria of Sørensen, Hart and Sachs et al. were applied to diagnose the Scheuermann's disease cases. Lateral spine radiographs were available for 2,753 participants from a population-based study (age 45 years and over), of which 111 cases were diagnosed with Scheuermann's disease. A genome-wide association study (GWAS) was conducted by applying a logistic model adjusted for sex and admixture principal components. To facilitate analysis of variants with lower allele frequency 1000 Genomes imputation (version: 06-2010) was applied.

RESULTS
We found a SNP (minor allele frequency 3%) on chromosome 4 associated at genome-wide significant level with radiographically diagnosed Scheuermann's disease (p = 3.9 x 10^-8, odds ratio 5.3). The SNP maps an intron of the tolloid-like-1 gene (TLL1). TLL1 is a protease that shares structural similarity to BMP1 (Bone morphogenetic protein 1) and is involved in collagen and chorion synthesis. TLL1 has been described to induce formation of cartilage in vivo and it has a high mRNA expression in the femoral growth plate.

CONCLUSION
This is the first GWAS for radiographic Scheuermann's disease, where we found a SNP associated at genome-wide significant level with Scheuermann's disease mapping to TLL1. Biologically interesting is that TLL1 is a protease that is involved in collagen and chorion synthesis and can induce formation of cartilage in vivo. However, our GWAS had a small sample size because of the relatively low disease prevalence the population-based study design resulted in a limited sample size. A replication study is necessary to confirm this finding.

CLINICAL RELEVANCE/APPLICATION
Gene discovery for Scheuermann's disease will aid diagnostics and development of therapies. More generally this will help us better understand the musculoskeletal biology of the spine.


Adriana F Nguyen MD (Presenter); Christopher J Gottsegen MD; George R Matcuk MD; Dakshesh B Patel MD; Deborah M Forrester MD; Eric A White MD

PURPOSE/AIM
This exhibit will provide a comprehensive review of soft tissue, articular and osseous masses found within the hand and wrist including multimodality characteristics with emphasis on MRI, differential diagnoses, demographic/clinical features and management.

CONTENT ORGANIZATION
1. Benign Soft Tissue Masses: ganglion cyst, giant cell tumor of tendon sheath, fibromatosis, lipoma, fibrolipomatous hamartoma and vascular malformations
2. Malignant Soft Tissue Masses: soft tissue sarcomas including epithelioid and synovial sarcoma
3. Benign Osseous Masses: enchondroma, osteochondroma, giant cell tumor, bizarre parosteal osteochondromatous proliferation (BPOP), florid reactive periostitis
4. Malignant Osseous Masses: osteosarcoma, metastatic disease
5. Miscellaneous Masses: infectious processes, gouty tophi, foreign bodies

SUMMARY
Palpable hand and wrist masses are a common clinical presentation. The majority of these lesions are benign. MR signal characteristics along with radiographic/CT features, anatomic location, site of origin and specific demographic factors can help differentiate among neoplastic and non-neoplastic lesions. This educational exhibit will provide the reviewing participant with a thorough discussion of the imaging and clinical features of an extensive list of soft tissue, articular and osseous masses located about the hand and wrist.

LL-MKX-TH8A • Virtual Monochromatic Spectral Imaging with Dual Energy Technology: Evaluation Flexor Tendon after Operations by Using Palmar Locking Plate for Distal Radius Fracture

Norimi Nishiyama (Presenter); Yoshihiro Takeda MD; Yuki Kobayashi

PURPOSE
Many medical institutions perform operations by using palmar locking plate for distal radius fracture because they are very efficient. With an increase in this operative procedure, we received critical complication reports which are called Flexor Disorders by palmar locking plate for distal radius fracture. Many medical institutions perform operations by using palmar locking plate for distal radius fracture because they are very efficient. With an increase in this operative procedure, we received critical complication reports which are called Flexor Disorders by palmar locking plate for distal radius fracture.

METHODS
To evaluate metal artifact by VMC Imaging of four kinds of phantoms which were rolled by bolus on artificial bone installed palmar locking plate for distal radius fracture. The materials of palmar locking plate for distal radius fracture were; Three kinds of titanium consist of 90% of titanium, 6% of aluminum, 4%of vanadium and one kind of pure titanium. The screws to fasten the plate were titanium alloy consists of 90% of titanium, 6% of aluminum and 4% of vanadium.

RESULTS
We could confirm the reduced metal artifact by VMS Imaging. VMS Imaging at 95 keV was the least metal artifacts at the closest part between palmar locking plate for distal radius fracture and flexor.

CONCLUSION
Virtual Monochromatic Spectral Imaging with Dual Energy Technology was the least metal artifacts at the closest part between palmar locking plate for distal radius fracture and flexor. We could confirm the reduced metal artifact by VMS Imaging. We could confirm the reduced metal artifact by VMS Imaging. We could confirm the reduced metal artifact by VMS Imaging.
comfortable with characterization of such findings in the bones, joints, and soft tissues, in providing a differential, and in making management recommendations. The purpose of this exhibit is to review a spectrum of such findings, to guide the body imager/generalist.

CONTENT ORGANIZATION
From case material at several institutions, multiple examples of bone and soft tissue incidental/potentially unanticipated CT findings in the chest, abdomen, and pelvis will be demonstrated and reviewed, with recommendations for differential diagnosis and patient management. Entities shown and discussed will include entities such as fibrous dysplasia, spinal pathology such as tubercles, acetabular paralabral cysts, bursal enlargement, clavicular hyperostosis, soft-tissue ossification, mastectomy, FAI, and pubic symphysis chordoid cysts.

SUMMARY
After reviewing this exhibit, the body imager/general radiologist will become more comfortable with the diagnosis and management of incidental and/or unanticipated musculoskeletal findings on CT examinations of the chest, abdomen, and pelvis.

Neuroradiology/Head and Neck - Thursday Posters and Exhibits (12:15pm - 12:45pm)
Thursday, 12:15 PM - 12:45 PM • Lakeside Learning Center

LL-NRS-THA • AMA PRA Category 1 Credit ™: 0.5
Host
Pratik Mukherjee, MD, PhD *

LL-NRE-TH11A • Thyroid Ultrasound Elastography: Why, How, When? Tips and Tricks
Vito Cantisani MD (Presenter); Pietro Lodise; Ester Mancuso; Mattia Di Segni MD; Carlo Catalano MD; Paolo Ricci MD; Elena Maggini

PURPOSE/AIM
To show main features, diagnostic accuracy and main recognized limitations of different elastographic techniques, suggesting how we can improve their diagnostic performance.

CONTENT ORGANIZATION
By assessing hardness as indicator of malignancy, elastography has recently become an additional tool for thyroid nodule differentiation and nowadays also in evaluation of diffuse thyroid diseases, in combination with base ultrasound and FNAC. The different techniques of elastography applied to the thyroid base their analysis on two different types of compression force. Free hand compression force includes the strain elastography (SE), with its qualitative and semi quantitative variants and the q-static analysis that uses the pulsation of the carotid artery (ECI index). The quantitative approach with compression induced by an acoustic pulse of the probe includes shear wave elastography (SWE) and Acoustic Radiation Force Impulse (ARFI).

SUMMARY
Considering literature updates and our experience we will present the feasibility, limitations of different techniques showings some tips and tricks to better improve the quality of each examination technique.

LL-NRS-TH12A • Diagnosis of Osteosclerosis: The Utility of Histogram-based Analysis of Multidetector Row CT Images
Koji Yamashita MD (Presenter); Takashi Yoshiura, MD, PhD; Akio Hiwatashi MD; Osamu Togao MD, PhD; Kazufumi Kikuchi MD; Seiji Kumazawa PhD; Takashi Inoguchi; Hiroshi Honda MD

PURPOSE
To evaluate the utility of the histogram-based analysis of multidetector row CT images in diagnosing osteosclerosis.

METHOD AND MATERIALS
Temporal bone CT of consecutive patients with osteosclerosis and normal controls were retrospectively analyzed. The diagnosis of osteosclerosis was confirmed during surgery in all cases. The control group consisted of the normal-hearing contralateral ears in patients with otitis media, cholesteatoma, trauma, facial nerve paralysis, or tinnitus. All CT images were obtained using a 64-detector-row CT scanner with 0.5-mm collimation, 80 mm FOV, and a 512 × 512 matrix. A region-of-interest (ROI) encompassing 10 × 10 pixels was placed in the bony labyrinth located anterior to oval window. For each ROI, histogram-based methods including the mean CT value, variance, kurtosis, skewness were measured. In addition, the energy, contrast, and entropy were derived from the texture analysis. Each metric was compared between the osteosclerosis and normal controls groups using Student’s t-test. In addition, the area under the ROC curves (AUC) value for the discrimination between osteosclerosis and normal controls was calculated.

RESULTS
Fifty one temporal bones of 38 patients with osteosclerosis (mean age: 49.0 ± 12.4 years old) and 30 control subjects (mean age: 44.6 ± 17.0 years old) were included. The mean CT value, contrast, and energy were significant lower in osteosclerosis cases than normal controls (p < 0.05). CONCLUSION
Our results demonstrated that the histogram-based analysis of CT images is useful to diagnose osteosclerosis. In particular, the mean CT value and the contrast showed higher diagnostic values.

CLINICAL RELEVANCE/APPLICATION
The histogram-based analysis of multidetector row CT images can be an effective and operator independent tool for diagnosis of fenestral osteosclerosis.

LL-NRS-THA • The Infraorbital Nerve Canal: Anatomic Considerations
Merve Gursoy MD; Emanuele Orru MD (Presenter); Lukasz Babiarz MD, MBA; Roxana Rivera-Michlig MD; David M Yousem MD *

PURPOSE
To assess the impact of race, sex, and ethnicity on the location of the infraorbital nerve canal (IOC) in the orbital floor.

METHOD AND MATERIALS
The study was HIPAA compliant and approved by the institutional IRB. Non contrast maxillofacial CT scans of patients without orbital pathology performed at our Institution in the past 5 months were retrospectively reviewed. To assess the location of the IOC on the orbital floor, we measured the distance between the medial orbital wall and the medial margin (medio-medial distance, MMD) of the IOC and the lateral orbital wall and the lateral margin of the IOC (lateral-lateral distance, LLD) on coronal images bilaterally. The results were analyzed to determine if there are significant (p < 0.05).

RESULTS
We conducted measurements on 240 patients, 162 (67.5%) F and 78 (32.5%) M with an average age of 50.4 years (range: 18-92 years, SD: 16.6). There were 77/78 (9.9%) AAM, 71/78 (91.1%) CM, 31/162 (19.1%) AAF, and 131/162 (80.9%) CF.

There was a significant (p < 0.05). CONCLUSION
The IOC location on the orbital floor measured in normal subjects is more medial in the general groups of C vs AA and in CF vs AAF. This finding has
LL-NRS-TH3A • Primary Squamous Cell Carcinoma in Intracranial Epidermoid with Review of Literature

Jignesh Modi MD (Presenter) ; Dee H Wu PhD ; John T Doan MD

PURPOSE
We report an extremely rare case of primary intracranial squamous cell carcinoma arising from a pre-existing benign epidermoid cyst follow by literature review of published cases of primary intracranial squamous cell carcinoma.

METHOD AND MATERIALS
Retrospective review of the brain MRIs, whole-body PET/CT and Pathology report after surgery of a case of primary squamous cell carcinoma. Images were reviewed from PACS system, patient’s electronic medical record and Meditech system. We performed OVID literature search for all reported cases of malignant transformation of primary intracranial squamous cell carcinoma from epidermoid cyst and did not find any cases with the presentation in location and imaging that we report in this work.

RESULTS
A 29 yr old female presented with severe headaches. Brain MR showed lobulated lesion in left medial temporal lobe with increased signal intensity on T2 weighted images and Diffusion weighted images (DWI). Lesion showed decreased signal on T1 weighted images with no abnormal post contrast enhancement. Findings are consistent with an epidermoid cyst. Subsequently the patient presented after 6 yrs with recurrent seizures. Brain MR revealed heterogeneous enhancing mass in the left medial temporal lobe. Biopsy of the left temporal mass revealed squamous cell carcinoma arising from epidermoid cyst with possibility of metastatic squamous cell carcinoma was not excluded. A whole-body positron emission tomography scan showed hyper metabolic uptake of 18F-FDG in the left temporal lobe mass without evidence of distant metastasis. The patient was treated with chemotherapy and radiation therapy.

CONCLUSION
Literature review showed very few reported cases of primary intracranial squamous cell carcinoma arising from a pre-existing epidermoid cyst. None of the reported cases were in temporal lobes as per our knowledge. Our case shows malignant transformation of an epidermoid cyst in the temporal lobe into a primary squamous cell carcinoma. Imaging findings of malignant transformation were demonstrated brain MR and whole body PET/CT with diagnosis confirmed by histological examination.

CLINICAL RELEVANCE/APPLICATION
Organ specific dose reduction (OSDR) algorithms can reduce radiation on radiosensitive organs up to 59%. This study evaluates the influence of a new OSDR algorithm (XCare™, Siemens), which lowers the radiation exposure of superficial radiosensitive organs (e.g. eye lens, thyroid gland) by reducing the tube current-time product (mAs) for anterior 120° projections. Subjective and objective IQ was statistically compared.

SUBJECTIVE IQ was rated on a 5-point-scale (1_non-diagnostic; 5_excellent). Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) was calculated using ROI measurements.

RESULTS
SNR of the common carotid artery and middle cerebral artery was 53.6±22.7 and 43.3±15.3 (group A) versus 54.1±20.5 and 46.2±14.6 (group B). CNR was 40.4±19.3 and 29.7±12.0 (group A) compared to 40.7±16.8 and 32.9±10.9 (group B). Subjective IQ was excellent in both groups (mean score 4.4±0.7 versus 4.4±0.6). Differences between the two groups were not significant.

CONCLUSION
The OSDR algorithm XCare™ does not compromise image quality of head and neck CTA.

CLINICAL RELEVANCE/APPLICATION
The application of this novel OSDR device can be recommended for CTA in clinical routine to reduce the radiation to thyroid gland and ocular lenses.

LL-NRS-TH3A • The Preliminary Study of Using Lower Contrast Concentration (Iodixanol, 270mgI/mL) Combined with 80kVp and 80% ASiR in CTA for Head and Neck

Shan Hu (Presenter) ; Wenzhen Zhu MD, PhD ; Daoyu Hu MD, PhD ; Jinhua Zhang ; Weijia Wan ; Qiu X Wang

PURPOSE
To explore the clinical value of using iodixanol (270mg/mL) combined with 80kVp and 80%ASiR in CTA for head and neck.

METHOD AND MATERIALS
The mean CT value of Group B was significantly higher than Group A (447.4±100.45HU vs 330.05±78.80HU) (P<0.05).

RESULTS
The applications of iodixanol 270mg/mL combined with 80kVp and 80%ASiR in the CTA for head and neck provided acceptable image quality, with contrast...
MR Imaging of Endometrial Cancer and Its Role in Directing Surgical Management

Bradford D Moore MD (Presenter) ; Yang Tang MD, PhD

PURPOSE/AIM
Acute visual complaints such as sudden vision loss, orbital pain, diplopia, and ophthalmoplegia are common indications to obtain emergent orbital imaging. The purpose of this exhibit is to review the common emergent orbital and intracranial pathologies that may be diagnosed by cross-sectional imaging.

CONTENT ORGANIZATION
1. We will first adopt a compartmental approach to review the relevant MRI/CT anatomy of the orbits, optic pathway, and CN III, IV, V and VI. 2. Then acute pathologies that affect each compartment will be discussed using a case-based format, including: a. Orbit: Optic neuritis, idiopathic orbital inflammatory disease and mimickers, infection including orbital cellulitis, herpeticophthalmicus and enopthalmatitis, thyroid ophthalmopathy, and vascular pathology including thombrosis of orbital varix b. Sella/cavernous sinus/skull base: Pituitary apoplexy, lymphocytic hypophysitis, cavernous sinus thrombosis, cavernous-carotid fistula, invasive sinusitis, and skull base osteomeylitis c. Vascular: Amaurosis fugax, dural sinus thrombosis, pseudotumor cerebri, aneurysm, infarction affecting the optic pathway, and PRES

SUMMARY
Knowledge of the anatomy and imaging features of common pathologies involving the orbits, optic pathway, and skull base is essential to triage patients with acute neuro-opthalmologic symptoms.

MR Imaging of Endometrial Cancer and Its Role in Directing Surgical Management

Bradford D Moore MD (Presenter) ; Yang Tang MD, PhD

PURPOSE/AIM
Acute visual complaints such as sudden vision loss, orbital pain, diplopia, and ophthalmoplegia are common indications to obtain emergent orbital imaging. The purpose of this exhibit is to review the common emergent orbital and intracranial pathologies that may be diagnosed by cross-sectional imaging.

CONTENT ORGANIZATION
1. We will first adopt a compartmental approach to review the relevant MRI/CT anatomy of the orbits, optic pathway, and CN III, IV, V and VI. 2. Then acute pathologies that affect each compartment will be discussed using a case-based format, including: a. Orbit: Optic neuritis, idiopathic orbital inflammatory disease and mimickers, infection including orbital cellulitis, herpeticophthalmicus and enopthalmatitis, thyroid ophthalmopathy, and vascular pathology including thombrosis of orbital varix b. Sella/cavernous sinus/skull base: Pituitary apoplexy, lymphocytic hypophysitis, cavernous sinus thrombosis, cavernous-carotid fistula, invasive sinusitis, and skull base osteomeylitis c. Vascular: Amaurosis fugax, dural sinus thrombosis, pseudotumor cerebri, aneurysm, infarction affecting the optic pathway, and PRES

SUMMARY
Knowledge of the anatomy and imaging features of common pathologies involving the orbits, optic pathway, and skull base is essential to triage patients with acute neuro-opthalmologic symptoms.

MR Imaging of Endometrial Cancer and Its Role in Directing Surgical Management

Bradford D Moore MD (Presenter) ; Yang Tang MD, PhD

PURPOSE/AIM
Acute visual complaints such as sudden vision loss, orbital pain, diplopia, and ophthalmoplegia are common indications to obtain emergent orbital imaging. The purpose of this exhibit is to review the common emergent orbital and intracranial pathologies that may be diagnosed by cross-sectional imaging.

CONTENT ORGANIZATION
1. We will first adopt a compartmental approach to review the relevant MRI/CT anatomy of the orbits, optic pathway, and CN III, IV, V and VI. 2. Then acute pathologies that affect each compartment will be discussed using a case-based format, including: a. Orbit: Optic neuritis, idiopathic orbital inflammatory disease and mimickers, infection including orbital cellulitis, herpeticophthalmicus and enopthalmatitis, thyroid ophthalmopathy, and vascular pathology including thombrosis of orbital varix b. Sella/cavernous sinus/skull base: Pituitary apoplexy, lymphocytic hypophysitis, cavernous sinus thrombosis, cavernous-carotid fistula, invasive sinusitis, and skull base osteomeylitis c. Vascular: Amaurosis fugax, dural sinus thrombosis, pseudotumor cerebri, aneurysm, infarction affecting the optic pathway, and PRES

SUMMARY
Knowledge of the anatomy and imaging features of common pathologies involving the orbits, optic pathway, and skull base is essential to triage patients with acute neuro-opthalmologic symptoms.

MR Imaging of Endometrial Cancer and Its Role in Directing Surgical Management

Bradford D Moore MD (Presenter) ; Yang Tang MD, PhD

PURPOSE/AIM
Acute visual complaints such as sudden vision loss, orbital pain, diplopia, and ophthalmoplegia are common indications to obtain emergent orbital imaging. The purpose of this exhibit is to review the common emergent orbital and intracranial pathologies that may be diagnosed by cross-sectional imaging.

CONTENT ORGANIZATION
1. We will first adopt a compartmental approach to review the relevant MRI/CT anatomy of the orbits, optic pathway, and CN III, IV, V and VI. 2. Then acute pathologies that affect each compartment will be discussed using a case-based format, including: a. Orbit: Optic neuritis, idiopathic orbital inflammatory disease and mimickers, infection including orbital cellulitis, herpeticophthalmicus and enopthalmatitis, thyroid ophthalmopathy, and vascular pathology including thombrosis of orbital varix b. Sella/cavernous sinus/skull base: Pituitary apoplexy, lymphocytic hypophysitis, cavernous sinus thrombosis, cavernous-carotid fistula, invasive sinusitis, and skull base osteomeylitis c. Vascular: Amaurosis fugax, dural sinus thrombosis, pseudotumor cerebri, aneurysm, infarction affecting the optic pathway, and PRES

SUMMARY
Knowledge of the anatomy and imaging features of common pathologies involving the orbits, optic pathway, and skull base is essential to triage patients with acute neuro-opthalmologic symptoms.

MR Imaging of Endometrial Cancer and Its Role in Directing Surgical Management

Bradford D Moore MD (Presenter) ; Yang Tang MD, PhD

PURPOSE/AIM
Acute visual complaints such as sudden vision loss, orbital pain, diplopia, and ophthalmoplegia are common indications to obtain emergent orbital imaging. The purpose of this exhibit is to review the common emergent orbital and intracranial pathologies that may be diagnosed by cross-sectional imaging.

CONTENT ORGANIZATION
1. We will first adopt a compartmental approach to review the relevant MRI/CT anatomy of the orbits, optic pathway, and CN III, IV, V and VI. 2. Then acute pathologies that affect each compartment will be discussed using a case-based format, including: a. Orbit: Optic neuritis, idiopathic orbital inflammatory disease and mimickers, infection including orbital cellulitis, herpeticophthalmicus and enopthalmatitis, thyroid ophthalmopathy, and vascular pathology including thombrosis of orbital varix b. Sella/cavernous sinus/skull base: Pituitary apoplexy, lymphocytic hypophysitis, cavernous sinus thrombosis, cavernous-carotid fistula, invasive sinusitis, and skull base osteomeylitis c. Vascular: Amaurosis fugax, dural sinus thrombosis, pseudotumor cerebri, aneurysm, infarction affecting the optic pathway, and PRES

SUMMARY
Knowledge of the anatomy and imaging features of common pathologies involving the orbits, optic pathway, and skull base is essential to triage patients with acute neuro-opthalmologic symptoms.

MR Imaging of Endometrial Cancer and Its Role in Directing Surgical Management

Bradford D Moore MD (Presenter) ; Yang Tang MD, PhD

PURPOSE/AIM
Acute visual complaints such as sudden vision loss, orbital pain, diplopia, and ophthalmoplegia are common indications to obtain emergent orbital imaging. The purpose of this exhibit is to review the common emergent orbital and intracranial pathologies that may be diagnosed by cross-sectional imaging.

CONTENT ORGANIZATION
1. We will first adopt a compartmental approach to review the relevant MRI/CT anatomy of the orbits, optic pathway, and CN III, IV, V and VI. 2. Then acute pathologies that affect each compartment will be discussed using a case-based format, including: a. Orbit: Optic neuritis, idiopathic orbital inflammatory disease and mimickers, infection including orbital cellulitis, herpeticophthalmicus and enopthalmatitis, thyroid ophthalmopathy, and vascular pathology including thombrosis of orbital varix b. Sella/cavernous sinus/skull base: Pituitary apoplexy, lymphocytic hypophysitis, cavernous sinus thrombosis, cavernous-carotid fistula, invasive sinusitis, and skull base osteomeylitis c. Vascular: Amaurosis fugax, dural sinus thrombosis, pseudotumor cerebri, aneurysm, infarction affecting the optic pathway, and PRES

SUMMARY
Knowledge of the anatomy and imaging features of common pathologies involving the orbits, optic pathway, and skull base is essential to triage patients with acute neuro-opthalmologic symptoms.
High noise/sound levels of gradients during MKI scans are the worst feature of this technique of which patients complain most. A new scanning technique called SilentMR reduces noise levels at the gradient level without reducing the power of gradients used during scan.

Evaluation
SilentMR (GE Healthcare, Milwaukee/WI) was performed in 32 patients referred to brain MRI with 12 channel head coil on a 3T system (Discovery 750w, GE Healthcare). Ethical committee waiver as well as written informed consent from each patient was obtained. Patients completed written survey regarding previous experience with subjective level of sound during MRI on a 6-point scale (0=not noise, 5=extreme sound/not bearable) before the exam. SilentMR (TIw, T2w or PDW 3D-Sequence) was performed in sagittal plane, 1 mm slice thickness, 256x256 matrix, field of view 25,6x25,6 cm. Patients completed another survey regarding subjective experience of SilentMR noise level after exam and were asked to report acceptance for this new sequence. Statistical analysis of differences in subjective noise level scores was performed with a two red-t-tile to calculate significance level. Scan time was recorded as well as technical difficulties occurring during scanning process to measure technical success. Diagnostic image quality was evaluated by a radiologist with experience >10 years qualitatively on a 2-point scale (0=not diagnostic, 1=diagnostic with some constrictions, 2=diagnostic without constrictions). In 9% of scans online reconstruction of images was delayed due to technical reasons. Image quality of 6% of scans was rated as diagnostic with some constrictions (e.g. increased background noise, limited SNR), 94% without as diagnostic limitations. Patients’ feedback of mean noise level score was 1,15 for SilentMR vs. 3,25 for conventional scans (P<0.001).

Discussion
SilentMR was technically successful, delivering diagnostic image quality, significantly reduced subjective sound levels leading to 100% patient acceptance.

CONCLUSION
SilentMR could lead to a more comfortable scan environment for patients.

LL-PHS-TH1A • Optimization of Contrast-enhanced Spectral Mammography (CESM) Depending on Clinical Indications
Clarisse Dromain MD (Presenter); Sylvie Saab-Puong *; Ann-Katherine Carton *; Serge L Muller PhD *; Corinne Balleyguier MD; Eva M Fallenberg MD *

PURPOSE
To optimize low (LE) and high-energy (HE) exposure parameters of CESM examinations in 4 different clinical applications: staging of extent of disease, problem solving, screening and CESM-guided biopsy for which different levels of average glandular dose and different ratios between LE and total doses are required.

METHOD AND MATERIALS
The optimization was performed on a Senografre DS with CESM SenoBright®(GE Healthcare). Simulations were performed for each of the 4 clinical indications to find the optimum for the acquisition parameters by maximizing the signal-difference to noise ratio (SDNR) on the recombined CESM image using different targeted doses and LE image quality. The linearity between iodine concentration and SDNR as well as minimal detectable iodine concentration were assessed for each of set of optimized parameters and compared with SenoBright®. The image quality of the LE was assessed on the CDMM contrast-detail phantom and compared with EUREF guideline limits.

RESULTS
Optimization of low and high energy exposure parameters according to different clinical indications allows increased contrast uptake detectability compared to parameters currently used in clinical routine CESM examinations, without significant loss in low energy image quality.

CLINICAL RELEVANCE/APPLICATION
Optimization of CESM exposure parameters depending on the clinical indication has the potential to improve the diagnostic performance of CESM examination in clinical routine.

LL-PHS-TH2A • Improved K-edge Imaging in Spectral Mammography with a Photon Counting Detector for Dose Reduction
Yu-Na Choi (Presenter); Seungwan Lee; Hee-Joung Kim PhD

PURPOSE
Conventional K-edge imaging with a specific energy window can improve the contrast-to-noise ratio (CNR) compared to the charge integrating mode with a full energy range. However, the detected X-ray photons with low energy below the K-edge absorption energy of the material are not used in K-edge imaging. X-ray photons at low energies contribute to the absorbed radiation dose for the target object. To resolve the above limitation, this study proposed an improved K-edge imaging method for spectral mammography.

METHOD AND MATERIALS
Improved K-edge imaging method uses various additional filters with different thicknesses for reducing the number of X-ray photons at low energy range. To perform the improved K-edge imaging for gadolinium, copper (Cu) filters with thicknesses of 0.25, 0.5, 0.75, 1.0, 1.25, 1.5, and 1.75 mm were used. In cases of improved K-edge imaging for iodine, Al filters with thicknesses of 4.0, 6.0, 8.0, 10.0, and 12.0 mm were used. To prevent an increase of statistical noise as the thickness of the additional filter increases, we adjusted the number of X-ray photons passed through each filter. We used PCXD (model: PID-350, Ajat Oy Ltd., Finland), which had an active area of 44.8 mm * 44.8 mm with a pixel pitch of 0.35 mm * 0.35 mm for small animal imaging. To evaluate the improvements in K-edge imaging, CNR, absorbed radiation dose, and the figure of merit (FOM) were used.

RESULTS
We achieved up to 75.60 and 31.88% reductions of the absorbed radiation dose for gadolinium and iodine, respectively, while maintaining image quality. The FOM values from improved K-edge imaging are increased by factors of 2.34-3.39 compared to the charge integrating method.

CONCLUSION
We have shown that the absorbed radiation dose of our improved K-edge imaging method was substantially reduced compared to the charge integrating mode and conventional K-edge imaging, while maintaining the image quality of conventional K-edge imaging.

CLINICAL RELEVANCE/APPLICATION
Our results can be used for spectral mammography. We designed breast phantoms with four different thicknesses of 10, 20, 30, and 40 mm, which included two contrast media: gadolinium and iodine.

LL-PHS-TH3A • Dynamic Digital Subtraction Angiography-An Innovative Method for Overcoming Patient Movement Artifacts
Reuven Shreter MD (Presenter) *; Guy Engelhard PhD *; Roni Shreter MD

CONCLUSION
A novel method that can reduce motion artifact during DSA studies is presented. Initial results appear to improve DSA reading in cases of patient motion.

Background
Digital Subtraction Angiography (DSA) is a two-step technique, whereby an acquisition of a 'mask' image is followed by the production of a series of images using rapid injections of contrast material. Each of the contrast images are then post-processed by subtracting the mask image from the contrast image, yielding images that ideally display the contrast material only. However, during the time elapsed between mask image acquisition and native image production patient movement may occur due to a number of reasons such as the injection of iodine. To compensate for the undesired motion, registration algorithms and other post-processing methods are used.

A novel Dynamic DSA (DDSA) method is described, with initial results suggesting automatic compensation for patient movements, thus eliminating the need for an additional mask image.

Evaluation
In the DDSA procedure, images are created by obtaining the difference between each image and its successive one. A threshold operation may be utilized or the absolute value instead.

A new series of images is reconstructed by creating a Time MIP (TMIP) study that extracts the maximum value from several (2 or more) difference images for each pixel and creates a new series of TMIP images.

Several TMIP series can be created with varying numbers of difference images. The TMIP series can be displayed in a cine mode or viewed individually.

Discussion
An innovative DDSA method is presented that allows an almost 'on-line' view of DSA studies even when a patient has moved during the study. Several studies were tried with good results, where the bones were canceled compared with the original DSA images. The subtraction algorithm is currently being improved; however the overall outcome is promising, indicating that the study can be used for diagnosis even in cases of massive motion.

An additional benefit is the reduction in radiation exposure to the patients as a mask image is not needed.

LL-PHS-TH4A • Classification of HISS-Imaged Breast Lesions Using DISPersion vs. Absorption (DISPA) Plots to Quantify Water Resonance Distortions
Quality of CT Images

RESULTS

In ASD-POCS reconstructions, some inserts of 0.5% and 0.3% contrast can be discerned, and bar phantoms of up to 12 line pair per cm can be resolved. In accounting for data-model inconsistency was varied over a range. We then quantitatively characterized the spatial resolution and contrast resolution from the adaptive-steepest-descent-POCS (ASD-POCS) algorithm was tailored and applied to reconstructing images from acquired data, where an algorithm parameter was set. We used the on-board imaging system to collect cone-beam data from a Catphan 504 phantom under the high-quality head protocol. The spatial resolution and contrast resolution, and explored the image-quality potential by varying the algorithm parameter.

METHOD AND MATERIALS

CBCT image quality through enhancing performance of hardware components and optimizing data-acquisition conditions. However, the full potential of CBCT apparatus it can be used in a variety of clinical practice areas.

CONCLUSION

Our tumor tracking using consecutive deformable registration can predict varying tumor location during free-breathing and reduce the processing time by simplifying the procedure of affine and deformable registrations for all respiratory images in chest 4DCT.

CLINICAL RELEVANCE/APPLICATION

Our tumor tracking method is useful to quantify tumor trajectory and irradiate the tumor while avoiding surrounding normal tissues in radiotherapy planning and irradiation delivery.

LL-PH-S-TH5A ● Tumor Tracking Using Consecutive Deformable Registration in 4D Chest CT Images

Helen Hong PhD (Presenter) ; Hyun Hee Jo ; Young-Nam Kang

POURPOSE

To predict varying tumor location during free-breathing in radiotherapy treatment planning, we propose a tumor tracking method using consecutive deformable registration for all respiratory phase images in 4DCT.

METHOD AND MATERIALS

Chest 4DCT images acquired at respiratory interval of 25% and were composed of ten different phases. Each phase image has spatial resolution of 512×512 pixels × 50–200 2D slices with voxel dimension of 0.98×0.98×3 mm³. In first step, we estimate global and local motions of the lung. The global motion is estimated by using Demon-based deformable registration between neighbor phases form EI to EE. In second step, tumors between EE and EI are tracked by applying the estimated global and local motion vectors.

RESULTS

To evaluate the accuracy of proposed tumor tracking method, locations of tumor tracking in the different phase images were qualitatively assessed with a color-coded mapping. The result show that proposed tumor tracking method well predicts tumor locations between EI and EE regardless of respiration rate. To evaluate the efficiency of proposed registration procedure, normalized cross correlation(NCC) was measured between A(typical registration procedure) and B(proposed registration procedure). The NCC of right(or left) lung of B was 0.95±0.02(0.97±0.01) and it was similar to the NCC of A. The total processing time of B was decreased by 32%(36%) for right(or left) lung than that of A. These results show that the proposed method efficiently calculates global and local lung motions and reduces the processing time of whole respiratory phases.

CONCLUSION

Our tumor tracking using consecutive deformable registration can predict varying tumor location during free-breathing and reduce the processing time by simplifying the procedure of affine and deformable registrations for all respiratory images in chest 4DCT.

CLINICAL RELEVANCE/APPLICATION

Our tumor tracking method is useful to quantify tumor trajectory and irradiate the tumor while avoiding surrounding normal tissues in radiotherapy planning and irradiation delivery.

LL-PH-S-TH6A ● Development of a Method ii½/Four Total Variation (DTV)ii½? Intended to Improve the Reduction of Radiation Exposure and Quality of CT Images

Katsumi Tsujikoa PhD (Presenter) ; Hironori Otsubo RT ; Yasukata Takahashi RT ; Ayako Gonaka ; Rina Terauchi

CONCLUSION

Using the DTV method we have successfully demonstrated that image noise can be reduced while maintaining the edge enhancement of the image compared to the TV method and IR of the DT device. The DTV method is effective in reducing image noise and controlling the edge enhancement. Furthermore a large reduction in radiation exposure is possible while maintaining diagnostic quality images. Since the DTV method is an independent image based image processing apparatus it can be used in a variety of clinical practice areas.

Background

The Total Variation (TV) method of successive approximation image processing performs well reducing image noise and with the reduction of radiation exposure. Furthermore we have developed a Double Total Variation (DTV) method, which performs an image subtraction of images before and after of the TV method. This we have found further reduces the image noise as well as improves the spatial resolution.

Evaluation

This experiment was performed using the image’s digital data. The experiments herein were performed using a cylindrical water phantom and a low-contrast phantom ladder. Additionally, experiments were conducted using CT clinical images. The comparison of the TV method and the DTV method and the effects on exposure reduction while utilizing a changing tube current (mA) are shown herein. The effects of the TV method and the DTV method with respect to spatial resolution are also included herein.

Discussion

(1)Both the TV and DTV method demonstrated a reduction in image noise. (2)Using the TV method the edge enhancement of the image is reduced. (3)Using the DTV method did not affect the edge enhancement and maintained the visually high spatial resolution. (4)The DTV method was able to maintain the high spatial resolution and with the signal to noise component separation factor and by controlling the number of approximations performed. (5)Image registration is unaffected by the DTV method.

LL-PH-S-TH7A ● Evaluation of Improved Cone-beam CT Image Quality by Optimization-based Reconstruction Algorithms

Xiao Han MSc (Presenter) ; Erik A Pearson BS, BEng ; Junguo Bian PhD ; Emil Y Sidky PhD ; Charles A Pelizzari PhD * ; Xiaochuan Pan PhD *

POURPOSE

Cone-beam CT (CBCT) has become an important tool for a wide range of clinical applications. Currently, considerable effort has been made toward improving CBCT image quality through enhancing performance of hardware components and optimizing data-acquisition conditions. However, the full potential of CBCT image-quality remains to be explored by advanced image-reconstruction techniques. In the work, we employed an optimization-based algorithm to experimentally characterize the reconstructed CBCT images of a quality-assurance phantom. We quantitatively evaluated technical-efficacy metrics such as spatial resolution and contrast resolution, and explored the image-quality potential by varying the algorithm parameter.

METHOD AND MATERIALS

We used the on-board imaging system to collect cone-beam data from a Catphan 504 phantom under the high-quality head protocol. The adaptive-steepest-descent-POCS (ASD-POCS) algorithm was tailored and applied to reconstructing images from acquired data, where an algorithm parameter accounting for because of the variations used to the signal and noise component separation factor and by controlling the number of approximations performed. (5)Image registration is unaffected by the DTV method.

RESULTS

In ASD-POCS reconstructions, some inserts of 0.5% and 0.3% contrast can be discerned, and bar phantoms of up to 12 line pair per cm can be resolved. In comparison, inserts of contrast below 1.0% and bar phantoms above 9 line pair per cm are difficult to discern/resolve in reference FDK reconstructions.
CONCLUSION
The ASD-POCS reconstructions with appropriately chosen parameter appeared to yield images of higher spatial resolution and higher contrast resolution than the reference FDK reconstructions.

CLINICAL RELEVANCE/APPLICATION
The work has the implication of improved CBCT image quality, which may benefit a number of clinical applications requiring high spatial and/or contrast resolution.

LL-PHS-TH8A • To Explore the 6 Degree Registration Marker and Method for Patients with Esophageal Cancer after CBCT Scan
Jiancheng Li (Presenter)

LL-PHE-TH9A • T1 and T2 Relaxation and Relaxability: What They Mean and How to Measure Them
Yaqi Shen PhD, MD; Frank K Goerner PhD (Presenter) *; Christopher G Snyder BS; Regina Moritz; Val M Runge MD *

PURPOSE/AIM
The most important metrics related to Gadolinium based MR contrast agents (GBCAs) and tissue enhancement are T1 and T2 relaxivities. This exhibit reviews the concepts and implications of T1 and T2 relaxation and relaxivities. This is followed by a demonstration and explanation of how to accurately measure them, providing as well a current comparison of the agents that are approved worldwide for clinical use.

CONTENT ORGANIZATION
a) Review concepts of T1 and T2 relaxation and relaxivity.
b) Demonstrate how to calculate T1 and T2 relaxation and relaxivity.
c) Outline optimal MR protocols for T1 and T2 measurements at 1.5T and 3T
d) Explain a practical method for obtaining clinically relevant T1 and T2 relaxation and relaxivity measurements.

SUMMARY
The objective of this exhibit is to improve the Radiologist’s and Medical Physicist’s understanding of the most important metrics related to GBCAs and how to accurately obtain those metrics.

Radiation Oncology and Radiobiology - Thursday Posters and Exhibits (12:15pm - 12:45pm)

LL-ROS-THA • AMA PRA Category 1 Credit ™ — 0.5
Host Nina A Mayr , MD
LL-ROS-TH1A • Can Baseline CT Features Be Used to Predict the Grade and Subtype of Non-Hodgkin’s Lymphoma?
Jennifer Sammon MBCh (Presenter) ; Maeve P Crowley MBCh, MRCPI ; Maria Twomey MBCh ; Derville M O’ Shea MBChB, PhD ; Kevin N O’Regan MD

PURPOSE
Aggressive lymphomas commonly present acutely with rapidly growing masses and systemic symptoms while indolent lymphomas present more insidiously with slow-growing lymphadenopathy. We hypothesize that baseline CT findings could help to predict the grade and subtype of lymphoma prior to biopsy.

METHOD AND MATERIALS
The baseline imaging of 104 patients (Male: Female = 57:47; Age range 19-85 and median age of 63.5) with Non-Hodgkin’s lymphoma (NHL) was reviewed. The histological diagnosis was blinded to the radiologists analyzing the baseline CTs. Baseline CTs were reviewed and information about lymph node size, node morphology, location, spleen size and extra-nodal involvement was collected.

RESULTS
The presence of a conglomerate nodal mass and extra-nodal involvement had a high specificity for high-grade lymphoma, 89% (95%CI 0.8-0.9) and 84% (95%CI 0.75-0.94) respectively. The mean nodal size was significantly greater in the high-grade NHL versus low-grade NHL (5.7 cm compared to 4.1 cm, P-value = 0.032). The most common aggressive NHL subtypes were diffuse large B-cell lymphoma (DLBCL, n=34) and indolent subtype was follicular lymphoma (FL, n=17). Seventy-five percent of patients with follicular lymphoma (FL) had discrete measurable lymph nodes, compared to 38% of the diffuse large B-cell lymphoma (DLBCL) group. Fifty-nine percent of the DLBCL group had extra-nodal involvement on their baseline CT compared to 11.6% of the FL group (P-value = 0.0001). The number of nodal regions involved was lower for DLBCL compared to FL (mean 2.6 versus 5.7) groups, (P-value= 0.0018).

CONCLUSION
Baseline CT scan characteristics can help to predict both the grade and subtype of NHL. Conglomerate nodal masses, bulky lymph nodes, fewer involved nodal regions, and extra-nodal involvement all showed a high specificity for high-grade NHL.

CLINICAL RELEVANCE/APPLICATION
This, to the best of our knowledge, has never been analyzed before and as lymphoma is a common malignancy, we feel this information is highly relevant to practicing radiologists.

LL-ROS-TH2A • Renal and Liver Dysfunction after Radiotherapy for Primary Gastric Lymphoma
Saiji Ohga MD (Presenter) ; Katsumasa Nakamura MD, PhD ; Tomonari Sasaki MD, PhD ; Tadamasu Yoshitake MD ; Kotaro Terasawa ; Koeri Asai ; Keiji Matsumoto ; Hideki Hirata ; Hiroshi Honda MD

ABSTRACT
Purpose/Objective(s): To evaluate the renal and liver dysfunction after radiotherapy for primary gastric lymphoma.

Materials/Methods: From 2002 to 2011, thirty three patients with stage I/II gastric lymphoma were enrolled. Patient age ranged from 41 to 88 years (median: 66 years). Twenty three were male and ten were female. Initial clinical staging was I in 20 and II in 13 according to the Lugano staging system. Seventeen patients had mucosa associated lymphoid tissue (MALT) lymphoma and 20 had diffuse large B cell lymphoma. Dose of 30 - 46 Gy (median: 30 Gy) was delivered using involved field radiation therapy. Liver dysfunction was defined as 2-fold increase of alkaline phosphatase (ALP) or transaminase of pretreatment level exceeding upper normal limit within 4 months after the end of radiotherapy. Renal dysfunction was defined as the elevated creatinine (CR) or blood urea nitrogen (BUN) exceeding pretreatment value and upper normal limit within 4 months after the end of radiotherapy.

RESULTS: The mean duration of follow-up was 36 months. A more than 2-fold increase of pretreatment ALP or transaminase level exceeding upper normal limits was observed in 8 patients (24%). An elevated CR or BUN exceeding pretreatment value and upper normal limit was observed in 6 patients (18%). Age, gender, staging, total dose and so on were not correlated with renal and liver dysfunction. In dose volume histogram (DVH) analysis, liver volume receiving >20 Gy (V20) was significantly correlated with liver dysfunction. No DVH parameters related with renal dysfunction. Abnormal ALP or transaminase level has continued in three of all patients with liver dysfunction since one year following radiotherapy. All three patients received rituximab-CHOP (RCHOP) as chemotherapy before radiotherapy. In renal dysfunction abnormal CR or BUN level has continued in four patients since one year. Three of 4 patients also received CHOP or RCHOP.

Conclusions: The rates of renal and liver dysfunction were low after radiotherapy for primary gastric lymphoma. However, we need to keep in mind that renal and liver dysfunction by the combined radiotherapy following chemotherapy continues for long time after radiotherapy. It is necessary to restrict V20 value of liver for preventing from liver dysfunction.

LL-ROS-TH3A • Optimal Fractionation Regimen for Electronic Brachytherapy for Treatment of Non-Melanomatous Skin Cancers
Michael K Cheung MD (Presenter) ; Benjamin G Slane MD ; John D Gordon MD ; Craig Hullet MD ; Baldassare Stea MD, PhD

LL-ROS-TH4A • External Beam Radiation Therapy for Locally Advanced and Metastatic Gastrointestinal Stromal Tumors
John J Cuaron MD (Presenter)

LL-ROE-TH5A • Challenges in Oncologic MR Imaging: HIT and MISS
Vadivel Devaraju PhD (Presenter) ; Derek J Hamlin MD ; Barry M McCook MD

PURPOSE/AIM
The objective of this presentation is to demonstrate the diagnostic difficulties encountered in patients with biopsy proven prostate carcinoma presenting for prostate thermo ablation. Tumors may be missed even when utilizing state of the art multiparametric imaging. We present several clinical scenarios and challenges faced in interpretations, which may result in so called HIT and MISS outcomes. The hypothesis behind the multiparametric MR imaging and the underlying physics principles are discussed.
Vascular/Interventional - Thursday Posters and Exhibits (12:15pm - 12:45pm)

Thursday, 12:15 PM - 12:45 PM • Lakeside Learning Center

**LL-VIS-THA • AMA PRA Category 1 Credit ™.0.5**

Host

Dmitry J Rabkin

**LL-VIS-TH1A • Effect of Hypoxia-Inducible Factor (HIF)-1 alpha Upgrade on Vascularogenic Mimicry (VM) and Angiogenesis in Rabbit VX2 Liver Tumors after Transcatheter Arterial Embolization (TAE)**

Jingfeng Zhang PhD, MD (Presenter); Bingying Lin; Lingxiang Ruan PhD, MD; Shunliang Xu

**PURPOSE/AIM**

The purpose of this study was to verify the hypothesis that upgrading of HIF-17 expression after TAE could result in more severe hypoxia, which activated HIF-17 pathway and angiogenesis, and affected the effect of treatment. VM was found as a new model of tumor micro- circulation, which has a close relationship with the growth, development, invasion, metastasis and prognosis of hepatic carcinoma. Therefore, our purpose was to investigate the expression of HIF-17 and its relation to VM and angiogenesis in Rabbit VX2 liver tumors after TAE.

**METHOD AND MATERIALS**

A total of twenty-four New Zealand White rabbits were successfully implanted with VX2 tumor in liver and divided into three group at random, such as Lipiodol-based TAE group (n = 8), Polyvinyl alcohol (PVA)-based group (n = 8) and Control group (n = 8). Tumors in each group were received TAE with Lipiodol, PVA particles (diameter: 300?m - 500?m) and Saline respectively after implating for two weeks. One, three and seven days after TAE, animals were humanely killed, and tumor samples were collected for immunohistochemical staining with HIF-17 and double staining with CD34 and PAS. Expression level of HIF-17 protein was evaluated, and VM density (VMD) and micro vascular density (MVD) was calculated.

**RESULTS**

Upgrading of HIF-17 expression is associated with the increasing of VM and angiogenesis after TAE, which has made a new challenge to the interventional therapy of hepatic carcinoma. HIF-17 might represent promising therapeutic targets for anti-microcirculation in combination with TAE against liver tumors.

**CONCLUSION**

HIF-17 might represent promising therapeutic targets for anti-microcirculation in combination with TAE against liver tumors.

**LL-VIS-TH2A • Therapeutic Effect of Intra-arterial Chemotherapy with DDP and 5-FU via Bilateral Uterine Arteries for Advanced Uterine Cervical Cancer**

Kang Zhou MD (Presenter); Xiaoguang Li MD; Zhengyu Jin MD

**PURPOSE/AIM**

To evaluate the response rate of patients with advanced uterine cervical cancer who were treated with neoadjuvant intra-arterial chemotherapy (NAIC) using a combination of DDP and 5-FU.

**METHOD AND MATERIALS**

Patients received 1 course and 18 patients received 2 courses. The overall response rate was 77.78%. The response rates of patients with IB2, IIA and IIB cervical cancer were 92.86%, 83.33% and 62.50% (p < 0.05).

**RESULTS**

NAIC is effective for preoperative treatment of advanced cervical cancer with easier radical hysterectomy. NAIC is more effective to stage IIB cervical cancer than stage IIA and IIB, and also to SCC than adenocarcinoma.

**CLINICAL RELEVANCE/APPLICATION**

NAIC is effective for preoperative treatment of advanced cervical cancer.

**LL-VIE-THSA • Thoracic Tumor Ablation: Review of Anatomic Considerations and Adjunctive Techniques**

Bradley B Pua MD (Presenter) *; Adam D Talenfeld MD; David Li MD, PhD; Ronald S Winokur MD; David C Madoff MD

**PURPOSE/AIM**

Purpose:

- To review important anatomic considerations when performing thermal ablation in the thorax.
- To provide a detailed pictorial of neurovascular anatomy and describe clinical findings if these sites are injured during thermal ablation.
- To describe adjunctive techniques to avoid injury to these structures.

**CONTENT ORGANIZATION**

- Pictorial review utilizing CT images and figures to describe the anatomic course of important neurovascular structures.
- Content will be organized by each neurovascular structure: with a figure of its anatomy, the CT correlate, then a description of its course and treatment if injured. An associated case is presented if applicable.
- A section will discuss adjunctive techniques to avoid these complications.

**SUMMARY**

Teaching points:

- To be able to describe and identify areas corresponding to important neurovascular structures in the thorax such as the phrenic nerve, vagus nerve, internal mammary vessels and course of the intercostal neurovascular bundle in varying ages.
- To be able to describe and treat complications associated with inadvertent injury to these structures.
- The viewer should be able to describe adjunctive techniques such as creation of an artificial pneumothorax or infusion of a saline/fluid buffer to protect these structures from thermal injury.

**LL-VIE-TH6A • Inject or Reject: Today's Role of the Sinogram**

Ann Packard MD; Chad J Fleming MD; Stephanie K Carlson MD *; Claire E Bender MD (Presenter)

**PURPOSE/AIM**

There is controversy as to the value of the sinogram in the management of patients with percutaneously or surgically placed drainage catheters. At our institution our Interventional Radiology division performed 2552 sinograms in 2012. The purpose of this exhibit is to share our experience and describe its value to our patients.

**CONTENT ORGANIZATION**

1. Introduction of exam basics
2. Indications/contraindications
3. Techniques/equipment
4. Patient management guidelines for optimal care
5. Specific management schemes for

a) abscesses, b) lymphoceles, c) high-output fistulae, d) low-output fistulae

SUMMARY
Careful dedicated performance and evaluation of the sinogram can optimize patient care.

LL-VIE1826-THA • Comprehensive Techniques of Difficult IVC Filter Removals and Value of Preretrieval Imaging

Luke J Higgins MD (Presenter); Camila G Zamboni MD; Kelvin K Hong MD *; Mark L Lessne MD

PURPOSE/AIM
To present our experience and review the recent literature regarding techniques and clinical considerations for difficult IVC filter removals. To describe the benefit of preretrieval imaging for procedural planning.

CONTENT ORGANIZATION
1. Introduction 2. Review types of retrievable IVC filters 3. Preretrieval imaging Provide specific imaging examples of difficult filter retrievals and how the use of preretrieval imaging optimizes procedural planning. 4. "IVC filter retrieval techniques" Advanced IVC filter retrieval techniques will be described with specific imaging examples. Periprocedural considerations, including intraprocedural anticoagulation and typical "tools of the trade" will be reviewed. 6. Complications of IVC filter retrieval" Both common and infrequent complications of IVC filter retrieval will be illustrated; techniques of complication management will be detailed.

SUMMARY
Both the diagnostic and interventional radiologist must be well versed in the imaging and management of IVC filters. This presentation will review the preprocedural, intraprocedural and complicating factors of difficult IVC filter removals.

Using myRSNA®: Hands-on Workshop

Thursday, 12:30 PM - 02:00 PM • S401CD

ICIA52 • AMA PRA Category 1 Credit ™:1.5
John W Basco, MS

LEARNING OBJECTIVES
1) Understand the different tools and applications within myRSNA. 2) Log in to myRSNA and set up a personal profile. 3) Using the tools within myRSNA, highlight different use case scenarios.


Thursday, 12:30 PM - 02:00 PM • S401AB

ICIW52 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
Holly A Burt
Chris Childs, MS
Susan M Anderson, MS

LEARNING OBJECTIVES
1) Use My NCBI to personalize PubMed. 2) Understand how to save search strategies and create email alerts. 3) Use filters to link to library full-text articles and to focus PubMed searches. 4) Understand how to save collections of citations including a personal bibliography.

ABSTRACT
In this hands-on workshop session, explore the free My NCBI tool in PubMed. Discover how to save search strategies, create email alerts to keep up with the latest publications, create instant links to library full-text resources, and build permanent online bibliographies. Topics covered include creating a free My NCBI account, adding search and library filters to PubMed, using My Bibliography to create an online list of personal publications, and the link between the NIH Manuscript Submission System and PubMed. Important highlights on effectively searching will also be included. The National Library of Medicine (NLM) provides free web access to nearly 24 million citations for biomedical and clinical medical articles through PubMed (available online at PubMed.gov MEDLINE is a subset of PubMed).

Molecular Imaging - Thursday Posters and Exhibits (12:45PM - 1:15PM)

Thursday, 12:45 PM - 01:15 PM • S503AB

CL-MIS-THB • AMA PRA Category 1 Credit ™:0.5

CL-MIS-THB • Qualitative Assessment in Radiotherapy of Lung Cancer Using Gemstone Spectral Imaging

Weihua Li MD, PhD (Presenter); Dan Wang; Beiqu Han MD; Bao-Zhong Shen

PURPOSE
To evaluate tumor responses in patients treated with radiotherapy for medically inoperable non-small cell lung cancer (NSCLC) by assessing intratumoral changes and damage of nearby tissues using gemstone spectral imaging (GSI).

METHOD AND MATERIALS
26 cases of early-stage, biopsy-proved, medically inoperable lung cancer (NSCLC) underwent gemstone spectral imaging before and 1-6 weeks after radiotherapy. The CT images before and after radiotherapy were obtained and iodine concentration, water concentration and spectrum energy curve and CT value at 40-50 keV were measured. All the data were post processed by using GSI viewer software. Tumor response was evaluated by comparing tumor dimensions, volumes and damage of nearby tissues before and after radiotherapy with standard PET/CT evaluation criteria. Those measurements between pre- and post-treatment and two methods were compared by using SPSS 17.0.

RESULTS
Mean CT values of tumor and iodine content of the tumor region of interest (ROI) in post-therapy were significant lower than that in pre-therapy (50.13±7.50 vs. 78.82±11.81 (HU), 0.91±0.32 vs. 2.65±0.35 (g/L), P

CONCLUSION
Gemstone spectral CT imaging is a noninvasive, precise and rapid screening method. By spectral imaging and material separation technology, it could provide more qualitative and quantitative assessment in radiotherapy of lung cancer.

CLINICAL RELEVANCE/APPLICATION
Gemstone spectral CT imaging could provide valuable information for the diagnosis and monitoring of tumor responses in patients treated with radiotherapy for non-small cell lung cancer.

CL-MIS-THB • 3T Cellular Imaging of Liver Inflammation in a Murine Model of Induced Hepatitis

Cindy Fayard (Presenter); Vanessa Deveaux; Florence Gazeau; Adrien Guillot; Lambros C Tselikas MD; Julien Calderaro; Sophie Lotersztajn; Alain Rahmouni MD; Alain Luciani MD, PhD

PURPOSE
To design and optimize a 3T MRI protocol for liver inflammation detection and quantification following USPIO IV injection in a murine model

METHOD AND MATERIALS
All experiments complied to current ethical regulations; P904 (Guerbet®, Aulnay, France) was used as USPIO contrast agent. 47 C57BL6 male mice were
CL-NMS-TH3B • AMA PRA Category 1 Credit ™:0.5

CL-NME-TH6B • SPECT/CT Userâ€™s Guide for Imaging Complicated Musculoskeletal Infections

Francisco J Lazaga MD (Presenter) ; Anshul Agarwal MD, PhD ; Aron J Gould-Simon MD ; Orhan K Oz MD, PhD ; William A Erdman MD

PURPOSE/AIM
To describe a logical approach to selection of the most effective SPECT/CT imaging techniques and radiopharmaceuticals in complicated musculoskeletal infections.

CONTENT ORGANIZATION
Indications for different SPECT/CT techniques in musculoskeletal infections.

SPECT/CT imaging using Tc-99m labeled leukocytes.

SPECT/CT imaging using In-111 labeled leukocytes.

Dual Isotope SPECT/CT imaging using Tc-99m Sulfur Colloid and In-111 labeled leukocytes, simultaneously.

SPECT/CT imaging using Ga-67.

MRL and Clinical Correlation.

Advantages of SPECT/CT Imaging.

SUMMARY
Hybrid SPECT/CT imaging is an effective tool in the evaluation of complicated musculoskeletal infections. Depending on the clinical scenario, selection of the appropriate radioisotope and imaging techniques is often essential for correct diagnosis. We aim to provide a logical approach to the utilization of SPECT/CT imaging, which can be expected to improve the management of patients with complicated musculoskeletal infections.

CL-NMS-TH1B • Association between Enhancement Patterns on Dynamic Contrast-enhanced CT/MRI and FDG PET-CT Findings in Primary Liver Tumors

Mitsukatsu Tatsumi MD, PhD (Presenter) ; Makoto Sakane MD ; Tonsok Kim MD ; Kayako Ishoishi ; Noriyuki Tomiyama MD, PhD ; Jun Hatazawa MD, PhD ; Hiromitsu Onishi MD ; Masatoshi Hori MD ; Eku Shimosegawa

PURPOSE
Primary liver tumors(PLTs) are often evaluated with FDG PET-CT after being detected on CT or MRI. Dynamic contrast-enhanced(DCE) CT/MRI provides information of tumor vascularity relative to surrounding liver tissue. The purpose of this study was to compare enhancement patterns(EPs) on DCE CT/MRI and PET-CT findings in PLTs, especially focusing on the hepatocellular carcinoma(HCC) and cholangiocarcinoma(CC).

METHOD AND MATERIALS
This retrospective study included 74 PLTs(one lesion per patient) evaluated with FDG PET-CT(28 HCCs, 40 CCs, and 6 others). DCE CT was performed separately from PET-CT in all pts with or w/o MRI(EOB DCE 54, SPIO non-dynamic 3, and no MRI 17). There were 4 major EPs observed on CT/MRI; type 1: arterial enhancement and washout(typical in hypervascular HCCs), 2: no arterial enhancement and mild washout(typical in hypovascular HCCs), 3: peripheral rim and gradual centripetal enhancement(typical in hypovascular CCs), and 4: other EPs. These EPs were compared to the positivity on PET and to SUVmax in PET-positive tumors, referring to the histological results.

RESULTS
CT/MRI exhibited type 1, 2, 3, and 4 EPs respectively in 22, 2, 45, and 5 of all 74 tumors. Only 6(27%) of the 22 type 1 tumors showed positive PET findings(1 fresh HCC, 4 rec HCCs, and 1 rec CC). All but one(13/14) type 1 fresh HCCs were negative on PET. The 45 type 3 tumors comprised 37 CCs(2 rec), 7 HCCs(1 rec), and 1 FHN. Most(36(80%) of them were positive on PET, including 31 CCs and 5 HCCs(both fresh). Additional 1 type 2(HCC) and 2 type 4(CC and lymphoma) tumors were positive on PET. Overall, 45(61%) of 74 tumors exhibited positive PET findings(6/22, 1/2, 36/45, and 2/5 respectively in type1, 2, 3, and 4). Mean SUVmax was 5.7+/−3.1 in type 1 and 7.7+/−4.7 in type 3 tumors. PET-positive HCCs(11/28: 39%) represented either type 3 EP or recurrence/large in type 1 EP, while CCs exhibited positive PET findings in most(33/40: 83%) of the cases without specific characteristics.

CONCLUSION
This study demonstrated that most hypervascular HCCs showed negative PET findings. CCs and HCCs with similar enhancement to CCs tended to show intense FDG uptake on PET. This information may help better understanding of the characteristics of HCCs and CCs.

CL-NMS-TH2B • 18FDG-PET to Assess Recurrence and Long Term Survival in Patients with Malignant Melanoma

Thomas C Launstein MD (Presenter) ; Sandra Rosenbaum MD ; Joachim Kloe ; Andreas Bockisch ; James Nagarajah

PURPOSE
To assess the diagnostic and prognostic value of FDG-PET/CT in the follow-up of malignant melanoma in comparison to the serum protein S100B.

METHOD AND MATERIALS
Ninety patients with either low-risk or high-risk malignant melanoma were included in this study. The follow-up was pursuant with the guidelines of the German Dermatological Association. The diagnostic accuracy and diagnostic power were determined for FDG-PET/CT and for the serum protein S100B.

RESULTS
In 28 of the 90 patients PET/CT was positive in the follow up, 47 patients had an elevated Serum S100B level. Sensitivity, specificity, PPV and NPV of PET/CT were 77%, 93%, 86% and 89%. The corresponding values for the serum protein S100B were 65%, 54%, 43% and 74%, respectively. PET/CT positive patients showed a significantly (p

CONCLUSION
The diagnostic accuracy and the prognostic power of FDG-PET/CT for the depiction of malignant melanoma and its recurrence is higher compared to the serum protein S100B.

CL-NMS-TH3B • Impact of Inter-reader Agreement, and Placement of Volume of Interest on Dual-Time Images at FDG PET/CT Liver SULmean

Abdel K Tahari MD, PhD (Presenter) ; Alin Chirindel MD ; Vasavi Paidpally MD ; Rathnam Subramaniam MD, PhD *

PURPOSE
FDG-PET/CT is suitable to confirm or exclude recurrences and can be used to assess the prognosis in patients with malignant melanoma.
Ultrasound imaging of hand fractures could become the first diagnostic approach in pediatric emergency department. Clinical relevance/application: Ultrasound showed excellent sensitivity and specificity in the diagnosis of hand fractures in children. We calculated for ultrasound a sensitivity of 95% and a specificity of 98%. In 2 cases ultrasound was negative while x-ray showed a minimal infraction. In 3 cases resulted negative in a first time by radiological examination. Of 100 patients with suspected hand fractures, we found by x-ray 37 patients with phalanx or metacarpal fractures. By ultrasound we detected 35 patients with fractures. The hand is the most frequently injured part of the body in the pediatric and adolescent age group and standard diagnostic procedure for hand fractures is radiography. Ultrasound has been used to evaluate bony injuries, mainly in adults and for long bone trauma. The aim of our study was to evaluate and confirm the safety and utility of the ultrasound diagnostic procedure in comparison to x-ray diagnosis. Results: A total of 412 patients with extra-cranial malignancies were analyzed. Of these, 204 had presented for baseline evaluation, 86 were for interim treatment response, 63 were for end-treatment evaluation and 59 were for suspected recurrence and restaging. The mean SULmean was between 1.52 and 1.55 in first set of studies and between 1.53 and 1.56 in second set of studies at the upper, portal, and lower levels of the right lobe of the liver. The ICC of the two readers varied between 0.986 and 0.986 in second images at each level. The ICC for first and second set of studies varied between 0.487 and 0.535 for reader 1 and between 0.472 and 0.545 for reader 2. There was significant but weak correlation for liver SULmean between first and second scans for each reader and level. Mean percentage bias was 0.83 ± 14.62 %, 2.21 ± 15.46 %, and 19.1 ± 14.28 % between first and second scans for reader 1 at the upper, portal, and lower levels respectively, and 2.08 ± 14.77 %, 2.09 ± 16.15 %, and 2.42 ± 14.75 % respectively for reader 2. Conclusion: Liver SUVmean at FDG PET/CT has excellent inter-reader agreement, with similar values and variance whether measured at the upper, lower, or portal vein levels. However, there was weak intra class correlation between liver SUVmean as measured between first and second set of studies for each reader and level. The standard deviation for percentage variation of liver SUV averaged 15.00 % between the two-time PET scans. Clinical relevance/application: Comparison of SUV on followup PET/CT scan should allow for at least 30% normal variation.
3. Diagnostic and follow-up imaging for carcinoid tumors using non-ionizing imaging modalities is an important consideration in the pediatric population.

SUMMARY

- Review of treatment, recommendations for follow-up imaging, and multi-disciplinary care.

4. Brief discussion of endobronchial, gastrointestinal, and testicular carcinoid tumors evaluated with advanced imaging modalities including CT, MRI, PET and ultrasound.

CLINICAL RELEVANCE/APPLICATION

- Carcinoid tumors are extremely rare in the pediatric population and are usually discovered unexpectedly after appendectomy.
- These slow-growing tumors in common and atypical organ systems using multiple imaging modalities.

RESULTS

- Study group included 14 patients (7 female, age range of 7 to 18 years, average 13 years). Image guided procedures included vascular stent (n=1), coil embolization (n=4), urinoma drainage catheter (n=4), ureteral stent (n=4) and nephrostomy tube (n=8).
- Renal salvage was successful in 11 (79%) cases. In 3 patients who underwent nephrectomy, one patient had continued severe urinary extravasation, one had a preexisting ureteropelvic junction obstruction and poor renal function and one was for failure to retrieve a fractured guide wire.

CONCLUSION

- We found that the utilization of interventional radiology procedures were able to salvage most kidneys with high-grade injuries where conservative management failed.

CLINICAL RELEVANCE/APPLICATION

- Whenever possible, in stable patients who fail conservative management for high-grade blunt renal trauma, interventional radiology should be the first line of management for renal salvage.

CL-PDS-TH4B • Percutaneous Radiofrequency Ablation for Children with Small Lung Metastases

Frederic Deschamps (Presenter) ; Geoffroy Farouil ; Laure Saumet ; Jean-Louis Bourguin ; Laurence Brugieres ; Jeanne Muret ; Thierry J De Baere MD *

PURPOSE

- Although percutaneous radiofrequency ablation (RFA) has been proven safe and effective for small lung metastases (LM), thoracotomy remains the gold standard for cancer children.

METHOD AND MATERIALS

- We prospectively analyzed all the children referred for RFA of LM in our Institute. Indications and feasibility were discussed at multidisciplinary meetings. The goal was to treat all the LM using RFA in order to avoid thoracotomy. All the procedures were performed under general anesthesia by an interventional radiologist under CT guidance. If LM were bilateral, two procedures were performed. The follow-up included a chest CT at 1 month and then, every 3 months. We noted the patients’ details (gender, age, primary tumor and number of previous thoracotomy(ies)) and metastases’ characteristics (number, bilateral, size, treatability by RFA), the procedure details (duration, number of LM treated per procedure, complication rate, duration of hospital stay), the rate of complete treatment per LM and the occurrence of new LM.

RESULTS

- 8 patients (5 males, 3 females, mean=10 years old, 3.3 to 15.5) suffering from osteosarcoma (n=5), hepatoblastoma (n=2) and Ewing sarcoma (n=1) were referred for RFA of 33 LM between October 2011 and February 2013. 7 patients had previous surgical resection of LM (mean previous thoracotomies= 2.1, 1 to 7). The LM were bilateral in 3 patients. The mean diameter was 5 mm (2 to 12). One LM was contraindicated for RFA because it was too close to the hilum and was referred for surgical resection. Thirty-two LM were successfully treated in 10 procedures (mean LM treated per procedure= 3, 1 to 7). We experienced 4 pneumothoraces, including 2 that required chest tube drainage. The patients didn’t experience any pain or dyspnea. The mean hospital stay was 3 days after the procedure (1 to 8). After a median follow-up of 255 days (42 to 380), the complete treatment was 100% per LM and no new LM occurred.

CONCLUSION

- RFA is a safe and effective for children with small lung metastases.

CLINICAL RELEVANCE/APPLICATION

- RFA is an alternative to thoracotomy, even in children, and must be taken into account in the management of small - and potentially iterative- lung metastases.

CL-PDS-TH5B • Simplifying Pediatric Size-Specific Dose Estimate: Relationship between Body Weight and Body Diameter in Pediatric CT

Runish D Khawaja MBBS, MD (Presenter) ; Beth Vettiyil MBBS ; Sarabjeet Singh MD ; Sarvenaz Pourjabbar MD ; Atul Padole MD ; Mannudeep K Kalra MD * ; Diego A Lira MD ; Ruth Lim MD * ; Randheer Shailam MD ; Katherine Nimkin MD ; Michael S Gee MD, PhD ; Pallavi Sagar MBBS ; Sirk J Westra MD

PURPOSE

- The size-specific dose estimate (SSDE) requires manual measurement of diameters (AP: anteroposterior; LAT: lateral and E: effective) for individual patients on their CT images on different axes, which is tedious and complex in clinical settings. The objective of our study was to determine if child’s body weight (BW) can be used as a surrogate for measuring patient diameter in pediatric settings.

METHOD AND MATERIALS

- AP and LAT body diameters were measured at mid-slice level in 522 (mean age: 12.7±6.8 years; M:F 294:228) consecutive pediatric chest and abdomen CT exams (=18 years). The study was IRB-approved, HIPAA-compliant. BW was grouped into 5 subgroups (n Kg), W1: 0-9 (n=20); W2: 9-20 (n=102); W3: 20-25 (n=92); W4: 25-35 (n=113); W5: 35-45 (n=292) and W6: >45 (n=15). Effective diameter (E1) was calculated as the square root of the product of AP and LAT. Effective diameter (E2) was also obtained at mid-slice level from an automatic software. Correlation coefficients were calculated between BW and body measurements (AP, LAT, E1 and E2) across: (a) BW subgroups, (b) age subgroups, (c) patient sex, and (d) overall. P-value of 0.001 with 99.9% confidence interval was considered significant.

RESULTS

- Mean BW was 51.2±26.4 Kg (range: 3-145 Kg). Mean AP, LAT, E1 and E2 were 207.1±50.8mm, 289.8±72.6mm, and 243.3±62.0mm and 233.6±55.4mm, respectively. BW had a strong correlation with AP, LAT, E1 and E2 diameters and BW (0.88, 0.85, 0.86 and 0.93 respectively; all p < 0.001). The manually measured E2 by 4%, there was a strong correlation (r=0.92). Correlation for effective diameter was similar for girls and boys (0.80 vs 0.77). The highest correlation value was reported for children weighing 0-9 Kg (0.82, p<0.001). The correlation for effective diameter was similar for girls and boys (0.80 vs 0.77). The highest correlation value was reported for children weighing 0-9 Kg (0.82, p<0.001).

CONCLUSION

- Body weight correlates strongly with all body measurements in pediatric patients. This finding was significantly stronger of lightweight (BW < 15 Kg).

CL-PDE-TH6B • Imaging of Pediatric Carcinoid Tumors: A Pictorial and Clinical Review

Shannon L Tocchio MD (Presenter) ; Kevin Ching MD ; Sameh Tadros MD, MSc

PURPOSE/AIM

- Carcinoid tumors are extremely rare in the pediatric population and are usually discovered unexpectedly after appendectomy. These slow-growing neuroendocrine tumors even more rarely present in the respiratory and genitourinary systems. This exhibit aims to illustrate the spectrum of pediatric carcinoid tumors in common and atypical organ systems using multiple imaging modalities.

CONTENT ORGANIZATION

1. Overview and epidemiology of pediatric carcinoid tumors. 2. Signs, symptoms, and clinical presentation. 3. Imaging findings of local and advanced endobronchial, gastrointestinal, and testicular carcinoid tumors evaluated with advanced imaging modalities including CT, MRI, PET and ultrasound. 4. Brief review of treatment, recommendations for follow-up imaging, and multi-disciplinary care.

SUMMARY

- Major teaching points include: 1. Pediatric carcinoid tumors are extremely rare and most commonly involve the gastrointestinal tract. 2. Gastrointestinal, endobronchial, and testicular carcinoid tumors should be included in the differential diagnosis in the setting of specific imaging findings and anatomic locations. 3. Diagnostic and follow-up imaging for carcinoid tumors using non-ionizing imaging modalities is an important consideration in the pediatric population.
LL-BRS-TB1 • Diffusion-weighted Imaging and 18F-fluoroexoxyglucose (FDG) PET/CT for Breast Cancer: Prognostic Value of Apparent Diffusion Coefficient (ADC) and Maximum Standardized Uptake Value (SUVmax) of Breast Cancer

E Rang Song (Presenter) ; Keum Won Kim MD ; Hye Young Jang ; Young Jun Cho MD ; Cheol Mog Hwang MD ; Dae Ho Kim ; Dong Ki Cho MD ; Minjae Yoon

PURPOSE
To correlate 18F-fluoroexoxyglucose (FDG) maximum standardized uptake value (SUVmax) and diffusion-weighted imaging (DWI) apparent diffusion coefficient (ADC) for clinicopathological prognostic factors and to compare the prognostic value of these indexes in breast cancer.

METHOD AND MATERIALS
50 breast cancers of 49 patients (age range: 37 - 83 years, mean age: 53 years) who underwent preoperative FDG PET/CT and DWI, were studied retrospectively. The breast cancers included 4 ductal carcinomas in situ (DCIS) and 46 invasive ductal carcinomas (IDC). The relationships between SUVmax and ADC with clinicopathological prognostic factors (age, tumor size, invasiveness, histologic grade, nodal metastasis, ER receptor status, PR receptor status, and HER-2 neu status) were evaluated by univariate and multivariate regression analysis and the degree of correlation was determined by Spearman's rank test. The patients were divided into a better prognosis group (n=16) and a worse prognosis group (n=34) based on invasiveness (DCIS or IDC) and the modified Nottingham prognostic index (NPI). Their prognostic values were examined by receiver operating characteristic (ROC) analysis.

RESULTS
SUVmax was significantly associated with histological grade and tumor size (p=0.05). There was a trend towards a significant correlation between lymph node status and E mean, E max (positive lymph node: E mean:177.8, E max:209.1; negative lymph node: E mean:122.1, E max:145.7; P-values 0.062, 0.047 respectively). There was significant correlation between LVI and all 3 SWE parameters (positive LVI: E mean:190.5, E max:217.8, E ratio:16.9; negative LVI: E mean:115.6, E max:142.6, E ratio:9.2; all P-values <0.05). There was a trend towards a significant correlation between lymph node status and E mean, E max (positive lymph node: E mean:177.8, E max:209.1; negative lymph node: E mean:122.1, E max:145.7; P-values 0.062, 0.047 respectively). There was a trend towards a significant correlation between lymph node status and E mean, E max (positive lymph node: E mean:177.8, E max:209.1; negative lymph node: E mean:122.1, E max:145.7; P-values 0.062, 0.047 respectively). There was a trend towards a significant correlation between lymph node status and E mean, E max (positive lymph node: E mean:177.8, E max:209.1; negative lymph node: E mean:122.1, E max:145.7; P-values 0.062, 0.047 respectively).

CONCLUSION
Significant positive correlation was found between cancer size and all SUVmax parameters (correlation for E mean: 0.518, E max:0.510, E ratio:0.580; all P-values <0.05). There was a trend towards a significant correlation between lymph node status and E mean, E max (positive lymph node: E mean:177.8, E max:209.1; negative lymph node: E mean:122.1, E max:145.7; P-values 0.062, 0.047 respectively). There was a trend towards a significant correlation between LVI and all 3 SWE parameters (positive LVI: E mean:190.5, E max:217.8, E ratio:16.9; negative LVI: E mean:115.6, E max:142.6, E ratio:9.2; all P-values <0.05). In multivariate analysis correlation between SUVmax and ADC was not significant with other clinicopathological factors. The results of the univariate and multivariate analyses suggest that SUVmax and ADC are predictive of tumor aggressiveness and nuclei status, and that the correlation is stronger than that of SUVmax and ADC.

CLINICAL RELEVANCE/APPLICATION
To correlate 18F-fluoroexoxyglucose (FDG) maximum standardized uptake value (SUVmax) and diffusion-weighted imaging (DWI) apparent diffusion coefficient (ADC) for clinicopathological prognostic factors and to compare the prognostic value of these indexes in breast cancer.
Correlation was made to the kinetic curve, mammographic breast density (BD) and background parenchymal enhancement (BPE).

RESULTS
Our cohort consisted of 45 women: 13 with invasive ductal carcinoma (IDC), 12 with ductal carcinoma in situ (DCIS) and 20 with benign lesions. The IER and DER for the lesion was able to discriminate between benign lesions and IDC (p value 0.017 and 0.039). The area under the ROC curve (AUC) for BD was 0.671, kinetic curve was 0.669, IER 0.719 and DER 0.719. The quantitative measures had better ability than the ordinal measures to discriminate between benign and malignant lesions in that each of the lesion's IER and DER had a higher AUC than the BD. There was a statistically significant difference however, between any pair of measures in terms of AUC (p > 0.69). A trend was noted with IDC being associated with increased BP (0.82) but not with BPE (p = 228).

CONCLUSION
IHC had higher DER values consistent with the rapid initial rise seen in malignant lesions. Higher BD but not BPE was seen in the patients with cancers compared to those with benign lesions.

CLINICAL RELEVANCE/APPLICATION
Quantitative analysis of enhancement curves can distinguish between benign and malignant lesions more accurately than ordinal measures. There was a higher increase in incidence of cancer with increased BPE.

LL-BRS-TH5B ● What Do Women Think? Knowledge and Opinions of Women Regarding Breast Density Legislation and Supplemental Whole Breast Ultrasound

Regina J Hooley MD (Presenter) *; Reni S Butler MD; Cary P Gross MD; Susan H Busch; Liane E Philpotts MD *

PURPOSE
Connecticut law 09-41 requires radiologists to inform patients with mammographically dense breast tissue that they may benefit from the addition of whole breast ultrasound (WBUS). The purpose of this study is to determine patient awareness of breast density and compliance with supplemental WBUS.

METHOD AND MATERIALS
During the period from 1/17/13 to 4/3/13, 236 patients were asked to complete a 12 item self-administered survey assessing knowledge about breast density and WBUS. Breast cancer risk was determined by medical record review. All women had a prior mammogram demonstrating heterogeneous or extreme dense breast tissue. A total of 221/236 patients had analyzable data.

RESULTS
Of the 221 patients, the average age was 52.1 years (median 50 years, range 21-90 years). Breast cancer risk was as follows: very strong, 5% (11/221); intermediate, 10% (23/221); weak or unknown, 85% (187/221). 94% (207/221) were aware of their breast density, with 90% (199/221) informed by their physician and 65% (145/221) receiving WBUS because their doctor ordered the exam. History of prior WBUS was seen in 68% (151/221) and 63% (95/151) received WBUS. The majority of women (91%, 201/221) reported WBUS was important in finding mammographically occult cancer, while 95% (92/99) reported increased anxiety due to breast density awareness and 89% (197/221) reported choosing WBUS despite an increased risk of additional testing. Of 45 women who did not have WBUS, 33% (15/45) reported never discussing breast density with their doctors and 16% (7/45) stated they were not familiar with WBUS. Compared to women in risk women, women with elevated risk were more likely to know their breast density (33/34 vs 174/187), more likely to have had a prior WBUS (29/34 vs 140/187) and more amenable to additional testing (32/34 vs 165/187), although this was not statistically significant (p < 0.05).

CONCLUSION
Since implementation of CT 09-41, 90% of women surveyed with dense breast tissue discuss breast density with their physicians and 89% of women report choosing WBUS despite a risk of false positive results. Less than 50% of patients with dense breasts report increased anxiety due to breast density awareness.

CLINICAL RELEVANCE/APPLICATION
Many women are aware of breast density and the limitations of mammography. Women with dense breasts are amenable to supplemental WBUS despite the chance of requiring additional testing or biopsy.

LL-BRS-TH6B ● Detection of Breast Cancer with Addition of Screening Ultrasound: Results from a Single Health Screening Center

Jung Min Chang MD (Presenter); Hye Young Koo MD; Woo Kyung Moon

PURPOSE
To determine the supplemental breast cancer detection yield of screening ultrasound (US) in women at a health screening center.

METHOD AND MATERIALS
Between January and December 2008, 6096 women underwent screening mammography (MG) and US at a single health screening center. Of those women, 3731 received prevalence screens and 2365 received incidence screens. Follow up exams were available for 1950 women receiving prevalence screens. Of these 1950 women, 281 women were excluded for positive or suspicious findings on MG. Finally, 1669 women with negative MG constuted our study population. When classified by BI-RADS breast composition, 570 were found to have fatty breasts, and 1099 showed dense breasts. BI-RADS final assessments were analyzed retrospectively, and the reference standard was defined as a combination of pathology and 12-month follow-up. The cancer detection rate (yield), positive predictive value (PPV1) of recalled cases (BI-RADS category 3, 4, 5), and positive predictive value (PPV3) of biopsies following US with negative MG were calculated.

RESULTS
Among a total of 1669 women who underwent US with negative MG, 1159 (75.0%) were classified as BI-RADS category 1 or 2, 415 (20.0%) were classified as BI-RADS category 3, and 95 (5.0%) were classified as BI-RADS category 4 (44 [n=87], 48 [n=5], 4C [n=3]). Core biopsies were recommended and performed for 90 breast lesions, with five lesions being malignant (all BI-RADS category 4). The mean size of invasive cancer was 1.0cm±0.4 (range 0.7-1.5cm). All women with breast cancers had dense breasts. Of the 5 cancer diagnoses, 2 were invasive ductal cancer, 1 was mixed invasive ductal and lobular cancer, and 2 were ductal carcinomas in situ. The cancer detection rate was 3 (5/1699 ± 1000) per 1000 screens (95% CI, 1.1-7.2). The PPV1 for recall was 0.01 (5/[5 1095]; 95% CI, 0.004-0.023), and the PPV3 for biopsies was 0.06 (5/90; 95% CI, 0.02-0.13). The number of screens needed to detect 1 cancer was 334 (95% CI, 299-371) for US with negative MG.

CONCLUSION
The addition of screening US to negative MG identified 3 cancers per 1000 screens in normal population, slightly lower than the cancer detection rate in high risk screening with much higher number of false-positives.

CLINICAL RELEVANCE/APPLICATION
Our study supports the benefit of screening breast US in women, especially with dense breasts. However, adding US to MG in this group may not be appropriate without reducing false positives.

LL-BRE-TH7B ● Managing Breast Abscesses: What is the Radiologist’s Role?

Sean Necessary MD; Christopher P Ho MD (Presenter); Michael A Cohen MD

PURPOSE/AIM
Breast abscess is a common problem encountered in the emergency department and outpatient clinic. Traditionally it has been managed with surgical incision and drainage (IandD), however there is increasing data to support ultrasound-guided percutaneous drainage as the first line of management. Outcomes are often successful and the complication rate is lower than that of traditional surgical IandD. In this exhibit we will review the typical clinical and imaging presentation of breast abscesses and review the radiologist’s role in the management and treatment of them.

CONTENT ORGANIZATION
1) Clinical presentations of patients presenting with breast abscesses
2) Imaging appearance of breast abscesses and specifically the findings to support an attempt at percutaneous drainage
3) Procedural steps for image-guided percutaneous drainage and outline appropriate follow-up/management recommendations

SUMMARY
Breast abscesses can be treated successfully with minimally invasive ultrasound-guided percutaneous drainage and antibiotic therapy. The radiologist should be familiar with the clinical and imaging presentations of breast abscesses as they can be confused with a malignant process and not all infections are amenable to percutaneous drainage. With this knowledge, the radiologist can become the lead therapist in managing many of these acute clinically significant lesions.

LL-BRE-TH8B ● Physics and Quality Control in Breast Imaging: What Every Radiology Resident and Practicing Radiologist Needs to Know

Katharine D Maglione MD (Presenter); Janet R Szabo MD; Neesha S Patel MD; Anita Mehta MD, MsC; Emily B Sonnenblick MD; Laurie R Margolies MD

PURPOSE/AIM
The upcoming American Board of Radiology (ABR) Exam of the Future will include up to 110 questions emphasizing physics content. The purpose of this exhibit is to review mammography physics and quality improvement for those taking the new ABR exam and for practicing radiologists.
METHOD AND MATERIALS

18 patients (12 males, 6 females) with normal cardiac function were enrolled. Coronary flow reserve (CFR) measurement quantified by low dose CTP and Renkin-Crone model algorithm with 320-row MDCT is clinically feasible. It can be used for detection of coronary artery disease (CAD).

RESULTS

The average CFR of patients was 2.37±0.81, which was significantly lower than that of controls (5.11±1.77, p<0.05). Increase in heart rate during stress was 19% in patients and 16% in controls, which was not significantly different (p=0.40).

CONCLUSION

This initial experience shows that respiratory dynamic 4D CT to evaluate functional tethering in re-do sternotomy improves pre-operative imaging accuracy and allows improved risk stratification and planning of surgical strategy, thus reducing the potential re-entry risk in patients.

CLINICAL RELEVANCE/APPLICATION

Respiratory dynamic 4D CT is useful in determining functional tethering of sternum to subjacent structures before re-do sternotomy and assists in pre-operative planning and risk stratification.

LL-CAS-TH2B • Radiation Dose Reduction for Coronary Artery Calcium Scoring at 320-detector CT with Iterative Reconstruction: Preliminary Clinical Study

Fuminari Tatsugami (Presenter); Toru Higaki PhD; Masao Kiguchi RT; Shuji Date; Akira Taniguchi RT*; Kazuo Awai MD*

PURPOSE

The purpose of this study was to compare the accuracy of coronary artery calcium scoring (CACS) on cardiac CT images acquired at a normal tube current and reconstructed with filtered back projection (FBP) with images acquired at a low tube current and reconstructed with iterative reconstruction (IR), for the assessment of the possibility of reducing the radiation dose for CACS on a 320-detector CT scanner.

METHOD AND MATERIALS

Thirty patients (9 women, mean age 68.1 ± 8.3 years) who suspected having coronary artery disease underwent two consecutive CT examinations for CACS. All scans were performed using a 320-detector CT scanner (Aquilion One, Toshiba Medical Systems, Tochigi, Japan) with 16cm of superior to inferior coverage in one tube rotation. Without table movement, volume acquisition of anterior chest was initiated at full expiration and continued for two respiratory cycles. A radiologist assessed the data as cine loops in multiple planes for the presence of differential motion between the sternum and subjacent structures with respiration, to determine tethering. The imaging findings were compared to intra-operative evidence.

RESULTS

3 of the 18 subjects were later deemed unfit for surgery hence were excluded from the study. Of the remaining subjects, surgical correlation was available for 12 whereas 3 subjects were awaiting surgery at the time of writing. We correctly excluded significant adhesions in 9 patients. Significant tethering was detected in 3 subjects, all of which were surgically confirmed. Overall there was excellent correlation between preoperative imaging and intraoperative findings. The technique enabled our surgeons to meticulously plan the procedures and to avoid re-entry related injuries. The average radiation exposure endured by the subjects was 8.3mSv.

CONCLUSION

The use of high-level AIDR 3D made it possible to reduce the radiation dose by 66% for CACS without impairing the quantification of coronary calcification.

CLINICAL RELEVANCE/APPLICATION

The use of high-level AIDR 3D is essential and while conventional CT is optimal for anatomical detail, it is of limited use in assessment of functional tethering of structures. Our aim was to assess the role of respiratory dynamic 4D CT for re-entry risk assessment in redo sternotomy.

LL-CAS-TH1B • Dynamic Four Dimensional CT Imaging for Re-Entry Risk Assessment in Re-do Sternotomy

Harish Narayanan FRANZCR, MBBS (Presenter); John M Troupis MBBS, FRANZCR; Fabiano Viana

PURPOSE

Re-do cardiac surgery can be associated with an increased risk of morbidity and mortality related to intraoperative injury. Adequate pre operative imaging is essential and while conventional CT is optimal for anatomical detail, it is of limited use in assessment of functional tethering of structures. Our aim was to assess the role of respiratory dynamic 4D CT for re-entry risk assessment in re-do sternotomy.

METHOD AND MATERIALS

18 patients (12 males, 6 females) with normal cardiac function were enrolled. Coronary flow reserve (CFR) measurement quantified by low dose CTP and Renkin-Crone model algorithm with 320-row MDCT is clinically feasible. It can be used for detection of coronary artery disease (CAD).

RESULTS

The average CFR of patients was 2.37±0.81, which was significantly lower than that of controls (5.11±1.77, p<0.05). Increase in heart rate during stress was 19% in patients and 16% in controls, which was not significantly different (p=0.40).

CONCLUSION

This initial experience shows that respiratory dynamic 4D CT to evaluate functional tethering in re-do sternotomy improves pre-operative imaging accuracy and allows improved risk stratification and planning of surgical strategy, thus reducing the potential re-entry risk in patients.

CLINICAL RELEVANCE/APPLICATION

Respiratory dynamic 4D CT is useful in determining functional tethering of sternum to subjacent structures before re-do sternotomy and assists in pre-operative planning and risk stratification.
Angiography?

Wen-Cai Yang (Presenter); Zhao-Hui Xian; Xiang-Ran Cai; Xu-Kai Mo; Chun-Liu Luo; Xiao-Bai Wang

PURPOSE
To investigate the lowest volume of contrast material (CM) to achieve sufficient and credible evaluation of the coronary arteries for 320-detector row computed tomography coronary angiography (CTCA).

METHOD AND MATERIALS
A total of 98 patients who underwent 320-detector row CTCA were divided into three groups: group A, receiving 0.7 mL/kg of CM injected during 9 seconds (n=34); group B, receiving 0.6 mL/kg of CM injected during 8 seconds (n=34); group C, receiving 0.5 mL/kg of CM injected during 6 seconds (n=30). The concentration of CM was 350 mg of iodine per milliliter. Each patient then received 30 mL of saline chaser with the same injection rate as the administration of CM. The groups were compared with respect to the attenuation values of the left ventricle (LV), ascending aorta (AA), descending aorta (DA), coronary sinus (CS) and the main coronary arterial segments (vessel diameters >2.0 mm). Image quality was evaluated using a 5-point grading scale.

RESULTS
The mean injection rate was 5.36±0.64 mL/s in group A, 5.06±0.83 mL/s in group B and 5.39±0.72 mL/s in group C (p=0.23). The mean attenuation values in the LV, AA, and DA were lower than those for group A and group B (p<0.05). Similar statistical results were found in the proportion of attenuation values >250 Hounsfield units in the main coronary arterial segments. Also, the image quality evaluation for group C was worse than that for group A and group B (p<0.05). There were no significant differences in the mean attenuation value of the CS and the image noise among the groups (p>0.05).

CONCLUSION
In order to achieve sufficient and credible evaluation of coronary arteries for CTCA using 320-detector row CT scanner, a total of at least 0.6 mL/kg with 350 mg I/mL of CM injected during 8 seconds was required.

CLINICAL RELEVANCE/APPLICATION
The morbidity of dose-dependent contrast-induced nephropathy will be reduced, if the lowest volume of contrast material is used in 320-detector row CTCA.

LL-CAS-THSB • Reduced Contrast Medium in 100kVp Coronary Artery Angiography with Dual-Source CT
Dan Han MD (Presenter); Jun Zhang

PURPOSE
To evaluate the image quality of 100kVp dual-source CT coronary angiography using three different contrast media (CM) injection protocols.

METHOD AND MATERIALS
In this IRB approved study, dual-source CT coronary angiography scans were performed in 120 patients, who were randomly divided into three groups using contrast medium with concentration of 370 mg I/mL, 320 mg I/mL and 270 mg I/mL at the same injection rate (5.0 mL/s, 14 s). The CT scan protocol was the same in the three groups. Before each scan, 100kVp, reference mas: 400 mas) with automatic tube current modulation activated. Two observers evaluated the visibility of 4 main branches of coronary arteries. The mean CT values in coronary artery, image noise, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), radiation dose, patient BMI were recorded and compared using one way ANOVA test among three groups.

RESULTS
The three groups all had an average body mass index (BMI) value of 22 kg/m². The assigned CM volume was 60 mL in 370 group, 65 mL in 320 group and 65 mL in 270 group. The visibility of 4 main branches of coronary arteries are all 100% in three groups by two observers. The mean CT value in 270 group (390.65 +/- 50.34 HU) was lower than 320 group (466.76 +/- 45.65 HU) and 370 group (710.32 +/- 45.65 HU), where the difference was statistically significant (p < 0.05). The SNRs and CNRs were 27.42 +/- 4.21 and 21.7 +/- 4.4 for 370 group; 27.68 +/- 4.09 and 20.1 +/- 5.2 for 320 group; 26.12 +/- 5.7 for 270 group. There was no statistical difference were found in image noise, SNR, CNR and radiation dose (p > 0.05).

CONCLUSION
Using 270 mg I/mL iodine Contrast Medium and 100 kVp tube voltage scan protocol with dual-source CT coronary angiography is feasible in patients with normal BMI. This scan protocol can substantially reduce iodine intakes for patients while preserve good diagnostic image quality.

CLINICAL RELEVANCE/APPLICATION
Using 270 mg I/mL iodine Contrast Medium with dual-source CT coronary angiography is equal to 370 mg I/mL in detecting plaque of coronary.

LL-CAS-TH6B • Undersampled Real Time Cine SSFP with Through-Time Radial GRAPPA: Analysis of Global LV Function and Ventricular Mass
Vikram M Raju MBBS, FRCR (Presenter); Marshall S Sussman PhD; Aaron Pellow; Mark A Griswold PhD *; Nicole Seiberlich PhD *; Bernd J Wintersperger MD *

PURPOSE
To evaluate real-time imaging using through-time Radial GRAPPA reconstruction in analysis of global left ventricular (LV) functional parameters.

METHOD AND MATERIALS
20 patients underwent evaluation of the LV function on 1.5T (Magnetom Avanto) employing a 32-element coil. Acquisition was performed using a real-time radial SSFP sequence in a multislice breath-hold setting with a temporal resolution of 2x2mm**2 (matrix: 128; slice: 6mm) and temporal resolution of 46ms (TR 2.9ms). Through-time radial GRAPPA reconstruction was performed off-line (MATLAB) incorporating fully-sampled (128 projections; 40 phases) radial calibration data acquired prior to the undersampled datasets. Cartesian cine SSFP was acquired at identical slice positions in multiple consecutive breath-holds with a spatial resolution of 1.3-1.5x1.3-1.5mm, 6mm slices and 35ms temporal resolution (TR 3ms). Breath-hold real-time datasets were evaluated for end-diastolic volume (EDV), end-systolic volume (ESV), injection fraction (EV) and myocardial mass (MSS) and results compared to segmented cine SSFP with appropriate correction for multiple pair-wise testing (P < 0.05).

RESULTS
Results of real-time cine imaging did correlate significantly with segmented cine imaging for EDV (r=0.996; P < 0.001).

CONCLUSION
Real-time imaging using through-time radial GRAPPA allows for adequate temporal and spatial resolution to ensure adequate volumetric analysis of the LV.

CLINICAL RELEVANCE/APPLICATION
Radial through-time GRAPPA enables accurate high-resolution real-time cine imaging for potential application in heart rhythm disturbances.

LL-CAS-TH7B • Multiple Vulnerable Plaque Characteristic Factors Co-existing in Single Non-Obstructive Non Calcified or Mixed Plaques in Coronary Arteries Are Higher Risk Predictors of Major Cardiac Events on CT
Naoko Mizuno (Presenter); Hiroyuki Takaoka MD, PhD; Nobusada Funabashi MD, PhD; Masae Uehara MD; Koya Ozawa MD; Yoshihide Fujimoto; Yoshio Kobayashi

PURPOSE
To evaluate the significance of three vulnerable plaque characteristic factors (VPC) co-existing in single non calcified plaques (NCP) or mixed plaques (MP) in non obstructed coronary arteries on CT: 1) low attenuation (LA) (< 300HU), 2) positive remodeling (PR) and 3) spotty calcification (SC), for the risk of major adverse cardiac events (MACE).

METHOD AND MATERIALS
166 consecutive subjects with suspected coronary artery disease (81 male; 62 ± 13 years; hypertension, 61%; diabetes mellitus, 21%; dyslipidemia, 56%; smokers, 45%; obese, 49%) underwent cardiac CT (Light speed Ultra 16, GE Healthcare) from 2003 to 2004. On CT no significant stenosis (> 50%) of coronary arteries was observed; subjects were retrospectively followed for a median of 103 months after CT and incidence of MACE was compared. Subjects with old myocardial infarction or myocardial diseases were excluded from the analysis. MACE included cardiac death, acute coronary syndromes, new onset of angina pectoris, and cardiac failure.

RESULTS
39 subjects had NCP (17) or MP (22), of whom 8, 29, and 14 subjects had LA, PR, and SC in NCP or MP, respectively. These were classified into 4 groups, 1) 128 who did not have NCP or MP with any VPCs, 2) 20 who had NCP or MP with one VPC, 3) 14 who had NCP or MP with two VPCs and 4) 2 who had NCP or MP with three VPCs (4%) had MACE. Subjects who had NCP or MP with = two VPCs (n=16) had a higher risk of MACE than subjects with = one VPC (n=150) (P < 0.05) during the observation period. Significant differences between subjects with NCP or MP with = two VPCs and others (zero, one VPC groups) were observed at each time point when the whole period of follow-up was compared by Kaplan Meier analysis and log rank test (P < 0.001). A Cox proportional hazard model revealed that presence of NCP or MP with = two VPCs on coronary arteries on CT was a greater predictor of MACE (Hazard ratio 7.5, 95% confidential interval 1.0-55.4, P < 0.05) than other factors.

CONCLUSION
Presence of NCP or MP with = two VPCs in non obstructed coronary arteries on CT were critical factors for the prediction of MACE in subjects with normal myocardium on follow-up for a median of 103 months.
The aim of our study was to investigate the feasibility of a microdose CT using the same dose as a conventional radiograph in two plains for lung nodule detection.

**PURPOSE**

The introduction of convincing software generated nodules in real patient data could overcome the lack of a ground truth in lung cancer screening validation of observer performance. The imaging quality of DES-DT can facilitate detection of pulmonary nodules.

**METHOD AND MATERIALS**

80 lobulated and spiculated nodules were simulated and 1 to 9 of the nodules were randomly positioned inside 24 thoracic CT datasets of subjects with and without proven real nodules. In total 120 nodules were simulated and 1 to 9 of the nodules were randomly positioned inside 24 thoracic CT datasets of subjects with and without proven real nodules. Five thoracic radiologists (average experience, 18 years) performed the initial evaluation of chest dual-energy subtraction digital tomosynthesis (DES-DT) and dual-energy subtraction radiography (DES-R) for detection of pulmonary nodules.

**RESULTS**

Using both modalities, correct detection rate increased to 90.2% (46/51). TEE detected 5 cases with leaflet perforation that could not be expected using cardiac CT. However, valvular dehiscence was over-diagnosed with TEE in 3 patients. On the other hand, the presence of abscess/pseudoaneurysm could be found by CT more than that of TEE in two patients. For evaluating prostatic valve involvement in 17 patients, CT could suggest correct findings of IE than TEE in one patient. In seven patients, significant coronary artery disease (stenosis >50% in one patient, and >70% in 6 patients) were detected by CT.

**CONCLUSION**

Preoperative Cardiac CT is useful to demonstrate the detailed findings of IE which might be valuable information to make surgical planning, and to detect coexisting coronary artery disease.

**CLINICAL RELEVANCE/APPLICATION**

Preoperative Cardiac CT is useful to demonstrate the detailed findings of IE which might be valuable information to make surgical planning, and to detect coexisting coronary artery disease.

**RESULTS**

Using both modalities, correct detection rate increased to 90.2% (46/51). TEE detected 5 cases with leaflet perforation that could not be expected using cardiac CT. However, valvular dehiscence was over-diagnosed with TEE in 3 patients. On the other hand, the presence of abscess/pseudoaneurysm could be found by CT more than that of TEE in two patients. For evaluating prostatic valve involvement in 17 patients, CT could suggest correct findings of IE than TEE in one patient. In seven patients, significant coronary artery disease (stenosis >50% in one patient, and >70% in 6 patients) were detected by CT.
LL-CHS-TH4B • Reproducibility of MDCT-measured Forced Expiratory Tracheal Collapse in COPD Patients: Comparison between Spirometric Monitoring and Verbal Respiratory Instructions from CT Technologists

Phillip M Boiselle MD (Presenter); Stephen Loring MD; Carl O’Donnell PhD

PURPOSE
To compare the reproducibility of MDCT-measured forced expiratory tracheal collapse in COPD patients with and without the use of spirometric monitoring.

METHOD AND MATERIALS
Twelve patients meeting GOLD-criteria for COPD (7M, 5 F, mean age = 65 ± 7 years) underwent repeat CT imaging 1 and 2 years after baseline imaging of tracheal dynamics employing the same CT scanner and identical imaging parameters (64-MDCT, 40 mAs, 120 kVp, and 0.625 mm detector collimation). At baseline and year 1 (Yr1), a respiratory physiologist coordinated CT acquisitions with spirometric monitoring at both end-inspiration and during dynamic forced expiration. Airway diameter was defined as the average of two cross-sectional areas (CSA) of the trachea. When the tracheal lumen was measured at 1 cm above the aortic arch at end-inspiration and dynamic expiration, and the percentage (%) expiratory reduction in tracheal lumen was calculated. Measurements from each time point were compared using paired sample correlations.

RESULTS
Mean tracheal measurements were similar at each time point. Mean end-inspiratory CSA was 298 ± 87 mm² at baseline, 297 ± 99 mm² at Yr1, and 310 ± 93 mm² at Yr2 Tech; mean dynamic expiratory CSA was 133 ± 40 mm² at baseline, 129 ± 39 mm² at Yr1, and 126 ± 39 mm² at Yr2 Tech, and mean % expiratory reduction was 54 ± 8% at baseline, 54 ± 13% at Yr1, and 55 ± 12% at Yr2 Tech. Similar correlations were observed between baseline and Yr1 and between Yr1 and Yr2 Tech for end-inspiratory CSA (R² = 0.97 and 0.98, p < 0.001 for both) and dynamic expiratory CSA (R² = 0.70 and 0.75, p=0.001 and 0.005, respectively). For % expiratory reduction measures, a stronger correlation was observed between Yr1 and Yr2 Tech (R² = 0.81, p=0.002) than between baseline and Yr1 (R² = 0.53, p=0.53).

CONCLUSION
MDCT measurements of tracheal dynamics performed with the commonly used method of dynamic expiratory measurements from a trained CT technologist are as reproducible as those performed with the more invasive and resource-intensive technique of spirometric monitoring.

CLINICAL RELEVANCE/APPLICATION
Verbal respiratory instructions from a trained CT technologist are sufficient for dynamic expiratory CT imaging of the trachea, without the need for spirometric monitoring.

LL-CHS-TH5B • Quantitative Ct Air Trapping in Physiological Aging: A Structure Function Analysis

Sebastien Bommart MD, PhD

PURPOSE
To quantify the effect of aging on small airway remodeling using air trapping at computed tomography (CT).

METHOD AND MATERIALS
Eighty nine carefully phenotyped healthy volunteers, age ranging from 60 to 90 years old, mean age 72 ± 7 years, prospectively underwent spirometrically monitored baseline and repeat CT imaging at 1 and 2 years. Cross-sectional area of the trachea was measured 1 cm above the aortic arch at end-inspiration and dynamic expiration, and the percentage (%) expiratory reduction in tracheal lumen was calculated. Measurements from each time point were compared using paired sample correlations.

RESULTS
We determined the change in ultrasound visualization rates of the appendix significantly increased from 33.7% (119/353) to 49.4% (292/591) between periods 1 and 2 which was significantly increased (p=0.029).

CONCLUSION
Ultrasound accounted for 70.6% (36/51) of all imaging diagnoses of appendicitis during period 1 and 86% (86/100) during period 2, which was significantly increased from 50% (25/50) during period 1 (p=0.002). The average ultrasound visualization rate of the appendix significantly increased from 33.7% (119/353) to 49.4% (292/591) between periods 1 and 2 (p < 0.001), indicating that ultrasound is a reliable tool for diagnosing appendicitis.

CLINICAL RELEVANCE/APPLICATION
Ultrasound may be replaced for lung nodule detection with radiation dose kept to an identify minimum.
CONCLUSION
Implementation of additional ultrasound protocol maneuvers significantly increased visualization rates of the appendix and the proportion of imaging-based diagnoses of appendicitis made by ultrasound, significantly decreasing the rate of subsequent CT scans performed.

CLINICAL RELEVANCE/APPLICATION
Coronal scanning in the left posterior oblique position and repeat supine scanning can significantly increase ultrasound visualization rates of the appendix and decrease utilization of CT scans.

LL-ERS-TH2B ● MDCT Evaluation of Bowel Obstruction: Can the Radiologist’s Experience Make a Difference?
Raffaella Basilico MD (Presenter); Nicoletta Civitareale MD; Manuela Mereu MD; Annarita Ferri MD; Alessandra Lella MD; Andrea Delli Pizzi MD; Eleonora Di Campi MD; Antonio R Cotroneo MD

PURPOSE
To evaluate the diagnostic performance of MDCT in the detection of site and cause of bowel obstruction and in the diagnosis of bowel wall ischemia or infarction, by comparing three readers with different experience

METHOD AND MATERIALS
The MDCT examinations of 130 patients with surgical and histological diagnosis of bowel obstruction were retrospectively analyzed by three readers with different experience in abdominal disease: abdominal radiologist, general radiologist and a third year resident. For each reader we calculated the CT concordance with pathology results and the MDCT diagnostic accuracy in the evaluation of the cause and the site of obstruction and in the detection of bowel wall ischemia or infarction. For the latter parameter, the sensitivity and specificity values as well as PPV and NPV were also determined.

RESULTS
The causes of bowel obstruction were: adhesions (36.3%), neoplasms (22.7%), hernias (13.6%), volvulus (12.5%), other causes (14.7%). The CT concordance with pathology in determining the cause of bowel obstruction was statistically significant for all readers (0.77, 0.78 and 0.74 respectively) with diagnostic accuracy values of 83%, 83% and 66.6%. The diagnostic accuracy in defining the site of obstruction was 90%, 83% and 78%, being the proximal ileum the most difficult portion of the bowel to identify as the site of obstruction. The sensitivity, specificity, PPV and NPV in identifying bowel wall ischemia or infarction were significantly higher for the abdominal radiologist than the other two readers (80%, 100%, 100%, 93% vs for reader 1, 50%,93%,67%,87% for reader 2, 50%, 50%, 50%, 62% vs 50% for reader 3).

CONCLUSION
MDCT is accurate in diagnosing the cause and the site of bowel obstruction, although a specific training would be preferable for residents. The MDCT evaluation of bowel wall ischemia or infarction is influenced by the radiologist’s experience in abdominal disease probably because an abdominal radiologist is able to better detect subtle CT findings of bowel ischemia than general radiologists or residents.

CLINICAL RELEVANCE/APPLICATION
MDCT is accurate in diagnosing the cause and the site of bowel obstruction. The radiologist’s experience in abdominal disease represents an added value in the diagnosis of bowel wall ischemia

LL-ERS-TH3B ● Acute Cholecystitis Caused by Radiolucent Stone or Sludge: Roles of Ultrasonography (US) and Magnetic Resonance Cholangiography (MRC)
Meehyun Park (Presenter); Hye-Suk Hong; Ji Young Woo MD; Yul Lee MD; Ik Yang MD; Ah Young Jung; Yoo Na Kim; Ji Young Hwang MD; Su Kyung Jeh

PURPOSE
To investigate roles of US and MRC for diagnosing acute cholecystitis when gallstones are not visible on CT.

METHOD AND MATERIALS
During a 3-year period, we retrospectively collected abdominal CT of consecutive 590 patients with surgically confirmed acute cholecystitis. CT scans were evaluated in terms of visualization of gallstones and 104 cases with no visible gallstones at CT were further investigated. Of the 104 patients, 76 (M:F=38:38; age, 18-89 years) had US (n=49), MRC (n=47), or both (n=20) before surgery and were enrolled as a final study population. Two reviewers performed image analysis in consensus. In terms of evaluating acute cholecystitis at CT, reviewers diagnosed each case as one of the following: “definitely not”, “suspected of acute cholecystitis”, “definitely acute cholecystitis”. US and MRC images were analyzed in terms of the presence of obstructing stone or sludge in the gallbladder, cases were diagnosed as either “no cholecystitis” or “acute cholecystitis”. Surgical and pathologic records were used as reference standard for the presence of stone or sludge in the gallbladder and for the final diagnosis. Accuracy in detecting stone or sludge in the gallbladder was compared between US and MRC using the Chi-square test. Sensitivity in diagnosing acute cholecystitis was calculated and compared between US and MRC using the Fisher’s exact test. A p value of less than 0.05 was considered statistically significant.

RESULTS
In CT diagnosis of acute cholecystitis, there were 2 cases of “definitely not”, 54 of “suspected of acute cholecystitis”, and 20 of “definitely acute cholecystitis”. The accuracy in detecting gallstone or sludge was not significantly different between US and MRC (84% vs 91%) (p=0.247). The sensitivity of MRC in diagnosing acute cholecystitis was significantly higher than that of US for total population (87% vs 71%, p=0.048) and for 54 patients with “suspected of cholecystitis” at CT (91% vs 72%, p=0.036).

CONCLUSION
US and MRC were comparable in the detection of obstructing gallstone or sludge when acute cholecystitis was suspected or indicated at CT without visible gallstones. MRC showed higher sensitivity in diagnosing acute cholecystitis than US.

CLINICAL RELEVANCE/APPLICATION
When acute cholecystitis is initially suspected but not conclusive at CT without visible gallstone, MRC is more sensitive as a confirming imaging tool compared with US.

LL-ERS-TH4B ● Emergency Contrast-enhanced Ultrasonography for Pancreatic Injuries in Blunt Abdominal Trauma
Faqin Lv (Presenter); Jie Tang; Yukun Luo MD; Yongkang Nie MD, PhD; Tanshi Li

PURPOSE
The portability of CEUS makes it a good tool in trauma settings because examinations can be performed quickly at a patient’s bed-side and benefits patients with either stable or unstable hemodynamics. The purpose of this study was to investigate the application of emergency contrast enhanced ultrasonography (CEUS) in blunt pancreatic trauma.

METHOD AND MATERIALS
During a 3-year period, we retrospectively collected abdominal CT of consecutive 590 patients with surgically confirmed acute cholecystitis. CT scans were evaluated in terms of visualization of gallstones and 104 cases with no visible gallstones at CT were further investigated. Of the 104 patients, 76 (M:F=38:38; age, 18-89 years) had US (n=49), MRC (n=47), or both (n=20) before surgery and were enrolled as a final study population. Two reviewers performed image analysis in consensus. In terms of evaluating acute cholecystitis at CT, reviewers diagnosed each case as one of the followings: “definitely not”, “suspected of acute cholecystitis”, “definitely acute cholecystitis”. US and MRC images were analyzed in terms of the presence of obstructing stone or sludge in the gallbladder, cases were diagnosed as either “no cholecystitis” or “acute cholecystitis”. Surgical and pathologic records were used as reference standard for the presence of stone or sludge in the gallbladder and for the final diagnosis. Accuracy in detecting stone or sludge in the gallbladder was compared between US and MRC using the Chi-square test. Sensitivity in diagnosing acute cholecystitis was calculated and compared between US and MRC using the Fisher’s exact test. A p value of less than 0.05 was considered statistically significant.

RESULTS
In CT diagnosis of acute cholecystitis, there were 2 cases of “definitely not”, 54 of “suspected of acute cholecystitis”, and 20 of “definitely acute cholecystitis”. The accuracy in detecting gallstone or sludge was not significantly different between US and MRC (84% vs 91%) (p=0.247). The sensitivity of MRC in diagnosing acute cholecystitis was significantly higher than that of US for total population (87% vs 71%, p=0.048) and for 54 patients with “suspected of cholecystitis” at CT (91% vs 72%, p=0.036).

CONCLUSION
US and MRC were comparable in the detection of obstructing gallstone or sludge when acute cholecystitis was suspected or indicated at CT without visible gallstones. MRC showed higher sensitivity in diagnosing acute cholecystitis than US.

CLINICAL RELEVANCE/APPLICATION
When acute cholecystitis is initially suspected but not conclusive at CT without visible gallstone, MRC is more sensitive as a confirming imaging tool compared with US.

LL-ERE-THSB ● Update on Imaging of Acute Pancreatitis: What the Radiologist Needs to Know
Leena Tekchandani MD (Presenter); Ritu Bordia MBBS; Lewis Shin MD; Giovanna Casola MD; James Grendell; Douglas S Katz MD; Bruce R Javors MD

PURPOSE/AIM
To review the current status of imaging of acute pancreatitis for the emergency and general radiologist, with an emphasis on the role of CT and the revised Atlanta Classification System.
**CONTENT ORGANIZATION**

The exhibit will cover the latest literature on, and will demonstrate with imaging examples from several institutions: - pathogenesis and clinical presentation of acute pancreatitis - diagnostic criteria per the revised Atlanta Classification - indications for imaging and technical considerations - clinical systems for predicting severity - Balthazar/CT severity index - emphasis will be placed on CT and the revised Atlanta Classification System - with explanation of new terminology (e.g. WON, walled-off necrosis; APFC - acute peripancreatic fluid collection; ANC - acute necrotic collection) - review of US and MR findings - imaging of complications (e.g. splenic venous thrombosis; hemorrhage; pseudoaneurysm; fistula; disconnected pancreatic duct) and less common presentations (e.g. acute on chronic; underlying neoplasm; groove; autoimmune) - potential imaging pitfalls - prognosis and treatment

**SUMMARY**

After review of this exhibit, the emergency and general radiologist will be more familiar with the latest concepts in imaging of acute pancreatitis, particularly the new terminology of the Altanta Classification and how to report the CT findings.

---

**Gastrointestinal - Thursday Posters and Exhibits (12:45pm - 1:15pm)**

**Thursday, 12:45 PM - 01:15 PM • Lakeside Learning Center**

**Back to Top**

**LL-GIS-THB • AMA PRA Category 1 Credit ™: 0.5**

**LL-GIE-TH1B • Categorization of Other Malignancy Using LI-RADS v2013.1**

Amol Shah BS (Presenter); Masahiro Tanabe MD; Eduardo A Costa MD; Abdullah T Alturki MD, MBBS; Kevin A Zand MD; Elhamy R Heba BMBCh; Marilia P Ferreira MD; Claude B Sirlin MD *

**PURPOSE/AIM**

The purpose of this exhibit is to:

1. Understand the concept, definition, reporting, and management of other malignancy.
2. Review examples of other malignancy in the liver.
3. Review clinical and imaging features suggestive of non-HCC malignancy.

**CONTENT ORGANIZATION**

- Introduction to LI-RADS: LI-RADS is an ACR-endorsed system of standardized terminology and criteria to interpret and report imaging examinations of the liver. LI-RADS assigns an ordinal score (1 to 5) to liver observations indicating likelihood of HCC.
- Overview of other malignancy: concept, definition, reporting, management.
- Clinical and imaging features of HCC and common non-HCC malignancies in the liver.
- Sample CT/MR images and schematics of HCC as well as common non-HCC malignancies.

**SUMMARY**

The teaching points of this exhibit are:

1. Examples of common non-HCC malignancies include:
   - Cholangiocellular carcinoma
   - Metastasis
   - Lymphoma
   - Post-transplant lymphoproliferative disorder
2. Differentiation between HCC and non-HCC malignancies is important as the management and prognosis differ.

**LL-GIE-TH1B • Imaging Pancreatic Pathology with PET/MRI: A Pictorial Essay**

Jose L Vercher-Conejero MD (Presenter) *; Raj M Paspulati MD; Andres Kohan MD *; Christian Rubbert MD *; Sasan Partovi BS *; Pablo R Ros MD, PhD *; Peter F Fahlhaber MD *; Karin A Herrmann MD

**PURPOSE/AIM**

1. To illustrate the imaging appearance of a variety of pancreatic pathologies using PET/MRI as a new hybrid imaging modality
2. To outline the advantages and potential value of PET/MRI in pancreatic imaging

**CONTENT ORGANIZATION**

Current role and diagnostic value of PET (CT) and MRI in the diagnosis of pancreatic pathology Specific technology key features of PET/MRI

- Scanner design
- MR based attenuation correction and 3-segment model attenuation map
- Sequential image acquisition with state-of-the-art Time of Flight PET technology and 3Tesla MRI

Propose and discuss an appropriate integrated imaging protocol/workflow for PET/MRI in pancreatic pathology

- Whole body attenuation correction and anatomic reference
- Organ specific protocols for pancreas and liver
- Whole body PET

Pictorial review of a variety of benign and malignant pancreatic To discuss the potential benefits and incremental value of PET/MRI in pancreatic imaging over current standard of care imaging protocols

**SUMMARY**

Teaching points:

- Understand the technical features of pancreatic PET/MRI exams and learn how to efficiently perform PET/MRI for pancreatic pathology
- Learn about the imaging appearance of various pancreatic diseases in PET/MRI
- Identify potential benefits of PET/MRI for diagnosis and staging of pancreatic diseases

**LL-GIE-TH1B • Quantitative Comparison of Dual Energy CT vs. 120kVp CT of Pancreatic Ductal Adenocarcinoma: Does DECT Improve CNR (Lesion Conspicuity)?**

Priya R Bhosale MD (Presenter); Aparna Balachandran MD; Ott Le MD *; Patricia S Fox MS; Eric Paulson; Eric P Tamm MD

**PURPOSE**

To compare contrast to noise ratio (CNR) for pancreatic ductal adenocarcinoma (PDA), performed with pancreatic phase dual energy (DECT) versus 120 kVp CT.

**METHOD AND MATERIALS**

Seventy-eight patients underwent baseline multiphasic pancreatic protocol for PDA (40 DECT, 38 120kVp). On pancreatic phase DECT, CNR for PDA at monochromatic energies of 50, 60, 70 keV and iodine material density (IMD) images were obtained. In an analogous fashion, CNR was obtained from 120 kVp CT. The CNR was calculated as region of interest (ROI) PDA-ROI of pancreas / SD of pancreas. Wilcoxon signed rank and two sample tests were used to compare the quantitative measures from DECT to 120kVp. Bonferroni correction was applied.

**RESULTS**

IMD images provided significantly higher CNR for PDA, than any of the other DECT energies (p

**CONCLUSION**

DECT IMD images provided significantly higher CNR for PDA. Compared to standard 120kvp, each of the DECT energies provided significantly higher CNR for PDA than 120kvp. Such results indicate DECT improves lesion conspicuity of PDA compared to routine 120kVp CT.

**CLINICAL RELEVANCE/APPLICATION**

DECT with its high CNR may help in better detection and localization of pancreatic ductal adenocarcinoma

**LL-GIS-TH2B • Localization of Liver Tumors according to the Couinaud Segmentation: Results of an Innovative Computer Aided Method**
Histologic Grades

LL-GIS-TH4B • LL-GIS-TH3B • performed. Additionally, mesh deformation and localisation in relation to the hernia were rated. Using linear contrast and mixed models, statistical analysis was performed.

RESULTS
1-Kappa values were 0.84 between juniors and 0.88 between seniors indicating a very good reproducibility into each group. 2-Kappa values ranged from 0.80 to 0.81 (substantial to almost perfect agreement) between juniors and senior standard; from 0.84 to 0.91 (almost perfect agreement) between seniors and gold standard.

4-Probability of agreement between all observers and gold standard decreased for some localization: tumors located S1, S2, S6 for juniors and S3 for seniors. 4-Probability of agreement was independent of tumor size

CONCLUSION
The concept of liver segmentation based on few landmarks easily recognizable by any CT reader provides adequate and reproducible localization of tumors into the liver. Such approach may be useful for non expert radiologists while facilitating visual representation and treatment planning for surgeons

CLINICAL RELEVANCE/APPLICATION
The proposed computer aided method provides simple anatomical liver segmentation and helps non expert radiologist for better localization of liver tumors aiming to facilitate surgical treatment plans.

LL-GIS-TH3B • MR Prediction of Tumor Grade in Rectal Cancer Using Chemical Exchange Saturation Transfer Imaging

Akihiro Nishie MD (Presenter) • Yoshihiko Asayama MD • Yusuhiro Ushijima MD • Yukihisa Takayama MD * • Nobuhiro Fujita MD, PhD; Hiroshi Honda MD; Dai Shimamoto; Osamu Togao MD, PhD; Takashi Yoshiiura MD, PhD; Makoto Obara *; Jochen Keupp PhD *

PURPOSE
To elucidate if chemical exchange saturation transfer (CEST) imaging can predict tumor grade of rectal cancer and to investigate the feasibility of this new MR sequence for predict malignant potential

METHOD AND MATERIALS
A total of ten patients with rectal cancer who underwent MR examination including CEST imaging were enrolled. CEST imaging was scanned with single-shot 2D TSE-DRIVE on a 3T clinical scanner (Achieva TX 3.0T, Philips Healthcare, NL) using a 32-channel SENSe Torso/Cardiac coil and 2-channel parallel transmission. The sequence parameters were as follows: Tsat=0.5 s, TR/TE=5000/6 ms, FOV=230 mm2, spatial resolution=1.8×1.8×5 mm3, 25 saturation frequency offsets (Δf: -50, 0, +50 ppm), affording 2 minutes scanning time. B0 correction was also performed. MTR asymmetry (MTRasy) was defined as: MTRasy = (Ssat(-offset)-Ssat(+offset))/S0, where Ssat and S0 are signal intensities on the images with presaturation pulse at -6.0 to +6.0 ppm and control (160 ppm). The calculated MTRasy map at the offset of 3.5 ppm was generated, and region-of-interests were carefully placed in the entire area of each rectal cancer on this map to measure APT signal (%). Each tumor was also historically divided into three tumor grades (well-, moderately- and moderately differentiated adenocarcinomas). The mean APT signal was compared among the three tumor grades using a Fisher’s least significant difference.

RESULTS
The mean APT signal of well-differentiated adenocarcinoma (n=2; 0.15±0.05%) was significantly lower than those of well- to moderately and moderately differentiated adenocarcinomas (n=3; 2.57±0.22% and n=5; 2.24±0.50%) (p=0.021). CONCLUSION
CEST imaging can predict tumor grade of rectal cancer non-invasively

CLINICAL RELEVANCE/APPLICATION
CEST imaging describes high ability to synthesize protein of cancer and may enable us to quantify tumor malignancy and proliferative potential. APT signal can be a new imaging biomarker of cancer.

LL-GIS-TH4B • Diffusion-weighted MR Imaging of Gallbladder Adenocarcinoma: Differentiation from Adenoma and Analysis with Emphasis on Histologic Grades

Nam Kyung Lee MD (Presenter) • Suk Kim MD; Ji Eun Jo; Jihyun Bae MD; Tae Un Kim; Dong Uk Kim; Hyung Il Seo MD

PURPOSE
Generally, histologic grades of gallbladder adenocarcinoma correlate with survival. However, it is difficult to differentiate histologic grades of gallbladder adenocarcinoma by imaging. The purpose of our study was to investigate the value of DWI for differentiating gallbladder adenocarcinoma from adenoma, and differentiating gallbladder adenocarcinoma according to histologic grades.

METHOD AND MATERIALS
Fourty-three patients with gallbladder adenocarcinoma and 8 patients with adenoma who had undergone MR with respiratory-triggered DWI were included in this retrospective study. Signal intensity of gallbladder adenocarcinoma and adenoma was analyzed on DWI (b=800s/mm2), in comparison with spleen signal by Chi-square test. ADC values of adenocarcinoma and adenoma were compared separately for 1.5-T and 3.0-T by Mann-Whitney U test. Gallbladder adenocarcinoma were divided to three groups according to histologic grades; well-differentiated (n=10), moderately-differentiated (n=17), and moderate-to-poor- and poor-differentiated adenocarcinomas (n=16). Qualitative DWI analysis was scanned with single-shot 2D TSE-DRIVE on a 3T clinical scanner (Achieva TX 3.0T, Philips Healthcare, NL) using a 32-channel SENSe Torso/Cardiac coil and 2-channel parallel transmission.

RESULTS
DWI intensity was significantly different between gallbladder adenocarcinoma and adenoma. ADC values of gallbladder adenocarcinoma and adenoma were 0.999±0.02×10-3 mm2/sec, respectively at 1.5-T (p=0.002), and 1.179±0.42×10-3 mm2/sec, respectively at 3.0-T (p=0.066). DWI intensity was not significantly different according to histologic grades of gallbladder adenocarcinoma. However, ADC values of well-differentiated adenocarcinoma were significantly higher than other high-grade adenocarcinomas. ADC values of well-differentiated, moderately-differentiated, moderate-to-poor- and poor-differentiated adenocarcinomas were 1.240±0.15×10-3, 0.990±0.25×10-3, and 0.930±0.64×10-3 mm2/sec, respectively at 1.5-T (p=0.033), and 1.512±0.38×10-3, 1.088±0.45×10-3, and 0.984±0.26×10-3 mm2/sec, respectively at 3.0-T (p=0.030).

CONCLUSION
DWI can be reliable for differentiating gallbladder adenocarcinoma according to histologic grades as well as differentiating gallbladder adenocarcinoma from adenoma.

CLINICAL RELEVANCE/APPLICATION
DWI can be used to predict the survival rate of gallbladder carcinoma by differentiating gallbladder adenocarcinoma according to histologic grades.

LL-GIS-TH5B • First In-patient MR-Visualisation of Polymer-based Mesh Implants Used for Surgical Hernia Treatment

Nils A Kraemer (Presenter); Nienke L Hansen MD; Alexander Ciritsis; Alexandra Barabasch; Martina Distelmaier; Jens Otto MD; Nicolas Kuehnert; Joachim Conze; Christiane K Kuhl MD *

PURPOSE
Surgical hernia treatments using polymer based mesh implants are one of the most frequent operations worldwide. As the implants are invisible using conventional imaging methods, iron-oxides were integrated into the mesh polymer base material to visualize them in MRI. The purpose of this study is to evaluate the conspicuity of these mesh implants in patients treated for inguinal hernia and assessment of immediate post surgical mesh configuration.

METHOD AND MATERIALS
Approved by the ethics committee, 13 patients treated with iron-loaded mesh implants via laparoscopic or via open surgical procedure were prospectively examined beginning March 2012. MRI was conducted one day after surgery at a 1.5 Tesla scanner using three different conventional gradient echo (GRE1-3) and one T2-weighted turbospin echo (TSE) sequences. Three radiologists independently assessed mesh conspicuity and diagnostic value by the following criteria using a 4-point-scale: visual contrast-to-noise ratio, conspicuity to air artifacts, and diagnostic quality rating with respect to the mesh and to the surrounding anatomy. Mesh deformation and coverage of the hernia were visually assessed and rated using a 5-point semi-quantitative scoring system. Additionally, mesh deformation and localization in relation to the hernia were rated. Using linear contrast and mixed models, statistical analysis was performed.
RESULTS
MRI successfully visualized all implants. GRE sequences clearly exhibited the mesh implants as a thick hypointense line. GRE1 was rated best (3.8; p
CONCLUSION
The combination of iron-loaded implants and MRI facilitates mesh visualization for the first time in patients. After surgical hernia repair, mesh localization and configuration can be clearly assessed.
For MRI protocol, we propose a combination of different gradient echo sequences and T2-weighted TSE sequences.

CLINICAL RELEVANCE/APPLICATION
Using this new technique, MRI could become a non-invasive alternative to open surgical exploration if mesh-related complications after hernia surgery are suspected.

LL-GIS-TH6B ● Role of CT in Differentiating Intestinal Tuberculosis from Crohn’s Disease
Raju Sharma MD (Presenter) ; Saurabh Kedia MD ; Vineet Ahuja MD ; Devasenathipathy Kandasamy ; Birender Nagi MD
PURPOSE
Intestinal tuberculosis (ITB) and Crohn’s disease (CD) have close clinical, radiological, endoscopic, and histological resemblance. There is lack of literature on computed tomography (CT) in differentiating between CD and ITB. Present study was designed to compare CT features of ITB and CD, and develop a predictive model to differentiate ITB and CD.

METHOD AND MATERIALS
All patients with ITB and CD, who underwent CT enteroclysis/CT enterography/CT abdomen before starting treatment, were recruited in the study. The gold standard for diagnosis of CD and ITB were ECCO guidelines and Paustian’s criteria respectively. The CT images were evaluated by 2 independent observers who were blinded to the diagnosis.

RESULTS
One hundred eleven patients were included in the final analysis (60 CD, 51 ITB, mean age 36.4±14.2 years vs 34±13.3 years, p=0.36). Significantly more patients with ITB had short segment involvement (70.6% vs 26.7%, p < 0.001), ileocecal involvement (49% vs 18.3%, p=0.001), 1cm in size (19.6% vs 1.7%, p 3 segments involved (25% vs 19.6%, p=0.138). Based on above features predictive models were developed which could differentiate ITB and CD with > 90% accuracy.

CONCLUSION
Predictive models based on combination of CT findings to differentiate CD and ITB were developed, and they achieved an accuracy of >90%.

CLINICAL RELEVANCE/APPLICATION
CT is a robust modality for differentiating Intestinal Tuberculosis from Crohn’s disease. Although overlapping findings do occur, certain combination of findings can differentiate between the two.

LL-GIS-TH7B ● Percutaneous Radiologic Gastrostomy in Patients with Subtotal Gastrectomy
Young Chul Cho BS (Presenter) ; Ji Hoon Shin MD ; Ho-Young Song MD ; Jin Hyoung Kim MD ; Jung-Hoon Park RT ; Soo Hwan Kim MD
PURPOSE
To evaluate the technical feasibility, safety, and clinical effectiveness of percutaneous radiologic gastrostomy (PRG) in patients who had previously undergone subtotal gastrectomy.

METHOD AND MATERIALS
From April 2006 to April 2012, 19 patients were treated with two types of gastric surgery in 13 patients, subtotal gastrectomy with gastrojejunostomy, and in 6 patients, distal gastrectomy with gastroduodenostomy. PRG procedures with one-anchor technique were attempted and the remnant stomach was punctured with a 21-gauge Chiba-needle, which was exchanged for a 6-Fr Heff catheter. For gastropexy, a single anchor was used and gastrostomy tube placement was performed through the same tract of the anchor with a 12 – 14 F Wills-Oglesby gastrostomy catheter. Technical success rate, cause of technical failure, procedure time, and complications were evaluated and compared between two surgery types.

RESULTS
PRG with the one-anchor technique was performed successfully in 10 (53%) of 19 patients. In nine technical failure, percutaneous radiologic jejunostomy (PRJ) with same procedural technique was performed successfully. Cause of technical failure were small remnant stomach (n=3), high-lying remnant stomach (n=2), and bowels anterior to the stomach (n=4). The average procedure time was 6.35 minutes (PRG) and 13.28 minutes (PRJ). Complications after PRG (n=2) and PRJ (n=0) occurred in two patients involved pneumoperitonum requiring tube removal and massive bleeding requiring embolization. Incidence of technical failure was significantly greater in patients with subtotal gastrectomy with gastrojejunostomy than distal gastrectomy with gastroduodenostomy (6 vs. 0, P = 0.011).

CONCLUSION
PRG with the one-anchor technique is a technical feasible, safe, and clinical effective in patients with subtotal gastrectomy. PRJ can be alternative option in patients with subtotal gastrectomy with gastrojejunostomy or technical failure of PRG.

CLINICAL RELEVANCE/APPLICATION
PRJ can be more effective method in patients with small remnant stomach, high-lying remnant stomach, and bowels anterior to the stomach than PRG.

LL-GIS-TH8B ● CT Courvoisier Sign: A Common and Comparatively Reliable CT Finding in Malignant Obstruction of the Biliary Tract
Patrick McLaughlin FFRCSI (Presenter) ; David Tso MD ; Kevin Murphy MBCh, MRCS ; Joseph Coyle MBCh, MRCPI ; Edward Fitzgerald MBCh ; William Yee ; Luck J Louis MD ; Michael M Maher MD, FRCR ; Savvas Nicolaou MD
PURPOSE
The authors anecdedly observed a mild increase in attenuation value of bile within the gallbladder during CT of patients with malignant obstruction of the biliary tract. We therefore conducted a retrospective study to determine the incidence of this sign and to evaluate its sensitivity and specificity for predicting the cause of biliary obstruction.

METHOD AND MATERIALS
6,157 biliary intervention procedures were performed between January 2007 and August 2012 at a single quaternary referral hepatobilary centre. A subgroup of 630 patients who underwent abdominal CT prior to biliary intervention procedure were selected. CT images of these patients were reviewed by 2 abdominal radiologists and all patients with biliary dilation (n=357) were included. Patients who had a prior choledochectomy or evidence of previous biliary intervention were excluded leaving 199 patients for analysis. Objective analysis of bile attenuation was performed within the gallbladder and common bile duct using 3cm2 and 0.5cm2 regions of interest. The presence or absence of pancreatic duct dilatation, gallstones or discernable cause for biliary obstruction was recorded. Electronic medical and histopathological records were queried for all patients and definitive diagnoses were found in all but 1 case.

RESULTS
We define the CT Courvoisier sign as elevated attenuation (>15HU) of bile within the gallbladder which in our cohort of 199 patients with biliary obstruction was found to be a common and reliable CT indicator of malignant biliary obstruction.

CONCLUSION
The CT Courvoisier sign is found in approximately 40% of patients with biliary obstruction and has an 83% specificity for malignant obstruction.

LL-GIE1257-THB ● Image Guided Ablation in Hepatic Malignancies: Which, Why, When and How to Do It?
Anuradha S Shenoy-Bhangle MD (Presenter) ; Avinash R Kambadakone MD, FRCR ; Raul N Upot MD ; Ashraf Thabet MD ; Debra A Gervais MD * ; Ronald S Arellano MD
PURPOSE/AIM
Percutaneous image guided ablative therapies are increasingly used for treatment of various hepatic malignancies. Availability of various ablative technologies makes it imperative to choose the right ablation technique to achieve a successful outcome and minimize complications. The purpose of this exhibit is to provide the radiologist with a guide to ensure effective ablative treatment of hepatic malignancies.

CONTENT ORGANIZATION
1. Review the various ablative techniques for hepatic tumors including radiofrequency ablation, microwave ablation, cryoablation, and irreversible electroporation.
2. Discuss the advantages and disadvantages of each ablative technique.
3. Discuss the indications and technique for ablation of hepatic malignancies using various technologies.
4. Illustrate the various techniques by citing examples of routine and challenging cases in a pictorial view.
Image guided ablation is an established minimally invasive technique associated with low morbidity being increasingly used in the management of patients with hepatic malignancies. Tailoring the most appropriate ablation technology to a particular hepatic tumor is imperative to ensure successful results.

Genitourinary/Uroradiology - Thursday Posters and Exhibits (12:45pm - 1:15pm)

Thursday, 12:45 PM - 01:15 PM • Lakeside Learning Center

LL-GUS-THB • AMA PRA Category 1 Credit ™:0.5

LL-GUS-TH2B • PI-RADS in Practice - The Predictive Value of PI-RADS Scoring in Targeted Prostate Biopsies for Patients with Elevated PSA, and Previous Negative Biopsies

Elaine Ni Murchu MBCh (Presenter) ; Fardod O’Kelly ; Connor D Collins MBCh ; Gerald Lennon ; David Mulvin ; David Galvin ; David Quinlan
 ; Colm J McMahon MBCh

PURPOSE
To assess the value of PIRADS scoring in predicting positive biopsy in patients with previous negative biopsy and elevated PSA, where the repeat biopsy is MR directed, trans-rectal ultrasound guided.

METHOD AND MATERIALS
HIPAA compliant. IRB approved study. 52 patients (mean age 64 years, range 52-76), with previous negative prostate biopsy and elevated PSA (mean = 14.4, range = 7-34.4) underwent combined targeted and 12 sample sectoral biopsy over a 14 month period. Each patient’s MRI was retrospectively reviewed, blinded to biopsy result and each area of abnormality on MRI was scored according to PI-RADS scheme, with separate T2, DWI, and overall scores per lesion.

RESULTS
Positive biopsy was obtained in 24/52 patients (overall yield of 46%). Predictive values based on most suspicious lesion overall per patient. PIRADS scores 1-5 (clinically significant cancer highly unlikely, unlikely, equivocal, likely, highly likely respectively). The positive predictive value of T2 PI-RADS scores of 1,2,3,4 and 5 were, 0.33,33, 58 and 100% respectively. The positive predictive value of DWI PI-RADS score of 1,2,3,4 and 5, was 0,N/A(no scores of 2), 0, 42 and 57% respectively. Only patients with overall score of 3-5 were biopsied, the positive predictive value of overall PIRADS score of 3, 4, 5 was 14, 57 and 100% respectively.

CONCLUSION
PIRADS provides a useful framework for reporting likelihood of prostate cancer, facilitating communication and guiding expectation of clinicians and patients in the setting of MRI assessment for occult prostate cancer and targeted biopsy.

CLINICAL RELEVANCE/APPLICATION
In patients with raised PSA and previous negative prostate biopsy, the use of MRI can help target repeat biopsy and predict the likelihood of a positive result.

LL-GUS-TH2B • Potential Role of MDCT Spectral Imaging by Using Material Density Analysis to Diagnose Urinary Obstruction

Catherine Roy MD (Presenter) ; Philippe Host MD ; Gauthier Bazille MD ; Isham Labani ; Mickael O Donna ; Herve Lang

PURPOSE
To evaluate MDCT Spectral Imaging Quantitative assessment of water within the kidney parenchyma in cases of hydrenephrosis in order to diagnose urinary obstruction.

METHOD AND MATERIALS
140 patients with unilateral urinary tract dilation divided in two groups of 70 patients : Group I with various causes of known chronic dilatation ; Group II coming from the emergency unit with acute renal colic underwent three acquisitions : non-contrast scan using Helical CT (GE Discovery CT750HD 64-slice scanner with Spectral Imaging single source fast switching) ; non contrast and enhanced conventional acquisition at excretory phase. All patients had normal renal function. There was no special recommendation for hydration. We used same helical pitch and detector collimation for all scans (1.375, 0.625mm).

On conventional unenhanced acquisition, there was no difference of UH value in Group I between both sides. For Group II, mean difference in UH value was 4±18 mg/cc and 1106±16 mg/cc for Group I and II, respectively. There was no statistically significant difference in renal water content between both sides for Group I and II. All patients of Group II presented an excretory delay from at least 5 min.

RESULTS
On conventional unenhanced acquisition, there was no difference of UH value in group I between both sides. For Group II, mean difference in UH value was 4±18 mg/cc and 1106±16 mg/cc for Group I and II, respectively. There was no statistically significant difference in renal water content between both sides for the Group I, but difference was significant for Group II (p < 0.05).

CONCLUSION
The water content calculated by spectral imaging can detect urinary obstruction without any contrast medium injection, in patients with urinary tract dilatation. It seems more sensitive than the UH value.

CLINICAL RELEVANCE/APPLICATION
Calculation of water content using spectral imaging can diagnose urinary obstruction in hydrenephrosis.

LL-GUS-TH3B • The ¢œÆStriated MR Nephrogram¢²½?: An Infrequent Finding on Delayed Post-contrast Images of the Kidneys

Andrew T Trout MD (Presenter) ; Alex Towbin MD * ; Bin Zhang PhD ; Marguerite Care MD

PURPOSE
The purpose of this study is to describe the “striated MR nephrogram” (Fig.), an appearance that can be seen on delayed, post-contrast MRI, and to determine its frequency and identify potential causative factors.

METHOD AND MATERIALS
After IRB approval, 3 pediatric radiologists retrospectively reviewed delayed post-contrast spinal MR exams performed in children between Jan 1, 2006 and July 1, 2012. The following variables were recorded: presence of low signal renal striations; presence of gadolinium in the bladder; aortic and inferior vena cava diameters; timing of the contrast administration in relation to imaging; and the scanner on which the exam was performed. Charts were reviewed for patient demographics and clinical information relevant to renal function including: renal function lab results, GFR (calculated and determined by scintigraphy), and history of renal disease.

RESULTS
Striations were observed in one or both kidneys in 117 of 912 cases (12.8%). There was a significant association between the presence of striations and the specific scanner on which the exam was performed (p=0.001) though this was not related to field strength (1.5T vs. 3T). Other significant predictors of the presence of a striated nephrogram included: aortic diameter (Y

CONCLUSION
The “striated MR nephrogram” is an uncommon, but not infrequent, phenomenon on delayed post-contrast images. This phenomenon is likely caused by concentrated gadolinium within the collecting ducts. While there is a statistically significant association between the presence of striations and several variables, the cause of the observed phenomenon in only select patients is unclear and does not appear to reflect poor renal function, timing or hydration status. The radiologist should be aware that the “striated MR nephrogram” may be present on delayed post-contrast images, and it should not be mistaken for a pathologic process.

CLINICAL RELEVANCE/APPLICATION
A striated appearance of the kidney may be observed in 12.8% of delayed post-contrast MR images. This presumably relates to concentrated gadolinium and does not represent pathology.

LL-GUS-TH4B • Functional Study with MRI Decafoxograpy in Patients Suffering from Deep Endometriosis

Silvia Bernardo MD (Presenter) ; Lucia Manganaro MD ; Valeria Vinci MD ; Paolo Sollazzo ; Matteo Saldari ; Maria Eleonora Sergi MD ; Carlo
Oncogenetics of Clear Cell Renal Cell Carcinoma (ccRCC) in the Era of Personalized Medicine: What Radiologist Needs to Know?

Tharakeswara Kumar Bathala MD (Presenter) ; Ajaykumar C Morani MD ; Hyunseon C Kang MD, PhD ; Shiva Gupta MD ; Dhakshina M Ganeshan MBBS, FRCR ; Vikas Kundra MD, PhD *

PURPOSE/AIM
1. Describe oncogenetics of ccRCC, with an emphasis on genetic pathways of ccRCC carcinogenesis.
2. Introduce Radiogenomics, an evolving science that links diagnostic imaging features to gene expression patterns.
3. Describe current and future clinical applications of oncogenomics and radiogenomics.

CONTENT ORGANIZATION
1. Pathological Classification of RCC
2. Carcinogenesis of ccRCC
3. Genetic Pathways of Hereditary and Sporadic ccRCC
4. Phenotypic Heterogeneity (imaging features) of ccRCC in Correlation with Gene Expression
5. Genetic Pathways Affecting Current Targeted Therapies

SUMMARY
Recent advances in the understanding of molecular pathways underlying ccRCC has led to development of new therapies and imaging strategies. The role of radiology as essential link on oncogenetics has becomes more and more important in the era of personalized medicine. This exhibit will feature the information on the recent developments in oncogenics of ccRCC highlighting the importance of radiology (radiogenomics) in the changing landscape of ccRCC management.

How to Tangibilize Quality in a Medical Imaging Clinic? - Results of an Opinion Survey

Leonardo K Bittencourt MD, MSc (Presenter) ; Emerson L Gasparetto MD ; Roberto Vieira ; Romeu C Domingues MD

PURPOSE
With the ever growing tendency for mergers, acquisitions and turnabouts in private medical imaging market, competition for referrals is becoming a key issue to ensure the survival of small/middle clinics.

In this context, not only the final customer, i.e. the patient, is taken into account, but also his/her referring physician, who is ultimately the main responsible for the renewal of our workflow.

Therefore, an opinion survey was developed, aiming to assess the main factors that our nearby physicians take into account when choosing the best clinic to image their patients.

METHODS
We distributed an online survey to a mailbase that included about 300 physicians in the city of Rio de Janeiro, among different medical specialities.

In addition to the socio-demographic information, the core of the research consisted of a list of 'quality criteria' for a radiology department, that the referrers should order according to the degree of importance.

The information was then tabulated in a proper spreadsheet, allowing the researchers to analyze the data.

RESULTS
The sampled physicians spend about 44% of their time in private offices, 24% at private hospitals, and 32% at public hospitals. 72% of the patients were referred by HMO's, while 17% had only private patients. The patient's choice was found to be 98% of the physicians influence the patient on the choice for a specific clinic.

The 'quality criteria' that were reputed as the most important when judging an imaging clinic were the following, in decreasing order:
- Reports and results that are 'more correct';
- Updated and/or academical radiologists;
- State-of-the-art equipment;
- Radiologists directly involved with my medical specialty

This clinic is considered as 'the best' by my peers

Other criteria that ranked high were: easily accessible radiologists, radiologists that are kind to my patient, readiness on the delivery of reports, readiness to fit urgent cases into the schedule, and punctuality.

CONCLUSION
The quality criteria assigned by attending physicians were identified and graded, reflecting the main points where the marketing effort should be emphasized: tangibilizing the medical accuracy of test results, the involvement of physicians in clinical academic and scientific activities, advertisement on the quality of the equipment, conducting scientific/social sessions assistants with referrers from key medical specialties, and obtaining statements and testimonies from attending physicians that are opinion-makers.

Current Status Nephrogenic Systemic Fibrosis

Laleh Daftaribesheli MD (Presenter) ; Shima Aran MD ; Hani H Abujudeh MD, MBA *

PURPOSE
The sampled physicians spend about 44% of their time in private offices, 24% at private hospitals, and 32% at public hospitals. 72% of the patients were referred by HMO's, while 17% had only private patients. The patient's choice was found to be 98% of the physicians influence the patient on the choice for a specific clinic.

The 'quality criteria' that were reputed as the most important when judging an imaging clinic were the following, in decreasing order:
- Reports and results that are 'more correct';
- Updated and/or academical radiologists;
- State-of-the-art equipment;
- Radiologists directly involved with my medical specialty

This clinic is considered as 'the best' by my peers

Other criteria that ranked high were: easily accessible radiologists, radiologists that are kind to my patient, readiness on the delivery of reports, readiness to fit urgent cases into the schedule, and punctuality.

CONCLUSION
The quality criteria assigned by attending physicians were identified and graded, reflecting the main points where the marketing effort should be emphasized: tangibilizing the medical accuracy of test results, the involvement of physicians in clinical academic and scientific activities, advertisement on the quality of the equipment, conducting scientific/social sessions assistants with referrers from key medical specialties, and obtaining statements and testimonies from attending physicians that are opinion-makers.
Nephrogenic Systemic Fibrosis (NSF) is a debilitating complication of the Gadolinium Based Contrast Agents (GBCAs) in patients with severe renal failure. The current guidelines regarding restrictive use of GBCAs in these patients decreased its incidence dramatically. The purpose of this educational exhibit is to discuss and compare the most recent guidelines along with presenting the latest discoveries on this subject.

CONTENT ORGANIZATION
1. Epidemiology of the NSF
2. Clinicopathological diagnosis of NSF and treatment options
3. Most updated recent guidelines regarding GBCAs use in different patients: ESUR (European Society of Urogenital Radiology) 2013 updated guideline and ACR (American Colleague of Radiology) 2012 updated guideline
5. Presenting the latest discoveries on NSF pathogenesis, mechanism of development and treatment

SUMMARY
The incident of NSF decreased dramatically following implementation of the past guidelines. In this review we introduce the latest worldwide guidelines regarding GBCA usage, we also present the latest basic science discoveries regarding NSF

**LL-HPS-TH1B • CT Scanning in Head Injuries-Are We Compliant with the NICE Guidelines?**

**Orla Drumm** MBChb, MSc (Presenter) ; **Conor Bowe** ; **John Ryan**

**PURPOSE**
The National Institute for Health and Care Excellence (NICE) is a UK based institute which provides national guidance and advice to improve health. The NICE guidelines for the management of patients with head injuries were published in 2007 and are frequently used in emergency departments across Europe. A simple algorithm identifies patients who should undergo CT brain scanning. Our aim was to assess compliance with these guidelines in a busy emergency department.

**METHOD AND MATERIALS**
We performed a retrospective study of all patients who presented with head injuries to the emergency department over a one month period. Patients who had a CT scan were identified and analyzed as to the appropriate use of the NICE guidelines.

**RESULTS**
138 patients presented with head injuries. 97 were male and 41 were female. The mean age was 41 years. 49 patients (36%) had a CT brain performed and form the basis of this study. Of these patients, 45% (n=22) of the CT scans performed complied with the NICE guidelines and 51% (n=25) did not. The remaining 4% (n=2) had alcohol intoxication. Overall, 22% (n=11) who underwent a CT brain had acute pathology. However, in patients who fulfilled the criteria for CT brain as per the NICE guidelines 36% (n=8) had positive findings. In those who did not fulfill the criteria (51% of the study group) one patient (4%) had positive findings.

**CONCLUSION**
Our study shows poor compliance with the NICE guidelines and suggests that improved adherence to the guidelines when evaluating patients with head injuries and the appropriateness for a CT scan would significantly reduce Radiology workload, patient radiation exposure and cost.

**CLINICAL RELEVANCE/APPLICATION**
Our study shows poor compliance with the NICE guidelines in the management of head injuries. As a result many unnecessary CT scans are performed with implications for both patients and Radiologists.

**LL-HPS-TH2B • The Potential Effect of the Choosing Wisely Initiative on Radiology**

**Vijay M Rao** MD (Presenter) ; **David C Levin** MD *

**PURPOSE**
The Choosing Wisely initiative (CW) is a major undertaking that was first announced by the American Board of Internal Medicine Foundation in April 2012 to try and reduce unnecessary tests and procedures. The ACR and 26 other national medical societies have joined, but despite the fact that it was widely publicized, most radiologists are still unfamiliar with it. Our purpose was to try and determine how much of this initiative is focused on radiology.

**METHOD AND MATERIALS**
The CW web site and other materials were studied. Each participating society had been asked to select 5 tests or procedures it felt were overutilized. "All 135 tests/procedures were reviewed to determine which ones pertained to imaging and how much overlap existed. Imaging tests were then categorized by body system.

**RESULTS**
Among their 5 options, 21 of the 27 societies chose at least 1 imaging exam that was judged to be overused. Of the 135 tests/procedures listed by the 27 societies, 61 were imaging tests and reducing the number of procedures there were a total of 49 separate imaging tests. Six of these were echocardiography exams, which are only rarely performed by radiologists; eliminating these left 43 imaging tests commonly performed by radiologists.Ten of these tests fell into the following body system categories: cardiac 11, head/neck 10, pediatric 5, musculoskeletal 4, abdominal/pelvis 4, vascular 4, chest 2, breast 2, whole body 1. Of the 43 tests, 9 were listed by more than 1 society.

**CONCLUSION**
The CW campaign is now widespread and will likely continue to grow. It very clearly targets radiology as a specialty whose services are often overused and/or unnecessary. Radiologists need to become familiar with the list of studies that are perceived to be overused. They must then either refute the allegations of overuse or take steps to limit their use. As the recognized stewards of imaging during a time when great effort is being made to reduce costs, radiologists will likely be judged by their response to this well publicized initiative. It is very important that they be knowledgeable and involved.

**CLINICAL RELEVANCE/APPLICATION**
Choosing wisely campaign to reduce unnecessary or overutilized imaging tests.

**LL-HPS-TH3B • Benchmarking the Elapsed Time for Patients with a Breast Biopsy Recommendation: Time from Initial Breast Imaging Evaluation to Biopsy Pathology Resolution for Benign Breast Disease**

**Carmen S Kirkness** PhD (Presenter) ; **Jessica A Guingrich** MD ; **Jimma Ren** PhD ; **Danette Dobbet** MS ; **Denise Mammolito** MD ; **Lynne Jalovic** MD ; **Ravi S Ramakrishna** DO, MBA ; **Kelly Kennell** MD

**PURPOSE**
Prompt evaluation after abnormal mammography is thought to reduce a patients' anxiety yet the determination of the evaluation time after abnormal mammography is lacking. The purpose of this study was to evaluate and characterize the time from an abnormal mammogram to biopsy pathology resolution for those women who had a biopsy recommendation.

**METHOD AND MATERIALS**
This study included women aged 13to 93 years who were recommended for biopsy (BIIRADS 0, 4, 5) after an abnormal mammogram (1314 screening and 1656 diagnostic) in a rural non-academic medical center in Central Illinois between 2001 and 2007. The outcome was the number of weeks between the abnormal mammogram (screening and diagnostic) and time to benign biopsy pathology resolution. Logistic regression models were used to assess the effect of age, race, and marital status.

**RESULTS**

**CONCLUSION**
Determination of pathology after an abnormal mammography was timely for the majority of women. Women that waited one month or more to have a biopsy were young and non-married African American. Further research is required to determine why race differences exist in non-married women.

**CLINICAL RELEVANCE/APPLICATION**
Benchmarking elapsed time from abnormal mammography to benign pathology resolution provides a clinical practice standard of care to compare services and practices across the nation.
Background
There is increasing awareness of certain subpopulations of women for whom mammography alone has reduced performance, particularly those with dense parenchyma or with high risk of developing breast cancer. Integrating risk assessment into the daily practice of breast imaging, answering patients’ questions and making appropriate imaging recommendations for screening remains challenging. Many practitioners are not intimately familiar with the various risk assessment tools. The ACR has released the ACIP, an algorithmic decision tool to assist referring physicians in making the most appropriate imaging decision for breast cancer screening could prove to be useful in everyday practice.

Evaluation
Decision Support System for Breast Cancer Screening (DSSBCS) can be run as an independent standalone web application or as applications within Google, Apple iOS or Microsoft-based mobile platforms. Users of this system simply enter specific patient information in a user-friendly tool which in return calculates the life-time risk for breast cancer, the age to start screening, and the most appropriate supplemental screening tool.

Discussion
Clinical decision support (CDS) systems are cost-effective, efficient and reliable methods for adjudicating the clinical indications of imaging studies by comparing those indications to evidence-based scores, and allowing physicians to recommend the most appropriate imaging for the patient. Several CDS systems are currently commercially available and use of such systems is being widely considered by healthcare systems, payers, and regulators. DSSBCS is a dedicated system designed to guide the radiologist and referring physician to the identification of women who may benefit from supplemental screening and to help to recommend when and which techniques to use for this additional screening.

LL-INS-TH2B • Proposal of an IHE Integration Profile for the Electronic Storage of Shared Images within a Community Using DICOM KOS

Minoru Hosoba PhD (Presenter)

PURPOSE
In the HIE (Health Information Exchange), shared images imported from other facilities are requested to storage legally if they are used for diagnosis in the local Enterprise according to the MHW guideline in Japan (i.e. Electronic storage). When HIE increases, a number of duplicated images may be stored in every Enterprise and this is difficult to handle without any problems. To reduce such risks, only pointing information to shared images should be stored as the Electronic storage. In this paper, use of the DICOM KOS (Key Object Selection document so called “manifest”) as pointing information is proposed for the Electronic Storage in a standardized way.

METHOD AND MATERIALS
DICOM KOS has been applied to the IHE XDS-I integration profile in the image sharing infrastructure. The Electronic storage workflow in local Enterprise for images imported from other facilities can be established with the implementation of XDS-I. KOS has UID information to link SOP instance and facility UID and it is possible to check all original imported images consistently from an anywhere. After diagnosis of selected images imported with KOS, it is recreated from original imported KOS with SOP instance UID of related images and stored with SOP instance status AO (Authorized Original) attribute. KOS SOP instance status attribute is set to AO within the authorization operation for preventing deletion of the file. The facilities whose images are referenced from other Enterprises should keep related images safely according to the Electronic storage requirement of the MHW guideline in the case of outside storage of the facility. Notification about the results of pointing can be performed with KOS conveyed by XDR-I transactions.

RESULTS
This integration profile can provide infrastructure of combining the fact of diagnosis using imported images from other Enterprise with KOS and realize the effective solution for the Electronic storage of shared images. In case of XDR and PDI, same scenario can be applied if KOS is generated previously and sent with the image.

CONCLUSION
The proposed integration profile can provide infrastructure of using imported images from other Enterprise and storing their pointing data called KOS for the Electronic storage and realize its effective solution for shared images.

CLINICAL RELEVANCE/APPLICATION
The proposed profile can be applicable to image sharing infrastructure for clinical image diagnosis and storage in a standardized measure.

LL-INS-TH4B • Challenges in Radiology Reporting for Serial Tumor Assessment Using RECIST

Rony Kampalath MD (Presenter) ; Apostolia M Tsimberidou MD, PhD * ; Roland Bassett ; David J Vining MD *

PURPOSE
The purpose of this project was to conduct an audit of radiology reports to determine if radiologists at a major cancer hospital properly used Response Evaluation Criteria in Solid Tumors (RECIST) for the serial assessment of tumor response to anticancer treatments.

METHOD AND MATERIALS
Institutional Review Board (IRB) approval was granted for this retrospective data review. We analyzed baseline and subsequent computed tomography (CT) reports from 112 patients with advanced cancer treated in Phase I clinical trials at the MD Anderson Cancer Center to determine if radiologists (1) reported tumor measurements, (2) linked the measurements to the patient(s) name and (3) whether there was correlation of tumor measurements between the serial CT examinations for each patient.

RESULTS
We analyzed radiology reports from 112 consecutive patients enrolled in Phase I clinical trials. Six patients were excluded due to the absence of follow up exams, and 9 were excluded due to no measurements being reported in the baseline studies. We then audited the baseline and subsequent CT reports from the remaining 97 patients (194 total reports) which revealed that radiologists reported tumor measurements in 92% of all cases but saved the relevant annotated images in PACS in only 34% of baseline and 42% of follow up examinations. A total of 314 (3.2/patient) tumors were measured and reported in the baseline examinations, of which 113 (35%) had measurements reported for the same lesions in subsequent examinations.

CONCLUSION
The consistent use of RECIST in radiology reporting is critical as the accurate and timely assessment of tumor response determines whether cancer patients enrolled in clinical trials are to continue treatments with an experimental agent(s). However, our study reveals that radiologists at a major cancer hospital failed to accurately apply RECIST. Potential solutions include better training of radiologists in how to utilize RECIST, quality audits to identify reporting deficiencies, and possibly the application of structured reporting methods to facilitate the continuity of radiological information for serial tumor assessment.

CLINICAL RELEVANCE/APPLICATION
Conventional radiology reporting for the application of RECIST needs to be improved with better training of radiologists and/or the use of structured reporting solutions.

LL-INS-TH5B • Automatic Segmentation of the Thoracic Cage Using Rib and in the Volumetric CT Data

Jangpyo Bae MS (Presenter) ; Namkug Kim PhD ; Joon Beom Seo MD, PhD ; Sang Min Lee MD

PURPOSE
The accurate delineation of the thoracic cage region is vital for the various kinds of clinical applications including thoracic cage volumetry and mediastinum fat quantification of patients with chronic obstructive pulmonary disease (COPD). The purpose of this study is to develop and evaluate an automatic segmentation method for the thoracic cage.

METHOD AND MATERIALS
Volumetric CT scans of fifty one patients with chronic obstructive pulmonary disease (COPD) were performed by a 16-multi detector row CT scanner (Siemens Sensation 16) with in 0.75mm collimation. The thoracic cage region was separated from the other region by using the inner thoracic wall and the diaphragm surface by using a 3D surface fitting method. The inner thoracic wall can be composed of 4 exclusive quarter-surfaces of 3D closed thoracic cage made from threshold-based rib segmentation with the ray projection. In the case of diaphragm, the lower surface of each lung was used for input of the 3D surface fitting. Therefore, thoracic cage region was calculated from these five surfaces. Because accuracy of diaphragm surface is low, the supplementary segmentations of the heart and the surrounding fat of that heart were performed by a sphere shape prior level set and a typical level set method respectively with two manual points on the top and bottom of the heart. To assess the accuracy of the proposed algorithm, the segmentation results of 51 patients were compared with those of manual segmentation by an expert thoracic radiologist. Evaluation metrics for segmentation accuracy include volumetric overlap ratio (VOR), false positive ratio on VOR (FPRV), false negative ratio on VOR (FNRV), average symmetric absolute surface distance (ASASD), average symmetric squared surface distance (ASSSD), and maximum symmetric surface distance (MSSD).
CONCLUSION
We proposed the automatic thoracic cage segmentation method with rib, thoracic wall, diaphragm, and heart segmentation with 3D surface fitting in the 3D volumetric CT data, which might be clinically applicable.

CLINICAL RELEVANCE/APPLICATION
Our method would be useful in the various kinds of clinical applications including thoracic cage volumetry, and mediastinum fat quantification of patients with chronic obstructive pulmonary disease.

LL-INE3191-THB • Anonymization and Transmission of DICOM between PACS, Local and Remote XNAT Instances
Jenny Gurney MS (Presenter) ; James Ransford BS ; Kenneth W Clark MBA, MS ; Matthew House ; Mikhail V Milchenko PhD ; Kirk Smith BS ; Daniel S Marcus PhD *

Background
The XNAT imaging informatics platform is increasingly used in clinical translational research. A common requirement in this type of research is to transfer a large number of clinical studies from a DICOM-based PACS into XNAT. In the transmission process, researchers often need to blind the DICOM or anonymize it for public use. This task is typically time-consuming and error-prone. This same workflow is also common in transferring data from one XNAT repository to another. The Joint Anonymization and Archive Transmission (JAAT) tool simplifies and automates this process for XNAT users by integrating several DICOM tools: XNAT Gateway, RSNA CTP, and DCMTK.

Evaluation
DICOM transmission involves various challenges. Typical PACS retrieval tools do not support bulk downloads. Mailing a hard drive is slow and has an increased risk of PHI exposure. PHI sent over the Internet must use a secure connection. DICOM anonymization often requires familiarity with the DICOM Standard as it applies to HIPAA as well as the expertise to implement the standard through methods like id remapping, sequence anonymization and date incrementing. Many research groups may not have the resources to anonymize and transmit DICOM properly. Through the integration of key technologies, JAAT aims to reduce the researcher’s effort in DICOM transfer to the preparation of a single DICOM-XNAT metadata mapping spreadsheet.

Discussion
JAAT has been in operation since December 2012 at the Central Neuroimaging Data Archive (CNDA) at Washington University (WU). XNAT’s flagships deployment. As of mid-March 2013, the tool has been used to anonymize and transmit over 1000 imaging studies for researchers. At WU, JAAT is used in three basic ways: 1. PACS-to-XNAT: Data transmission from the Barnes-Jewish and Children’s Hospitals PACS into the CNDA. 2. XNAT-to-XNAT: Export of anonymized data from CNDA, a private repository, to XNAT Central, a public repository. 3. XNAT Project Cloning: Cloning of an existing CNDA project to a new project while anonymizing the DICOM for a specific audience.

CONCLUSION
JAAT enables researchers using XNAT to request bulk moves of DICOM data between repositories in an efficient, customized, and HIPAA compliant way.

LL-INE3232-THB • Leveraging ‘The Wisdom of Crowds’ in Collaborative Image Diagnosis
David W Piraino MD (Presenter) * ; Daniel W Palmer PhD ; Nancy A Obuchowski PhD ; Michael J Wang MD ; Jennifer Bullen MSC

Background
The phenomenon described as “the wisdom of crowds” posits that a group of individuals working independently on a problem on which they have varying levels of knowledge, can perform better than most of the individuals alone. Their solutions must be aggregated to produce a single solution that can outperform those from experts. Because each individual has some knowledge and some bias, the combination of their solutions should reinforce the knowledge (because it is the same) but cancel out the biases (because they are different). In order for a crowd to exhibit ‘wisdom’, they must attain the characteristics of diversity, and independence. Diversity ensures that many different approaches are considered. Independence prevents specific biases from spreading across the collective. Radiological diagnosis of images, including consults, violate both of these characteristics. We designed an experiment to satisfy these conditions to evaluate whether this phenomenon could be applied to radiology.

Evaluation
Seventy-four musculoskeletal images with surgical proof or proof by follow-up imaging were included. One third were normal, 1/3 were abnormal but easy to diagnosis, and 1/3 were abnormal but considered difficult to diagnose. Seventy musculoskeletal radiologists marked the location of the abnormality and provide a differential diagnosis. Each radiologist evaluated each image separately without knowledge of other responses. A consensus diagnosis was calculated by a computer algorithm. Sensitivities and specificities were calculated for each reader and the algorithmic consensus. The sensitivity of the consensus was greater than the sensitivity of all 12 readers and the consensus specificity was 10% of the readers and equal to the other 2.

Discussion
The algorithmic consensus derived from independent readers had a greater sensitivity than all readers (statistically significant for 4 readers using McNemar’s test at 0.05 level) and had a specificity greater than or equal to all readers (statistically significantly for 4 readers using McNemar’s test).

CONCLUSION
This experiment demonstrates that algorithmic aggregation of individual expert image diagnoses can perform better than individual experts.

LL-INE3189-THB • 3D Deformable Registration of CT Lung Images Based on Point Set and Intensity Information
Wei Xia BEng ; Xin Gao PhD (Presenter) ; Lei Wang PhD ; Zhiyong Zhou ; Ran Zhang BEng

Background
Respiratory movement of the lung may bring trouble to radiation treatment planning and interventional treatment. A pulmonary respiration model needs to be established by 3D deformable registration of CT Lung images. However, such registration process is a difficult and time-consuming task. This work’s aim is to reduce registration time and improve accuracy.

Evaluation
Registration of lung regions was performed on CT images from 4 patients, including 2 patients with nodules and 2 patients without lung disease. Pulmonary surfactant and vessels were first segmented from the lung images. The two parts were represented by point set. Each set of points was registered using coherent point drift (CPD) to obtain corresponding point displacement vectors. Then the squared Euclidean distance between point displacement vectors and the transformation vectors obtained by cubic B-spline was minimized as an objective function by the L-BFGS-B method. In addition, the component of transformation vectors was restricted to a certain size to avoid the folding of the image. Finally, the transformation obtained by point set registration was used as the initial parameters of a intensity information based registration which used mutual information, cubic B-spline and L-BFGS-B. The final transformation is the combination of the transformation derived by point set registration and intensity-information registration. A semi-automatic landmark annotating system was used to generate the corresponding landmarks for evaluating the accuracy by calculating distance error. 150~250 landmarks were detected in each image pair.

Discussion
Compared with the method which was only based on mutual information, the experimental result showed that the proposed method reduced as much as 70% of the time consumption and had smaller (0.5%~13%) distance error.

CONCLUSION
The results demonstrated that the proposed method is able to accomplish deformable registration of 3D CT lung images with less time and better accuracy, which is useful to build pulmonary respiration model and localize the instrument in lung.

LL-INE3187-THB • Perfusion Analysis Software Accuracy Evaluation: A Digital Phantom Based Study
Panagiotis Korfiatis PhD (Presenter) ; Leland S Hu MD ; Zachary S Kelm BS ; Bradley J Erickson MD, PhD *

Background
Perfusion analysis software is widely available in clinical practice, however it is often treated as a black box tool. The values produced are generally accepted, but validation is challenging. The purpose of the current study is to describe an evaluation framework we developed for the accuracy of relative cerebral blood volume (rCBV) measurements from these tools, as well as investigate their robustness to noise, i.e. their ability to perform measurements of data originating from different image acquisition protocols.

Evaluation
Boxplots analysis was performed to provides a visual representation of variation of rCBV values for each noise level considered in this study for tumor with and without leakage respectively. Moderate positive correlations (0.30.7) correction was found for 1 package. In most cases, correlation decreased as the noise level increased.
Discussion
We developed software that would create DSC images simulating a gadolinium bolus into a "brain" with gray matter, white matter, and 4 tumors with varying levels of contrast agent leakage. The software allows us to introduce varying levels of noise, and to alter the appearance of the bolus. For this study, we only alter noise levels. rCBV quantification was performed using three commercially-available software packages (nordicICE, GE FuncTOOL and IB Neuro) on simulated brains with fifteen different levels of Gaussian noise. Furthermore, leakage correction was applied when it was available in the software. For each noise level, 21 simulations were performed. We computed errors in tumor rCBV and the Pearson correlation coefficient (r) was calculated to determine the correlation between the output of each software.

CONCLUSION
Increasing noise degrades the performance of all software packages, some more than others. Leakage-correction improved the accuracy of the rCBV calculation for tissues with contrast leakage. Further investigation is needed to evaluate the use of preprocessing methods as a means to provide robustness to noise.

LL-INE3228-THB • Lung Lobar Segmentation Using an Anatomy-based Priority Knowledge in Low-dose Chest CT: Application to COPD Patients

Sang Joon Park (Presenter) ; Jin Mo Goo MD, PhD * ; Jung Im Kim MD ; Hyun-Ju Lee MD, PhD ; Chang Hyun Lee MD, PhD ; Chang Min Park MD, PhD ; Sang Min Lee MD

Background
Lung lobar segmentation in CT images is a challenging tasks because of the limitations in image quality from parenchymal diseases and CT image acquisition, especially low-dose CT for clinical routine environment. The purpose our study was to propose and explore an automatic segmentation technique for pulmonary lobes and to validate its performance with COPD cases.

Evaluation
Thirty COPD patients were selected for investigating the performance of the lobar segmentation scheme in this study. The images were obtained with low-dose chest CT (40 mAs at 120 kVp) using soft reconstruction kernel (Sensation 16). A PC-based in-house software was developed for fully automated segmentation of the pulmonary lobes using the following steps: First, segmentation of airways, vessels and lungs were performed. Then we extracted minor and major fissures by using eigenvalues-ratio of the Hessian matrix. To enhance and recover the faithful 3-D fissure plane, our proposed fissure-enhancing filter were applied to the images. After finishing above steps, for careful smoothening of fissure planes, 3-D rolling-ball algorithm in xy and xz coordinate planes was performed, respectively.

Discussion
By using 30 chest CT data sets, two expert thoracic radiologists performed visual scoring with 5 scales (0: failure, 1: poor, 2: fair, 3: satisfactory, 4: excellent). The mean scores of right and left lungs were 3.56 ± 1.54 (90%) and 3.40 ± 1.09 (95%), respectively. Results show that our proposed scheme showed better results in the lung lobe than in the right lung. This is due to the fact that 3 cases included large incomplete fissures, another 1 case had a tuberculosis and the others showed fibracite changes adjacent to the fissure planes in the right lung.

CONCLUSION
By using novel lobar segmentation steps comprising decomposition of fissure planes, we could segment pulmonary lobes up to 95% success rate even if some cases showed difficult situations for identifying the normal fissures. This study can be a vital role as a preprocessing step for regional analysis including lobes and pulmonary segments in the lung parenchyma for various lung diseases in the clinical environment.

LL-INE3230-THB • Multi-phase and Multi-planar Liver Segmentation for Living Donor Liver Transplantation in Abdominal Contrast-Enhanced CT Images

Yu Jin Jang BEng (Presenter) ; Helen Hong PhD ; Jin Wook Chung MD *

Background
For liver donor liver transplantation, liver segmentation is difficult due to the variability of its shape across patients and similarity of the density of neighbor organs such as heart, stomach, kidney, and spleen. In this paper, we propose a multi-phase and multi-planar liver segmentation method in portal phase of abdominal contrast-enhanced CT images.

Evaluation
All CT datasets were acquired on ninety-nine living donors using a SIEMENS CT system. Each image had a matrix size of 512x512 pixels with in-plane resolutions ranging from 0.50 to 0.75 mm. The slice thickness ranged from 2.0 to 5.0 mm and number of images per scan ranged from 68 to 320. For extracting an optimal volume circumscribing a liver, lower and side boundaries are defined by positional information of pelvis, rib, and lungs. The upper boundary is defined by separating the lungs and heart from the liver. For extracting an initial liver volume, optimal liver volume is segmented using adaptively selected threshold through the histogram analysis in upper right-hand portion of the abdominal cavity. For removing neighbor organs from initial liver volume, morphological opening and connected component labeling are applied to multiple planes. For the restoration of missing areas in the liver volume of previous step, the location of missing area is automatically detected and boundary refinement technique is applied to the detected areas. The performance of proposed method was evaluated by visual scoring (1=worst, 5=best) of radiologist. The score was 4.89 for right lobe extraction, 4.12 for left lobe extraction, 4.55 for spleen and stomach elimination, and 4.42 for kidney elimination.

Discussion
Our optimal liver volume defines an optimal segmented region and minimizes the leakage of liver border to neighbor organs and abdominal wall. Our neighbor organ elimination based on multi-planar anatomy helps to separate liver region from neighbor organs such as heart, stomach, spleen, and kidney. Our liver boundary refinement technique allows the missing left lobe in previous step to be restored.

CONCLUSION
Our method can be used for the liver volumetry for the pre-surgery planning of living donor liver transplantation.
1. Conventional sequences of MR neurography used for the diagnosis of upper limb peripheral neuropathy
2. Newer sequences of MR neurography used for the diagnosis of upper limb peripheral neuropathy
3. MRI (conventional as well as DWI) findings of traumatic upper limb peripheral neuropathy
4. MR findings of non traumatic upper limb peripheral neuropathy
5. USG appearance of traumatic upper limb peripheral neuropathy
6. USG appearance of non traumatic upper limb peripheral neuropathy
7. MRI and USG correlation
8. Surgical correlation , wherever possible

SUMMARY
Peripheral neuropathies describe damage to nerves of peripheral nervous system which clinically present as sensory or motor weakness. They can be broadly categorized into entrapment neuropathies (resulting from anatomatic constraints at specific location) or non entrapment neuropathies (traumatic, metabolic, infectious, inflammatory etc). The advantage of MRI and USG include establishing the continuity/gap of the nerve in traumatic injuries; defining the cause and secondary changes in cases of entrapment neuropathy. This has a direct bearing on the management decision (surgical vs. conservative) and prognosis.

LL-MKS-TH1B • Diagnostic Accuracy of the Ultrasound for Femoral Hernia

Navaraj Subedi MBBS, FRCR (Presenter) ; Harun Gupta MD ; Philip J Robinson MD

PURPOSE
Early diagnosis of occult femoral hernia in symptomatic patients is crucial due to higher rates of mortality and morbidity. The aim of this study was to evaluate ultrasound accuracy for femoral hernia diagnosis which is not well established in the literature. All studies to date were mainly for inguinal hernias.

METHOD AND MATERIALS
Retrospective analysis of ultrasound positive but clinically occult 38 femoral hernias. Clinical records for all patients were reviewed for surgical verification and clinical follow-up. Surgical findings of a femoral hernia sac or widened femoral canal requiring repair with symptomatic relief post procedure were considered positive for femoral hernia.

RESULTS
Of a total 38 femoral hernias at ultrasound, 31/38 suspected femoral hernias underwent surgical exploration with 29 true positives and 2 false positives at ultrasound. Ultrasound accuracy was 90 %. One patient reported as irreducible femoral hernia at ultrasound was subsequently shown to be post surgical scarring at MRI and hence no surgical exploration was performed. The remaining 7 femoral hernias were deemed unsuitable for surgery because of patient co-morbidities.

CONCLUSION
This study confirms high diagnostic accuracy of ultrasound for non palpable femoral hernia in symptomatic groins when compared to surgical findings

CLINICAL RELEVANCE/APPLICATION
Although ultrasound is operator dependent this should be the first line investigation for patients with suspected femoral hernias when expertise is available.

LL-MKS-TH2B • Ultrasonography-guided Suprascapular Nerve Block Using 0.75% Ropivacaine in Patients with Chronic Shoulder Pain: What Is the Optimal Dose?

Jae Young Kim MD (Presenter) ; Byeong Seong Kang ; Sang Hun Ko ; Nam-Du Ha ; Jae Cheol Hwang ; Young Cheol Weon MD ; Seong Hoon Choi ; Shang Hun Shin MD ; Woon Jung Kwon MD

PURPOSE
The purpose of this study is to determine the optimal dose of 0.75% ropivacaine for an ultrasonography-guided suprascapular nerve block (SNB) in order to manage both pain and disability in patients with chronic shoulder pain.

METHOD AND MATERIALS
This prospective study involved 100 patients with chronic shoulder pain; it was conducted between October 1, 2011 and August 31, 2012. Full-thickness or partial-thickness rotator cuff tear, bursitis or advanced adhesive capsulitis was not seen on MR imaging in any enrolled patients. All patients underwent ultrasonography-guided SNB at our medical institution. These patients were randomly divided into four groups (A – D) of 25 patients each and received infusion of 0.75% ropivacaine. In group A, the SNB was performed using 2.5 ml 0.75% ropivacaine. Group B was injected with 5 ml, group C with 7.5 ml, and group D with 10 ml. Each patient’s outcome was assessed on the basis of the visual analog scale (VAS) scores at rest and on movement, American Shoulder and Elbow Surgeons (ASES) scores, and the ASES scores immediately before the nerve block, immediately following the procedure, one week, and one month following the procedure, respectively.

RESULTS
There was no statistically significant difference among the four groups regarding the VAS scores at rest before the procedure, immediately following the procedure, or at the one-week and one-month follow-up examinations. On the one-month follow-up, the VAS score on movement in the group B patients was significantly different compared to that of group A, however, there was no significant difference compared to the scores of group C and group D. There was also no statistically significant difference in the ASES scores among the four groups before the procedure, immediately following the procedure or on the one-week and one-month follow-up examinations. There were no complications except for one patient in group D whose complaint of mild nausea immediately following the procedure.

CONCLUSION
These data suggest that the optimal volume of 0.75% ropivacaine is 5 ml for ultrasonography-guided SNB in patients with chronic shoulder pain.

CLINICAL RELEVANCE/APPLICATION
The 5ml of 0.75% ropivacaine is the most effective dose for an ultrasonography-guided SNB and is recommended in patients with chronic shoulder pain.

LL-MKS-TH3B • MRI of Acute Soleus Muscles Strains in Patients with Acute Complete Tears of the Anterior Cruciate Ligament

Michael Olson DO, MBA (Presenter) ; Ryan Davies DO ; Alan Rogers MD ; Jason E Payne MD ; Barbaros S Erdal DDS, PhD ; Joseph S Yu MD

PURPOSE
To evaluate the incidence of acute soleus strains associated with an acute rupture of the anterior cruciate ligament.

METHOD AND MATERIALS
The MRI of 87 patients with surgically confirmed complete ACL tears between 2007 and 2012 were retrospectively reviewed for soleus muscle strains, defined as interstitial edema or intramuscular hematoma. Imaging was performed on 1.5 and 3 Tesla MRI scanners. Chronic ACL tears, partial tears, tibial avulsion injuries and ACL graft disruptions were excluded from the study. The images were reviewed by a musculoskeletal radiologist and fellow. The soleus muscle abnormalities were evaluated for location, size, grade, and presence of hematoma.

RESULTS
We evaluated 481 patients (average age of 27.1 years, range 12 to 60 years). 65 patients had grade I strains defined as interstitial edema and 73 patients had grade II strains defined as intramuscular hematoma formation. The incidence of acute soleus strains in our study group was 28.7%. The soleus muscle actively contracts when the tibia begins to translate anteriorly thus aiding in its stabilization, along with the gastrocnemius muscle, by way of the Achilles tendon. This occurs through a vestibulocochlear response. The soleus injury occurs during contraction when an ACL ruptures.

CONCLUSION
The agonist and antagonist properties of the knee bones are important as secondary stabilizers to the integrity of the knee. There is a high incidence of acute soleus strains in patients with complete ACL tears which occurs when the tibia translates anteriorly against eccentric contraction of the soleus muscle.

CLINICAL RELEVANCE/APPLICATION
An understanding of the agonist behavior of the soleus muscle on the knee explains the high incidence of strains in patients with ACL tears.

LL-MKS-TH4B • MRI Grading of Cervical Neural Foraminal Stenosis: Reliability Study with Comparison of 2D Conventional and 3D Isotropic Protocol

Woo Young Kang (Presenter) ; Chang Ho Kang MD ; Kyung-Sik Ahn MD ; Suk-Joo Hong MD ; Baek Hyun Kim MD

PURPOSE
To determine and compare the reliability of 2D and 3D MRI interpretations in cervical neural foraminal stenosis.

METHOD AND MATERIALS
Forty-one patients with possible cervical spinal stenosis prospectively underwent cervical spine MRI in which the protocol included 2D T1 and T2-weighted fast
Inflammatory Pseudotumors: A Hidden Reality for Radiologists

Jon Etxano MD; Pedro Slon MD (Presenter); Maria Paramo Alfaro MD; David Cano MD; Romina Zalazar MD; Isabel Vivas Perez MD; Maite Millor MD

PURPOSE
The purpose of this exhibit is: 1. To review the radiological appearance with histological correlation of inflammatory pseudotumors (IPs) in different locations of the body. 2. To learn about their epidemiology, clinical presentation, differential diagnosis and treatment.

CONTENT ORGANIZATION
1. Introduction
2. Imaging Techniques 3. Inflammatory pseudotumors in different locations of the body (head and neck, lung, hepatic, splenic, gastrointestinal tract, mesenteric and genitourinary) 3.1 Etiology 3.2 Clinical presentation 3.3 Radiological appearance and histological correlation 3.4 Differential diagnosis 3.5 Treatment 4. Conclusion

SUMMARY
Inflammatory pseudotumors conform a rare group of different lesions which are frequently misdiagnosed as malignancies because of their radiological appearance. Radiologists should be aware of this entity to include it in the differential diagnosis of solid tumors, mainly when typical locations are involved.
PURPOSE/AIM
Sialolithiasis is the most common disorder of major salivary glands. Sialography is used to diagnose a blocked salivary gland or duct and has evolved through conventional catheter contrast enhanced radiography to use of digital subtraction radiography, non-enhanced CT, CT sialography and more recently non-invasive MR sialography. In this review we will discuss the technical aspects, procedural failure and complications, benefit and limitations of each modality.

CONTENT ORGANIZATION
We will describe the technical aspects with images describing normal anatomy in each modality. Multiple cases including sialolithiasis, papillary stenosis, strictures, intraglandular sialoelastos and changes related to external compression by tumor will be shown. We will describe the value of lemon juice in MR sialography to stimulate salivation that improves detection of strictures and functional obstruction. Use of interventional sialography procedure for treatment will be reviewed.

SUMMARY
We describe the evolution of different techniques including conventional and CT or MR sialography to image salivary ducts and salivary stone diseases.

LL-NRE-TH7B • Intrathymic Fat-containing Lesions Using CT Imaging with Systemic Literature Review
Hyung Suk Seo (Presenter); Ki Hwan Kim; Younghen Lee MD; Sang-II Suh

PURPOSE/AIM
Fat-containing thymic lesions have been known to be very rare and only several pathologic reports were published. The purposes of this study were to determine the prevalence of intrathymic fat lesions on CT imaging, to analyze the CT appearances and the pathology, and to review previous reports systematically.

CONTENT ORGANIZATION
In 1,205 patients who underwent neck CT scanning for 1 year, 13 patients(M:F=4:9; mean age 44.6±15.2 years) had intrathymic fat-containing lesions, a prevalence of 1.2%. Mean size of the intrathymic fat-containing lesion was 5.7 mm(range: 2.6-10.6 mm). Most of them were nodular-shaped(92%) and homogeneous(92%) with a band connecting to extrathyroid fat(77%) like scoop (Figure). Posterior(85%), medial(85%), and upper (92%) locations of the both thymic lobes were common. In 4 patients who underwent surgery, a fat-containing nodular hyperplasia, an ectopic thymic tissue with mature fat, and an only mature fat tissue were confirmed. In 40 fat-containing thyroid lesions in 15 previous studies, 11 were diffuse lesions and 29 were focal lesions.

SUMMARY
The prevalence of intrathymic fat-containing lesions was 1.2%. Most of them were nodular and homogeneous with fatty bands in posterosmedial location of both upper thyroid lobes. These finding may support the developmental anomaly hypothesis and might prevent unnecessary invasive procedures.

LL-NRE-TH10B • Imaging of Petrous Apex
Santanu Chakraborty FRCR; Wayd Williams; Joseph P O’Sullivan MD; Alain Berthiaume BSc, RT (Presenter)

PURPOSE/AIM
Our HR 3D–DWI has isotropic voxel dimensions that enables reformation in any arbitrary plane. It makes easier anatomical registration with CT images and surgical planning for cholesteatoma.

CONCLUSION
Bony structures. In all patients, the location and extent of the cholesteatoma on the fused images corresponded well with the intraoperative findings. On the fused images, the extent of the cholesteatoma, which was depicted as a conspicuous high intensity lesion could be easily evaluated with background asymmetry. The location and extent of cholesteatomas on the fused images was compared with the intraoperative findings.

CLINICAL RELEVANCE/APPLICATION
Our HR 3D–DWI has isotropic voxel dimensions that enables reformation in any arbitrary plane. It makes easier anatomical registration with CT images and surgical planning for cholesteatoma.

LL-NRE-TH18B • High-resolution Three-dimensional Diffusion-weighted MRI/CT Image Data Fusion for Cholesteatoma Surgical Planning: A Feasibility Study
Koji Yamashita MD (Presenter); Takashi Yoshiura MD, PhD; Akio Hiwatashi MD; Osamu Togao MD, PhD; Kazufumi Kikuchi MD; Hiroshi Honda MD; Nozomu Matsumoto

PURPOSE
To assess the feasibility of high-resolution three dimensional diffusion-weighted images (HR3D–DWI) / multi–detector row CT (MDCT) images data fusion for surgical planning for cholesteatoma.

METHOD AND MATERIALS
A total of 14 patients (M/F= 7/7, age 11 to 72 years, mean 42.5 years) with acquired cholesteatoma underwent preoperative MRI using a 3.0 T clinical unit and an 8-channel head coil. For each subject, HR3D–DWIs were obtained using a turbo field–echo with diffusion–sensitized driven-equilibrium prepartion with following parameters: TR/TE = 6.2/3ms, FA = 10°, ETL = 75, b factor = 800x/mm2, voxel size = 1.5x1.5x1.5mm3, NEX = 2, SENSE factor = 2, and acquisition time = 5min19s. These patients also underwent MDCT with a slice thickness of 0.5mm. Fusion of the HR3D–DWIs and MDCT images was performed using a landmark rigid registration method by a board–certified neuroradiologist on a workstation. The location and extent of cholesteatomas on the fused images was compared with the intraoperative findings.

RESULTS
On the fused images, the extent of the cholesteatoma, which was depicted as a conspicuous high intensity lesion could be easily evaluated with background bone structures. In all patients, the location and extent of the cholesteatoma on the fused images corresponded well with the intraoperative findings.

CONCLUSION
Image fusion between HR3D–DWI and MDCT images is feasible, and provides valuable preoperative information for surgical planning to otolaringologists.

CLINICAL RELEVANCE/APPLICATION
Our HR 3D–DWI has isotropic voxel dimensions that enables reformation in any arbitrary plane. It makes easier anatomical registration with CT images and surgical planning for cholesteatoma.
Jae Young Seo ; Keum Won Kim MD (Presenter) ; Hee Jung Moon MD ; Eun-Kyung Kim ; Jin Young Kwak MD

PURPOSE
Combination of the BRAFV600E mutation with cytologic results can improve the diagnostic performance of papillary thyroid carcinoma (PTC). However, it is unclear whether routine molecular tests should be done considering cost-effectiveness. Therefore, we investigated the additional diagnostic yield of the mutation test and evaluated the frequency of the BRAF mutation in conventional PTC (cPTC) according to US features and the Bethesda System for Reporting Thyroid Cytopathology (BSRTC) based on the BRAFV600E mutation status confirmed through cytologic or resected tumor samples.

METHOD AND MATERIALS
During the study period, 279 patients who underwent FNA with an additional BRAFV600E mutation test were diagnosed as conventional PTC after surgery. We analyzed the association between the mutation and several clinical factors.

RESULTS
Of the 279 cPTCs, 250 (89.6 %) had the BRAFV600E mutation. Among the clinicopathologic features, only taller than wide shape showed a statistically significant association with the mutation (P = 0.029). Among PTCs with the BRAFV600E mutation, the highest detection rate of the mutation in FNA washouts was 96.2 % in PTCs with malignant cytology. The detection rates of the mutation in FNA washouts of PTCs with the BRAFV600E mutation were statistically different according to the BSRTC. Among PTCs except for ones of malignant cytology, 53 PTCs showed the mutation in FNA washouts. The BRAF mutation test was helpful in diagnosing an additional 19% (53/279) of PTCs. When we evaluated the frequency of the BRAF mutation in PTCs based on US features according to the BSRTC, the frequency of the BRAF mutation in cPTCs with suspicious US features was higher than that of cPTCs with negative US features regardless of the BSRTC.

CONCLUSION
A routine additional BRAFV600E mutation test may have a limited role in diagnosing PTCs. Instead, suspicious US features may be helpful in deciding whether an additional BRAFV600E mutation test should be done in thyroid nodules with indeterminate cytology.

CLINICAL RELEVANCE/APPLICATION
The BRAFV600E mutation test is a very useful additional tool to FNA for diagnosing papillary thyroid carcinoma (PTC).

LL-NRS-TH3B • Application of Serial Dynamic Contrast-enhanced Magnetic Resonance Imaging (DCE-MRI) in Early Predicting Chemoradiotherapy Response of Nasopharyngeal Carcinoma
Chen Yunbin MD ; Dechun Zheng MS (Presenter) ; Xiangli Liu BS ; Luying Xu BS ; Weibo Chen MSC ; Queenie Chan PhD ; Jianji Pan

PURPOSE
To prospectively evaluate the feasibility of acquiring serial DCE-MRI in early predicting chemoradiotherapy (CRT) response of nasopharyngeal carcinoma (NPC).

METHOD AND MATERIALS
Thirty-five patients with stage III and IV NPC underwent 5 MRI scans at baseline (Pre-Tx), 3 days (Day3-Tx) and 20 days (Day20-Tx, one cycle of NAC) after neoadjuvant chemotherapy (NAC) initiation, 6 days after radiotherapy initiation (Day50-Tx) and at terminal of CRT (Post-Tx) respectively. Kinetic parameters (Ktrans, Kep, Ve, and Vp) were calculated based on extended Tofts model. Tumor response after NAC and definite CRT were assessed and categorized respectively into stable disease (SD), partial response (PR) or completed response (CR) based on WHO criteria. Kinetic parameters at Pre-Tx and Day20-Tx and their changes during chemoradiotherapy (2-DX) were compared between responders and non-responders using student t test or Mann-Whitney U test. The diagnosis accuracies of kinetic parameters were calculated with receiver operating characteristic curve (ROC) analysis.

RESULTS
A total of 146 scans were acquired. Two patients withdrew due to serious motion. After NAC, 8 of 33 patients were categorized into PR; and 21 of 31 into CR at the end of CRT. The PR group after NAC had significantly higher median Ktrans and Kep values at Pre-Tx (p < .01). The MD group had significantly lower median Ve values at Pre-Tx (p < .01). Five of 7 subjects showed increase in number of connections among regions in the sensorimotor network from M1 to M3. Four out of 7 subjects showed significant increase in connection strength from M1 to M2 and from M1 to M3 (corrected for multiple comparisons, fdr method, p < .01). Five of 7 subjects showed increase in number of connections among regions in the sensorimotor network from M1 to M3.

CONCLUSION
This pioneering DCE-MRI based study showed that early non-invasive monitoring of NPC therapy response was feasible. Particularly, pretreatment Ktrans and Kep and earlier changes during therapy were valuable imaging predictors of NPC.

CLINICAL RELEVANCE/APPLICATION
Serial DCE-MRI scan and analysis during CRT process is useful strategy to evaluate and predict tumor response to NAC and CRT in NPC. Ktrans and Kep might become potential prognostic indicators of NPC.

LL-NRS-TH4B • Changes in Resting-state Functional Connectivity Following BCI-EEG Based Intervention in Sub-acute and Chronic Stroke Patients
Veena A Nair PhD (Presenter) ; Jie Song MS ; Brittany Young ; Leo Walton ; Scott Grogan BS ; Justin Sattin ; Dorothy Farrar-Edwards ; Justin Williams ; Vivek Prabhadhakaran MD, PhD

PURPOSE
We used BCI-EEG driven functional electrical stimulation(FES) of the affected arm, and tone stimulation(TS) to facilitate upper extremity movement following ischemic stroke. We examined changes in resting state functional connectivity MRI (rs-fcMRI) in the sensorimotor network using 10 minutes eyes-closed resting fMRI. Additionally, we investigated brain-behavior correlation between rs-fcMRI and self-reported measures of hand strength as assessed by the Stroke Impact Scale(SIS).

METHOD AND MATERIALS
Seven patients (mean age = 64 yrs, 4 males, 6 left hemisphere strokes, between 3 months to 23 months from stroke onset) with persistent mild to severe upper extremity impairment following ischemic stroke received intervention(2 hrs/session, maximum of 15 sessions over 5-6 weeks) using BCI-EEG driven TS and FES. rs-fcMRI images were acquired on a GE 3T MRI scanner as subjects lay in the scanner with eyes closed at 3 time-points- pre(M1), mid(M2), and immediately post intervention(M3). Rs-fcMRI involving connections among 22 regions in the sensorimotor network were examined. The SIS was administered before each scanning session.

RESULTS
Four out of 7 subjects showed significant increase in connection strength from M1 to M2 and from M1 to M3(individual analysis corrected for multiple comparisons, fdr method, p < .01). Five of 7 subjects showed increase in number of connections among regions in the sensorimotor network from M1 to M3. Change in connection strength from M1 to M2 moderated with change in hand strength domain of the SIS(r2 = 0.42, r = .65).

CONCLUSION
BCI-EEG driven intervention targeted at the sensorimotor network leads to increase in functional connectivity strength as well as the number of connections. These data suggest that BCI-EEG driven FES and TS intervention may promote brain plasticity in sub-acute and chronic stroke patients with variable clinical characteristics.

CLINICAL RELEVANCE/APPLICATION
Analysis of resting state functional connectivity in the sensorimotor network following post-stroke therapy using a brain-computer-interface (BCI)-EEG driven intervention may identify functional come

LL-NRS-TH5B • Evaluation of WBAA with Registration-based Cube Propagation for Brain Atrophy Quantification
Martin Lillholm MSc, PhD (Presenter) ; Akshay Pai ; Lauge Sorensen ; Mads Nielsen PhD * ; Jon Sporring * ; Sune Darkner ; Erik B Dam PhD

PURPOSE
Atrophy for the whole brain and sub-structures is becoming common as study outcome in clinical trials assessing the efficacy of potential treatments of diseases involving dementia. In this study, we evaluated the sensitivity to change related to progression of Alzheimer’s disease of a novel software framework, WBAA.

METHOD AND MATERIALS
The recently defined Alzheimer's disease neuroimaging initiative (ADNI) standardized collection ('ADNI1:Annual 2 Yr 1.5T' at adni.loni.ucla.edu) with 504 subjects (169 normals, 544 mild cognitively impaired, 101 Alzheimer) including baseline and 12-month 1.5T T1 magnetic resonance imaging (MRI) scans was used. The MRIs were processed using longitudinal FreeSurfer and the whole brain atrophy application (WBAA 1.0 by Biomediq) that performs non-rigid registration followed by atrophy estimation quantification using cube propagation (CP). The WBAA was also evaluated with CP replaced by the common Jacobian integration (JI) method. Sensitivity to change was evaluated by atrophy differences between healthy and Alzheimer subjects quantified using Cohen's D and required study sample sizes.

RESULTS
leads to advantages of preoperative planning.
As example, quantifications of the hippocampus atrophies estimated using WBAA were -1.3% and -0.6% for the Alzheimer and healthy subjects whereas the ventricle estimates were +9.3% and +4.1%, respectively. Corresponding Cohen's D for WBAA on these two regions were 1.1 and 1.0. For whole-brain, hippocampus, ventricles, and medial temporal lobe, the WBAA Cohen's D were 0.7, 1.1, 1.0, and 1.3. The corresponding sample sizes were 173, 124, 113, and 67. For WBAA with JI, Cohen's D were 0.5, 1.1, 1.0 and 1.2; with sample sizes 230, 139, 112, and 101. For longitudinal FreeSurfer, Cohen's D were 0.7, 1.0, 1.0, and 1.3; with sample sizes 183, 152, 118, and 102.

CONCLUSION
The WBAA using CP for brain atrophy quantification provided sensitivity equal or superior to leading, competing methods. Specifically, the WBAA sample sizes were generally lower.

CLINICAL RELEVANCE/APPLICATION
Unlike longitudinal FreeSurfer, WBAA allows quantification of final atrophy estimates directly after each visit. Adding the matching/improved sensitivity, WBAA seems appropriate for clinical trials.

LL-NRS-TH6B • The Role of Us Estrogas in the Differential Diagnosis of Nodules Associated with Chronic Thyroiditis

Evsen Polattas Solak MD (Presenter); Suna O Oktar MD; Emetullah Cinli MD; Doga Ozdemir MD; Cem Yucel MD

PURPOSE
The aim of this study was to evaluate diagnostic performance of US elastography in differentiating benign and malignant thyroid nodules in the background of chronic thyroiditis and to compare it with grey scale US and Doppler findings.

METHOD AND MATERIALS
Patients with chronic thyroiditis who had a coexisting nodule that was proven by fine needle aspiration or surgical pathologic analysis to be benign or malignant were included in the study. The US elastographic image was matched with an elasticity color scale and nodules were classified into 4 groups using elasticity score. In addition, parenchyma to tumor strain ratio (strain index) was calculated. Grey scale properties (internal structure, echogenicity, presence or absence of hypoechoic halo sign, microcalcifications, 'taller than wide' sign), vascularity scores, elasticity scores and mean strain ratios of all nodules were compared with their pathologic diagnosis.

RESULTS
Sixty seven of all nodules were benign and seven were malignant. Five of all malignant nodules were papillary carcinoma, one of them was lymphoma and one of them was thyroid carcinoma including different differentiation areas (papillary carcinoma+epidermoid carcinoma+sarcomatous component).

Hypoechogenicity or hypochoic halo sign, microcalcifications, 'taller than wide' sign and irregular course of vascular structures were statistically related with malignancy. There was a statistically significant relation between high elasticity score and malignancy. We determined 6.16 as the cut-off point of the strain ratio. There was a statistically significant difference between the nodules with the strain ratio above and below 6.16. Solid internal structure, hypochoegnecy, absence of hypoechoic halo sign, microcalcifications, 'taller than wide' sign and irregular course of vascular structures in nodule had the highest sensitivity (100%); the strain ratio above 6.16 had the highest specificity (100%) among all nodule characteristics.

CONCLUSION
Strain ratio values of malignant nodules with chronic thyroiditis is higher than the values of malignant nodules developing at the background of normal thyroid parenchyma. US elastography is an assisting imaging technique to differentiate benign and malignant nodules associated with chronic thyroiditis.

CLINICAL RELEVANCE/APPLICATION
US elastography can be used to differentiate malignant nodules from benign nodules associated with chronic thyroiditis, especially in focal thyroiditis which can mimic carcinoma in gray scale features.


Jesse Tanguay (Presenter); Seungman Yun; Ian A Cunningham PhD

PURPOSE
Advances in x-ray detector technology are leading to the development of energy-resolving photon-counting (EPC) detectors with the potential to determine the energy spectrum of interacting photons. These devices carry the promise of advanced spectroscopic procedures such as energy-resolved angiography to generate iodine-specific images from a single exposure without the need for a pre-injection mask image and thereby reduced motion artifacts. However, there are a number of challenges that must be overcome before the full benefits of EPC detectors can be achieved. The purpose of this study is to describe the extension of cascaded systems analysis (CSA), widely used for the description of image noise and detective quantum efficiency of conventional systems, to describe signal and noise in energy-resolving detectors.

METHOD AND MATERIALS
1.0, and 1.3; with sample sizes 183, 152, 118, and 102.
The CSA approach is used to describe mechanisms of energy deposition in the detector with the objective of predicting detector performance. It is shown this can be achieved by propagating the probability density function (PDF) of the number of secondary image quanta through each stage of a cascade of image-forming processes. This results in the PDF of the number of detected image quanta and incorporates the statistical properties of each process on the absorbed energy spectrum. This approach is used to include emission and reabsorption of characteristic and Compton scatter, conversion to secondary quanta, incomplete collection of secondary quanta, and additive electronic noise. The mean and variance in the number of detected photons in energy-bin data is calculated. Comparisons are made with Monte Carlo (MC) calculations.

RESULTS
The CSA approach agrees very well with MC calculations. In general, our analysis suggests that detectors with poor collection efficiencies and high additive noise will result in loss of photon counts from low-energy bins and escape of Compton scatter x rays will result in loss of photon counts from high-energy bins.

CONCLUSION
The CSA approach allows for an accurate understanding of the distribution of detected photon energies obtained with EPC detectors, critical for an evaluation of detector performance and the development of new detector designs.

CLINICAL RELEVANCE/APPLICATION
Models of signal and noise in energy-resolving photon-counting detectors are required for the development and evaluation of new detectors for advanced radiographic procedures.

LL-PHS-TH2B  •  Assessing Needle Accuracy of Stereotactic Breast Biopsy Equipment
Zheng Shi PhD (Presenter)

CONCLUSION
A new phantom is proposed to replace the gelatin phantom for the needle accuracy test on stereotactic breast biopsy equipments. It gives a qualitative result that is a measurable distance between the needle tip and target instead of a visual estimation. The ACR 1 mm accuracy criterion can be assessed.

Background
The ACR stereotactic breast biopsy accreditation program requires a needle accuracy test by using a gelatin phantom. The sampling aperture must be within 1 mm of the simulated lesion. The large target is always ‘grabbed’ by a large size needle. The method is essentially a visual check that does not yield a qualitative result. The intrinsic system accuracy is virtually impossible to assess.

Evaluation
The new phantom is inelastic and made of styrofoam. An aluminum foil and a thin plastic film are sandwiched between two styrofoam blocks. To simulate a microcalcification target, a small hole of about 1 mm diameter is poked on the aluminum foil. A real needle without a vacuum system is used. The small hole on images is calculated for the position. After the needle aims at the target, the needle is pushed manually until the needle tip just touches the aluminum foil. The needle tip mark on the foil is simply compared with the pre-made hole location. The off target distance is measured using a loupe with a scale. In the past 5 years, author has using this method at multiple. In contrary to the gelatin phantom that resulted almost ‘all pass’. The styrofoam phantom yields a 75% overall pass rate. For a single unit, some show consistent high pass rate. Other show consistent high fail rate. The needle tip off the target more than 1 mm usually indicates poor calibration, loose needle holder and guide.

Discussion
A successful result will require the needle tip just marking the foil without piercing a large hole. It can be achieved by control the push force, using a thicker plastic film so the tip will not go deeper, using a multimeter and displayed depth data to control the needle stop. Before the test, one must make sure that there is no excessive movement of the needle holder and guide.

LL-PHS-TH3B  •  An X-ray Phase Contrast Method Suitable for Clinical Translation
Alessandro Olivo (Presenter) ; Marco Endrizzi PhD ; Spyros Gkoumas PhD ; Charlotte Hagen ; Magdalena Szafraniec MSc ; Paul C Diemoz PhD ; Peter Robert Thomas Munro PhD ; Julie Horrocks PhD ; Massimo Marenzana PhD ; Sarah J Vinnicombe MRCP, FRCR ; Louise Jones MBCh, PhD ; Robert Speller PhD *

CONCLUSION
Our system, built with commercially available components, provides significantly enhanced image quality and feature detection over conventional methods, at doses, exposure times and alignment requirements compatible with a clinical environment. We thus believe it can be translated into clinical practice quickly and with minimal engineering investment.

Background
Much effort has been devoted to the translation of X-ray Phase Contrast Imaging (XPCI) into clinical practice. Thus far, this has not been successful, as all proposed implementations (e.g. grating interferometry) require excessive delivered dose, excessive exposure times, alignment requirements on the nanometer scale, incompatible with a clinical setting.

Evaluation
We previously adapted the edge-illumination XPCI technique for use with conventional sources, through two x-ray masks placed either side of the sample. We have now modified the system to reduce the delivered dose without affecting phase sensitivity, by employing a narrower aperture in the pre-sample mask and a smaller displacement between masks. The pre-sample mask protects the sample from unwanted dose, whilst the smaller aperture size preserves phase sensitivity. We used the system to image breast tissue and cartilage specimens in vitro, showing significant enhancements over conventional absorption methods.

LL-PHS-TH4B  •  Performance Assessment of a New CT Detector with Minimal Electronic Noise for Low Dose Abdominal Perfusion Imaging
Ernst Klotz DiplPhys (Presenter) * ; Ulrike Haberland * ; Bernhard Schmidt PhD *

PURPOSE
80 kV are not routinely used for abdominal CT perfusion imaging with conventional detectors because non-linear effects occur when the electronic noise of the detector dominates the measured signal. We evaluated a new detector design (Stellar, Siemens Healthcare) with minimal electronic noise for this special application.

METHOD AND MATERIALS
Inserts with iodine concentrations of 0.5, 1.0 and 15 mg/ml were placed in a 30 and a 40 cm water phantom. Both phantoms were examined with 100 kV and 80 kV on two otherwise identical scanners equipped with a conventional and a Stellar detector (SOMATOM Definition Flash). Scans were performed using dynamic modes (scan duration 30 s). We varied mAs per time point from 15 to 300 (CTDIdvol 0.3 to 12 mGy) and measured image noise and iodine contrast. As noise/\sqrt{CTDIdvol} is constant for Poisson distributed photon noise at the same kV, we determined when this product started to increase as an indicator of the onset of relevant electronic noise. We also compared iodine contrast-to-noise ratios (CNR) between 100 kV and 80 kV in order to determine mAs settings of equal performance.

RESULTS
Noise was at least 14% lower for the Stellar detector at all kV and mAs settings. For the conventional detector at 80 kV electronic noise became dominant below 1.2 mGy for the 30 cm phantom and below 6 mGy for the 40 cm phantom with increasingly prominent visual artifacts if dose was further reduced. For the Stellar detector at 80 kV dose could be reduced to 0.3 mGy for 30 cm and to 2 mGy for 40 cm without electronic noise contamination and without any visual artifacts. Using 80 kV the same CNR and image quality of the clinical default setting of 100 kV were obtained at 60% (30 cm phantom) and at 65% (40 cm phantom) of the dose.

CONCLUSION
The Stellar detector allows the routine use of 80 kV for abdominal perfusion imaging. Depending on patient size this reduces the dose by 35% to 40% compared to the current standard of 100 kV at identical CNR and image quality.

CLINICAL RELEVANCE/APPLICATION
With the Stellar detector 80 kV can be safely used for routine abdominal perfusion imaging without any reduction in CNR or image quality at up to 40% lower dose values.

LL-PHS-TH5B  •  A Dynamic-programming Projection-domain Extrapolation Method for CT Wide-Cone Reconstruction
Paulo R Mendonca PhD (Presenter) * ; Zhye Yin * ; Bruno De Man PhD *

PURPOSE
In a circular cone-beam scan, voxels in regions at the edge of a volume (typically corresponding to the initial and final z positions) are not always in the path of the x-ray beams during the rotation of the x-ray source, and these gaps in projection data result in "z-truncation artifacts" during reconstruction. Such artifacts are often mitigated through projection-based extrapolation methods, a critical step in reconstruction algorithms for wide-cone CT geometries. The most common of these extrapolation methods is the copying of the initial and final rows of projection data, or "extrapolation by duplication. \end{quote}
METHOD AND MATERIALS

The limitations of extrapolation by duplication motivate the search for a method that considers the local smoothness of projection data. In the dynamic-programming extrapolation method, a set of transformations that maps sequences of nearby rows at either edge of the projection data is estimated through the minimization of spatial and intensity distortion between two transformed input rows and a target row. This optimization problem is solved through dynamic programming, guaranteeing global optimality. Once the optimal mappings are estimated, extrapolation is carried out by applying the transformations to the edge rows of the data, thereby creating virtual rows that follow the trend of the data on immediately adjacent areas.

RESULTS

We applied the dynamic-programming extrapolation approach to simulated dynamic nCT chest phantom data with wide-cone geometry and a cone angle of 14.6 degrees. Both pre-filtered and filtered views were processed to generate additional 6 rows at top and bottom edges of the projection data, for a total of 12 extrapolated rows. The augmented data were reconstructed using Advanced Wide-Cone Filtered Backprojection to improve the image quality of the edge slices.

CONCLUSION

We developed a projection-domain method for row-extrapolation technique based on estimating optimal extrapolation functions via dynamic programming. The method is effective to mitigate the truncation artifacts of CT reconstructions, particularly for wide-cone geometries, resulting in weaker truncation artifacts from highly attenuating anatomical features while maintaining CT values elsewhere.

CLINICAL RELEVANCE/APPLICATION

In CT geometry with cone angle as large as 14.6 degree, z-truncation artifacts become one of limiting factors to achieve full diagnostic image quality at edge slices.

PHS-TH6B • Non-ECG-assisted High-pitch Dual Source MDCT Angiography of the Thoracoabdominal Aorta: How Does the Radiation Dose and Noise Compare to Standard-pitch MDCT in Different Size Patients?

Achille Mileto MD (Presenter); Rendon C Nelson MD *; Lynne M Hurwitz MD *; Juan Carlos Ramirez Giraldo PhD; Kingshuk Roychoudhury; Danielle Seaman MD; Jared D Christensen MD; Daniele Marin MD

PURPOSE

To investigate within the same patient the relationship between radiation dose and noise to patient body size in thoracoabdominal aortic CT angiography (CTA), using non-ECG-assisted high-pitch dual-source and standard-pitch acquisitions.

METHOD AND MATERIALS

This HIPAA-compliant retrospective study received IRB approval with a waiver of informed consent. Fifty consecutive patients (29 men, 21 women; mean age, 68 years ± 13 standard deviation (SD); mean body mass index (BMI), 29.9 kg/m2 ± 7) underwent clinically-indicated CTA of the thoracoabdominal aorta using a second-generation dual-source system. Standard-pitch (pitch=0.8) unenhanced acquisition was followed by a non-ECG-assisted high-pitch (pitch=1.6-3.0;mean, 2.8±0.2) dual-source contrast-enhanced acquisition. Radiation dose was calculated for each patient as CTDIvol and size-specific dose estimate (SSDE). Noise was measured as voxel SD from a region-of-interest in the subcutaneous fat of the thoracic and abdominal wall. The relationship between CTDIvol, SSDE, and noise as a function of BMI was assessed using linear regression models.

RESULTS

Mean CTDIvol and SSDE (±SD) were significantly lower with high-pitch compared to standard-pitch acquisition (8.2±1.0 vs 10.6±3.0 mGy and 9.0±1.5 vs 11.2±2.1 mGy, respectively [P<0.05]). The noise was significantly lower in the abdomen in the high-pitch mode (8.0±1.5 vs 11.2±2.1 mGy, respectively [P<0.05]) as well.

CONCLUSION

Non-ECG-assisted high-pitch dual-source acquisition for aortic CTA yields lower radiation dose, at the cost of higher noise in large patients.

CLINICAL RELEVANCE/APPLICATION

Radiologists should be aware of the higher noise using high-pitch settings in large patients, likely reflecting limitation of the scanner output.

PHS-TH7B • A MR-compatible Laparoscope and Pneumatic Bone-drill for Real-time MR-guided Interventions and Orthopaedic Surgery

Felix V Guettler (Presenter); Kim Winterwerber; Christian Seebauer; Jens Rump; Andreas Heinrich; Ulf K Teichgraeber MD

CONCLUSION

Real-time MR-image guidance using an MR-compatible laparoscope or bone-drill is feasible. Professional manufacturing methods might allow better handling and performance of the introduced devices.

Background

The background of this proof-of-concept study is to demonstrate the feasibility of complex RT-MR-guided interventions and orthopedic surgery developing prototype MR-compatible surgical equipment applying to pre-clinical MR-guided methods i.e. bone biopsies or retrograde drilling of the talus.

Evaluation

Laparoscope: Ex-vivo phantoms (n=5) with lumbar vertebral segments were treated using interactive PDw TSE with a custom-made surgical coil (Philips Research, HH, Germany). MR- and corresponding endoscopic images were displayed on two in-room monitors. For the laparoscope and endoscopic subsystem an artifact-free internal calibration was performed. High-pitch (pitch=2.0) and low-pitch (pitch=2.6) images were acquired with a 120° field of view and a matrix of 512x512. The acquisition was performed using a 1.5T MR system (Philips Healthcare). All probes (n=5) were able to completely extract marked disc tissue from the phantom. Bone drill: MR-compatibility and -artifacts were determined. The bone-drill prototype is fully MR-compatible according to ASTM F2503 and is almost transparent to x-ray. The drill has a weight of 0.8kg and a variable speed of 0-625rpm. The torque amounted a max. of 0.4Nm resulting in a power of 15W. The operating pressure is 6-7bar with an air consumption of ca. 250l/min. The noise level in operator position is 60dB(A). The autoclave of the drill at 134°C and 2bar proceeded without any impairment of the function.

Discussion

The development of a MR-compatible laparoscope and bone-drill might allow MR-guided methods using an additional intraoperative view of the inner organ with high soft-tissue contrast. Also an X-ray transparent bone-drill might allow intraoperative CT-imaging.

PHS-TH8B • Advanced Glycation End-Products: A Novel Therapeutic Target for Radiation Toxicity

Colin E Champ LL-PHS-TH8B • LL-PHS-TH7B • LL-PHS-TH6B • Noise Compare to Standard-pitch MDCT in Different Size Patients?

Evan E Wray MD (Presenter); Kim Winterwerber; Christian Seebauer; Jens Rump; Andreas Heinrich; Ulf K Teichgraeber MD

PURPOSE

To investigate within the same patient the relationship between radiation dose and noise to patient body size in thoracoabdominal aortic CT angiography (CTA), using non-ECG-assisted high-pitch dual-source and standard-pitch acquisitions.

METHOD AND MATERIALS

This HIPAA-compliant retrospective study received IRB approval with a waiver of informed consent. Fifty consecutive patients (29 men, 21 women; mean age, 68 years ± 13 standard deviation (SD); mean body mass index (BMI), 29.9 kg/m2 ± 7) underwent clinically-indicated CTA of the thoracoabdominal aorta using a second-generation dual-source system. Standard-pitch (pitch=0.8) unenhanced acquisition was followed by a non-ECG-assisted high-pitch (pitch=1.6-3.0;mean, 2.8±0.2) dual-source contrast-enhanced acquisition. Radiation dose was calculated for each patient as CTDIvol and size-specific dose estimate (SSDE). Noise was measured as voxel SD from a region-of-interest in the subcutaneous fat of the thoracic and abdominal wall. The relationship between CTDIvol, SSDE, and noise as a function of BMI was assessed using linear regression models.

RESULTS

Mean CTDIvol and SSDE (±SD) were significantly lower with high-pitch compared to standard-pitch acquisition (8.2±1.0 vs 10.6±3.0 mGy and 9.0±1.5 vs 11.2±2.1 mGy, respectively [P<0.05]). The noise was significantly lower in the abdomen in the high-pitch mode (8.0±1.5 vs 11.2±2.1 mGy, respectively [P<0.05]) as well.

CONCLUSION

Non-ECG-assisted high-pitch dual-source acquisition for aortic CTA yields lower radiation dose, at the cost of higher noise in large patients.

CLINICAL RELEVANCE/APPLICATION

Radiologists should be aware of the higher noise using high-pitch settings in large patients, likely reflecting limitation of the scanner output.

PHS-TH9B • A MR-compatible Laparoscope and Pneumatic Bone-drill for Real-time MR-guided Interventions and Orthopaedic Surgery

Felix V Guettler (Presenter); Kim Winterwerber; Christian Seebauer; Jens Rump; Andreas Heinrich; Ulf K Teichgraeber MD

CONCLUSION

Real-time MR-image guidance using an MR-compatible laparoscope or bone-drill is feasible. Professional manufacturing methods might allow better handling and performance of the introduced devices.

Background

The background of this proof-of-concept study is to demonstrate the feasibility of complex RT-MR-guided interventions and orthopedic surgery developing prototype MR-compatible surgical equipment applying to pre-clinical MR-guided methods i.e. bone biopsies or retrograde drilling of the talus.

Evaluation

Laparoscope: Ex-vivo phantoms (n=5) with lumbar vertebral segments were treated using interactive PDw TSE with a custom-made surgical coil (Philips Research, HH, Germany). MR- and corresponding endoscopic images were displayed on two in-room monitors. For the laparoscope and endoscopic subsystem an artifact-free internal calibration was performed. High-pitch (pitch=2.0) and low-pitch (pitch=2.6) images were acquired with a 120° field of view and a matrix of 512x512. The acquisition was performed using a 1.5T MR system (Philips Healthcare). All probes (n=5) were able to completely extract marked disc tissue from the phantom. Bone drill: MR-compatibility and -artifacts were determined. The bone-drill prototype is fully MR-compatible according to ASTM F2503 and is almost transparent to x-ray. The drill has a weight of 0.8kg and a variable speed of 0-625rpm. The torque amounted a max. of 0.4Nm resulting in a power of 15W. The operating pressure is 6-7bar with an air consumption of ca. 250l/min. The noise level in operator position is 60dB(A). The autoclave of the drill at 134°C and 2bar proceeded without any impairment of the function.

Discussion

The development of a MR-compatible laparoscope and bone-drill might allow MR-guided methods using an additional intraoperative view of the inner organ with high soft-tissue contrast. Also an X-ray transparent bone-drill might allow intraoperative CT-imaging.

PHS-TH10B • Advanced Glycation End-Products: A Novel Therapeutic Target for Radiation Toxicity

Colin E Champ MD (Presenter)

RADIATION ONCOLOGY AND RADIATION BIOLOGY – Thursday Posters and Exhibits (12:45pm - 1:15pm)

Thursday, 12:45 PM - 01:15 PM • Lakeside Learning Center

LAKESIDE LEARNING CENTER

Back to Top
RESULTS
Results: Sixteen children (5 girls and 11 boys) were tested. The mean age at transplant was 11.8 years (range 3-20 years). At a mean of 4.4 years post-transplant, the mean overall IQ was 104.9 (range 84-143), and mean change in IQ for those tested pre- and post-transplant was +4.8 points (range -1 to +91). The mean post-transplant total academic achievement score was 99.6 (range 80-148). 5/16 children were noted to have significant relative deficiencies in processing speed on post-transplant testing, and 4/16 patients had deficits in working memory.

CONCLUSION
Conclusion: In a series of 16 children with ALL and CNS involvement treated with TBI plus CSI prior to SCT, neurocognitive testing revealed normal post-transplant IQs. Mean post-transplant total academic achievement scores were also normal. Nearly one-third of children were found to have deficits in processing speed and/or working memory when tested after transplant, although the number of patients available for comparison with both pre- and post-transplant testing is small.

CLINICAL RELEVANCE/APPLICATION
Clinical Relevance: Children with ALL and CNS involvement appear to have normal IQs after TBI plus CSI prior to SCT; further study of effects on processing speed and working memory is warranted.

LL-ROS-TH3B ● Solitary Fibrous Tumors: Radiographic and Pathologic Responses to Neoadjuvant Radiotherapy
Laura E Kollar MD (Presenter) ; Alina Bischin ; Ashley Gullett ; Andrew D Trister MD, PhD ; Stephanie Punt ; Ernest Conrad MD ; Gabrielle Kane MB, EdD, FRCP ; Edward Y Kim MD

PURPOSE
Solitary fibrous tumors (SFT) are rare tumors, historically managed by surgery, with little data available regarding their response to radiotherapy (RT). We set out to review treatment effects of neoadjuvant RT and to investigate the correlation between radiographic and pathologic response.

METHOD AND MATERIALS
We identified 87 patients with diagnosis of SFT through 2 prospectively collected databases (2000-13). Of those, 5 were treated with RT followed by surgical resection. Pathology and imaging were available for all patients. RECIST was utilized to determine response to treatment. Volumetric analysis was performed using MIM Software.

RESULTS
2 patients were male, 3 female. Average age at diagnosis was 57 years (range 34-72). 2 were extremity, 2 were pelvic, and 1 was pleural based. Histologically, 3 were benign/low grade and 2 were malignant. Median pre-RT tumor size was 12 cm in maximal dimension (range 6-29), with average volume of 1819.4 cc (range 63.2-7534.5). All patients received neoadjuvant RT, with doses ranging from 48-50 Gy. 1 patient received neoadjuvant chemotherapy. 3 patients had MR and 2 patients had CT imaging. By RECIST, 1 had PR and 4 showed SD. Volumetrically, tumors decreased on average by 26.8% (range 13.7-44.3%). Pathologically, 4 showed some degree of necrosis (range 5-95%); 1 was not reported. Radiographic response did not appear to correlate with pathologic response. 1 patient with 95% necrosis on pathology only had 13.7% decrease in tumor volume. Of note, this patient also received neoadjuvant chemotherapy. After average follow up of 24 months (range 7-89), 4 patients were NED and 1 patient had LR 3 months after re-resection, though was noted to have extensive seeding of tumor after initial surgery.

CONCLUSION
This is the largest series we are aware of examining the use of pre-op RT in the management of SFTs. In this small series, all patients experienced a decrease in tumor volume after RT (average 26.8%), though the magnitude of response did not always correlate directly with degree of necrosis on pathology. 4 of 5 patients developed some degree of necrosis on final pathology. Volumetric analysis demonstrated decreases in tumor size more readily than RECIST measurements.

CLINICAL RELEVANCE/APPLICATION
This is the largest series to date evaluating the role and treatment responses to preoperative radiotherapy in the management of solitary fibrous tumors, correlating radiographic and pathologic findings.

LL-VIS-TH1B ● Looking beyond International Normalized Ratio (INR) in Liver Interventions
Archana T Laroia MD (Presenter) ; Sandeep T Laroia MD

PURPOSE
INR remains a much used laboratory parameter to evaluate bleeding diathesis in patients with liver disease. Based on elevated INR value, the patient is often treated with either Vitamin K or fresh frozen plasma (FFP), especially if the patient has to undergo a guided invasive intervention like liver biopsy or TIPS procedure. However clinically significant bleeding from the intervention site remains rare. FFP infusions remain a routine clinical practice despite the potential for significant adverse effects as well as significant resource utilization. A more reliable test is Thromboelastography (TEG), which is evaluated against INR.

METHOD AND MATERIALS
Thirty one patients with liver disease induced bleeding diathesis (defined as INR> 1.5) were studied. TEG was obtained and patients’ clinical course was followed. Various parameters of TEG test as well as other anticoagulant protein levels were studied where available.

RESULTS
Twenty two (73%) of the patients with elevated INR had TEG parameters within normal limits. These patients also maintained normal hemostasis during their clinical course. Remaining nine (27%) patients had abnormal INR as well as abnormal TEG parameters. Three (33%) of these patients showed evidence of clinically significant bleeding.

CONCLUSION
Measuring TEG parameters is a better way to assess hemostasis in patients with liver injury rather than relying solely upon INR. INR remains a much used laboratory parameter to evaluate bleeding diathesis in patients with liver disease. Based on elevated INR value, the patient is often treated with either Vitamin K or fresh frozen plasma (FFP), especially if the patient has to undergo a guided invasive intervention like liver biopsy or TIPS procedure. However clinically significant bleeding from the intervention site remains rare. FFP infusions remain a routine clinical practice despite the potential for significant adverse effects as well as significant resource utilization. A more reliable test is Thromboelastography (TEG), which is evaluated against INR.

CLINICAL RELEVANCE/APPLICATION
Measuring TEG parameters is a better way to assess hemostasis in patients with liver injury rather than relying solely upon INR. INR remains a much used laboratory parameter to evaluate bleeding diathesis in patients with liver disease. Based on elevated INR value, the patient is often treated with either Vitamin K or fresh frozen plasma (FFP), especially if the patient has to undergo a guided invasive intervention like liver biopsy or TIPS procedure. However clinically significant bleeding from the intervention site remains rare. FFP infusions remain a routine clinical practice despite the potential for significant adverse effects as well as significant resource utilization. A more reliable test is Thromboelastography (TEG), which is evaluated against INR.

LL-VIS-TH2B ● MR Image Characteristics during and after Cryoablation of Uterine Fibroids
Tadashi Shimizu MD (Presenter) ; Noriko Nishioka MD ; Daisuke Abo MD ; Yusuke Sakuhara MD

PURPOSE
To demonstrate characteristics of MR images of uterine fibroids during and after cryoablation.

METHOD AND MATERIALS
Symptomatic uterine fibroids were ablated percutaneously using a MR compatible high-pressure argon-based cryoablation system under open MR imaging guidance. Follow up T1-weighted, T2-weighted and Gd-DTPA enhanced T1-weighted MR images were taken over at one day, two week, and six week intervals in 6 patients and in 4 weeks in one patient.

RESULTS
Eight fibroids in 7 patients were treated. Six fibroids were intramural and two were submucosal. The maximum diameters of the fibroids ranged from 3.4 to 9.5 cm and the mean was 7.4 cm. The maximum diameters of the frozen area ranged from 4.8 to 8.5 cm and the mean was 6.6 cm. The average freezing time was 18.9 min. In five patients of intramural fibroids, the non-contrast enhanced areas in Gd-DTPA enhanced T1-weighted images after cryoablation were larger than the frozen area. In two cases of submucosal fibroids, normal myometrium around the fibroids were frozen and the signal intensity of the MR images returned to normal in six weeks.

CONCLUSION
MR images after cryoablation indicate the necrotic area is larger than the frozen area in the uterine fibroid and we can expect spontaneous recovery of normal myometrium in the frozen area.

CLINICAL RELEVANCE/APPLICATION

LL-VIS-TH3B • Comparing a Volumetric Post-processing Analysis Technique to Orthogonal Measurement of Ascending Thoracic Aortic Aneurysms Using ECG-gated CTA

Amanda M Wiant

**PURPOSE**

Are ascending thoracic aortic aneurysm (TAA) volumetric measurements with a novel volumetric method strongly correlated to, more sensitive than, and more reproducible than conventional orthogonal measurements?

**METHOD AND MATERIALS**

ECG-gated CT angiography of subjects between 18 and 89 years old may have been diagnosed with TAA and who had undergone at least two ECG-gated CTAs of the thoracic aorta at Northwestern Memorial Hospital as a standard of care were used for this study. Exclusion criteria included a history of known aortic dissection, non-diagnostic imaging studies, or a history of cardiac surgery or surgery on the aorta or aortic valve between or before two serial scans. Orthogonal diameter measurements were taken from CTA image reports. Volumetric measurements were obtained from the same CTA scans using a semi-automated Vitrea software.

**RESULTS**

Volumetric and orthogonal measurements were successfully obtained from 108 CTA imaging studies. The Pearson product-moment correlation coefficient demonstrated a Pearson r of 0.823 and 0.856 between maximum orthogonal and volumetric measurements in both the aortic sinus and the ascending aorta, respectively. Based on the paired t-test, both orthogonal and volumetric measurements demonstrated significant changes in aneurysm size to a confidence level of at least 95%. The comparison of inter-observer and intra-observer agreement showed high intra- and inter-observer reliability over both volumetric and orthogonal measurements. Intra-observer correlation coefficients for volume measurements ranged from 0.98 to 0.99 for measurements taken at different levels of the aorta, compared to 0.97-0.98 for diameter measurements at the same levels. Inter-observer correlation coefficients ranged from 0.94-0.98 for volumes and 0.92-0.97 for diameters.

**CONCLUSION**

Volumetric analysis of ascending TAA is highly correlated to the conventional two-dimensional method, there seems to be no significant difference in sensitivity between the two methods, and both methods demonstrated strong measurement reproducibility. From this research, the time-intensive volumetric analysis does not add a significant benefit over orthogonal analysis.

**CLINICAL RELEVANCE/APPLICATION**

The results of this study suggest that volumetric analysis does not provide a significant advantage over the less time intensive, conventional orthogonal method of ascending TAA measurement.

---

**LL-VIS-TH4B • Development and Evaluation of a MR-compatible Guidewire with a Diameter of 0.018"±½?: Preliminary Results**

Robin Bruhn (Presenter); Miriam Ariens; Christian Wasiak *; Paul Born *; Matthias Von Walter *; Christiane K Kuhl MD *; Nils A Kraemer MD **

**PURPOSE**

In spite of many challenges, MRI guided vascular interventions may offer advantages because they may allow the depiction of not only the target vessel, but also the surrounding anatomy of the target-organ. For all types of vascular procedures, a guidewire is needed to navigate to the catheter to the target vessel. In trans-arterial tumor therapies, small vessels need to be selectively engaged with microcatheters. Purpose of this research was to evaluate a new 0.018" MR-compatible guidewire (GW) in an in-vitro phantom.

**METHOD AND MATERIALS**

We developed a MR-compatible GW consisting of a non-ferromagnetic fibre glass core and two surrounding layers of agamid fibre. Using the micropullwinding technique, stiffness and flexibility of the GW can be varied individually along the shaft. Iron oxide nanoparticles in 3 different concentrations (M1, M2, M3) applied along the tip at distances of 1 cm are used for visualization in MRI. A hydrophilic coating assures gliding of the GW (sliding friction coefficient Two different gradient echo sequences with a temporal resolution of 0.30 sec and 0.78 sec, respectively, were used to visualize navigation of this GW in an in-vitro vessel phantom with and without flow simulation. Visibility of the GW was assessed by measuring marker susceptibility artefacts (a total of n=56) on the MR images. To evaluate clinical GW steerability, different phantom vessels were engaged under MR guidance.

**RESULTS**

On both real-time sequences the markers attached to the GW tip allowed precise visualization. The mean diameters of the marker susceptibility artefacts in pulse sequences acquired horizontal (X) and along B0 (Y) were 5.5/8.4mm (X/Y) (standard deviation (SD) 1.1/1.2mm) for M1; 7.5/9.3mm (SD 0.8/0.8mm) for M2 and 9.4/12.1mm (SD 1.0/1.2mm) for M3. Under MRI guidance, all target vessels of the phantom could be engaged successfully in adequate time.

**CONCLUSION**

The new micropullwinding technique offers the opportunity to build a thin (0.018") MR-compatible GW that appears to be useful for superselective vascular MR-guided interventions. Animal experiments are in preparation.

**CLINICAL RELEVANCE/APPLICATION**

With the new production technique an adjustable 0.018" GW for superselective endovascular MR-guided interventions may become feasible.

---

**LL-VIE-THSB • Cone-Beam Computed Tomography in the Interventional Radiology Suite: Technical Optimization and Clinical Application**

Katherine Bruksch BA (Presenter); Laurence Donahue MD; Ramona Gupta MD; Robert K Ryu MD; Robert J Lewandowski MD *

**PURPOSE/AIM**

Cone-beam computed tomography (CBCT) offers improved spatial/contrast resolution over conventional digital subtraction angiography (DSA) and is being increasingly utilized by interventional radiologists (IRs) to provide intra-procedural information. This educational exhibit aims to provide a comprehensive analysis of the technical optimization and increasing clinical application of CBCT in the IR suite.

**CONTENT ORGANIZATION**

This exhibit will review technical aspects of CBCT, highlighting potential advantages/disadvantages of CBCT versus DSA and conventional CT-angiography. Tips for optimizing imaging/clinical applications of CBCT will also be presented. The exhibit will then provide a comprehensive clinical/pictorial review of current vascular and non-vascular applications of CBCT in the IR suite. A critical review of the published medical literature will support the clinical impact of CBCT.

**SUMMARY**

CBCT is being increasingly applied during IR procedures because it provides improved intra-procedural imaging, patient safety, and efficacy of minimally invasive procedures. This exhibit will feature clinical examples to demonstrate the utility of CBCT and review techniques to optimize its utilization.

---

**LL-VIE-TH6B • Stop the Bleeding! A Review of Current Embolization Techniques and Materials**

Jenanan Vairavamurthy MD (Presenter); Marcin K Kolber MD; Adam R Zybulewski; James E Silberzweig MD

**PURPOSE/AIM**

Cone-beam computed tomography (CBCT) offers improved spatial/contrast resolution over conventional digital subtraction angiography (DSA) and is being increasingly utilized by interventional radiologists (IRs) to provide intra-procedural information. This educational exhibit aims to provide a comprehensive analysis of the technical optimization and increasing clinical application of CBCT in the IR suite.

**CONTENT ORGANIZATION**


**SUMMARY**

Embolization therapy is a standard interventional procedure. Successful therapy is predicated on technical skills, knowing disease pathology, and an understanding of the various embolic agents used. A case based review of the different embolic agents presented in this education exhibit will allow the reader to have a deeper understanding of embolotherapy and be better prepared for successful treatment in emergent and non-emergent settings.

---

**LL-VIE1294-THB • Intraneal Osmangraphy for Thoracic Duct Embolization: A Pictorial Guide**

Amanda M Wiant MD (Presenter); Ernesto Santos MD
LEARNING OBJECTIVES
1) Define Normalization of Deviance. 2) Discuss the History of Normalization of Deviance as it relates to NASA and health care in general. 3) Reflect on current practice and describe normalization of deviance as it is applied in imaging. 4) List negative consequence of normalization of deviance in imaging.

ABSTRACT
As an imaging professional we are taught to be a patient advocate, to be technically competent and to have a patient safety mindset. Why is it then that often times we see “seasoned” imaging professionals taking shortcuts and exhibiting behaviors that don’t necessarily embody those characteristics? This lecture will explore “Normalization of Deviance” as a possible cause of this phenomenon. Normalization of Deviance breaks the safety culture, substituting a slippery slope of tolerating more and more errors and accepting more and more risk, always in the interest of efficiency and on-time schedules.” (Prielipp, Mägo, Morell and Brull, 2010) Simply, we take short cuts and veer from standards in the interest of patient flow and these short cuts become the norm because we don’t “see” any extreme negative outcome. Overtime, these new norms push the boundaries more and more. Normalization of Deviance theory has been applied to the Challenger space shuttle accident. Before the space shuttle blew up, O-ring erosion problems were documented numerous times. Over many occurrences and time, the engineers and managers started believing that these flaws were acceptable. This deviance became the new norm UNTIL the space shuttle accident. This lecture will discuss some of the new possible negative outcomes.

RadioGraphics' Publication Information for Potential Authors

Thursday, 01:30 PM - 02:45 PM • E350

LEARNING OBJECTIVES
1) Prepare a format- and content-compliant manuscript for possible publication. 2) Use ScholarOne Manuscripts to submit a manuscript for possible publication. 3) Become familiar with the RadioGraphics publication process.

ABSTRACT
Many hours are spent writing and organizing the manuscripts, and their accompanying images, submitted to RadioGraphics. This workshop is designed to assist potential authors in the preparation and submission of manuscripts for possible publication. This year, authors will be navigated through ScholarOne Manuscripts, our new online manuscript submission and processing site.

Proper attention to content elements, figure preparation, and format compliance not only reduces delays in processing, but also provides optimal opportunity for favorable reviews and less revision. This course will include a PowerPoint TM presentation that provides an overview of the publication process and the guidelines for submitting print-quality images, as well as a live demonstration of the ScholarOne Manuscripts site. It will conclude with a question and answer session.

URL's for submitting print-quality images, as well as a live demonstration of the ScholarOne Manuscripts site. It will conclude with a question and answer session.

Case-based Review of Neuroradiology: Head and Neck (An Interactive Session)

Thursday, 01:30 PM - 03:00 PM • S100AB

LEARNING OBJECTIVES
1) Emphasize pertinent anatomy in the adult neck as it pertains to image interpretation through well selected cases. 2) Generate succinct, well thought out differential diagnoses for a spectrum of head and neck lesions. 3) Identify important imaging findings that allow the radiologist to be specific about establishing ‘the’ diagnosis. 4) Avoid the common adult radiologic diagnostic pitfalls.

ABSTRACT
This session will evaluate a spectrum of pathologies encountered in the adult head and neck. The session will emphasize critical analysis of image findings which allow the radiologist to generate a succinct, short differential diagnosis, and in many instances, the correct diagnosis. There will be emphasis on correct anatomic localization of pathology in the head and neck, patterns of radiologic pathology, as well as management decisions that may include additional imaging studies, or clinical interventional.

MSCN53B • Pediatric Head and Neck

Nafi Aygun (Presenter)

LEARNING OBJECTIVES
1) Provide a short differential diagnosis for neck tumors in children in varying ages. 2) Recognize various congenital anomalies in the neck. 3) Manage neck emergencies effectively.

ABSTRACT
A review of various developmental, infectious and neoplastic conditions in the neck and skull base in children will be provided with a case-based approach with emphasis on key imaging findings that help in differential diagnosis.

MSCN53C • Common Misdiagnoses

Hugh D Curtin (Presenter)
LEARNING OBJECTIVES
1) Identify the most common areas where abnormalities are overlooked and will be able to identify subtle abnormalities at those locations. 2) Identify areas to search for additional diagnoses that must not be overlooked once a primary diagnosis is established.

Case-based Review of Pediatric Radiology: Pediatric Abdominal Imaging (An Interactive Session)
Thursday, 01:30 PM - 03:00 PM • S406A

MSCP53 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5
Director
Edward Y Lee, MD, MPH

MSCP53A • Congenital and Acquired Abdominal Masses in Pediatric Patients

Bernard F Layla DO (Presenter)

LEARNING OBJECTIVES
1) Discuss a systematic approach in the imaging evaluation of abdominal masses in children. 2) Review the typical imaging appearance of selected congenital and acquired masses in the pediatric population. 3) Discus pitfalls in the diagnostic imaging of abdominal masses in children.

MSCP53B • Abdominal Vascular Anomalies and Abnormalities in Children

Arnold C Merrow MD (Presenter) *

LEARNING OBJECTIVES
1) Discuss the basic classification scheme of pediatric vascular anomalies, including vascular neoplasms and congenital vascular malformations. 2) Review helpful clinical features and imaging findings of vascular anomalies in children. 3) Discuss other abnormalities of pediatric abdominal vessels, including thrombosis, stenosis, and aneurysms.

ABSTRACT
The etiology of abdominal trauma in children includes, but is not limited to motor vehicle collisions, bicycle collisions, falls, sports injury and assault (child abuse). Although ultrasound may play a role in quick evaluation of the unstable patient for intraperitoneal hemorrhage, computed tomography (CT) remains the chief mode of evaluation of the hemodynamically stable child with suspected abdominal injury. CT for abdominal trauma is performed with intravenous contrast, but without an oral contrast preparation. Use of a multi-detector CT with very thin source images allows for near isotropic images with high quality sagittal and coronal reformed images. 3D images, including dedicated pelvic reformat for pelvic fracture, are readily created. Systematic review of abdominal CTs performed for trauma increases sensitivity. Injuries to the liver, spleen, kidneys, pancreas and adrenal glands may occur. Severity of injury and/or the identification of active extravasation may alter management. Injuries to the gastrointestinal tract are uncommon, but may bear significant morbidity if not properly diagnosed. While free intra-peritoneal gas may be seen with bowel injury, it is not uniformly seen and may rarely be caused by an alternative etiology. Children are more prone than adults to hypoperfusion complex. Gut hypoperfusion complex may be an indicator of tenuous patient stability. Injuries to the renal collecting system and bladder are rare, but when present require specific treatment. Diaphragm injury is rare. Large vessel vascular injury due to blunt abdominal trauma is uncommon in children, but may occur. Careful review of a trauma CT is not complete without a careful review of bone window images for skeletal fracture. Seatbelt injuries are more common in children than adults. Seatbelt injuries produce predictable but varied injuries to multiple structures. Younger children and infants may be the victim of child abuse. With child abuse, injury to any organ may occur.

Thursday Plenary Session

Thursday, 01:30 PM • Arie Crown Theater

RSNA/AAPM Symposium

Moderator
Jeffrey H Siewerdsen , PhD * , Baltimore, MD
AAPP Liaison to the RSNA Scientific Program Committee

LEARNING OBJECTIVES
1) Learn how multi-modality imaging methods are being used in combination with high-precision radiation therapy delivery techniques to understand fundamental mechanisms of cancer pathogenesis, progression, and treatment response. 2) Learn the challenges and advances associated with quantitative imaging, and understand how more accurate and quantitative imaging is central to advancing the understanding of major questions in 21st century medicine. 3) Learn how imaging in partnership with medical physics and other technical and clinical disciplines provides a vital tool and multidisciplinary expertise for such advances.

Imaging in Partnership: With Radiation Therapy

David A Jaffray , PhD *, Toronto, ON, CANADA

LEARNING OBJECTIVES
View learning objectives under main course title.

Imaging in Partnership: With Physics and Quantitative Medicine

James A Deye , PhD , Bethesda, MD

LEARNING OBJECTIVES
View learning objectives under main course title.

Interventional Oncology Series: Liver Metastases and Bone

Thursday, 01:30 PM - 06:00 PM • S405AB

VSIO51 • AMA PRA Category 1 Credit ™: 4.25 • ARRT Category A+ Credit: 5
Moderator
Matthew R Callstrom , MD, PhD *

LEARNING OBJECTIVES
1) Describe the characteristics of liver metastases and bone tumors amenable to interventional oncologic treatment. 2) Describe new techniques for the percutaneous treatment of liver metastases and bone tumors. 3) Describe the role of percutaneous ablation for liver metastases and bone tumors in the context of other treatments including surgery and radiation oncology.

ABSTRACT
**VSIO51-01 • Which Ablation - Where and Why**

**Riccardo A Lencioni** MD (Presenter)

**LEARNING OBJECTIVES**

1) To describe the different methods and techniques used for image-guided tumor ablation.
2) To understand the use of image-guided ablation in focal cancer therapy.
3) To understand the role of image-guided ablation with respect to surgical and medical treatments.

**VSIO51-02 • IRE for Liver Metastases**

**Govindarajan Narayanan** MD (Presenter) *

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**VSIO51-03 • Chemo ± RFA; Does RFA Provide a Benefit?**

**Alison R Gillams** MBChB (Presenter) *

**LEARNING OBJECTIVES**

1) To learn the survival results for patients treated with ablation, chemotherapy and combinations of ablation and chemotherapy.
2) To learn the optimal timing of ablation and chemotherapy in different clinical situations.

**ABSTRACT**

Chemotherapy regimes in the 80’s and early 90’s using 5 fluorouracil (5FU) based regimens did not improve survival. They did result in a morphologic response on imaging in just 30% of patients. Median survival was about 9 months. It was not until the late 90’s with the introduction of irinotecan and oxaliplatin that a change in survival was seen. Response rates increased to 50% and the use of sequential oxaliplatin and irinotecan produced a further small increase in survival. This improvement was further honed with the realisation that only Kras wild type patients responded and Kras testing is now routine prior to both chemotherapy and IRE. Disease progression may differ between the primary lesion and the metastatic disease but the difference is small. Median survival for patients who receive all the possible chemotherapeutic options is now approximately 21 months, 5 year survival remains exceptional. Ablation is generally used in small volume, liver only disease in inoperable patients. The median survival is of the order of 36 months with 5 year survival of 30%. This is better than has been achieved with any chemotherapy regime and so ablation should be offered to all suitable patients. Adjuvant chemotherapy has been shown to be useful in post resection patients and there is some anecdotal evidence that it is useful post ablation. Neo adjuvant chemotherapy is used to downsize metastases in patients who are not initially resectable or ablatable in the hope that they will become suitable for definitive treatment. Although some tumours will disappear on imaging, the chances of recurrence are very high (96%) and therefore treatment should be aimed to encompass all the original sites of disease.

**VSIO51-04 • Microwave Ablation (MWA) Therapy of Liver Metastases from Colorectal Carcinoma Post Systemic Chemotherapy**

**Nour-Eldin A Nour-Eldin** MD, MSc (Presenter) ; **Nagy N Naguib** MSc ; **Tatjana Gruber-Rouh** ; **Thomas Lehnert** MD ; **Thomas J Vogl** MD, PhD

**PURPOSE**

to evaluate the safety, efficiency, effectiveness, and overall outcome in patients treated with microwave thermal ablation of colorectal metastases post systemic chemotherapy.

**METHOD AND MATERIALS**

An institutional review board-approval was obtained with informed consent of all patients. Retrospective analysis of prospective intention to treat study was performed from January 2008 to January 2013, and included 92 patients (mean age 56 years SD: 2.6) with 132 liver metastases measuring 0.7–5.0cm, who were treated with microwave ablation (MWA). Local tumor control, complications, and long-term survival were analyzed.

**RESULTS**

The mean follow-up period was 32.5 months. Complete ablation was achieved in 117 of 132 (88.6%) nodules. Seventeen of the 117 (14.5%) successfully treated nodules developed local recurrence. Univariate analysis showed that tumor size of < 3 cm is a significant risk factor (P = 0.04). Multivariate analysis showed that number of cycles of chemotherapy (FOLFOX) was a significant prognostic factor for overall recurrence (P=0.03), whereas disease-free interval was the significant prognostic factor for distant recurrence (P=0.05). Major complications occurred in 1.1% of patients. No procedure-related mortalities were observed. The 1, 2, 3, and 5-year overall survival rates after the initial ablation were 82, 61.2, 51.2, and 38.3%, respectively. The main cause of death was systemic tumor progression in 63.5% of the patients.

**CONCLUSION**

MWA is a safe and effective treatment therapeutic option for patients with liver metastases from Colorectal Carcinoma post systemic chemotherapy.

**CLINICAL RELEVANCE/APPLICATION**

Thermal ablative techniques such as MWA are safe and effective minimally invasive therapeutic option in the management of patients with hepatic metastasis, especially after systemic chemotherapy.

**VSIO51-05 • Surgery for CRC Liver Mets - When Is Ablation Indicated?**

**Yuman Fong** MD (Presenter) *

**LEARNING OBJECTIVES**

1) To learn the available ablative options for metastatic colorectal cancer.
2) To understand the determinants of success and failure for ablative treatments of liver metastases.
3) To understand the use of ablative therapy as an adjunct to surgery in the care of patients.
4) To understand the use of ablative therapy in the treatment of recurrent liver metastases.

**VSIO51-06 • Treatment of Difficult Liver Metastases**

**Thierry J De Baere** MD (Presenter) *

**LEARNING OBJECTIVES**

1) To know what are the most difficult situations when treating liver metastasis with percutaneous ablation techniques.
2) To know tips and tricks that can help to improve results during percutaneous ablation of liver metastases.
3) To know what are the limitations of different ablation technologies of percutaneous ablation according to tumor size and location.

**ABSTRACT**

Percutaneous ablation of liver metastases allows for complete ablation in approximately 90% in well selected indications. Some metastases are more difficult to ablate due to either difficulty in targeting, or their location close to large vessels, close to fragile neighboring organs, or in proximity to the liver hilum. Difficulties in targeting are often due to poor visualization of the targeted tumor with image guidance. We will present possible benefit of fusion imaging between US and enhanced CT and discuss accuracy of such technique. We will describe technique end results of tumor tagging with either percutaneous tagged with intra-arterial injection of Lipiodol. Location close to large vessels favors convective tissue cooling and is responsible for lower rates of complete ablation with RFA for such tumor. Combining RFA with percutaneous balloon occlusion of hepatic or portal veins can improve results and the technique will be presented. Other ablative technologies can improve results of ablation close to large vessels and will be discussed namely with regards to microwave ablation and irreversible electroporation. Neighboring organ can be preserved from any damage by using adrodesion (air or carbon dioxide) or administration of IRE for liver metastases.

**VSIO51-07 • Assessing Geometric RF Ablation Accuracy and Predicting Outcome within 24h after Treatment by Mapping the Preprocedure Liver Lesion to the Postprocedure Ablation Zone**

**Frederik Vandenbroucke** MD (Presenter) ; **Jef Vandemeulebroecke** PhD, MSc ; **Nico Buls** DSc, PhD * ; **Pablo R Ros** MD, PhD * ; **Johan De Mey** *

**PURPOSE**

to evaluate the predictive value of early assessment of the geometrical accuracy of the procedure by using contrast enhanced CT images acquired before and within 24h after ablation.

**METHOD AND MATERIALS**

Twenty-three patients, with a total of 45 liver lesions, received a CT scan before and 24 hours after RF ablation. Follow up PET/CT scans were performed every 2-3 months after the intervention. Pre- and post-ablation CT images were aligned using commercial registration software. Lesion and ablation zone were semi-automatically segmented and masked during registration. A global, rigid registration based on mutual information was performed. If required, this was followed by an interactive local registration based on a smaller region of interest. Using the registered images, we verified the geometrical accuracy of the RF ablation treatment by measuring the minimal distance between the lesion and the outer edge of the ablation zone, and correlated this to local tumor.
**Results**

Eleven lesions (24.4%) showed LTP during a mean follow up of 62 weeks. Registration was successful for all lesions, although 5 were perceived as challenging. Based on the registered images, 29 lesions were completely covered by the ablation zone, while 10 were not. For 6 lesions, the edge was found to coincide with the edge of the ablation zone. Incomplete coverage of the lesion was found to be a powerful predictor for LTP (Se = 100%, Sp = 85%, PV = 69%, NPV = 100%). Interestingly, two lesions only showed LTP after 5-6 months, and both belonged to the group were the edges of lesion and ablation zone coincided.

**Conclusion**

Verifying the coverage of liver metastases by an ablation zone through registration of pre- and early post-ablation CT images is feasible and has a strong predictive power for treatment outcome. Increasing the robustness and degree of automation of the procedure could further improve the accuracy and reproducibility of the method.

**Clinical Relevance/Application**

Early and accurate detection of RF ablation failure may allow for reablation and will ultimately improve the efficacy of this minimally invasive procedure.
LEARNING OBJECTIVES

View learning objectives under main course title.

**VSIO51-14 • Cementoplasty Beyond the Spine**

**Giovanni Carlo Anselmetti MD (Presenter) * **

**LEARNING OBJECTIVES**

1) To learn indications and contra-indications to cementoplasty beyond the spine. 2) To learn the optimal technique, regarding materials and image guiding systems, in performing percutaneous cementoplasty.

**ABSTRACT**

Bone is one of the most frequent sites of spread for many common cancers. In such case, when appropriate systemic treatment for the underlying cancer fails, patients should be considered for specific treatment, the principal modality being radiotherapy and bisphosphonates. These therapies leave approximately one third of cases with inadequate pain control. This failure prompted the search for other strategies aimed at bone pain control through local bone augmentation such as percutaneous cementoplasty (PC).

PC can be performed under combined Computed Tomography (CT) and Fluoroscopic guidance; flat panel angiographic suite with integrated CT can also be used. Both systems allow precise positioning of the needle within the bone lesion. Most frequently PC is executed in sacrum, hip and femur but this procedure is also successful and feasible in fingers, astragalus, calcaneus, ribs, sternum, etc. Local anesthesia is employed in most cases.

Bone lesions are localized on CT and the most adequate access point is identified. A dedicated vertebroplasty beveled needle is then advanced into the bone lesion. Bone cement is injected under continuous fluoroscopic control. After PC a CT scan of the treated region is carried out to assess the extent of lesion filling and to visualize possible PMMA leaks.

Patients are discharged the same procedural day.

In our experience PC was technically successful in all cases with no immediate severe complications. In lesions with lost integrity of the cortical bone, asymptomatic leakage of PMMA in the soft tissues can occur but, normally, it not requires any treatment.

Delayed complications such as fractures in metastases of the femoral diaphysis can occur; lytic lesions of the long bones’ shaft cannot be treated with PC due to high risk of fracture during ambulation.

PC, in our opinion, should be proposed in all patients with painful or invalidating bone lesions when conventional therapies fail or surgery is not feasible.

**VSIO51-15 • Chondrolysis and Femoral Head Osteonecrosis: A Complication of Periacetabular Cryoablation**

**Michael V Friedman MD (Presenter); Jack W Jennings MD; Travis J Hillen MD *; Daniel E Wessell MD, PhD * **

**PURPOSE**

Cryoablation is an emerging alternative in the treatment of primary osseous malignancies or metastatic diseases that are not amenable to more conventional therapies. As experience compounds with this newer, less-invasive technique, associated complications will be continually defined. We describe a novel complication associated with percutaneous cryoablation of percutaneous bone tumors.

**METHOD AND MATERIALS**

Between 2008 and 2013, 41 patients with a total of 100 musculoskeletal lesions were treated by cryoablation at our institution. 12 patients were referred to our department for the primary treatment of periacetabular osseous malignancies. There were a total of 15 lesions, with 3 of the 12 patients having bilateral lesions. Follow-up clinical notes and imaging of the patients were retrospectively reviewed for a minimum of 2 months. Generalized estimating equations were performed to assess the effect that patient demographics and treatment parameters (including ablation time, cycle distribution, and probe proximity to the femoral head and fovea) had on development of chondrolysis and osteonecrosis.

**RESULTS**

Chondrolysis or femoral head osteonecrosis developed in 31% (4 of 13) of periacetabular lesions. Of the remaining patients with non-periacetabular lesions that underwent cryoablation, none subsequently developed osteonecrosis. Patients who developed chondrolysis or osteonecrosis had ablation zones closer to the joint. There was no difference in ablation times or cycle distribution. Chondrolysis or osteonecrosis developed within a 5 month period, with a mean of 89 days. 3 of the 4 patients who developed chondrolysis have undergone total joint replacement.

**CONCLUSION**

Chondrolysis or femoral head osteonecrosis developed in 31% of periacetabular malignancies treated by cryoablation, ultimately requiring joint replacement in 3 of 4 patients. Careful pre-ablation planning and risk/benefit analysis should be considered before performing periacetabular cryoablation, and patients should subsequently be monitored for developing chondrolysis.

**CLINICAL RELEVANCE/APPLICATION**

Percuticular cryoablation can be associated with osteonecrosis and chondrolysis, and therefore, careful pre-ablation planning and risk/benefit analysis should be performed prior to proceeding.

**VSIO51-16 • Percutaneous Image-guided Ablation of Metastatic Renal Cell Carcinoma**

**Brian T Welch MD (Presenter); Matthew R Callstrom MD, PhD *; Jonathan M Morris MD; Anil N Kurup MD; Grant D Schmit MD; Thomas D Atwell MD; Adam J Weisbrod MD; Manish Kohli MD; Brian Costello MD; Christine Lohse; Stephen Boorjian; Robert Thompson MD **

**PURPOSE**

Over 65,000 new cases of RCC will be diagnosed this year in the United States. Approximately 50% of RCC patients will present with or subsequently develop metastases after primary treatment. Our purpose is to assess the safety, local control, complications, and adjunctive survival of ablation in treatment of mRCC in this selected cohort.

**METHOD AND MATERIALS**

A retrospective review was performed of 61 patients who underwent 74 ablation procedures to treat 82 mRCC lesions with intent of local control (i.e. not palliative). Technical success, safety, local control, complications, and survival were analyzed according to standard criteria.

**RESULTS**

Four (4%) technical failures were observed. Time to recurrence was assessed for the subset of 76 (93%) tumors that were followed past ablation. Six (7.9%) tumors recurred at a mean of 1.6 years following ablation (median 1.4; range 0.6 -2.9). The mean duration of follow-up for the 70 tumors that did not recur was 1.9 years (median 1.2; range 10 days - 7.5 years). Estimated local recurrence-free survival rates (95% CI; number still at risk) at 1, 2, 3, 5, and 7 years following ablation were 94% (88 – 100; 41), 94% (88 – 100; 32), 83% (70 – 97; 17), 83% (70 – 97; 5), and 83% (70 – 97; 3), respectively. Estimated overall survival rates (95% CI; number still at risk) at 1, 2, 3, 5, and 7 years following ablation were 87% (79 – 97; 42), 83% (73 – 94; 31), 76% (63 – 90; 19), 52% (35 – 76; 6), and 52% (35 – 76; 2), respectively. Recognizing this highly selected patient population and additional concurrent or subsequent treatment, estimated cancer-specific survival rates (95% CI; number still at risk) at 1, 2, 3, 5, and 7 years following ablation were 91% (83 – 99; 42), 86% (76 – 96; 31), 82% (71 – 95; 19), 62% (46 – 85; 6), and 62% (46 – 85; 2), respectively. Four (5%) CTCAE grade 3 or greater complications were observed; there were no deaths related to the ablation.

**CONCLUSION**

Image guided ablation of mRCC is a relatively safe procedure with acceptable local control rates. In carefully selected patients, adjunct ablation with systemic therapy, radiation, and surgery may confer a survival benefit, although further follow-up and validation are needed.

**CLINICAL RELEVANCE/APPLICATION**

In carefully selected patients, adjunct ablation with systemic therapy, radiation, and surgery may confer a survival benefit, although further follow-up and validation are needed.

**VSIO51-17 • Bone Metastases Tumor Board**

**Matthew R Callstrom MD, PhD (Presenter) * **

**LEARNING OBJECTIVES**

1) Describe the characteristics of bone tumors amenable to interventional oncologic treatment in the context of other treatments including surgery and radiation oncology. 2) Describe the techniques to avoid complications in the percutaneous treatment of metastatic bone tumors. 3) Describe characteristics of metastatic bone tumors that benefit from combination treatments.
RSNA Diagnosis Live™: Radiology Potpourri

Thursday, 03:00 PM - 04:00 PM • E450A

LEARNING OBJECTIVES
1) The participant will be introduced to a series of radiology case studies via an interactive team game approach designed to encourage "active" consumption of educational content. 2) The participant will be able to use their mobile wireless device (tablet, phone, laptop) to electronically respond to various imaging case challenges; participants will be able to monitor their individual and team performance in real time. 3) The attendee will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

ABSTRACT
The extremely popular audience participation educational experience is back! Diagnosis Live! is an expert-moderated session featuring a series of interactive case studies that will challenge radiologists’ diagnostic skills and knowledge. Building on last year’s successful Diagnosis Live! premiere, this session features a lively, fast-paced game format: participants will be automatically assigned to teams who will then use their personal mobile devices to test their knowledge in a fast-paced session that will be both educational and entertaining. After the session, attendees will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance.

Hot Topic Session: Metal-on-Metal Arthroplasty Complications

Thursday, 03:00 PM - 04:00 PM • E451A

LEARNING OBJECTIVES
1) Identify normal imaging appearance of metal on metal arthroplasty and differentiate from other implant types. 2) Identify the imaging appearance of Adverse Reaction to Metal Debris on various imaging modalities including MR and CT. 3) Understand basic concepts to reduce metal artifacts in CT and MRI in imaging hip arthroplasty patients. 4) Understand role of imaging-guided procedures in ARMD diagnosis.

LEARNING OBJECTIVES
View learning objectives under main course title.

Hot Topic Session: MR Quantification Techniques in the Liver (Fat, Iron, Fibrosis)

Thursday, 03:00 PM - 04:00 PM • E350

LEARNING OBJECTIVES
1) Understand the relative accuracy and performance of US, CT and MRI for the detection and quantification of hepatic steatosis. 2) Understand the fundamentals of emerging confound-corrected MRI methods to quantify liver fat content.

LEARNING OBJECTIVES
View learning objectives under main course title.

LEARNING OBJECTIVES
1) To provide the learner with an understanding of patient-centered care and examples of how integrating patient-centered care practices into the provision of care will enhance the patient experience. 2) To enable the learner to demonstrate practical skills in enhancing the patient experience. 3) To provide learner with an overview of the implications of patient-centered care on value-based care delivery.

ABSTRACT
Patient-centered care considers that patient care is not only focused on improving the overall quality of care, but more importantly places the focus of care on the patient. Determining what matters to the patient is the first step in a patient-centered approach to care delivery. Increasingly, attention is placed on the patient’s judgement of the care received. Emphasis is also being placed on reimbursing care based on the patient’s judgement of the delivery of the care. The patient-provider relationship or encounter may be the determinant of the patient's perception of the treatment and the outcome of care. Patients want to communicate effectively with their provider. When good communication with the provider exists, patients report better outcomes. Providers who are not engaged in patient-centered care risk being judged adversely by patients. Providers should understand the tenets of patient-centered care delivery and the implications for the lack thereof.

LEARNING OBJECTIVES
1) To provide the learner with an understanding of patient-centered care and examples of how integrating patient-centered care practices into the provision of care will enhance the patient experience. 2) To enable the learner to demonstrate practical skills in enhancing the patient experience. 3) To provide learner with an overview of the implications of patient-centered care on value-based care delivery.

ABSTRACT
Patient-centered care considers that patient care is not only focused on improving the overall quality of care, but more importantly places the focus of care on the patient. Determining what matters to the patient is the first step in a patient-centered approach to care delivery. Increasingly, attention is placed on the patient’s judgement of the care received. Emphasis is also being placed on reimbursing care based on the patient’s judgement of the delivery of the care. The patient-provider relationship or encounter may be the determinant of the patient's perception of the treatment and the outcome of care. Patients want to communicate effectively with their provider. When good communication with the provider exists, patients report better outcomes. Providers who are not engaged in patient-centered care risk being judged adversely by patients. Providers should understand the tenets of patient-centered care delivery and the implications for the lack thereof.

LEARNING OBJECTIVES
1) To identify normal imaging appearance of metal on metal arthroplasty and differentiate from other implant types. 2) To identify the imaging appearance of adverse reaction to metal debris on various imaging modalities including MR and CT. 3) To understand basic concepts to reduce metal artifacts in CT and MRI in imaging hip arthroplasty patients. 4) To understand role of imaging-guided procedures in ARMD diagnosis.

LEARNING OBJECTIVES
View learning objectives under main course title.

LEARNING OBJECTIVES
1) To provide the learner with an understanding of patient-centered care and examples of how integrating patient-centered care practices into the provision of care will enhance the patient experience. 2) To enable the learner to demonstrate practical skills in enhancing the patient experience. 3) To provide learner with an overview of the implications of patient-centered care on value-based care delivery.

LEARNING OBJECTIVES
View learning objectives under main course title.
LEARNING OBJECTIVES
1) Briefly review different MR-based techniques to evaluate liver fibrosis. 2) Understand the fundamentals of MR elastography. 3) Understand the performance of MR elastography for evaluating liver fibrosis.

Hot Topic Session: Amyloid Imaging
Thursday, 03:00 PM - 04:00 PM • S404AB

LEARNING OBJECTIVES
1) Describe the role of amyloid and FDG PET imaging for tracking the progression of Alzheimer's disease from preclinical stage to dementia. 2) Properly choose amyloid imaging, MRI and FDG PET for the differential diagnosis of dementia. 3) Learn the appropriate use criteria for amyloid PET.

S404AB • Amyloid PET and FDG PET across the AD Spectrum: Redundant or Complementary?
Alexander Drzezga MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

S404B • Multimodality Imaging and the Role of Amyloid PET in Differential Diagnosis of Dementia
Kejal Kantarci MD, MS (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

S404C • Appropriate Use Criteria of Amyloid PET
Satoshi Minoshima MD, PhD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT
This session will review the Appropriate Use Criteria for Amyloid PET Imaging published in 2013 by the Amyloid Imaging Task Force jointly supported by the Society of Nuclear Medicine and Molecular Imaging (SNMMI) and Alzheimer's Association (AA) and discuss various clinical scenarios in which amyloid PET imaging is appropriate and not appropriate in dementia workup.

URL

Hot Topic Session: From Irene to Sandy: How to Keep a Digital Department Running during a Natural Disaster
Thursday, 03:00 PM - 04:00 PM • S403A

LEARNING OBJECTIVES
1) Understand the challenges of natural disasters to a radiology department. 2) Learn about the dangers to patients, personnel and equipment posed by natural disasters. 3) Explore methods to maintain operation of essential radiologic services during natural disasters. 4) Understand how to recover a radiology dept from natural disasters.

Hot Topic Session: Clinical 'Killer Applications' for Spectral CT
Thursday, 03:00 PM - 04:00 PM • S403B

LEARNING OBJECTIVES
1) Understand the advantages of using spectral CT over conventional CT. 2) Learn about state-of-the-art clinical applications of spectral CT. 3) Assess future potential applications of spectral CT to clinical practice.

S403A • The Physics behind Spectral CT - What Is Possible Today and Tomorrow?
Mats Danielsson PhD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under the main title.

S403B • Thoracoabdominal Material Specific Vascular Imaging
Ioannis Vlahos MRCP, FRCR (Presenter) *

LEARNING OBJECTIVES
View learning objectives under the main title.

S403C • Characterization of Fat Using Dual Energy
Anders Persson MD, PhD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under the main title.

S403D • Killer Applications of Dual-Energy CT in the Abdomen
### Case-based Review of Neuroradiology: Interventional Image-based Diagnosis (An Interactive Session)

**Thursday, 03:30 PM - 05:00 PM • S100AB**

**MSCN54** • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

**Director**

Pina C Sanelli, MD

**MSCN54A** • Spine Interventional

A. Orlando Ortiz, MD, MBA (Presenter) *

**LEARNING OBJECTIVES**

1) A comfortable handle on the approach to the typical spine patient. 2) An understanding of the commonly present variations that can affect diagnostic or treatment outcome.

**MSCN54B** • Neurovascular Interventional

Michele H Johnson, MD (Presenter) *

**LEARNING OBJECTIVES**

1) An understanding of the variety of endovascular interventions. 2) Comprehension of how diagnostic neuro-imaging affects intervention. 3) Knowledge of the common variations that can affect diagnostic or treatment outcome.

### Case-based Review of Pediatric Radiology: Pediatric Pelvis Imaging (An Interactive Session)

**Thursday, 03:30 PM - 05:00 PM • S406A**

**MSCP54** • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

**Director**

Edward Y Lee, MD, MPH

**MSCP54A** • Congenital and Acquired Scrotal Lesions in Children

Angelisa M Paladin, MD (Presenter)

**LEARNING OBJECTIVES**

1) Review helpful clinical aspects and imaging characteristics of congenital and acquired scrotal lesions in children. 2) Learn characteristic imaging findings to narrow the differential of scrotal tumors.

**MSCP54B** • Adnexal Masses in Pediatric Patients

Mary R Wyers, MD (Presenter)

**LEARNING OBJECTIVES**

1) Discuss imaging modality choices for evaluating the pediatric female pelvis. 2) Review characteristic imaging findings of adnexal masses in children and discuss differential diagnoses of various lesions which will be presented. 3) Discuss work up and management of adnexal masses in children.

**MSCP54C** • Bowel Disorders in Pediatric Population

Michael S Gee, MD, PhD (Presenter)

**LEARNING OBJECTIVES**

1) Review the pathophysiology and characteristic imaging features of pediatric bowel disorders. 2) Discuss the pros and cons of different imaging modalities for evaluating bowel disorders in young patients.

### ASRT@RSNA 2013: Improving Practice in Pediatric Skeletal Radiography

**Thursday, 03:40 PM - 04:40 PM • N230**

**MSRT56** • AMA PRA Category 1 Credit ™:1 • ARRT Category A+ Credit:1

**Director**

Maryann Hardy, MSc, PhD

**LEARNING OBJECTIVES**

1) Understand the main features of skeletal growth and development in childhood. 2) Understand how skeletal growth and development can result in predictable pathological appearances on radiographs that may inform image acquisition techniques. 3) Appreciate how normal variations in the juvenile skeleton can mask or mimic common pathologies and influence the interpretation of radiographic images. 4) Examine, through the use of case studies, the appropriateness of diagnostic radiography image acquisition techniques and image quality assessment criteria.

**ABSTRACT**

Children are an important patient group accounting for an estimated 20% of imaging examinations. Many published papers and authors have stated that imaging children requires a unique set of skills and knowledge as children are “not little adults”. Much of this literature explores psychosocial development in children, communication and interaction. However, radiographers working with children also need to have a good understanding of anatomical growth and development to improve image acquisition techniques and appreciation of the distinctive radiographic appearances associated with the juvenile skeleton. Using case studies from clinical practice, this presentation will explore how knowledge of skeletal development during childhood can prevent the misapplication of image acquisition techniques and quality assessment criteria and the misinterpretation of normal developmental variations.

### Pulmonary Thromboembolism: Concepts and Controversies 2013

**Thursday, 04:30 PM - 06:00 PM • S406B**

**RC701** • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

**RC701A** • Overdiagnosis: Fact or Fiction?

Linda B Haramati, MD, MS (Presenter) *

**LEARNING OBJECTIVES**

1) To describe the meaning of 'overdiagnosis' in the context of pulmonary embolism. 2) To develop an overview of the different types of evidence for overdiagnosis of pulmonary embolism on CT. 3) To understand why small pulmonary emboli may be physiologic. 4) To incorporate a more nuanced understanding of pulmonary embolism into the clinical practice of CT interpretation.

**ABSTRACT**

In 2001 CT became the most common imaging modality for suspected PE in the USA. It is unsurpassed in depicting pulmonary artery anatomy and pathology and is useful in demonstrating alternative diagnoses that explain the patients symptoms. CT is also quick and easy. However, overdiagnosis is increasingly
Differentiating Chronic from Acute PE

Sanjeev Bhalla MD (Presenter)

LEARNING OBJECTIVES
1) To identify suitable image acquisition strategies for right heart assessment. 2) To discuss image post-processing for quantitative imaging of right heart strain. 3) To compare the clinical usefulness of various imaging markers for patient prognostication in acute pulmonary embolism.

RC701E • Pulmonary MRA: How I Do It

Mark L Schiebler MD (Presenter) *

LEARNING OBJECTIVES
1) Introduction to Magnetic Resonance Angiography to the Pulmonary Arteries (MRA-PE): Over 20 years of translational research with no breakthroughs in efficacy. 2) Medical radiation risk remains for young individuals. Nice to have an option besides CTA-PE. 2) Identify common artifacts of Pulmonary MRA and thor solutionsto improve quality and efficacy while minimizing patient risk: Maki artifact; Gibbs artifact (ringing); Wrap; Motion. 3) Overcoming barriers to clinical implementation: Evidence from PIOPED III for efficacy; Effectiveness data showing high negative predictive value for MRA-PE; Treating sub segmental PE; in patients without procoagulant conditions, does not prolong life expectancy.

ABSTRACT
Pulmonary MRA (MRA-PE) has been recently shown by the PIOPED III study; to be less sensitive than CTA for the diagnosis of Pulmonary Embolism (PE); However, it has also been shown that if performed in a technically adequate fashion, MRA-PE is highly diagnostic for this condition. Radiation dose from MRA-PE is an ongoing concern especially in young patients. There are many issues that need to be addressed technically and during scan acquisition to ensure high quality MRA-PE exams: 1. Repeat if there is respiratory motion, 2. Reduce spatial resolution to achieve shorter breath hold times, 3. Dilute contrast and deliver dose over the entire acquisition to limit, 4. Included entire AP chest to prevent wrap, 5. Cardiac motion through the lingula and middle lobes, 6. Gibbs ringing artifact, 6. Bronchial proximity susceptibility adjacent to pulmonary artery branches, 7. Respiratory motion, 8. Parallel imaging G factor artifact. We have reviewed all of our symptomatic patients studied with MRA-PE (used as the first line test for PE). There were 579 consecutive symptomatic patients who underwent pulmonary MRA as their primary examination for the determination of PE; Four hundred and Thirty patients were found to be negative by MRA-PE and have a PE diagnosis. Of these patients, only 10 patients were found to have a subsequent VTE in the 3 month EMR period of follow up (40/579 = 7.0%). Of the 430 patients with a negative MRA-PE exam, only ten patients were found to have a subsequent VTE in the 3 month EMR period of follow up (10/430 = 2.3%). The negative predictive value for MRA-PE in this series was 97.7%. Beginning a clinical MRA-PE program at major institutions, using parallel imaging with physics support, is now imminent feasible and justified for use in vulnerable patients.

RC701D • Imaging Right Heart Dysfunction and Prognostication

U. Joseph Schoepf MD (Presenter) *

LEARNING OBJECTIVES
1) To understand optimizing technique for the individual patient. 2) To discuss ways to minimize radiation. Abstract:

1. To understand optimizing technique for the individual patient. 2. To discuss ways to minimize radiation. 3. To discuss ways to minimize radiation. Abstract:

1. To understand optimizing technique for the individual patient. 2. To discuss ways to minimize radiation. 3. To discuss ways to minimize radiation. Abstract:

1. To understand optimizing technique for the individual patient. 2. To discuss ways to minimize radiation. 3. To discuss ways to minimize radiation.
Cardiomyopathy

Thursday, 04:30 PM - 06:00 PM • E450A

LEARNING OBJECTIVES
1) To understand the role of CT/MR in determining the etiology of cardiomyopathy. 2) Understand the role of CT/MR in selecting patients for revascularization. 3) Understand the role of CT/MR in selecting patients for device therapy.

Interactive Game: Musculoskeletal Pitfalls and Pearls

Thursday, 04:30 PM - 06:00 PM • E450A

LEARNING OBJECTIVES
This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Non-traumatic CNS Hemorrhage

Thursday, 04:30 PM - 06:00 PM • E451A

LEARNING OBJECTIVES
1) At the end of this lecture the participant should be able to recognize the variable appearance of parenchymal and subarachnoid hemorrhage on CT/CTA and MRI/MRA imaging. 2) In addition, the learner should be able to provide a differential diagnosis based on imaging characteristics and location. 3) The clinical examples will also include cases that allow the learner to become familiar with the complications of non traumatic intracranial hemorrhage.

ABSTRACT
The lecture begins with an overview of the common causes of non-traumatic intracranial hemorrhage. The pathophysiology of hypertensive hemorrhage is discussed followed by a series of examples demonstrating the classic locations and appearance on CT and MR imaging. The presentations of aneurysmal and non aneurysmal subarachnoid hemorrhage will be reviewed with emphasis on the evaluation of vasospasm using CTA and CT perfusion imaging. Vascular malformations are discussed by using clinical cases that show hemorrhages from feeding artery aneurysms, intra-nidal aneurysms and venous outflow obstruction/thrombosis. Advanced 4D MRA techniques are introduced that use compressed sensing, under-sampling, and constrained reconstruction to provide...
LEARNING OBJECTIVES
1) Select and apply proper imaging technics and modalities. 2) Identify the basic imaging findings of the CNS infectious diseases. 3) Understand important clues for differential and procedural diagnosis. 4) Develop an overall perspective concerning image-guided procedures.

ABSTRACT
Central nervous system (CNS) infections remain as an important cause of morbidity and mortality worldwide. Altered immune status due to HIV infection, immunosuppressive therapies, the increase in international travel and widespread use of antibiotics contribute the emergence of CNS infections. Patient demographics (age/immune status), the pace of the clinical presentation (altered mental status or focal neurologic findings) and laboratory data are the main determinants for diagnosing CNS infections. Rapid diagnosis and initiation of appropriate therapy are at utmost importance for patient outcomes. CNS infections that commonly present in urgent care settings include meningitis, cerebritis, encephalitis, spinal epidural abscess and subdural empyema. Meningitis is an acute inflammation involving the leptomeninges and is caused by viruses (such as the inhaled bacteria), acute lymphocytic (viral) or chronic. Streptococcus pneumoniae and Neisseria meningitides are the most common responsible agents in adults, whereas group B beta hemolytic streptococcus and gram-negative enteric microorganisms are the most prevalent agents in newborns in developed and developing countries, respectively. Meningitis is an acute disorder, and the majority of patients present within the first 7 days of illness. It is important to diagnose meningitis early as it is associated with a poor prognosis if left untreated. Acute meningitis is typically divided into viral, bacterial, and fungal etiologies. Viruses are the most common cause of acute meningitis and are responsible for approximately 20% of cases. Bacterial meningitis is caused by pathogens such as Neisseria meningitides, Streptococcus pneumoniae, and Haemophilus influenzae. Fungal meningitis is less common and is usually caused by Candida species. The clinical presentation of meningitis includes fever, headache, stiff neck, confusion, and seizures. Other symptoms may include photophobia, vomiting, and altered mental status. Imaging findings in meningitis are variable and depend on the causative agent. MRI is the gold standard imaging modality for the diagnosis of meningitis due to its ability to provide detailed information about the surrounding tissue and the lesional characteristics. MR imaging features include abnormal signal intensity and increased fluid diffusion within the leptomeninges (including the subarachnoid space). Treatment is usually antibiotics; when meningitis is caused by a fungal pathogen, antifungal therapy is indicated. Meningitis can lead to serious complications, such as hydrocephalus, seizures, and brain injury. Early recognition and treatment are critical for optimal outcomes. CNS infections remain a significant challenge in emergency medicine practice due to the rapid progression of symptoms, the need for prompt diagnosis and treatment, and the potential for severe complications. Understanding the clinical presentation, diagnosis, and management of CNS infections is crucial for optimizing patient outcomes and minimizing complications. 

LEARNING OBJECTIVES
1) Recognize traumatic, infectious, and vascular pathologies that acutely compromise vision. 2) Identify infections in various ‘spaces’ of the neck (mastoid, carotid, parotid, parapharyngeal) that may compromise the airway. 3) Identify acute traumatic and inflammatory lesions affecting the temporal bone. 4) Recognize acute vascular injuries of the neck.

ABSTRACT
The parapharyngeal region is separable into three major compartments. Substantial fascial layers organize these compartments and have a substantial effect on the imaging appearance of lesions occurring in each. The compartments are the prestyloid parapharyngeal space, post or retrostyloid parapharyngeal space and the carotid space. The parapharyngeal region is separable into three major compartments. The prestyloid parapharyngeal space contains structures such as the parapharyngeal region, the carotid artery, the styloid process, the parapharyngeal fat, and the stylo-mandibular tunnel. The prestyloid parapharyngeal space is a potential space that contains fat and glandular tissue. Lesions in the prestyloid parapharyngeal space are almost always salivary gland in origin. They are anterior to the carotid artery and push the parapharyngeal
fat antero-medially. Lesions in the poststyloid parapharyngeal compartment push the carotid artery anteroinferiorly compressing the parapharyngeal fat antero-laterally. Masses in this space are usually nerve sheath tumors or parangangiomas (glomus vagale). Lesions of the masticator space compress the parapharyngeal fat postero-medially and distort the fat planes between the pterygoid muscles. These lesions are not salivary tumors but may be of osseous, odontogenic, neural or mesenchymal origin. Temporomandibular joint pathology also occurs here. The third division of the trigeminal nerve passes into the trigeminal fat pad located along the medial margin of the lateral pterygoid muscle just inferior to foramen ovale. Perineural spread can reach the trigeminal fat pad and foramen ovale by following the auriculotemporal nerve from the parotid gland or the other major branches of the third division of trigeminal.

**RC706C • Perineural Spread**

Lawrence E Ginsberg MD (Presenter)

**LEARNING OBJECTIVES**
1) Review the various cutaneous malignancies that may affect the face and scalp, focusing on imaging appearance and staging evaluation. 2) Understand the clinical circumstances and imaging appearance and strategies related to perineural tumor spread in head and neck malignancies. 3) Understand the spectrum of upper aerodigestive tract malignancy attributable to minor salivary glands, including the anatomic distribution, imaging appearance including non-specificity, and patterns of spread, particularly by perineural mechanism.

**Advancements in Renal Tumor Treatment: What We Need to Know Before and After Therapy**

**Thursday, 04:30 PM - 06:00 PM • S105AB**

**RC707 • AMA PRA Category 1 Credit ™ • ARRT Category A+ Credit:1.5**

**Coordinator**
Erick M Remer, MD
Ronald J Zagoria, MD
Debra A Gervais, MD *

**LEARNING OBJECTIVES**
1) Attendees will learn the current treatment options for RCC, including partial nephrectomy and tumor ablation. 2) Attendees will be able to articulate the benefits and drawbacks of treatment options, specifically complications and outcomes. 3) Attendees will understand the steps of renal tumor ablation and considerations for ablation success. 4) Attendees will be able to report salient imaging findings before and after RCC treatment, especially partial nephrectomy and tumor ablation.

**ABSTRACT**
This course will provide an introduction to the incidence of RCC, trends in imaging, and the distinction of tumor types. Current treatment options (partial nephrectomy, tumor ablation) and how they are performed will be discussed and the benefits and drawbacks of each will be detailed. Findings that are important to report when interpreting studies before and after treatment will be reviewed.

**Emergency Musculoskeletal Radiology: The Usual (and Unusual) Suspects**

**Thursday, 04:30 PM - 06:00 PM • E350**

**RC708 • AMA PRA Category 1 Credit ™ • ARRT Category A+ Credit:1.5**

**Coordinator**
Joseph S Yu MD (Presenter)

**LEARNING OBJECTIVES**
1) Discuss musculoskeletal conditions that may present with chest pain. 2) Review appropriate imaging algorithm for different processes. 3) List differential diagnosis for location-specific sources of pain.

**ABSTRACT**
Non-cardiac chest pain is a symptom that is frequently encountered in medicine. It tends to elicit a long list of differential diagnoses. The vast majority of people who present with chest pain do not have pathology related to the musculoskeletal system. Occasionally, however, the sternum, clavicles, and ribs along with their articulations may be an unsuspected source of pain. Initial assessment of the thorax begins with a routine radiographic series of the chest. Properly exposed upright PA and lateral radiographs made in full inspiration are often sufficient, but in certain instances, these projections may not allow adequate visualization of the osseous anatomy owing to the superimposition of structures with the mediastinal soft tissues or an incomplete depiction of the contour of the bones, such as the ribs and sternum. As such, a more tailored approach may be required, utilizing cross-sectional imaging modalities such as computed tomography (CT) and magnetic resonance imaging (MR) for evaluating pathologic processes that affect the sternum and sternoclavicular joints, a dedicated bone-destructive imaging technique for the osseous structures, and for localization of the ribs. Occasionally, a coned-down fluoroscopic or radiographic evaluation is adequate, such as a lateral view of the sternum for a dislocation. Scintigraphic examinations such as bone scintigraphy, gallium scanning, and white blood cell scanning are efficacious for assessing metabolic processes that increase bone turnover or produce an inflammatory response. In this course, a differential diagnosis for painful noncardiac and extrapleural conditions of the chest will be discussed including fractures and dislocations, stress fractures, arthritis, costochondritis, sternocostoclavicular hyperostosis, condensing osteitis, infection, muscle tears, and tumors.

**RC709B • Acute Hip Pain in the ED: Fracture and Beyond**

Bharti Khurana MD (Presenter)

**LEARNING OBJECTIVES**
1) To provide an understanding of the proximal femoral and pelvic fractures. 2) Describe the multi modality approach to acute hip pain in the Emergency Department. 3) Review the critical findings relevant to orthopedic surgeons for managing these fractures and avoid potential complications.

**ABSTRACT**
Hip fracture is a common injury with current incidence exceeding 250,000 per year in the United States. The incidence is increasing with increase in life expectancy and elderly population. A prompt diagnosis of hip fracture is important since morbidity and mortality increases as time elapses from the original injury. A thorough knowledge of anatomy, normal variations, pathophysiologic and radiologic modalities of fractures can increase the sensitivity and specificity of plain radiographs as well as cross sectional imaging in detecting these injuries. Although radiography has been reported more than 90% sensitive in detecting fracture, 2-11% of ED patients harbor radiographically occult fractures. Detection of fracture on MRI is based on presence of marrow edema around the fracture site and does not rely on cortical or trabecular displacement. Awareness of treatment principles and potential complications will help radiologists in improving the value of their service to orthopedic surgeons. Other causes of acute hip pain include muscle injuries, infection, neoplasms, transient osteoporosis, osteonecrosis and rapidly progressive osteoarthritis. Abbreviated MRI protocols are helpful in the ED. A checklist for a systematic approach is critical for the radiologists interpreting these studies in ED to avoid potential misses and pitfalls.

**RC708C • Radiologic Detection and Characterization of Retained Foreign Bodies in Extremities**

Ken F Linnau MD,MS (Presenter)

**LEARNING OBJECTIVES**
1) Identify the most common extremity foreign body encountered in Emergency Radiology. 2) Discern the most appropriate imaging modality (computed radiography, ultrasound, CT, and MRI) to visualize a suspected retained foreign body at high conspicuity. 3) Describe the imaging characteristics of various retained foreign materials across the various modalities (computed radiography, ultrasound, CT).

**ABSTRACT**
PURPOSE/AIM: To review the prevalence and describe the imaging characteristics of the most commonly encountered subcutaneously retained extremity foreign bodies in the emergency room setting on various imaging modalities (CR, US, CT, MR). CONTENT ORGANIZATION: Overview of the most commonly retained subcutaneous foreign bodies and review of the current literature. Display the different categories of foreign bodies and their imaging characteristics. Foreign body categories will include plastic, wood, glass, gravel, fish bones, needles and tubing. Describe each foreign body appearance on computed radiography, ultrasound, CT and MRI and provide illustrative clinical examples.

**Gastrointestinal: Biliary Imaging (An Interactive Session)**

**Thursday, 04:30 PM - 06:00 PM • E505C**
However, there are a number of concepts which help the practitioner maximize the utility of the technique, including understanding the keyhole effect, treating clinical history of the presence of pain, a recent increase in size and a sonographic finding of a soft tissue component may suggest a more aggressive etiology.

Sonography is a useful tool for evaluating superficial lumps and bumps in the adult patient. Lipomas are one of the more common superficial lumps, and the common pitfalls when using sonography to evaluate patients for inguinal hernias.

LEARNING OBJECTIVES
1) Recognize the sonographic features of thyroid nodules that are most predictive of malignant nodules. 2) Recognize the sonographic features of thyroid nodules that are most predictive of benign nodules. 3) Discuss different recommendations and indications for performing FNA of thyroid nodules.

ABSTRACT
Thyroid nodules are commonly noted in the thyroid gland of adults when examined by sonography. The sonographic features of thyroid nodules have been recognized to be the most important feature of thyroid nodule assessment with respect to the risk of malignancy. The optimal management of an incidentally-detected thyroid nodule depends on a working knowledge of the sonographic features that raise suspicion for malignancy as contrasted with those features present in the much more common, benign nodule. This talk will review those sonographic features as well as discuss the rationale for the recommendations from both the Endocrinology and the Radiology literature concerning which nodules should undergo fine-needle aspiration (FNA).

RC710C • Lumps, Bumps, and Hernias
Gandikota Girish MBBS (Presenter)

LEARNING OBJECTIVES
1) Understanding the sonographic appearance of lipomas in the subcutaneous tissues. 2) Differentiating lipomas from liposarcomas. 3) Understanding some of the common pitfalls when using sonography to evaluate patients for inguinal hernias.

ABSTRACT
Sonography is a useful tool for evaluating superficial lumps and bumps in the adult patient. Lipomas are one of the more common superficial lumps, and sonographic evaluation can demonstrate compressibility, vascularity, homogeneity and overall appearances similar to adjacent adipose tissue. However a clinical history of the presence of pain, a recent increase in size and a sonographic finding of a soft tissue component may suggest a more aggressive etiology. Inguinal hernias are a common clinical condition which may present with inguinal discomfort, and Ultrasound is a useful means for making a definite diagnosis. However, there are a number of concepts which help the practitioner maximize the utility of the technique, including understanding the keyhole effect, treating the inguinal canal as a vessel, understanding the relationship between the deep ring and the inferior epigastric artery, and being aware of the thin man pitfall...
LEARNING OBJECTIVES
1) Recognize the strengths of FDG PET/CT and dedicated CT imaging in head and neck cancer. 2) Recognize the false positives and false negatives associated with FDG PET/CT and CT imaging. 3) Understand the importance of combining PET and dedicated CT imaging findings for a thorough interpretation.

ABSTRACT
Accurate staging and timely detection of recurrence are of prime importance for for improving outcome in head and neck cancer patients. FDG PET/CT imaging helps in staging and detecting persistent or recurrent disease, estimate its extent and monitor tumor response and occasionally detect synchronous second primary tumors. After radical surgery or radiation therapy for HNC, conventional imaging modalities can be highly inaccurate in differentiating tumor from non-neoplastic post-treatment changes as normal tissue planes are altered substantially. FDG-PET has higher sensitivity and specificity for detecting metastatic lesions in HNC than other conventional imaging modalities including CT. Although in some instances PET can be false negative without the existence of a morphologic imaging component. Combined PET/CT scanners overcome some of these limitations by fusing the morphologic data obtained by CT with the functional data of PET. In this session case examples will be presented to highlight the superior sensitivity and specificity of FDG PET/CT imaging. In addition, case examples of dedicated CT will be presented in those cases when FDG PET imaging can be misleading with false positive or negative results.

RC711A ● Correlative CT and PET Imaging: Superiority of CT
Peter M Som MD (Presenter)

LEARNING OBJECTIVES
1) The attendee will learn from case examples how the morphologic information of CT and MR imaging are a critical part of a PET study. 2) The attendee will learn by case examples the imaging findings on CT and MR that should make one question the pathologic significance of PET avidity.

ABSTRACT
Although PET avidity can identify head and neck cancers that may be poorly seen on morphologic imaging, there are times when the PET findings may be misleading. These include PET avidity in non-cancerous lesions, apparent PET avidity related to artifact, and the absence of PET avidity due to limited biomass in necrotic lesions. Case examples will be presented to illustrate these points.

RC711B ● Correlative CT and PET Imaging: Superiority of PET
Lale Kostakoglu MD,MPH (Presenter)

LEARNING OBJECTIVES
1) Recognize the strengths of FDG PET/CT imaging over CT imaging in head and neck cancer. 2) Recognize the false positives and false negatives associated with FDG PET/CT imaging. 3) Understand the importance of combining PET and CT imaging findings for a thorough interpretation.

ABSTRACT
MR, CT, and FDG PET/CT have strengths and weaknesses in the detection and staging head and neck carcinoma. While PET/CT is highly sensitive in the detection of primary head and neck carcinoma and metastatic nodal disease, there are limitations including avidity in muscle activation and inflammatory lesions as well as the detection of perineural tumor spread and metastatic necrotic nodal disease. MRI case studies will be presented highlighting the areas of superiority of MRI over FDG PET/CT.
The prevalence of symptomatic peripheral artery disease (PAD) ranges around 3% in patients aged 40 and 6% at an age of 60 years. Additionally, the prevalence of asymptomatic PAD lies between 3% and 10% in the general population increasing to 15% to 20% in persons older than 70 years of age. However, these data still might underestimate the total prevalence of PAD since screening studies showed that between 10% and 50% of all patients with intermittent claudication (IC) never consult a doctor about their symptoms. These data prove the need for an accurate and reliable method for assessment of the peripheral vasculature. Digital subtraction angiography (DSA) still serves as the reference standard for all vascular imaging techniques. However, because of the absence of ionizing radiation, the use of non-nephrotoxic contrast agents or even non-contrast-enhanced sequences and the large toolbox of available techniques for high-resolution static and dynamic imaging Magnetic Resonance Angiography (MRA) constitute an excellent non-invasive alternative. Different acquisition schemes and contrast agent application protocols as well as different types of data sampling for static, dynamic, contrast- and non-contrast-enhanced imaging enable to tailor each exam to a specific question and patient respectively.

**RC712D • Endovascular Treatment of PAD**

Stephen T Kee  MD (Presenter)

**LEARNING OBJECTIVES**

View learning objectives under main course title.

---

**Pediatric Neuroimaging II**

Thursday, 04:30 PM - 06:00 PM • S102AB

**RC713 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5**

**RC713A • MRI Imaging of Brain Development**

Robert C McKinstry  MD, PhD (Presenter) *

**LEARNING OBJECTIVES**

1) Describe how water and myelin content influence the T1 and T2 relaxation times. 2) Describe the time course and regional variation of brain maturational changes. 3) Use a systematic approach to determine the child’s brain age.

**RC713B • Congenital Brain Malformations**

Sarah S Milla  MD (Presenter)

**LEARNING OBJECTIVES**

1) Understanding the classification of congenital brain malformations, particularly cortical malformations. 2) Comprehension of the genetic undertones of congenital brain malformations. 3) Ability to identify imaging appearance of common cortical malformations on brain MR imaging.

---

**Interactive Game: Interventional**

Thursday, 04:30 PM - 06:00 PM • E353A

**RC714 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5**

**Moderator**

Steven M Zangan, MD  Brian S Funaki, MD  Rakesh C Navuluri, MD

**LEARNING OBJECTIVES**

1) Recognize vascular and non-vascular conditions and their image-guided treatment in the chest, abdomen and pelvis. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

---

**Digital Breast Tomosynthesis**

Thursday, 04:30 PM - 06:00 PM • E451B

**RC715 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5**

**RC715A • Clinical Implementation**

Lawrence W Bassett  MD (Presenter)

**LEARNING OBJECTIVES**

1) Identify the key practical issues affecting the clinical implementation of digital tomosynthesis. 2) Understand the technical aspects of digital tomosynthesis that will impact clinical workflow and IT resources. 3) Integrate changes to current workstation read-out protocols to allow for efficient interpretation of digital tomosynthesis studies.

**ABSTRACT**

Author will discuss approaches of image acquisition in digital breast tomosynthesis (DBT). The basics of DBT image interpretation and potential challenges of clinical digital breast tomosynthesis will be reviewed.

**RC715B • Interpretation**

Emily F Conant  MD (Presenter) *

**LEARNING OBJECTIVES**

1) Understand the basics of DBT image presentation and interpretation. 2) Review DBT applications in screening and diagnosis. 3) Identify potential challenges in clinical implementation of DBT.

**RC715C • Research Evidence**

Etta D Pisano  MD (Presenter) *

**LEARNING OBJECTIVES**

1) Understand the published literature on the use of tomosynthesis for breast cancer screening. 2) Understand the proposed trial design for the Tomosynthesis Mammographic Imaging Screening Trial (TMIST) and what that trial adds to the available data on tomosynthesis.

---

**What the Referring Physician Needs to Know (Sponsored by the RSNA Public Information Committee)**

Thursday, 04:30 PM - 06:00 PM • S504AB

**RC716 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5**

**Moderator**

Judy Yee, MD  Jeffrey D Kopin, MD  Stephan G Wyers, MD
Advances in Cross-sectional Oncologic Imaging

Thursday, 04:30 PM - 06:00 PM • S504CD

Ultrasound/Opto-Acoustic Molecular Imaging

Juergen K Willmann, MD (Presenter)

LEARNING OBJECTIVES

1) Discern what referring physicians need from radiologists at various stages of patient care. 2) Recognize referring physicians’ preferences in communication methods. 3) Identify referring physicians’ needs regarding structured reporting and appropriateness criteria. 4) Understand how to improve your communications and work more effectively with referring physicians to enhance patient care. 5) Recognize opportunities to improve/expand your interactions with referring physicians.

Ultrasound Molecular Imaging

Juergen K Willmann, MD (Presenter)

LEARNING OBJECTIVES

1) To understand the acquisition and quantification principles of ultrasound molecular imaging. 2) To understand the characteristics and biodistribution of molecularly targeted ultrasound contrast agents. 3) To understand the role of ultrasound molecular imaging in preclinical and clinical applications.

Sonographically-guided Drug Therapy

Alexander L Klibanov, PhD (Presenter)

LEARNING OBJECTIVES

1) To identify the basic principles of ultrasound-microbubble interaction, drug-carrier systems pharmacokinetics and ultrasound contrast imaging, apply this knowledge for the development of triggered delivery approaches in the setting of personalized medicine. 2) To understand advantages and disadvantages of ultrasound for detection and characterization of focal lesions has been substantially improved. Recently, targeted contrast-enhanced ultrasound imaging (ultrasound molecular imaging) has gained great momentum in preclinical research by the introduction of ultrasound contrast agents that are targeted at molecular markers over-expressed on the vasculature of certain diseases. By combining the advantages of ultrasound with the ability to image molecular signatures of diseases, ultrasound molecular imaging has great potential as a highly sensitive and quantitative method that could be used for various clinical applications, including screening for early stage disease (such as cancer); characterization of focal lesions; quantitative monitoring of disease processes at the molecular level; assisting in image-guided procedures; and, confirming target expression for treatment planning and monitoring.

In this refresher course the concepts of ultrasound molecular imaging are reviewed along with a discussion on current applications in preclinical and clinical research.

Microbubble-enhanced Ultrasound in Oncology

Hyun-Jung Jang, MD (Presenter)

LEARNING OBJECTIVES

1) To understand the fundamental principles of photoacoustic imaging and major components of photoacoustic imaging system. 2) Knowing how photoacoustic images are formed and how to interpret photoacoustic images. 3) Understand how imaging contrast agents or imaging probes affect contrast, penetration depth and specificity in photoacoustic imaging. 4) Understand the ability of photoacoustic imaging system to visualize anatomical, functional and molecular properties of imaged tissue. 5) Identify the role of photoacoustic imaging in pre-clinical and clinical applications.

Photoacoustic Imaging

Stanislav Emelianov, PhD (Presenter)

ABSTRACT

Photoacoustic imaging or tomography – a non-ionizing, non-invasive, real-time imaging technique capable of visualizing optical absorption properties of tissue at reasonably deep and high spatial resolution, is a rapidly emerging biomedical and clinical imaging modality. Photoacoustic imaging is regarded for its ability to provide in-vivo morphological and functional information about the tissue. With the recent advent of targeted contrast agents, photoacoustics is capable of in-vivo molecular imaging, thus facilitating further molecular and cellular characterization of tissue. This presentation is designed to provide both a broad overview and a comprehensive understanding of photoacoustic imaging. With a brief historical introduction, we will examine the foundations of photoacoustics, including relevant governing equations, optical/acoustic properties of the tissues, laser-tissue interaction, system hardware and signal/image processing algorithms. Specifically, we will discuss the advantages of multi-modal imaging and image-guided therapy including drug delivery and release. The presentation will continue with an overview of several commercially available and clinically-relevant systems capable of photoacoustic imaging. Regulatory aspects of photoacoustic imaging systems and imaging contrast agents will be presented. Finally, current and potential biomedical and clinical applications of photoacoustics will be discussed.
1) To identify when and where CEUS is useful in oncologic patients relevant to clinical practice. 2) To understand advantages of CEUS in oncologic imaging including a real-time dynamic imaging and purely intravascular property of microbubble contrast agents. 3) To understand the background rationales and potential role of CEUS in monitoring antivascular treatment and tumor perfusion measurement.

**ABSTRACT**

**RC718B • Dual-Energy CT in Oncology**

Anno Graser MD (Presenter) *

**LEARNING OBJECTIVES**

1) To understand basic principles of dual energy CT in imaging of soft tissues. 2) To learn about the properties of iodine distribution maps in dual energy CT, and how to exploit them in the characterization of malignancy. 3) To understand the perspectives of dual energy CT in response assessment based on DECT quantification of iodine uptake. 4) To learn how to build successful dual energy CT examination protocols for disease characterization in patients with malignancy. 5) Dose issues in dual energy CT will also be explained in this refresher course lecture.

**RC718C • Practical Utilization of 3D Techniques in Cancer Imaging**

Zhen J Wang MD (Presenter)

**LEARNING OBJECTIVES**

1) Review 3D imaging techniques available for common modalities in oncologic imaging. 2) Illustrate uses of 3D imaging in everyday clinical practice. 3) Review cases where 3D imaging makes a difference.

**ABSTRACT**

**Medical Physics 2.0: Information Management and Display**

Thursday, 04:30 PM - 06:00 PM • N229

**RC721 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**

Co-Director
Ehsan Samei, PhD *
Co-Director
Douglas E Pfeiffer, MS *

**RC721A • Information Management and Display Perspective**

Ehsan Samei PhD (Presenter) *

**LEARNING OBJECTIVES**

1) To gain an appreciation for interaction between medical physics and information technology in modern medicine. 2) To understand how physics can add value to patient care in the area of information and image management and technology.

**RC721B • Information Management and Display 1.0**

Donald Peck PhD (Presenter)

**LEARNING OBJECTIVES**

1) Review the different areas of imaging informatics. 2) Understand the methodology for developing informatics standards and the role of physicists and radiologists in the process. 3) Review the current status of informatics standards 4) Review current technology for validating the function of these systems.

**ABSTRACT**

Imaging informatics is part of every radiology practice today. Imaging informatics covers everything from the ordering of a study, through the data acquisition and processing, display and archiving, reporting of findings and the billing for the services performed. The standardization of the processes used to manage the information and methodologies to integrate these standards is being developed and advanced continuously. These developments are done in an open forum and imaging organizations and professionals all have a part in the process. In this presentation the flow of information and the integration of the standards used in the processes will be reviewed. The role of radiologists and physicists in the process will be discussed. Current methods for validation of informatics systems function will also be discussed.

**RC721C • Information Management and Display 2.0**

Michael J Flynn PhD (Presenter)

**LEARNING OBJECTIVES**


**Uncertainties in Imaging for Radiation Oncology: Sources and Mitigation Techniques-Image Registration**

Thursday, 04:30 PM - 06:00 PM • S502AB

**RC722 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**

Co-Director, Moderator
Kristy K Brock, PhD *

**LEARNING OBJECTIVES**

1) Describe methods to perform QA/QC of deformable registration. 2) Propose methods to account for uncertainties. 3) Highlight clinical integration.

**RC722A • Uncertainties in Deformable Registration**

Kristy K Brock PhD (Presenter) *

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC722B • Clinical Practice**

Patrick Kupelian MD (Presenter) *

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**Minicourse: Recording and Reporting Radiation Dose: CT**

Thursday, 04:30 PM - 06:00 PM • E351

**RC723 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**

Director
J. Anthony Seibert, PhD
Professionalism and the Radiology Trainee

Thursday, 04:30 PM - 06:00 PM • S403A

LEARNING OBJECTIVES
1) To discuss effective strategies to address the issue of the impaired and/or incompetent colleagues. 2) To explain how to handle unprofessional behavior within and across disciplines. 3) To formulate approaches to accountability, the unexpected outcome, and the role of apology.

ABSTRACT
Unprofessional behavior during medical school, residency, and fellowship training has been linked to subsequent disciplinary action by medical boards. Consequently, educational initiatives fostering professionalism are essential for residency and fellowship training in order to promote high-quality patient care. Moreover, professionalism is now one of the six competencies that residents are required to achieve before completing their training and taking the new core examinations. Professionalism is one of the most challenging components of the core ACGME competencies to teach and evaluate during residency training.

In summary, this presentation will discuss existing CT dose parameters, and will then review a number of proposed new CT dose parameters which will likely be useful for CT dose assessment in the future. The recent growth of CT technology has outgrown the simple dose metrics of the past, and there is a need for the CT community to embrace new and more accurate CT dose metrics.

Measuring and Indices in CT Dose

John M Boone PhD (Presenter) *

LEARNING OBJECTIVES
1) The audience will be able to identify and discuss the standard parameters used for reporting dose in computed tomography, including the volume CTDI (CTDIvol) and the dose length product (DLP); and (2) The audience will be able to identify and discuss parameters which influence the radiation dose to the patient, including patient size, dose modulation protocols, and scan length. 3) Participants will be able to identify the limitations of using effective dose in describing radiation dose levels to individual patients.

ABSTRACT
Computed tomography has experienced rapid growth in utilization over the past 10 years, due in part to the dramatic increase in image quality and decrease in scan time that helical and multi-slice CT scanners have afforded. This increased utilization has raised legitimate concerns about the radiation dose levels in CT. Traditional dose metrics such as the volume computed tomography index (CTDIvol) and the dose length product (DLP) will be discussed. The limitations of these metrics in the context of individual patient dosimetry will also be explained. In recent years, a number of new CT dose concepts have been introduced in the peer-reviewed literature, in task group reports, and in other documents. A number of these new dose metrics will be discussed, including the rise-to-equilibrium-dose, H(L), and the site-specific dose estimate (SSDE). CT dosimetry has historically been performed using integrating ion chambers. In light of the increasing scanning capabilities of modern CT scanners, the utility of a real-time radiation meter will be discussed. Real-time dose meters can substantially reduce the time required by the physicist in the CT scanner suite, while increasing the quantity and quality of the dose information that is measured.

Niche applications include the rapid assessment of beam quality (half value layer) and the characterization of the beam shaping filters used in CT. In summary, this presentation will discuss existing CT dose parameters, and will then review a number of proposed new CT dose parameters which will likely be useful for CT dose assessment in the future. The recent growth of CT technology has outgrown the simple dose metrics of the past, and there is a need for the CT community to embrace new and more accurate CT dose metrics.
and navigation tools, and business analytics applications can be used to overcome some of the existing limitations. The RSNA's Quantitative Imaging Biomarkers Alliance (QIBA) is an initiative with international participation from medical physicists, clinicians, researchers, industry scientists, and government officials all interested in optimizing the potential of quantitative imaging. A major QIBA informatics activity, the imaging data warehouse is in progress. Current status and future plans will be described.

RC725B • Standards for Quantitative Imaging

David A Clunie MBBS (Presenter) *

LEARNING OBJECTIVES
1) Identify the importance of quantitative imaging principles in the setting of clinical trials. 2) Identify the role of standards, including DICOM and others, in the successful application of quantitative imaging principles. 3) Analyze quantitative imaging techniques and apply this knowledge to protocol development in the setting of clinical trials.

RC725C • Clinical and Research Needs for Quantitative Imaging Informatics Tools

Bradley J Erickson MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) Become familiar with the quantitative imaging tools that are available for clinical and research uses. 2) Become familiar with the clinical and research problems that are being addressed by quantitative imaging. 3) Become familiar with the clinical and research problems that might be addressed by quantitative imaging in the near future and how to prepare one's practice for these uses.

ABSTRACT
Quantitative imaging is more than just the measurement of structures in images. It is a new way of approaching diagnosis and therapy assessment. While simple linear measurements might qualify as quantitative imaging, it is important to think of QI in a much broader context. In addition to measuring spatial quantities like length, area, and volume, one can measure image values on functional imaging, which might represent a physiologic value. One can measure textures and edge properties, potentially replacing the 'it just looks like it' answer to why an expert can diagnose a certain disease. Measuring change can also be more than just spatial. Spatial change detection is important, of course, and doing it well is a critical component of QI. Measuring change in non-spatial properties is likely to become more important in the future. Finally, while some might believe that genomics will largely replace imaging, there is currently much interest in the use of imaging to provide pervasive and non-destructive prediction of genomic, proteomic, and metabolomic properties that are likely to be of great value to patient care.

Decision Support in Clinical Practice

Thursday, 04:30 PM - 06:00 PM • N226

RC726 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+: Credit:1.5

Co-Moderator
Charles E Kahn , MD, MS *
Co-Moderator
Elizabeth S Burnside , MD, MPH *

LEARNING OBJECTIVES
1) Understand the current process of how reimbursement for new technology is obtained from CPT code development, valuation and coverage. 2) Understand what quantitative image features are and the various ways in which they may be obtained. 3) Learn about potential applications of quantitative image features, such as content-based image retrieval, decision support, and discovery of relationships between image features and molecular properties of disease.

ABSTRACT
Decision support systems use knowledge -- ranging from books, to web sites, to real-time artificial intelligence systems -- to help physicians improve their decision making. This Refresher Course will review a number of systems that can help radiologists' decision making. We will describe tools for information retrieval and image retrieval, and systems that use rules or probabilities to help identify the most likely diagnosis. We will discuss how evolving technologies provide new ways to integrate advanced decision support into routine clinical practice, and how decision support systems can improve outcomes in patient care.

RC726A • CPOE: Radiology Decision Support for the Clinician

Charles E Kahn MD, MS (Presenter) *

LEARNING OBJECTIVES
1) Define decision support systems and their role in radiology. 2) Describe widely used decision support technologies. 3) Explore how radiology decision support systems can improve patient care outcomes.

ABSTRACT
Decision support systems use knowledge -- ranging from books, to web sites, to real-time artificial intelligence systems -- to help physicians improve their decision making. This Refresher Course will review a number of systems that can help radiologists' decision making. We will describe tools for information retrieval and image retrieval, and systems that use rules or probabilities to help identify the most likely diagnosis. We will discuss how evolving technologies provide new ways to integrate advanced decision support into routine clinical practice, and how decision support systems can improve outcomes in patient care.

RC726B • Decision Support in Predicting Diagnosis and Outcomes

Elizabeth S Burnside MD, MPH (Presenter) *

LEARNING OBJECTIVES
1) Understand the potential role of informatics in predicting diagnosis and outcome based on variables derived from imaging. 2) Appreciate the important trade-offs that exist when developing or using predictive models. 3) Learn about the application and critical evaluation of different methodologies that can provide predictive information.

ABSTRACT
Quantitative imaging is more than just the measurement of structures in images. It is a new way of approaching diagnosis and therapy assessment. While simple linear measurements might qualify as quantitative imaging, it is important to think of QI in a much broader context. In addition to measuring spatial quantities like length, area, and volume, one can measure image values on functional imaging, which might represent a physiologic value. One can measure textures and edge properties, potentially replacing the 'it just looks like it' answer to why an expert can diagnose a certain disease. Measuring change can also be more than just spatial. Spatial change detection is important, of course, and doing it well is a critical component of QI. Measuring change in non-spatial properties is likely to become more important in the future. Finally, while some might believe that genomics will largely replace imaging, there is currently much interest in the use of imaging to provide pervasive and non-destructive prediction of genomic, proteomic, and metabolomic properties that are likely to be of great value to patient care.

ABSTRACT
Quantitative imaging is more than just the measurement of structures in images. It is a new way of approaching diagnosis and therapy assessment. While simple linear measurements might qualify as quantitative imaging, it is important to think of QI in a much broader context. In addition to measuring spatial quantities like length, area, and volume, one can measure image values on functional imaging, which might represent a physiologic value. One can measure textures and edge properties, potentially replacing the 'it just looks like it' answer to why an expert can diagnose a certain disease. Measuring change can also be more than just spatial. Spatial change detection is important, of course, and doing it well is a critical component of QI. Measuring change in non-spatial properties is likely to become more important in the future. Finally, while some might believe that genomics will largely replace imaging, there is currently much interest in the use of imaging to provide pervasive and non-destructive prediction of genomic, proteomic, and metabolomic properties that are likely to be of great value to patient care.

From Research to Reimbursement: The Story of CT Colonography and What It Teaches Us about Healthcare Payment Policy (In Conjunction with the American College of Radiology) (An Interactive Session)

Thursday, 04:30 PM - 06:00 PM • S103CD

RC727 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+: Credit:1.5

Bibb Allen , MD
James V Rawson , MD
Ezequiel Silva , MD
Robert K Zeman , MD
Geraldine B McGinty , MD
Pamela Kassing
Mark O Bernardy , MD
Timothy A Crummy , MD

LEARNING OBJECTIVES
1) Understand the current process of how reimbursement for new technology is obtained from CPT code development, valuation and coverage. 2) Using CT colonography as an example, the participants will become familiar with the specific processes for obtaining coverage for new technology and procedures in the public and private sectors and how a myriad of governmental agencies and other policymaking groups are involved in determining which new procedures are covered. 3) Understand why obtaining coverage has become the limiting factor in bringing new technology to the mainstream. 4) Interactive techniques will be
Abdominal MRI Technique Update (An Interactive Session)
Thursday, 04:30 PM - 06:00 PM • E450B

RC729 • AMA PRA Category 1 Credit™: 1.5 • ARRT Category A+ Credit: 1.5

RC729A • Respiratory Artifacts in Abdominal MRI: Causes and Cures
Eduard E De Lange MD (Presenter)
LEARNING OBJECTIVES
1) Understand how the characteristics of commonly used abdominal-imaging pulse sequences influence their susceptibility to respiratory artifacts. 2) Explain differences between multi-slice and single-shot pulse sequences. 3) Describe various approaches for suppressing respiratory artifacts. 4) Optimize routine imaging protocols for abdominal MRI.

RC729B • Choosing an MRI Contrast Agent
Jay K Pahade MD (Presenter)
LEARNING OBJECTIVES
1) Provide background of different available MRI contrast agents and their properties. 2) Discuss safety profiles and concepts related to minimizing risk of NSF. 3) Review common indications for different available MRI contrast agents and their relative strengths and weaknesses.

RC729C • Optimizing Contrast Enhancement: 2013 and Beyond
Martin R Prince MD, PhD (Presenter)*
LEARNING OBJECTIVES
1) Learn how to perform high temporal resolution dynamic MR Contrast enhanced imaging. 2) Learn post-processing strategies for high temporal resolution MR data. 3) Review applications of high temporal resolution imaging.

ABSTRACT

Leveraging Imaging Informatics to Improve Radiology Education: Beyond the Teaching File (An Interactive Session)
Thursday, 04:30 PM - 06:00 PM • S103AB

RC730 • AMA PRA Category 1 Credit™: 1.5 • ARRT Category A+ Credit: 1.5
Moderator 
Marc D Kohli, MD *

RC730A • Simulation Systems in Radiology Education
Kitt Shaffer MD,PhD (Presenter)
LEARNING OBJECTIVES
1) Describe two professional systems that currently use simulation extensively for teaching. 2) List three teaching situations in radiology where simulation could be integrated. 3) Describe three levels of training in radiology where simulation could play a role.

ABSTRACT
This interactive session will explore the role of simulation in all types of professional training outside of radiology, as well as potential educational, training, evaluation and quality improvement settings within radiology where simulation may play a role in the future.

RC730B • Educational Tools for the Next Generation in Radiology
Richard E Sharpe MD, MBA (Presenter)
LEARNING OBJECTIVES
1) Explain factors that are changing the face of radiology education. 2) Contrast the educational tools used by past, present and future generations of radiologists. 3) Describe cutting edge innovative educational tools for diagnostic radiology training.

RC730C • Quality Improvement Tools in Education
Jason N Itri MD, PhD (Presenter)
LEARNING OBJECTIVES
1) Define standards for evaluating the quality of an assessment method. 2) List quality-related educational outcomes for radiology trainees. 3) Describe IT tools that can be used to assess trainee performance and the impact of interventions. 4) Discuss educational and training interventions that improve quality-related outcomes.

ABSTRACT

RC730D • Taking Audience Response to the Next Level
Lonie R Salkowski MD (Presenter)
LEARNING OBJECTIVES
1) Demonstrate the ability to set-up, prepare and incorporate a presentation into an audience response system. 2) Determine methods for exporting and analyzing data from an audience response session. 3) Identify differences of using audience response systems on PC versus Mac platforms. 4) Identify techniques where the audience response system can be applied to active learning environments.

ABSTRACT
This session will demonstrate ways to incorporate audience response devices into learning environments, and assist users how to use the data that is collected behind the scenes within audience response systems.

Common Spinal Injection Procedures for Diagnosis and Treatment of Back Pain (Hands-on Workshop)
Thursday, 04:30 PM - 06:00 PM • E263

RC731 • AMA PRA Category 1 Credit™: 1.5 • ARRT Category A+ Credit: 1.5
A. Orlando Ortiz, MD, MBA *
John M Mathis, MD, MSc
Chi-Shing Zee, MD
Bassem A Georgy, MD, MSc *
Allan L Brook, MD *

LEARNING OBJECTIVES
Managing the Problem Employee

Thursday, 04:30 PM - 06:00 PM • S403B

LEARNING OBJECTIVES
1) Describe an appropriate imaging work up for malignant bile duct obstruction (MBDO). 2) List the indications for percutaneous biliary intervention in the setting of MBDO. 3) Formulate a plan to achieve clinical goal of drainage based on imaging and clinical data. 4) Understand potential complications of biliary drainage in MBDO and their management.

ABSTRACT
BILIARY COMPLICATIONS FOLLOWING ORTHOTOPIC LIVER TRANSPLANTATION Roy Gordon MD, Interventional Radiology, University of California, San Francisco

Transplant patients are different for a number of reasons as listed below: •Most liver transplant patients have benign disease and a potential for long-term survival
•Resources (livers and financial) are limited, so every effort must be made to salvage the transplanted liver
•Immunosuppression alters both response to infection and the healing process Participants in this course will learn about the incidence, nature and management of biliary complications following liver transplantation both from the diagnostic and the therapeutic approach. The following questions will be addressed: 1. Should bile leaks be treated surgically or non-operatively? 2. Should anastomotic strictures be treated surgically or dilated? 3. How should non-anastomotic strictures be managed? In addition some other biliary problems in the liver transplant recipient will be presented detailing diagnosis and management
•Bile duct filling defects
•Sphincteric dysfunction
•Mucocele of cystic duct remnant
•Problems related to split livers (living donors) PERCUTANEOUS INTERVENTION IN MALIGNANT BILIARY OBSTRUCTION -- ANNE COVEY MD FSIR INDICATIONS FOR BILIARY DRAINAGE

MR Imaging-guided Breast Biopsy (Hands-on Workshop)

Thursday, 04:30 PM - 06:00 PM • E260

LEARNING OBJECTIVES
1) Establish criteria for MR Image-guided breast biopsy patient selection. 2) Cultivate a working understanding of MR Image-guided biopsy and needle localization instrumentation and implementation. 3) Basic MR Image-guided biopsy and needle localization parameters and requirements for appropriate coil, needle and approach selection. 4) Discuss practice integration issues. 5) Benefits and limitations of availability of MR Image-guided biopsy/needle localization in your practice.

ABSTRACT
This course is intended to provide both basic didactic instruction and hands-on experience in the application of MRI guided breast biopsy and needle localization. Because MRI is having a progressively larger role in the evaluation of breast cancer each year, there has been a tremendous increase in the need for MRI guided biopsy and needle localization of the identified abnormalities, since many of these can only be identified at MRI. This course will be devoted to the understanding and identification of: 1) appropriate patient selection 2) optimal positioning for biopsy 3) target selection and confirmation 4) various biopsy techniques and technologies 5) potential problems and pitfalls

IR Management of Biliary Obstruction: What You Didn't Learn in Fellowship (How-to Workshop)

Thursday, 04:30 PM - 06:00 PM • E261

LEARNING OBJECTIVES
- Describe and demonstrate methods for patient selection, evaluation and technique for Image-guided injection procedures used in spine pain management
- These procedures will include epidural steroid injections, nerve root blocks, facet blocks, sacroiliac joint injections, lumbar synovial cyst therapy, radiofrequency ablations, and discography
- Review procedural complications and how to avoid them
- Discuss pertinent anatomy, instruments and pharmacology
- These objectives will be accomplished using didactic lectures complemented by procedure videos, supervised hands on lab work with training models and round table case discussions

ABSTRACT
Neck and back pain complaints are very common in the general population. Radiologists can contribute to the diagnosis and management in patients who are not responding to conservative management. Spine injection procedures can frequently be performed on an outpatient basis with a brief recovery phase. These procedures are performed with imaging guidance, often a multi-directional fluoroscope, in order to correctly localize the specific anatomic sites in or about the spine for diagnostic and or therapeutic needle localization. An understanding of patient selection, indications and contraindications, are paramount to the safety and success of these procedures. The diagnostic and therapeutic potential of these procedures is also facilitated by a thorough evaluation of the spine, with respect to both anatomy and potential pathology, with cross sectional imaging techniques as well as other radiologic tests. Communication of these results between the Radiologist and the spine proceduralist will contribute to optimal patient outcomes.

Back to Top
1. Biliary sepsis
2. Intractable pruritus
3. Lower bilirubin for chemotherapy
4. Biliary diversion (leak)
5. Improve QOL

INDICATION FOR PERCUTANEOUS DRAINAGE MBO
1. Failed endoscopy
2. High obstruction
3. Obstructed Roux loop
4. Access for additional therapies (stone removal, dilation, brachytherapy)

PRE PROCEDURE WORK UP IMAGING
1. Obstructive vs. non obstructive jaundice
2. Level of obstruction
3. Portal vein status
4. Atrophy
5. Parenchymal lesions
6. Ascites
7. Liver anatomy

LABS
1. Platelet count
2. INR
3. LFTs

PROCEDURE ISSUES
1. Right vs left drain
2. Atrophy/portal vein compromise
3. Ascites
4. Catheter vs stent

Techniques for Interventional Sonography and Thermal Ablation (Hands-on Workshop)
Thursday, 04:30 PM - 06:00 PM • E264

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) Introduce these component skill sets into further life-long learning for expansion of competency and preparation for more advanced interventional sonographic learning opportunities.

ABSTRACT
Advanced Image Analysis, including Applications such as Automated Stent Planning and Multimodality Image Fusion and Treatment Planning (Hands-on Workshop)
Thursday, 04:30 PM - 06:00 PM • S401CD

LEARNING OBJECTIVES
1) To get hands-on experience using 3D / 4D tools to process huge data sets, specifically multislice CT and MR using data sets. 2) How to effectively deal with the following data: CT and MR angiograms, perfusion, and bone. 3) Getting hands on experience using 3D / 4D tools to process data in near realtime. 4) Introduce the basic 3D tools that are available and how they can be used both within radiology as well as how they apply to referring clinicians.

ABSTRACT
This course will focus on how to get hands-on experience using 3D / 4D tools to process huge data sets, specifically multislice CT and MR using data sets. How to effectively deal with the following data: CT and MR angiograms, perfusion, and bone. It will also focus on providing hands on experience using 3D / 4D tools to process data in near realtime for emergencies like stroke work-up. It will also introduce the basic 3D tools that are available and how they can be used both within radiology as well as how they apply to referring clinicians.

Using RADIANCE for CT Dose Monitoring and Quality Assurance: A Hands-on Course
Thursday, 04:30 PM - 06:00 PM • S401AB

LEARNING OBJECTIVES
1) Download and install RADIANCE. 2) Configure RADIANCE for their facility. 3) Set up RADIANCE to query and retrieve dose sheets automatically from PACS or another archive. 4) Use the RADIANCE reporting tools to review their institutional dose data. 5) Export dose data from RADIANCE for custom analysis using a spreadsheet or database.

ABSTRACT
RADIANCE is a freely-available, open source software packaged designed to facilitate dose monitoring, dose reporting and quality assurance for computed tomography (CT) examinations. It uses optical character recognition (OCR) to extract structured data from the image-based dose sheets that have been and continue to be produced by CT scanners worldwide. The structured data is parsed and useful dose-related parameters are extracted, including the x-ray tube voltage (kV), x-ray tube current (mA), volumetric CT dose index (CTD1vol) and dose-length product (DLP). In addition, information about the patient, type of
Disclosure Index

A

Abajudeh, H. H. - Research Grant, Bracco Group Consultant, RCG HealthCare Consulting
Aghenitie, I. - Employee, Eloquentix
Agillosz, O. - Researcher, im3D SpA
Agrawal, M. D. - Advisor, Bayer AG
Alessio, A. M. - Research Grant, General Electric Company Consultant, Lantheus Medical Imaging, Inc
Allibek, S. - Consultant, General Electric Company Speakers Bureau, General Electric Company Speakers Bureau, Siemens AG
Alperin, N. - Stockholder, Alperin Noninvasive Diagnostics, Inc
Altes, T. A. - Research Grant, Vertex Pharmaceuticals Incorporated Research Grant, Novartis AG Research support, Siemens AG
Anders, B. - Employee, General Electric Company
Annapragada, A. - Founder, Marval Biosciences LLC Stockholder, Marval Biosciences Inc Founder, Alzeza Biosciences LLC Stockholder, Alzeza Biosciences LLC Founder, Sensulin LLC Stockholder, Sensulin LLC Stockholder, Abbott Laboratories Stockholder, Johnson & Johnson Stockholder, Merck & Co, Inc
Anselmetalii, G. - Research Consultant, Medtronic, Inc
Antoch, G. - Speaker, Siemens AG Researcher, Bayer AG
Aoyagi, K. - Employee, Toshiba Corporation
Argus, A. D. - Advisory Board, Devicor Medical Products, Inc
Atkinson, N. J. JR - Research Grant, Koninklijke Philips Electronics NV Speakers Bureau, Koninklijke Philips Electronics NV
Barron, B. J. - Stockholder, Immunomedics Inc
Bashir, M. R. - Research Support, Bracco Group Research Support, Siemens AG Consultant, Bayer AG Research Consultant, Siemens AG
Bassillon, G. M. - Research Grant, Bayer AG Research Grant, Siemens AG
Beauchamp, N. J. JR - Research Grant, Koninklijke Philips Electronics NV Research Grant, Siemens AG Speakers Bureau, Koninklijke Philips Electronics NV Speakers Bureau, Siemens AG
Beaure, R. W. - Research Consultant, Siemens AG Speakers Bureau, Siemens AG
Bayram, E. - Employee, General Electric Company
Becchamp, N. J. JR - Research Grant, Koninklijke Philips Electronics NV
Beaume, P. E. - Consultant, Wright Medical Group, Inc Consultant, Getinge AB
Beilner, J. - Employee, Siemens AG
Berman, D. S. - Research Grant, Lantheus Medical Imaging, Inc Research Grant, Astellas Group Research Grant, Siemens AG Speaker, Bristol-Myers Squibb Company Speaker, Covidien AG Speaker, Astellas Group Stockholder, Spectrum Dynamics Ltd Consultant, Bracco Group Consultant, FurozPharma, Inc
Bent, A. - Employee, im3D SpA
Beylin, D. - Consultant, Gamma Medica, Inc Employee, BLN Scientific, LLC Stockholder, BLN Scientific, LLC Employee, Brain Biosciences, Inc Stockholder, Brain Biosciences, Inc
Bippus, R. - Employee, Koninklijke Philips Electronics NV
Bjerner, T. - Medical Advisory Board, Carestream Health, Inc
Blake, M. A. - Editor with royalties, Springer Science+Business Media Deutschland GmbH
Blum, A. G. - Research Consultant, Toshiba Corporation Research Consultant, General Electric Company
Bonarzi, F. M. - Research Grant, Bayer AG Research Grant, Siemens AG Research Grant, Siemens AG
Boon, W. W. - Consultant, Siemens AG Research Grant, Siemens AG Research Grant, Siemens AG Research Grant, Siemens AG
Boonin, W. W. - Founder, Montage Healthcare Solutions, Inc Consultant, Varian Medical Systems, Inc
Borm, P. - Employee, Nano Imaging GmbH
Bowden, D. - Speaker, Medical Technology Management Institute Speaker, Digital Radiography Solutions
Braillet, J. - Medical Advisory Board, IMACTIS
Brook, K. - License agreement, RaySearch Laboratories AB Research Grant, Varian Medical Systems
Brown, K. M. - Employee, Koninklijke Philips Electronics NV
Brown, K. M. - Employee, Koninklijke Philips Electronics NV
Brown, R. - Investor, RadExchanger, LLC
Butler, J. - Speaker, Johnson & Johnson
Bulls, N. - Medical Advisory Board, General Electric Company
Burse, N. - Employee, General Electric Company
Burnside, E. S. - Research Grant, Hologic, Inc Stockholder, Novofer Therapeutics, Inc Stockholder, NeuWave Medical Inc
Burrows, P. E. - Research Consultant, Pierre Fabre Laboratories
Bryder, M. - Research Grant, General Electric Company
C

Callstrom, M. R. - Research Grant, Endocare, Inc Research Grant, Siemens AG
Canstein, C. - Employee, Siemens AG
Carbone, L. A. - Research Consultant, im3D SpA
Carlson, S. K. - Royalties, Medspira, LLC
Carr, J. C. - Speaker, Lantheus Medical Imaging, Inc
Carrascosa, P. M. - Research Consultant, General Electric Company
Carrino, J. A. - Research Grant, Siemens AG Research Grant, Carestream Health, Inc Research Consultant, General Electric Company
Carton, A. - Principal investigator of clinical study sponsored by GE Healthcare
Chang, P. J. - Co-founder, Sientom/Koninklijke Philips Electronics NV Technical Advisory Board, Alzeza Medical Advisory Board, Koninklijke Philips Electronics NV Medical Advisory Board, Siemens AG Medical Advisory Board, lifeIMAGE Medical Advisory Board, Merge Healthcare Incorporated
Chen, Y. - Research Consultant, EMB Technologies, Inc
Choi, S. - Employee, Samsung Electronics Co Ltd
Chung, J. - Grant, BTG International Ltd
Chung, J. H. - Research Grant, Siemens AG
Clunie, D. A. - Employee, Bioclinica, Inc Owner, PixelMed Publishing LLC Research Support, Siemens AG
Cody, D. O. - In-kind support, General Electric Company
Colborn, R. E. - Employee, General Electric Company
Collins, J. D. - Consultant, C. R. Bard, Inc
Conant, E. F. - Consultant, Hologic, Inc
Cosgrove, D. O. - Research Consultant, SuperSonic Imagine Research Consultant, Bracco Group Speakers Bureau, Toshiba Corporation
Cox, C. - Research Grant, Toshiba Corporation
Coxson, H. O. - Research Grant, GlaxoSmithKline plc Contract, GlaxoSmithKline plc Contract, Olympus Corporation Steering Committee, GlaxoSmithKline plc
Cunningham, J. A. - Founder, DOE Instruments Inc
Cyr, C. - Research Grant, Bayer AG Research Grant, Novartis AG Speakers Bureau, Bayer AG


**D**

Dacher, J. - Consultant, General Electric Company

Dachman, A. - Consultant, General Electric Company

Dam, E. B. - Shareholder, Biomedig A/S Employee, Biomedig A/S

Dannan, M. - Stockholder, Koninklijke Philips Electronics NV Stockholder, Sectra AB Stockholder, Prismatic Sensors AB Stockholder, Innovix AB Stockholder, Biovis International AB

Dawson, L. A. - Research Grant, Bayer AG License agreement, RaySearch Laboratories AB

De Baere, T. J. - Consultant, Terumo Corporation Speaker, Covidien AG Speaker, Terumo Corporation Speaker, General Electric Company Consultant, General Electric Company Consultant, Guerbet SA Speaker, Guerbet SA

De Konings, H. - Research Grant, F. Hoffman-La Roche Ltd Equipment support, Siemens AG Medical Advisory Board, F. Hoffman-La Roche Ltd

De Man, B. - Employee, General Electric Company

De Mey, J. - Research Grant, General Electric Company

Depeuy, E. - Research Grant, UltraSPECT Advisory Board, UltraSPECT Consultant, Lantheus Medical Imaging, Inc Consultant, Eli Lilly and Company Steering Committee, Force Laboratories, Inc

Desser, T. S. - Royalties, Amirsyrs, Inc

Dewey, M. - Research Grant, General Electric Company Research Grant, Bracco Group Research Grant, Guerbet SA Research Grant, Toshiba Corporation Speakers Bureau, Toshiba Corporation Speakers Bureau, Bayer AG Speakers Bureau, Guerbet SA Consultant, Guerbet SA Author, Springer Science+Business Media Deutschland GmbH Institutional research agreement, Siemens AG Institutional research agreement, Koninklijke Philips Electronics NV Institutional research agreement, Toshiba Corporation

Di Carlì, M. F. - Research Grant, Toshiba Corporation Research Grant, Lantheus Medical Imaging, Inc

Do, D. - Research Grant, Koninklijke Philips Electronics NV

Donnelly, L. F. - Author with royalties, Reed Elsevier Author with royalties, Amirsyrs, Inc

Dorbala, S. - Consultant, Astellas Group Research Grant, Astellas Group

Doria, A. S. - Research Grant, Baxter International Inc Research Grant, Physicians Services Incorporated

Dreyer, K. J. - Medical Advisor, Agfa-Gevaert Group Medical Advisor, FUJIFILM Holdings Corporation Medical Advisor, General Electric Company Medical Advisor, McKesson Corporation Healthcare Advisor, Medical Advisor, Microsoft Corporation Medical Advisor, Merge Healthcare Incorporated Medical Advisor, RCG Healthcare Consulting Medical Advisor, Siemens AG Medical Advisor, Hue AS Medical Advisor, Planar Systems, Inc Medical Advisor, Toshiba Corporation Medical Advisor, TerraRecon, Inc Medical Advisor, Pro Medicus Limited Medical Advisor, LifeIMAGE Medical Advisor, Siemens Medical Solutions Corporation Medical Advisor, Hewlett-Packard Company Medical Advisor, EHC Corp Medical Advisor, Phase Forward Incorporated Medical Advisor, Winchester Systems, Inc Medical Advisor, Dell Inc Medical Advisor, Carestream Health, Inc Medical Advisor, Amirsyrs, Inc Medical Advisor, Reed Elsevier Employees, Perceptics, LLC Board Member, Diagnostic Imaging Board Member, AuntMinnie.com Board Member, Imaging Economics Author, Springer Science+Business Media Deutschland GmbH Shareholder, Apple Inc Shareholder, Microsoft Corporation Shareholder, Google Inc Shareholder, IBM Corporation Shareholder, Hewlett-Packard Company Shareholder, Dell Inc Shareholder, General Electric Company Shareholder, Nuance Communications, Inc

Drzezga, A. - Research Grant, Koninklijke Philips Electronics NV

Drzezga, A. - Research Grant, Bayer AG Research Consultant, Eli Lilly and Company Research Consultant, General Electric Company Research Consultant, Piramal Enterprises Limited Speakers Bureau, Bayer AG Speakers Bureau, Eli Lilly and Company Speakers Bureau, General Electric Company Speakers Bureau, Siemens AG Research Grant, Bayer AG

Dubrov, J. G. - Research Grant, Siemens AG Speaker, Siemens AG Research Grant, General Electric Company Research Grant, Pfizer Inc Research Consultant, Johnson & Johnson Research Grant, Johnson & Johnson Research Grant, Functional Neuronmodulation Ltd Research Grant, Bayer AG

Duwall, S. - Research Grant, Anolinx LLC Research Grant, F. Hoffman-La Roche Ltd Research Grant, Amgen Inc Research Consultant, Shire plc Research Grant, Mylan Inc Research Consultant, Merck & Co, Inc

**E**

Earls, J. P. - Consultant, General Electric Company Speakers Bureau, General Electric Company

Ehman, R. L. - CEO, Resoundant, Inc

Elliott, S. T. - Speaker, Koninklijke Philips Electronics NV Speaker, Bracco Group

Emelanov, S. - Co-founder, NanoHybrids Inc.

Engelhard, G. - Employee, Algoce Limited

Erickson, B. J. - Stockholder, Evident Health

**F**

Fallenberg, E. M. - Research Grant, Bayer AG Research Grant, Siemens AG Research Grant, General Electric Company Speaker, Siemens AG Speaker, General Electric Company Speaker, Bayer AG Speaker, Guerbet SA Travel support, Bayer AG

Faulhaber, P. F. - Speaker, Koninklijke Philips Electronics NV Grant, Koninklijke Philips Electronics NV Medical Advisor, MIM Software, Inc

Fidler, J. L. - Medical Advisory Board, Bracco Group


Fleischmann, D. - Research support, Siemens AG Research support, General Electric Company

Fleming, D. J. - Royalties, Reed Elsevier

Fletcher, J. G. - Grant, Siemens AG

Flohr, T. G. - Employee, Siemens AG

Fong, Y. - Consultant, Covidien AG Consultant, Johnson & Johnson Consultant, AngioDynamics, Inc Consultant, Perfint Healthcare Pvt. Ltd

Fowler, K. J. - Speakers Bureau, Lantheus Medical Imaging, Inc

Friedewald, M. S. - Consultant, Hologic, Inc Scientific Advisory Board, Hologic, Inc

Fujiisawa, Y. - Employee, Toshiba Corporation

Fuller, C. D. - Research Consultant, General Electric Company

**G**

Ganguli, S. - Research Grant, Merit Medical Systems, Inc

Garin, E. - Consultant, Nordin, Inc

Gazelle, G. - Consultant, General Electric Company Consultant, Marval Biosciences Inc

George, R. T. - Research Grant, Toshiba Corporation Research Grant, General Electric Company Consultant, ICON plc

Georgy, B. A. - Consultant, Johnson & Johnson Consultant, DFINE, Inc Medical Advisor, Osprey Therapeutic Medical Advisory Board, SpineAlign Medical, Inc Stockholder, Osprey Therapeutic, Inc Stockholder, DFINE, Inc Stockholder, SpinAlign Medical, Inc Stockholder, Spine Solutions, Inc

Gerards, D. - Research Grant, Covidien

Geshwind, H. H. - Consultant, Biosciences International plc Consultant, Bayer AG Consultant, Guerbet SA Consultant, Nordin, Inc Grant, Biocompatibles International plc Grant, F. Hoffman-La Roche Ltd Grant, Bayer Grant, Bayer AG Grant, Koninklijke Philips Electronics NV Grant, Nordion, Inc Grant, ContextVision AB Grant, Celonova BioSciences, Inc Founder, PreScience Labs, LLC CEO, PreScience Labs, LLC

Geyer, L. L. - Speaker, General Electric Company

Ghaghada, K. B. - Research Grant, Marval Biosciences Inc Consultant, Marval Biosciences Inc Shareholder, Marval Biosciences Inc


Gilkeson, R. C. - Research consultant, Riverain Technologies, LLC Research support, Koninklijke Philips Electronics NV

Gill, R. R. - Scientific Advisory Board, F. Hoffman-La Roche Ltd

Gillams, A. R. - Speaker, Covidien AG

Goerner, F. L. - Research Grant, Siemens AG Research Grant, Bayer AG Research Grant, Bracco Group

Goldberg, S. - Consultant, AngioDynamics, Inc Research support, AngioDynamics, Inc Research support, Cosman Medical, Inc Consultant, Cosman Medical, Inc

Gomes, A. S. - Stockholder, St. Jude Medical, Inc

Gomori, J. M. - Research Consultant, Medivision Ltd Research Consultant, BrainWatch Ltd Research Consultant, Medtronic, Inc Scientific Advisor, Brainwatch Ltd

Gondim, Teixeira, P. A. - Researcher, Toshiba Corporation

Goo, J. - Research Grant, Guerbet SA Research Grant, Toshiba Corporation

Gordon, P. B. - Stockholder, OncoGenex Pharmaceuticals, Inc Scientific Advisory Board, Hologic, Inc Consultant, Sono Medical Instruments, Inc

Graser, M. A. - Speaker, Siemens AG Speakers Bureau, Siemens AG Branch, Bayer AG

Green, G. E. - Co-author with royalties, Amirsyrs, Inc

Greenspan, B. S. - Consultant, CoreCare National

Grisswold, M. A. - Research support, Siemens AG Royalties, Siemens AG Royalties, General Electric Company Royalties, Bruker Corporation Contract, Siemens AG

Guo, W. - Research Grant, Siemens AG

Gupta, R. T. - Consultant, Bayer AG Speakers Bureau, Bayer AG
Macmahon, H. - Shareholder, Hologic, Inc Consultant, Riverain Technologies, LLC Royalties, UC Tech
Madabushi, A. - Research partner, Siemens AG Research partner, General Electric Company Research partner, F. Hoffman-La Roche Ltd Founder and President, IBIS, Inc
Madore, B. - Research Consultant, Millikelvin Technology LLC
Mahesh, M. - Royalties, Lippincott Williams & Wilkins
Mahoney, M. C. - Scientific Advisory Board, Hologic, Inc Research support, Hologic, Inc Consultant, Devicor Medical Products, Inc
Manand, A. - Royalties, General Electric Company
Marcus, D. S. - Owner, Radiologic, Inc
Marshall, J. - Employee, Hologic, Inc
Masuda, K. - Research Grant, Johnson & Johnson Equipment support, Johnson & Johnson
Matsumoto, S. - Research Grant, Toshiba Corporation
Mayo, J. R. - Speaker, Siemens AG
Mayo-Smith, W. W. - Royalties, Reed Elsevier Royalties, Cambridge University Press
McCullough, C. H. - Research Grant, Siemens AG
McDonald, J. S. - Research Grant, General Electric Company
McEnery, K. W. - Advisor, Koninklijke Philips Electronics NV
McKinion, R. C. III - Travel support, Siemens AG Speaker, Siemens AG
McNitt-Gray, M. F. - Institutional research agreement, Siemens AG Research support, Siemens AG
Mendelson, E. B. - Scientific Advisory Board, Hologic, Inc Research support, Siemens AG Speakers Bureau, Siemens AG Medical Advisory Board, Quantanson, LLC Consultant, Quantanson, LLC Speakers Bureau, SuperSonic Imagine Medical Advisory Board, Toshiba Corporation
Mendora, P. - Employee, General Electric Company
Merkle, E. M. - Advisor, Siemens AG Advisor, Bayer AG Speakers Bureau, Bayer AG Speakers Bureau, Bracco Group Research Support, Bayer AG Research Support, Bracco Group Research Support, Guerbet SA
Merrow, A. C. JR - Author, Amirsys, Inc
Mian, A. Z. - Stockholder, Boston Imaging Core Lab, LLC
Michaela, H. J. - Speakers Bureau, Siemens AG Speakers Bureau, Bayer AG Speakers Bureau, Guerbet SA
Miller, J. - Research Grant, Toshiba Corporation
Min, J. - Medical Equipment Company Research Support, General Electric Company Speakers Bureau, General Electric Company Medical Advisory Board, Arineta Ltd Research support, Koninklijke Philips Electronics NV Research support, Toshiba Corporation Medical Advisory Board, AstraZeneca PLC Medical Advisory Board, Bristol-Myers Squibb Company Consultant, HeartHealth, Inc Stockholder, TC3 Health, Inc Stockholder, MDX Medical Solutions
Min, J. K. - Speakers Bureau, General Electric Company Advisory Board, General Electric Company Speaker, General Electric Company
Minoshima, S. - License agreement, General Electric Company Research Grant, Koninklijke Philips Electronics NV Research Grant, Hitachi, Ltd Research Consultant, Hamamatsu Photonics KK Grant, Nihon Medi-Physics Co, Ltd Research Grant, Astellas Group Research Grant, Seattle Genetics, Inc
Morgan, J. - Spouse, Employee, Quanticell Pharmaceuticals Inc
Morgan, D. E. - Research support, Bracco Group Research Support, Koninklijke Philips Electronics NV
Morgan, M. B. - Consultant, Amirsys, Inc
Morgan, P. - Employee, FUJIFILM Holdings Corporation
Morra, L. - Researcher, i3dSpa
Moser, T. - Research Consultant, Horizon Sciences & Technologies Inc
Mur, M. - Consultant, Otsuka Pharmaceutical Co, Ltd Consultant, Alexion Pharmaceuticals, Inc
Mueller, P. - Consultant, Cook Group Incorporated
Mueller, S. P. - Consultant, Nordion, Inc
Mukherjee, P. - Research Grant, General Electric Company
Muller, S. L. - Employee, General Electric Company
Murakami, T. - Consultant, DAICHI SANKYO Group
N
Na, H. - Employee, General Electric Company
Naplo, S. K. - Stockholder, General Electric Company
Nakamoto, D. A. - Research Grant, Galil Medical, Ltd Research Agreement, Toshiba America Medical Systems - I receive no remuneration
Nakitani, K. - Research Grant, Nihon Medi-Physics Co, Ltd
Napel, S. - Medical Advisory Board, Fovia, Inc Consultant, Carestream Health, Inc Scientific Advisor, Echopixel, Inc
Narayanan, G. - Consultant, Biocompatables International plc Consultant, Angiodynamics, Inc Consultant, Boston Scientific Corporation
Narra, V. R. - Consultant, Biomedical Systems
Nayate, A. - Grant, Siemens AG
Neal, C. H. - Employee, Koninklijke Philips Electronics NV
Noh, Y. - Research Grant, Toshiba Corp Collaboration Research Grant, Koninklijke Philips Electronics NV Research Grant, Bayer AG Research Grant, DAICHI SANKYO Group Research Grant, Eisai Co, Ltd Research Grant, Terumo Corporation Research Grant, Covidien AG Research Grant, FUJIFILM Holdings Corporation
Okazaki, T. - Employee, Toshiba Corporation
Olsen, J. R. - Dfine, Inc Provision of consulting services regarding the use of radiotherapy for palliative treatment of bone metastases.
Ortiz, A. - Speakers Bureau, Medtronic, Inc Speakers Bureau, Stryker Corporation
Obara, M. - Employee, Koninklijke Philips Electronics NV
Oh, H. - Employee, Samsung Electronics Co Ltd
Ohno, Y. - Research Grant, Toshiba Corp Collaboration Research Grant, Koninklijke Philips Electronics NV Research Grant, Bayer AG Research Grant, DAICHI SANKYO Group Research Grant, Eisai Co, Ltd Research Grant, Terumo Corporation Research Grant, Covidien AG Research Grant, FUJIFILM Holdings Corporation
Ogawa, T. - Employee, Toshiba Corporation
Olsen, J. R. - Dfine, Inc. Provision of consulting services regarding the use of radiotherapy for palliative treatment of bone metastases.
Ortiz, A. - Speakers Bureau, Medtronic, Inc Speakers Bureau, Stryker Corporation
Pack, J. - Employee, General Electric Company
Palmer, S. L. - Research Consultant, Halt Medical, Inc
Pan, X. - Research Grant, Koninklijke Philips Electronics NV Research Grant, Toshiba Corporation Consultant, Utopia Compression Corporation
Parker, P. - Research Grant, Varian Medical Systems, Inc Research Grant, Calypso Medical Technologies, Inc Research Consultant, Koninklijke Philips Electronics NV Stockholder, Innovative Pulmonary Solutions, Inc Research Grant, Medtronic, Inc
Partovi, S. - Research Grant, Koninklijke Philips Electronics NV
Partridge, S. C. - Research Grant, Koninklijke Philips Electronics NV
Pawlik, T. - Consultant, Integra LifeSciences Holdings Corporation
Pelizzari, C. A. - Research Grant, Varian Medical Systems, Inc Scientific Advisory Board, RefleXion Medical Inc
Pepper, W. W. - Stockholder, General Electric Company Stockholder, TeraMedica, Inc
Peters, J. - Employee, Koninklijke Philips Electronics NV
Petrella, J. R. - Advisory Board, Johnson & Johnson Speakers Bureau, Quintiles Inc Advisory Board, Piramal Enterprises Limited
Petscavage-Thomas, J. M. - Consultant, Medical Metrics, Inc
Pfeiffer, D. E. - Consultant, Royal Corporation
Pfirrmann, C. W. - Advisory Board, Siemens AG Scientific Consultant, Medtronic, Inc
Phillip, J. F. - Medical Advisory Board, Siemens AG Medical Advisory Board, Toshiba Corporation Medical Advisory Board, Imprivata
Philpotts, L. E. - Consultant, Hologic, Inc
Pikens, D. R. III - Stockholder, Johnson & Johnson
Piper, J. W. - Employee, MIM Software, Inc Stockholder, MIM Software, Inc
Piraino, D. W. - Medical Advisory Board, Agfa-Gevaert Group
Pollak, R. S. - Employee, MIM Software, Inc
Pisano, E. D. - Board Member, NextRay Inc Stockholder, NextRay Inc Board Member, Zumattek, Inc Researcher, Sectra AB Board Member, ACR Imaging Metric Research Grant, Sectra AB
Valentino, D. - Research Grant, Siemens AG Research Grant, Pro Medicus Limited


Wang, K. - Employee, General Electric Company

Wass, C. - Employee, Fraunhofer-Gesellschaft

Weinberg, I. N. - Stockholder, Brain Biosciences, Inc

Wennstedt, G. J. - Medical Advisory Board, McKesson Corporation Stock Ownership, TeraMedica, Inc Medical Advisory Board, HealthMyne Owner, WITS, LLC

Wesscott, H. - Luminary, General Electric Company Speaker, Bracco Group

Wessell, D. E. - Research Consultant, Biomedical Systems

Wentz, L. M. - Advisory Board, Siemens AG

Wiebert, J. - Employee, Koninklijke Philips Electronics NV

Wilcox, A. - Speaker, Toshiba Corporation

Williamson, E. E. - Research Grant, General Electric Company

Willman, J. K. - Research Consultant, Bracco Group Research Grant, Siemens AG Research Grant, Bracco Group

Wilson, S. R. - Research Grant, Lantheus Medical Imaging, Inc Research Grant, Abbott Laboratories Consultant, Lantheus Medical Imaging, Inc Equipment support, Siemens AG Equipment support, Koninklijke Philips Electronics NV


Winterspencer, B. J. - Speakers Bureau, Bayer AG Speakers Bureau, Siemens AG

Wirth, S. - Speaker, General Electric Company

Wolfman, J. A. - Scientific Advisory Committee, Hologic, Inc Travel support, Hologic, Inc

Wood, D. - Consultant, Edwards Lifesciences Corporation Consultant, St. Jude Medical, Inc

Woodward, A. P. - Educator, Siemens AG Educator, Koninklijke Philips Electronics NV Educator, Toshiba Corporation

Woodward, P. J. - President, Amirsys, Inc

Wu, C. C. - Author, Amirsys, Inc

Yaguchi, A. - Employee, Employee, Toshiba Corporation

Yamagata, H. - Employee, Toshiba Corporation

Yamashita, Y. - Consultant, DAICHI SANKYO Group

Yankelevitz, D. F. - Research Grant, AstraZeneca PLC Royalties, General Electric Company

Yee, J. - Research Grant, Bracco Group Research Grant, EchoPixel, Inc

Yeh, B. M. - Research Grant, General Electric Company Consultant, General Electric Company

Yin, Z. - Employee, General Electric Company

Yoshikawa, T. - Research Grant, Toshiba Corporation

Yousem, D. M. - Author, Oakstone Publishing Author, Reed Elsevier

Yuan, C. - Research Grant, Koninklijke Philips Electronics NV Research Grant, VP Diagnostics, Inc Consultant, Medpace, Inc Consultant, Bristol-Myers Squibb Company Consultant, Boehringer Ingelheim GmbH

Zamboni, G. A. - Speaker, Guerbet SA

Zamyatin, A. - Employee, Toshiba Corporation

Zavrzin, V. - Stockholder, Brain Biosciences, Inc

Zhou, O. - Board of Directors, XinRay Systems Inc Research Grant, Carestream Health, Inc

Zumberge, N. A. - Stockholder, Coviden AG Stockholder, Abbott Laboratories Stockholder, Abbvie Inc Stockholder, Mallinckrodt plc Stockholder, Dexcel, Inc Stockholder, Merck & Co, Inc