### Wednesday, December 04, 2013

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:30-10:00 AM</td>
<td><strong>Room: E305</strong> • Controversy Session: MRI Contrast Use: Have Quality and Safety Collided?</td>
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<tr>
<td>10:30-10:00 AM</td>
<td><strong>Room: S105AB</strong> • Navigating the Regulatory, Reimbursement, and Compliance Landscape or Land Mines!</td>
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<tr>
<td>10:00-12:00 PM</td>
<td><strong>Room: S406A</strong> • Case-based Review of Musculoskeletal Radiology (An Interactive Session)</td>
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<td>10:30-10:00 AM</td>
<td><strong>Room: S103CD</strong> • BOOST: Genitourinary-Anatomy and Contouring (An Interactive Session)</td>
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<td><strong>Room: S402AB</strong></td>
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<tr>
<td>10:30-12:00 PM</td>
<td><strong>Room: N228</strong> • Chest Imaging: How Radiologic-Pathologic Correlation Informs Interpretation</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: E353A</strong> • What's New from the American Board of Radiology</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: N227</strong> • Bone and Cartilage Injury: Traumatic and Stress-related Chondral, Osteochondral and Subchondral Failure with E...</td>
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<tr>
<td>10:30-12:00 PM</td>
<td><strong>Room: N225</strong> • No Course RC503. See Series VSNA41 Cardiac Radiology Series: Transcatheter Aortic Valve Replacement (TAVR)</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: E350</strong></td>
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<tr>
<td>10:30-12:00 PM</td>
<td><strong>Room: S404AB</strong> • New Paradigms for the Treatment of Hodgkin's and non-Hodgkin's Lymphomas: The Crucial Role of Imaging</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: S404CD</strong> • Novel Applications of Dual Energy CT</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: N230</strong> • Abdominal MRA Update</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: S404AB</strong> • Managing Radiology IT in the EHR World</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: E263</strong> • Small Parts Interventional Ultrasound (Hands-on Workshop)</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: S403B</strong> • Managing Conflicts of Interest</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: E260</strong> • Fallopian Tube Catheterization (Hands-on Workshop)</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: E261</strong> • Imaging in Practice: MRI of the GIT (How-to Workshop)</td>
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<td><strong>Room: S401CD</strong> • Hands-on DICOM Metadata Manipulation (Hands-on Workshop)</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: S401AB</strong> • Using RADIANCE for Dose Monitoring and Quality Assurance: A Hands-on Course</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: E351</strong> • Cool Technologies for Radiologists</td>
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<td><strong>Room: S502AB</strong></td>
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<td><strong>Room: E352</strong> • Interventional Radiology Series: Embolotherapy</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: S01ABC</strong> • Next Generation IT Requirements for Improving Quality and Safety for Radiology</td>
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<td><strong>Room: S401AB</strong> • Creating Radiology eBooks for the iPad: A Hands-on Introduction to iBooks Author</td>
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<td><strong>Room: S0406A</strong> • Case-based Review of Musculoskeletal Radiology (An Interactive Session)</td>
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<td>10:30-12:00 PM</td>
<td><strong>Room: S100AB</strong> • Essentials of Musculoskeletal Imaging</td>
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<td><strong>Room: S103CD</strong> • BOOST: Genitourinary-Integrated Science and Practice (ISP) Session</td>
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Controversy Session: MRI Contrast Use: Have Quality and Safety Collided?

Wednesday, 07:15 AM - 08:15 AM  •  E350

**Moderators**
- Thomas M Grist, MD
- Jeffrey C Weinreb, MD
- Martin R Prince, MD, PhD

**LEARNING OBJECTIVES**
1. Be aware of the current issues relating to the use of gadolinium based contrast agents in patients with renal failure.
2. Be updated on factors relating to the relative and absolute risk of NSF in patients receiving gadolinium based contrast agents.
3. Be aware of current practical approaches to minimizing risk of NSF in patients with renal failure receiving gadolinium based contrast agents.
4. Be exposed to debate and discussion on the risk/benefit of using vs non using gadolinium based contrast agents in patients with renal failure.
5. Be better informed about management of the patient with renal failure requiring MRI with gadolinium based contrast agents.

**ABSTRACT**

**URL**

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Hot Topic Session: Indications for MRI versus Low Dose CT in Congenital Heart Disease

Wednesday, 07:15 AM - 08:15 AM  •  E353A

**Moderator**
- Rajesh Krishnamurthy, MD

**LEARNING OBJECTIVES**
1. Understand how new generation ultrafast wide array CT scanners with adaptive iterative reconstruction reduce radiation dose and decrease sedation rates in pediatric cardiac CT.
2. Learn about recent advances in use of MRI for evaluating morphology, function, flow and myocardial tissue properties in CHD.
3. Evaluate role of low-dose CT versus MRI for management decision-making in the pre-operative period in the following conditions: vascular rings and slings, pulmonary atresia, anomalous coronaries, single versus two ventricle repair, heterotaxy and aortopaties.
4. Evaluate role of low-dose CT versus MRI for management decision-making following palliation of CHD in the following conditions: Following coarctation repair, after two-ventricle repair of conotruncal anomalies, and single ventricle s/p Glenn and Fontan procedures.

**SHP40A**  •  Preoperative Evaluation of CHD

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

**SHP40B**  •  MRI

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

**SHP40C**  •  CT

**Rajesh Krishnamurthy** MD (Presenter)

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

**SHP40D**  •  Discussion

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

**SHP40E**  •  Postoperative Evaluation of CHD

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

**SHP40F**  •  MRI
### Navigating the Regulatory, Reimbursement, and Compliance Landscape or Land Mines! (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

**Wednesday, 08:30 AM - 10:00 AM • S105AB**

**MSAS41 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**

**Moderator**
Claudia A Murray
Thomas W Greeson, JD
Melody W Mulaik *
Barbara Rubel, MBA *

**LEARNING OBJECTIVES**
1) Analyze key regulatory and legislative issues that will impact radiologists in 2014. 2) Describe actions radiologists can take to prepare for ICD-10 implementation. 3) Articulate 2014 changes to CPT. 4) Describe trends and issues with audits in radiology and imaging including RAC and CERT audits. 5) Discuss regulatory requirements for global billing and out-of-state enrollment for interpretation services in wake of CMS’s guidance on Place of Service billing.

### Case-based Review of Musculoskeletal Radiology (An Interactive Session)

**Wednesday, 08:30 AM - 10:00 AM • S406A**

**MSCS41A • CT**

**Kenneth A Buckwalter MD (Presenter)**

**LEARNING OBJECTIVES**
1) Discuss appropriate indications for musculoskeletal CT imaging. 2) Understand how and why to perform CT arthrography. 3) Apply advances in CT technology to musculoskeletal imaging. 4) List technical factors to improve imaging of patients with orthopedic hardware.

**ABSTRACT**
This case based course will illustrate how CT can be used effectively in diagnosing musculoskeletal conditions.

**MSCS41B • Ankle and Foot**

**Zehava S Rosenberg MD (Presenter)**

**LEARNING OBJECTIVES**
1) To familiarize the attendees with key topics in ankle and foot pathology. 2) To comprehend, apply and analyze the imaging characteristics of osseous abnormalities, tendon disorders, ligament injuries and miscellaneous diseases of the foot and ankle.

**ABSTRACT**
This case based presentation will afford the radiologist with tools for interpreting common pathologic conditions in the foot and ankle.

**MSCS41C • Knee**

**David A Rubin MD (Presenter)**

**LEARNING OBJECTIVES**
1) Identify the application of basic anatomic, pathologic, and physiologic principles to specific disease processes that affect the knee. 2) Illustrate using case examples several important disease processes that affect the knee, using several imaging methods and emphasizing the value of each. 3) Present the major teaching points and differential diagnostic considerations for each of the chosen cases and, when appropriate, clarify the importance of early accurate diagnosis.

**ABSTRACT**
Accurate diagnosis of many disorders that affect the knee can be accomplished with basic or advanced imaging methods, or both. A series of cases will be used to illustrate a few of this disorders, with attention to the most appropriate imaging protocol, the salient imaging findings, the anatomic and pathophysiologic factors that explain the findings, and the important differential diagnostic considerations. Conventional radiography, CT scanning, and MR imaging will be emphasized throughout.

### Essentials of Neuro Imaging

**Wednesday, 08:30 AM - 10:00 AM • S100AB**

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**Shi-Joon Yoo MD (Presenter)**

**LEARNING OBJECTIVES**
View learning objectives under main course title.
LEARNING OBJECTIVES
1) To understand the etiology and pathophysiology of stroke. 2) To recognize different types of stroke. 3) To become familiar with the early signs of stroke on imaging studies. 4) To understand the advantages, disadvantages and limitations of CT and MR in the initial work-up of stroke patients. 5) To identify quantitative imaging biomarkers that can help to predict prognosis and outcome in stroke patients.

ABSTRACT
Neuroimaging studies play a crucial role in the diagnosis, management, and outcome prediction of patients with acute stroke. Patient history and clinical neurologic examination cannot reliably identify the involved vascular territory, nor the etiology, extent or type of stroke. With the arrival of promising new therapies aimed at re-establishing blood flow, reducing the size of the infarction and protecting the surrounding brain at risk (penumbra), the traditional role of neuroimaging has changed. Thanks to multiparametric CT and MRI techniques, our understanding of the pathophysiology of stroke, in terms of cerebral blood flow, cerebral blood volume and cell metabolism, has greatly improved. Identification of the ischemic penumbra with MRI and/or CT has entered routine clinical practice. A patient suspected of having suffered an acute stroke should be cleared for thrombolytic therapy, by excluding intracranial hemorrhage and non-stroke causes of the patient’s symptoms. The critical 3 to 6 hour time window for thrombolytic therapy necessitates rapid and accurate diagnosis. The fundamental goals of neuroimaging in the patient presenting with an acute stroke are therefore: 1) To rule out intracranial hemorrhage, e.g. by CT or MRI; 2) To show ischemic brain tissue, e.g. by DW-MRI; 3) To show tissue blood flow and identify the penumbra, e.g. by perfusion CT or MRI; 4) To assess vessel patency, e.g. by performing CTA or MRA; 5) To select suitable candidates for treatment and perform the procedures. The purpose of this presentation is to present a comprehensive imaging strategy for patients with suspected stroke, to discuss advantages, disadvantages and limitations of CT and MR in the initial work-up of acute stroke patients, to illustrate imaging patterns, and to identify quantitative imaging biomarkers that can help to predict prognosis and outcome in acute stroke patients.

MSES41B • Navigating the Sella and Central Skull Base
Christopher P Hess MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) To review the normal anatomy of the sella and surrounding structures. 2) To recognize MRI features of common sellar and parasellar lesions and important pitfalls. 3) To understand the implications of MRI findings on clinical management.

MSES41C • Understanding Transverse Myelitis
Girish M Fatterpekar MBBS (Presenter) *

LEARNING OBJECTIVES
1) To provide an approach toward evaluation of a patient with transverse myelitis. 2) To provide distinguishing features of neuromyelitis optica from multiple sclerosis and other infectious, inflammatory, metabolic and nutritional causes of transverse myelitis. 3) To provide evidence-based guidelines toward evaluation and treatment of transverse myelitis.

ABSTRACT
Transverse myelitis describes a heterogenous group of disorders characterized by acute or subacute motor, sensory and autonomic spinal cord dysfunction, usually with a discrete sensory level and increased signal on T2-weighted images. It is absolutely mandatory to exclude compressive, radiation-induced, vascular and traumatic causes before considering the usage of the term 'transverse myelitis'. On CSF evaluation, transverse myelitis is characterized by CSF pleocytosis or elevated IgG index. Numerous etiologies have been described for transverse myelitis. The presentation will evaluate neuromyelitis optica in detail including its imaging features, pathogenesis, and diagnostic criteria. Distinguishing features from other causes of transverse myelitis in particular, multiple sclerosis will be highlighted and discussed. Illustrative cases utilizing imaging features to aid in the diagnosis of other causes of transverse myelitis including metabolic causes such as Vitamin B12 deficiency, infectious causes such as HTLV myelopathy and paraneoplastic myelopathy will be discussed. The presentation will also provide evidence-based guidelines toward evaluation and treatment of transverse myelitis.

BOOST: Genitourinary-Anatomy and Contouring (An Interactive Session)
Wednesday, 08:30 AM - 10:00 AM • S103CD

MSSR41 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
Co-Director
Fergus V Coakley , MD
Co-Director
Bruce G Haffty , MD
Jelle O Barentsz , MD, PhD
Mark K Buyyounouski , MD *

LEARNING OBJECTIVES
1) Introduce imaging anatomy relevant to prostate cancer and review imaging issues for contouring primary tumors, nodal regions, and adjacent critical structures. 2) Review how the integration of different imaging modalities can affect tumor delineation. 3) How to choose appropriate imaging methods for specific purposes and to discuss the significance of certain imaging findings.

RSNA/ESR Emergency Symposium: General Principles, Pediatric and ENT Emergencies (An Interactive Session)
Wednesday, 08:30 AM - 10:00 AM • S402AB

MSSR41A • Imaging Strategies in Acute Stroke
Paul M Parizel MD, PhD (Presenter)

LEARNING OBJECTIVES
1) Demonstrate general principles of diagnostic imaging in Emergency Radiology in traumatic and non-traumatic emergencies. 2) Analyze ethiology, background and management of common radiological emergencies. 3) Identify the role, indications and protocols for US, CR, MDCT in modern emergency radiology.

ABSTRACT

MSSR41B • Navigating the Sella and Central Skull Base

Christopher P Hess MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) To review the normal anatomy of the sella and surrounding structures. 2) To recognize MRI features of common sellar and parasellar lesions and important pitfalls. 3) To understand the implications of MRI findings on clinical management.

MSSR41C • Understanding Transverse Myelitis

Girish M Fatterpekar MBBS (Presenter) *

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1) To provide an approach toward evaluation of a patient with transverse myelitis. 2) To provide distinguishing features of neuromyelitis optica from multiple sclerosis and other infectious, inflammatory, metabolic and nutritional causes of transverse myelitis. 3) To provide evidence-based guidelines toward evaluation and treatment of transverse myelitis.

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Transverse myelitis describes a heterogenous group of disorders characterized by acute or subacute motor, sensory and autonomic spinal cord dysfunction, usually with a discrete sensory level and increased signal on T2-weighted images. It is absolutely mandatory to exclude compressive, radiation-induced, vascular and traumatic causes before considering the usage of the term 'transverse myelitis'. On CSF evaluation, transverse myelitis is characterized by CSF pleocytosis or elevated IgG index. Numerous etiologies have been described for transverse myelitis. The presentation will evaluate neuromyelitis optica in detail including its imaging features, pathogenesis, and diagnostic criteria. Distinguishing features from other causes of transverse myelitis in particular, multiple sclerosis will be highlighted and discussed. Illustrative cases utilizing imaging features to aid in the diagnosis of other causes of transverse myelitis including metabolic causes such as Vitamin B12 deficiency, infectious causes such as HTLV myelopathy and paraneoplastic myelopathy will be discussed. The presentation will also provide evidence-based guidelines toward evaluation and treatment of transverse myelitis.
**LEARNING OBJECTIVES**

1) Plan safe and effective imaging strategies to evaluate abdominal pain in infants and children. 2) Understand the common and unusual causes of abdominal pain in different pediatric age groups. 3) Recognize potentially confusing variations in the appearance of these conditions with imaging.

**ABSTRACT**

**LEARNING OBJECTIVES**

1) Analyze imaging findings in patients presenting with acute head and neck conditions using a systematic spatial approach. 2) Demonstrate understanding of the role and indications of CT and MR in acute non-traumatic ENT case management. 3) Identify the extent of disease and recognize specific complications of cervicofacial infections.

**ABSTRACT**

Chest Imaging: How Radiologic-Pathologic Correlation Informs Interpretation

**Wednesday, 08:30 AM - 10:00 AM • N228**

**RC501 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5**

**LEARNING OBJECTIVES**

1) Understand the basic structures and systems that allow the respiratory system to function. 2) Utilize the knowledge of basic respiratory structures to improve their understanding of respiratory disease and therefore improve diagnostic accuracy. 3) Improve their understanding of disease that affects the lung interstitium, small airways, pulmonary vessels and lymphatics. 4) Learn an approach to the assessment of lung nodules including new information on small ground glass opacities.

**RC501A • Interstitial Lung Disease**

**Jeffrey R Galvin MD (Presenter)**

**RC501B • Diseases of the Small Airways**

**Phillip M Boiselle MD (Presenter)**

**RC501C • Vascular Disease**

**Aletta Ann Frazier MD (Presenter)**

**RC501D • Lymphoid Diseases**

**Tomas C Franquet MD (Presenter)**

**RC501E • Lung Nodules**

**Seth J Kligerman MD (Presenter)**

**What’s New from the American Board of Radiology**
**LEARNING OBJECTIVES**

1) Explain the Core and Certifying Exams; describe the relationship to/evolving impact of the new exams on training and practices. 2) Describe the ABR Board Eligibility policy and how a hospital credentials committee might apply it. 3) Describe recent ABR MOC program changes including: efforts to align MOC with practice requirements and incentives, self-assessment CME, and Continuous Certification. 4) Plan and execute a practice-relevant PQI project. 5) List the meaningful participation criteria for individual MOC Part IV credit when doing a group Part IV project. 6) Explain how IR/DR primary certification differs from VIR subspecialty certification; describe a likely sequence and timeline for its full implementation.

**ABSTRACT**

No Course RC503. See Series VSCA41 Cardiac Radiology Series: Transcatheter Aortic Valve Replacement (TAVR)

**No Course RC505. See Series VSNR41 Neuroradiology Series: Stroke**

**Bone and Cartilage Injury: Traumatic and Stress-related Chondral, Osteochondral and Subchondral Failure with Emphasis on Pathophysiology and Routine and Advanced MR Imaging**

**No Course RC506. See Series VSNR41 Neuroradiology Series: Stroke**

**RC506A • Nasopharynx**

Suresh K Mukherji MD (Presenter)

**LEARNING OBJECTIVES**

1) Understand the normal anatomical landmarks and relations of the nasopharynx and in particular the relationship of the nasopharynx to the central skull base. 2) Recognize normal physiological variations and inflammatory processes of the nasopharynx that might be mistaken for more sinister pathology. 3) Understand the pathological behavior and important staging features of nasopharyngeal carcinoma and lymphoma, the two most common nasopharyngeal malignant processes.

**ABSTRACT**

The nasopharynx is the most superior portion of the pharynx, extending anteriorly to the posterior choanae and inferiorly to the level of the soft palate. The nasopharynx attaches to the undersurface of the clivus via the pharyngobasilar fascia of the superior constrictor muscle. This fascia is in continuity with the buccopharyngeal fascia surrounding the pharynx. The foramen of Morgagni is a hiatus between the base of skull and constrictor muscle, through which the Eustachian tube, tensor veli palatini and levator veli pass. It is thus a potential weak spot in the head and neck, through which pathological processes may reach the skull base and spread intracranially.

Other important imaging landmarks include the lateral nasopharyngeal recess or fossa of Rosenmuller and the midline nasopharyngeal tonsil, or adenoids. Nasopharyngeal carcinoma (NPC) is a distinct entity from pharyngeal squamous cell carcinoma (SCCa). NPC has a unique histological appearance, has different inciting factors to SCCa, and has unique familial, genetic, and geographic predispositions. Nasopharyngeal carcinoma also has a different pathological behavior to pharyngeal SCCa, with a tendency for clival invasion, intracranial spread, and early systemic metastasis. In keeping with this distinct pathological behavior, NPC has particular imaging manifestations and staging criteria that differ significantly from pharyngeal SCCa. In this session we will review the key anatomic landmarks and the key imaging features of the nasopharynx and of nasopharyngeal carcinoma, reviewing the 2010 TNM staging updates and changes to the WHO pathological classification. We will also review important differentials for masses in this region.
LEARNING OBJECTIVES
1) Review the anatomy of the oral cavity and oropharynx. 2) Review common neoplasms that may involve this region. 3) Review common infectious and inflammatory processes that may involve the oral cavity and oropharynx.

ABSTRACT
The intent of this presentation is to review the normal anatomy of the oral cavity and oropharynx. In addition, this presentation will review the common pathology including neoplasms, infections and developmental processes that you will encounter in your practice.

RC506C • Larynx-Hypopharynx
Hilda E Stambuk MD (Presenter)

LEARNING OBJECTIVES
1) Review the imaging anatomy of the larynx. 2) Understand the key landmarks for describing a tumor of the larynx. 3) Understand imaging strategies for following patients after treatment for larynx carcinoma.

Abdominal Incidentalomas: What to Report for Adrenal, Renal and Adnexal Incidental Findings

Gastrointestinal: Abdominal Masses (An Interactive Session)

Advances in Gynecologic Ultrasound

RC510A • 3D Ultrasound in Gynecology
Beryl R Benacerraf MD (Presenter) *

LEARNING OBJECTIVES
1) To learn about the multiplanar reconstruction technique in scanning the pelvis, including its usefulness of looking at the coronal view of the uterus to evaluate the endometrium for polyps, fibroids and mullerian duct anomalies. 2) To learn to use 3D to determine the position of an IUD in the uterus. 3) To learn how 3D can help on detecting the causes of pelvic pain.

ABSTRACT
Three-dimensional (3D) ultrasound allows us to acquire a volume and display any plane of section within that volume regardless of the scanning orientation. The ability to display a 3D image of any type or plane has been one of the most powerful recent advances in sonography, particularly in the field of obstetrics and gynecology. In gynecology, 3D has allowed visualization of coronal view of the uterus, enabling us to diagnose mullerian duct anomalies without using MRI. We can also easily diagnose malpositioned IUDs (a common cause of pelvic pain and bleeding), polyps, submucous fibroids and other abnormalities related to the uterine cavity. 3D ultrasound also greatly facilitates the correct diagnosis of hydrosalpinges because of the infinite planes in which the tubal areas can be displayed.

RC510B • Ovarian Masses and Cysts
Phyllis Glanc MD (Presenter)

LEARNING OBJECTIVES
1) Analyze ultrasound imaging features of ovarian masses and apply this knowledge to discriminate benign from malignant lesions. 2) Demonstrate some practical tips and hints for problem solving. 3) Apply appropriateness criteria to determine when additional imaging techniques, such as MRI or CT, are indicated.

ABSTRACT
The first line of imaging when an ovarian lesion is suspected is ultrasound. In this session we will review classical imaging features on
ultrasound, demonstrate some tips and pitfalls and evaluate some less common findings. We will utilize this information to triage patients into different management strategies. We will incorporate current consensus and appropriateness criteria guidelines into our critical thinking. The role of additional imaging techniques such as MRI, CT and PET will also be discussed.

RC510C • Uterus and Endometrium

Ruth B Goldstein MD (Presenter)

LEARNING OBJECTIVES
1) Be able to state the acceptable standards for endometrial assessment in women with abnormal vaginal bleeding. 2) Be able to recognize a uterine abnormality in a postmenopausal woman that warrants further evaluation including tissue sampling or MRI. 3) Be able to recognize and diagnose adenomyosis. 4) Be able to diagnose a Mullerian Duct Anomaly of the uterus.

High-Resolution Radionuclide Breast Imaging (An Interactive Session)

Wednesday, 08:30 AM - 10:00 AM • SS0SAB

RC511 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

RC511A • Breast-specific Gamma Imaging: A Novel Approach to Breast Cancer Diagnosis

Rachel F Brem MD (Presenter) *

LEARNING OBJECTIVES
1) To understand the principles of Breast Specific Gamma Imaging. 2) To understand the literature supporting the use of BSGI. 3) Understand the clinical uses of BSGI. 4) Understand how to integrate BSGI into a clinical breast imaging practice. 5) Understand how to biopsy lesions visualized with BSGI. 6) To review some of the ongoing developments in BSGI.

RC511B • Positron Emission Mammography and Molecular Breast Imaging

Wendie A Berg MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) Understand currently approved uses of dedicated positron emission tomographic breast imaging ('positron emission mammography (PEM)'), including local staging, response to primary chemotherapy, and evaluation of possible recurrence. 2) Discuss areas for future research in high-resolution radionuclide breast imaging.

RC511C • Algorithms in Breast Imaging

Amy L Conners MD (Presenter)

LEARNING OBJECTIVES
1) Identify strengths and weaknesses of breast MR, breast specific gamma imaging (BSGI)/molecular breast imaging (MBI) and positron emission mammography (PEM) in common diagnostic and screening settings. 2) Apply knowledge of MR and nuclear breast imaging techniques to determine appropriate use for specific indications including staging of known breast cancer, neoadjuvant chemotherapy response, evaluation of possible recurrence post-breast conservation therapy, and screening of patients at increased risk of breast cancer.

ABSTRACT

Non-Atherosclerotic Vascular Diseases (An Interactive Session)

Wednesday, 08:30 AM - 10:00 AM • E353B

RC512 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

RC512A • Vasculitis

Phillip M Young MD (Presenter)

LEARNING OBJECTIVES
1) To review clinical and imaging manifestations of vasculitis. 2) To discuss imaging protocols for assessment of vasculitis.

ABSTRACT

RC512B • Genetic Disorders

Elliot K Fishman MD (Presenter) *

ABSTRACT

The rapid developments in CT angiography have provided unparalleled capabilities for evaluation of the vascular tree in studies that combine rapid data acquisition, isotropic data and 3 dimensional mapping. At the same time an ever increasing domain of knowledge is developing around a range of vascular pathologies including Marfans Syndrome, Loeys Dietz Syndrome and Ehlers Danlos Syndrome to name a few. With knowledge is expanding at break neck speed. In this presentation I will review many of the key imaging findings of a range of genetic vascular pathologies and define the unique findings of specific entities. The role of imaging in lesion detection, monitoring and guiding therapy is addressed. The role of the radiologist as part of the Vascular team is discussed as well. Finally specific protocols including how to optimize dose is addressed.

RC512C • Vascular Malformations

Klaus D Hagspiel MD (Presenter) *

LEARNING OBJECTIVES
1) To review the classification of vascular malformations and tumors and their clinical and MRI features. 2) To review appropriate MR imaging protocols for the assessment and treatment follow up of these lesions.

ABSTRACT

Vascular malformations and tumors comprise a wide, heterogeneous spectrum of lesions that often represent a diagnostic and therapeutic challenge. Frequent use of an inaccurate nomenclature has led to considerable confusion. Since the treatment strategy depends on the type of vascular anomaly, correct diagnosis and classification are crucial. Magnetic resonance (MR) imaging is the most valuable modality for classification of vascular anomalies because it accurately demonstrates their extension and their anatomic relationship to adjacent
The subjective interpretation of breast lesions with mammography, ultrasound, and MR-imaging is difficult to evaluate and therefore requires practice and issue meaningful, unambiguous breast imaging reports.

ABSTRACT

The Neuroradiologist plays a critical role in raising concern for abusive head trauma. However, to be effective in this role, it is important to be up to date on the patterns often associated with abusive head injury and their temporal evolution. In this lecture, recent literature and current controversies in parenchymal brain injury in the setting of child abuse will be reviewed.

Parenchymal Brain Injury in the Setting of Child Abuse

Ellen Grant MD (Presenter)

LEARNING OBJECTIVES

1) To review the unique properties of the infant brain that influence patterns of brain injury. 2) To review the common patterns of brain injury associated with abuse and discuss potential etiologies. 3) To increase awareness of white matter tears and delayed appearance of brain injuries. 4) To discuss optimal imaging protocols.

ABSTRACT

The Neuroradiologist plays a critical role in raising concern for abusive head trauma. However, to be effective in this role, it is important to be up to date on the patterns often associated with abusive head injury and their temporal evolution. In this lecture, recent literature and current controversies in parenchymal brain injury in the setting of child abuse will be reviewed.

Musculoskeletal Injuries and Common Mimickers

Jeannette M Perez-Rossello MD (Presenter)

LEARNING OBJECTIVES

1) Describe the skeletal injury patterns seen with physical child abuse. 2) Be familiar with the mechanism of injury of inflicted injuries. 3) Know the type and specificity of abusive injuries. 4) Differentiate metabolic bone disease, skeletal dysplasias, accidental injuries and normal variants that can mimic abuse. 5) Recommend imaging and medical workup for the evaluation of suspected abuse.

ABSTRACT

Skeletal injuries are the most common findings noted on imaging studies in cases of child abuse. In contrast to central nervous system and other visceral injuries, they are rarely life threatening. In infants, certain lesions, like posterior rib fractures and classic metaphyseal lesions, have high specificity for abuse. Posterior rib fractures at the costovertebral articulations occur with anteroposterior compression of the thorax that may be associated with shaking. The classic metaphyseal lesion (CML) results from torsional and tractional forces applied to the extremities, and may occur with acceleration forces associated with infant shaking. Other less specific injuries when correlated with other imaging findings and clinical history may add support for the diagnosis of abuse. The detection of skeletal injuries depends on the technical quality and thoroughness of the skeletal survey. Failure to perform an adequate skeletal survey may result in the return of a child to a potentially dangerous environment. Diagnostic imaging can identify a variety of conditions that can be confused with child abuse. Fractures and/or metaphyseal irregularities simulating CMLs can be seen in osteogenesis imperfecta, rickets, syphilis, certain bone dysplasias, and as a result of traumatic delivery. Radiographic images provided by the skeletal survey have a low yield in detecting spinal injury and are insensitive for subtle compression fractures, intraspinal hematomas and paraspinal soft tissue disruptions. These lesions are best identified by spinal MRI. Diagnosing an unexpected spinal injury will result in management interventions designed to protect the spine, while missing a spinal injury may result in ongoing spinal instability. Furthermore, identifying a traumatic spinal lesion in a complex case may add additional support to a diagnosis of trauma.

Imaging of Spinal Injuries in Abused Children

Michelle Silvera MD (Presenter)

LEARNING OBJECTIVES

1) Become familiar with the incidence and imaging appearance of spinal injuries in children with abusive trauma. 2) Better understand imaging strategies for detection of spinal injury in children with non-accidental trauma. 3) Be aware of the role of MRI in assessing spinal injury.

ABSTRACT

Skeletal injuries in young children with abusive trauma are difficult to diagnose clinically and easily overlooked. Therefore, careful imaging attention to the spine is warranted. The practicing radiologist plays an important role in recommending appropriate imaging tests in order to identify these injuries. Radiographic images provided by the skeletal survey have a low yield in detecting spinal injury and are insensitive for subtle compression fractures, intraspinal hematomas and paraspinal soft tissue disruptions. These lesions are best identified by spinal MRI. Diagnosing an unexpected spinal injury will result in management interventions designed to protect the spine, while missing a spinal injury may result in ongoing spinal instability. Furthermore, identifying a traumatic spinal lesion in a complex case may add additional support to a diagnosis of trauma.

No Course RC514. See Series VSIR41 Interventional Radiology Series: Embolotherapy

Wednesday, 08:30 AM - 10:00 AM

RC515 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

Stamatia V Destounis, MD
Edward A Sickles, MD
Ellen B Mendelson, MD *
Constance D Lehman, MD, PhD *

LEARNING OBJECTIVES

1) Understand the use of the BI-RADS lexicon in describing lesions found on mammography, ultrasound, and MR imaging. 2) Utilize the appropriate BI-RADS assessment categories for mammography, ultrasound, and MR imaging. 3) To use the BI-RADS lexicon in everyday practice and issue meaningful, unambiguous breast imaging reports.

ABSTRACT

The subjective interpretation of breast lesions with mammography, ultrasound, and MR-imaging is difficult to evaluate and therefore difficult to improve. The medical audit is the only way to measure breast imaging performance in a manner that includes not only technical,
but also interpretive capabilities of the system. The ‘Breast Imaging Reporting and Data System’ (BI-RADS) is a quality assurance tool, designed to standardize breast imaging reporting, reduce confusion in breast imaging interpretations, and facilitate outcome monitoring. Through a medical audit and outcome monitoring, the system provides important peer review and quality assurance data to improve the quality of patient care. The BI-RADS is the product of a cooperative effort between members of various committees of the American College of Radiology. The BI-RADS was first introduced in 1992 and has become a widely accepted tool all over the world. However, there is a need for continuous teaching of the BI-RADS classification because it is intended for use in everyday practice and should make it possible to issue meaningful, unambiguous breast imaging reports. This BI-RADS session has been organized to provide participants with an introduction to the most important sections of this system. These are the breast imaging lexicon for mammography, ultrasound, and MR imaging. Beside the theoretical background, participants will be trained and tested on how to apply the BI-RADS.

**Women and Cardiovascular Disease (In Conjunction with the American Association for Women Radiologists)**

**Wednesday, 08:30 AM - 10:00 AM • S104A**

**RC516 • AMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5**

**Moderator**

Yoshimi Anzai, MD

**RC516A • The Utility of Coronary CTA for the Evaluation of Coronary Artery Disease**

**Jill E Jacobs** MD (Presenter)

**LEARNING OBJECTIVES**

1) To understand the benefits and limitations of coronary CTA for the assessment of coronary artery disease.

**ABSTRACT**

1) To describe the various image acquisition protocols that are available for measuring myocardial perfusion with CT.
2) To recognize findings of normal and pathologic myocardial perfusion patterns at CT.
3) To discuss specific advantages of CT based assessment of myocardial perfusion in women.
4) To identify potential future clinical applications involving CT myocardial perfusion imaging.

**RC516B • Cardiac CT Perfusion for Coronary Artery Disease**

**U. Joseph Schoepf** MD (Presenter) *

**LEARNING OBJECTIVES**

1) To describe the various image acquisition protocols that are available for measuring myocardial perfusion with CT.
2) To recognize findings of normal and pathologic myocardial perfusion patterns at CT.
3) To discuss specific advantages of CT based assessment of myocardial perfusion in women.
4) To identify potential future clinical applications involving CT myocardial perfusion imaging.

**RC516C • Cardiac MR for Myocardial Infarction**

**Gisela C Mueller** MD (Presenter) *

**LEARNING OBJECTIVES**

1) To understand technique, imaging findings, and clinical application of MR for myocardial infarct.

**ABSTRACT**

1) To describe the MR technique for myocardial infarct.
2) To discuss segmental anatomy, MR appearances, and appropriate reporting of myocardial infarction.
3) To discuss differential diagnoses of myocardial infarct on MR images and diagnostic pitfalls.
4) To discuss clinical indications, alternative diagnostic methods, and impact on patient management of MR for myocardial infarction.

**Novel Applications of Dual Energy CT**

**Wednesday, 08:30 AM - 10:00 AM • SS04CD**

**RC517 • AMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5**

**Moderator**

Myrna C Godoy, MD, PhD

**RC517A • Dual-Energy CT: Thoracic Applications**

**Myrna C Godoy** MD, PhD (Presenter)

**LEARNING OBJECTIVES**

1) To comprehend the basic physical principles of dual-energy CT (DECT). 2) To review the current clinical potential applications of DECT in thoracic imaging.

**ABSTRACT**

There are different methods by which dual-energy CT images can be generated. The advantages of DECT technique are twofold: 1) Low kilovoltage imaging with increased iodine conspicuity (based on increased photoelectric interactions) is especially useful for evaluation of vascular structures. 2) Material specific post-processing allows material differentiation (based on the differential CT attenuation of selected substances at two different energies), which can be tailored for each particular clinical indication, for example to evaluate for contrast enhancement in pulmonary nodules. The current potential clinical applications of DECT in thoracic imaging include evaluation of pulmonary arteries, aorta, pulmonary nodules, pleural masses and airways disease.

**RC517B • New Insights on Dual Energy CT in Oncology**

**Carlo Nicola De Cecco** MD (Presenter)

**LEARNING OBJECTIVES**

1) To describe the basic principles of DECT imaging. 2) To explain how post-processing is practised. 3) To discuss radiation exposure issues. 4) To critically appraise the strengths and weaknesses of the technique in oncologic imaging. 5) To comment on the contribution of DECT imaging in oncologic patients management.

**ABSTRACT**

Dual Energy CT (DECT) is an innovative imaging technique, whose basic principle is the application of two distinct energy settings making it possible to distinguish materials with different molecular composition on the basis of their attenuation profiles and thus operating a transition from density based image to spectral imaging. DECT applications are based on two distinct capabilities: 1) material differentiation, which means achieving material-specific imaging with separation of distinct materials, for example iodine, calcium, and uric acid, within an image obtained during a single examination and 2) material identification and quantification, which means accurate assessment of the presence and amount of iodine within a target lesion. In particular, with DECT acquisition multiple data-sets such as elemental decomposition analysis, iodinated density map, monochromatic images or virtual unenhanced images can be obtained simultaneously making the Radiologist able to address different diagnostic problems and improving lesion detection and characterization. These technical characteristics make DECT an innovative imaging modality particularly useful in oncologic imaging, having clear advantages in tumor detection and characterization.
LEARNING OBJECTIVES
1) To review the technique and principles of DECT and spectral imaging as it pertains to the musculoskeletal application. 2) To demonstrate the musculoskeletal applications of DECT/spectral imaging with an emphasis on the ability to diagnose and monitor progression of gout. 3) To display additional abilities and demonstrate imaging examples of DECT/spectral imaging for the identification of bone marrow edema, soft tissue (tendon and ligamentous) injuries, and reduction of metal artifacts. 4) To review the advantages and limitations of DECT compared to other imaging modalities for musculoskeletal imaging.

ABSTRACT
Dual energy CT and Spectral imaging are useful tools for musculoskeletal imaging. We will focus on the utility of this in the setting of musculoskeletal imaging of gout by demonstrating its ability to aid in diagnosis in challenging cases, delineate anatomy of crystal deposition disease, and monitor disease progression and treatment of the monosodium urate crystals. The audience will learn the utility of DECT/Spectral imaging for additional musculoskeletal applications such as characterization of acute bone marrow edema, identification of tendon and ligamentous injuries and reduction of metal artifacts using monoenergetic imaging.

New Paradigms for the Treatment of Hodgkins and non-Hodgkins Lymphomas: The Crucial Role of Imaging

LEARNING OBJECTIVES
1) To understand the role of computed tomography and positron emission tomography-CT in the management of patients with Hodgkin and non-Hodgkin lymphoma. 2) To become familiar with the International Working Group Criteria, which integrate PET findings into lymphoma response assessment. 3) To become familiar with limitations of PET-CT in assessing lymphoma response by PET-CT. 4) To become aware of detection, lesion characterization, evaluation of response to therapy, and detection of oncologic-related disease. In conclusion, DECT represents an innovative imaging technique, which can significantly impact on the management of oncologic patients.
pittfalls (false positives) of PET-CT in the response assessment of patients with lymphoma.

ABSTRACT
Although computed tomography remains the gold standard for assessment of lymphoma response to therapy, PET-CT plays an important role for both staging and response evaluation. In this session we will review the role of imaging in lymphoma and demonstrate how it guides therapy in this patient population. The limitations of PET imaging as well as pitfalls and false positives of PET imaging will be addressed.

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**Medical Physics 2.0: Fluoroscopy**

**Wednesday, 08:30 AM - 10:00 AM • E451A**

**RC521 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1**

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

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

**RC521B • Fluoroscopy 1.0**

**Beth A Schueler PhD (Presenter)**

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

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

**RC521C • Fluoroscopy 2.0**

**Keith J Strauss MS (Presenter)**

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

**ABSTRACT**
Abstract Steps that are required to turn physics support of fluoroscopy from a compliance focused to operationally focused program will be discussed. New metrics and analytics to better quantify high contrast resolution, low contrast resolution, temporal resolution, and 3D imaging will be examined. Changes in testing protocols necessary to address new hardware technologies, new acquisition methods, state-of-the-art image processing and analysis will be reviewed. A recently developed “physics testing mode” that the vendors will provide in the near future will be described. Proper management of patient dose metrics will be reviewed. The presentation concludes with clinical implementation of these new strategies. Proper training and communication is critical. Proper configuration of acquisition parameters (focal spot size, voltage and added filter, tube current, pulse current, pulse width, pulse rate, scatter removal) as a function of patient size from the smallest neonate to the largest bariatric patient is key to providing diagnostic image quality at properly managed radiation doses. In addition, one must ensure that the detector dose as a function of filter type and thickness, pulse rate, field of view, and complexity of the examination is properly configured.

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**Uncertainties in Imaging for Radiation Oncology: Sources and Mitigation Techniques-Site-specific IGRT Applications: Impact of Different Approaches on Uncertainties**

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

**RC522 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**

**LEARNING OBJECTIVES**
1) Impact of different approaches on uncertainties for specific sites, including pelvis, HandN, thorax, and abdominal sites.

**RC522A • Pelvis**

**Emilie Soisson PhD (Presenter)**

**LEARNING OBJECTIVES**
1) Be able to describe the sources and magnitude of positional uncertainty in irradiation of the pelvis. 2) Understand the role of image guidance in localizing pelvic targets. 3) Be able to compare the imaging strategies employed in the pelvis and understand residual
ABSTRACT
Detection of organ motion is required for accurate targeting in radiation therapy of the pelvis. It is well known that pelvic targets change size, shape, and location as a result of changes in bladder and rectal filling and the size and location of these organs on the planning CT cannot be easily reproduced at treatment. While organ filling can be partially controlled through dietary regulation, complete immobilization is not possible. Image guidance (IGRT) provides the opportunity to monitor inter- and intra-fraction anatomical changes to better ensure plan delivery accuracy. In turn, IGRT has allowed for margin reduction and dose escalation, especially in the case of the prostate. The potential reduction in margin is then dependent on several factors including the ability to visualize the target and the frequency of imaging. Since target anatomy is generally not rigid with respect to bony landmarks, images used for localization must provide adequate soft tissue contrast or be used in combination with implanted surrogates. Due to the variety of IGRT approaches available and the possibility of having more than one imaging system in each treatment vault, it is now possible to inter-compare different IGRT methods to determine the uncertainty of a particular approach. Results of these studies are surprising and suggest that even though we think we can see the prostate with our chosen image guidance strategy, back-to-back imaging with different modalities will likely reveal that the prostate not only a different size but also often in a different place. In addition, intra-fraction motion is considerable in the prostate indicating that significant margins are might be required in the absence of intra-fraction tracking.

RC522C • Head and Neck
Laurence E Court PhD (Presenter)
LEARNING OBJECTIVES
1) Be able to describe the uncertainties in head and neck radiation therapy. 2) Appreciate the different approaches used. 3) Have an understanding of the range of margins used for head and neck treatments clinically, and the rationale for these. 4) Be able to logically compare published margins with their own clinical practice.

ABSTRACT
Head and neck cancer is a difficult site for radiation therapy because of the complexity in target delineation, normal tissue sparing and treatment planning. Typically, head and neck patients are immobilized using thermoplastic masks, which are custom-made to fit the individual patient. Generic, or patient-specific neck supports may be used. In many institutions IGRT is considered standard of care for these patients. Thus, many of the uncertainties in head and neck treatments are minimized. However, it is important to understand the residual uncertainties. The immobilization devices are good at minimizing intrafraction movement, but the complex motions of the head and neck region mean that there can be day-to-day variations in the relative positions of different regions, such as between the neck and head. The extent of these variations has been well studied, and will be described in this presentation. There are also different approaches to the IGRT process, including the use of 2D or 3D imaging. This session will explore the uncertainties in head and neck radiation therapy, including inter-fraction variations and also variability in contouring. Mitigation strategies will be discussed. We will describe the treatment margins used by different including their respective rationale.

RC522C • Thorax and Abdomen
Sonja Dieterich PhD (Presenter)
LEARNING OBJECTIVES
1) Be able to describe the sources of uncertainties in the thorax and abdomen. 2) Learn how different respiratory motion management influence margins. 3) Gain an understanding what typical ranges of margins are for the respective methods. 4) Be able to determine appropriate margins for their respective clinical practice.

ABSTRACT
The uncertainties thorax and abdominal regions in the human body consists of overall patient setup uncertainty, respiratory motion, and organ deformation. Depending on the location of the target, a site-specific combination of these three components make up the total uncertainty. Respiratory motion compensation methods are increasingly used in clinical practice to minimize uncertainties. The most commonly used respiratory motion compensation methods are: breath-hold, abdominal compression, gating, and real-time tracking. Each method has a different impact on uncertainties. The simulation imaging also contributes to variations in uncertainties. CT artifacts which may change the contouring margins used depend on the data acquisition technology used during simulation. Free breathing, deep inspiration or expiration breath-hold, gated 4D-CT (both phase-gated and amplitude gated), scanner speed, pitch, and number of slices per revolution all influence the uncertainties. In addition to uncertainties in the position of the target, the relative position of organs at risk (OAR) to the target area may also change intra- or inter-fractionally. The concept of using OAR margins in the planning phase to anticipate potential relative shifts of OAR to target position will be discussed. Assessing OAR dose during daily image-guided patient setup can help identify setup variations exceeding OAR safe margins. Strategies to address setup variations exceeding uncertainty limits based on clinical experience will be discussed.

Minicourse: Recording and Reporting Radiation Dose: National and International Perspectives and Activities
Wednesday, 08:30 AM - 10:00 AM • N226

RC523 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
Director
J. Anthony Seibert , PhD
URL’s
www.imp.uni-erlangen.de/RSNA2012

RC523A • The American College of Radiology Dose Index Registry
Richard L Morin PhD (Presenter)
LEARNING OBJECTIVES
1) Understand how registries perform. 2) Understand the way in which registries have altered physician behavior and improve patient care. 3) Identify the parameters involved in optimizing radiation dose in clinical practice. 4) Apply this knowledge by participating in a dose index registry and utilizing these techniques in Maintenance of Certification.

ABSTRACT
1) Understand that CTDI is merely a technical concept for scanner acceptance and constancy testing, but not a measure for patient dose. 2) Learn about concepts for patient- and scanner-specific patient dose estimates. 3) Learn about the concept of diagnostic reference levels and its strengths and weaknesses.

ABSTRACT
Detection of organ motion is required for accurate targeting in radiation therapy of the pelvis. It is well known that pelvic targets change size, shape, and location as a result of changes in bladder and rectal filling and the size and location of these organs on the planning CT cannot be easily reproduced at treatment. While organ filling can be partially controlled through dietary regulation, complete immobilization is not possible. Image guidance (IGRT) provides the opportunity to monitor inter- and intra-fraction anatomical changes to better ensure plan delivery accuracy. In turn, IGRT has allowed for margin reduction and dose escalation, especially in the case of the prostate. The potential reduction in margin is then dependent on several factors including the ability to visualize the target and the frequency of imaging. Since target anatomy is generally not rigid with respect to bony landmarks, images used for localization must provide adequate soft tissue contrast or be used in combination with implanted surrogates. Due to the variety of IGRT approaches available and the possibility of having more than one imaging system in each treatment vault, it is now possible to inter-compare different IGRT methods to determine the uncertainty of a particular approach. Results of these studies are surprising and suggest that even though we think we can see the prostate with our chosen image guidance strategy, back-to-back imaging with different modalities will likely reveal that the prostate not only a different size but also often in a different place. In addition, intra-fraction motion is considerable in the prostate indicating that significant margins are might be required in the absence of intra-fraction tracking.
There is no major debate regarding the validity of the computed tomography dose index (CTDI) in Europe because it is considered as a tool for scanner acceptance and constancy testing. Its use for that purpose is undisputed. Measures for patient dose have been a major topic for decades. There are no common regulations valid for all of Europe, but there are a number of initiatives and concepts in place already which originated here. Among these are primarily the generation of conversion coefficients $k$ for estimating values of the effective dose $E$ from the dose length product (DLP) by $E = k \times DLP$ and the concept of dose reference levels (DRL). DRLs for radiologically examinations in the European Union were demanded by law already in 2000.

Patient dose assessment relies predominantly on pre-tabulated values generated for anthropomorphic and voxel phantoms. Efforts are underway to provide more patient-specific dose estimates (PSDE) independent of CTDI phantom measurements. The lecture will review the above concepts and will point to both strengths and weaknesses.

**RC523C • Informatics Tools for Recording/Tracking Dose**

Kevin O'Donnell (Presenter)

**LEARNING OBJECTIVES**
1) Understand how DICOM Radiation Dose SR (RDSR) captures procedure dose information, the modalities and details covered. 2) Understand how the IHE Radiation Exposure Monitoring Profile (REM) coordinates the capture and management of RDSR objects and how it can be applied in a radiology practice. 3) Understand how 'CT dose screens' from legacy scanners can be ported into RDSR. 4) Understand how to apply the pre-scan dose pop-ups on the CT console specified in the MITA CT Dose Check (XR-25) standard. 5) Understand how to specify the above standards and features when purchasing and integrating radiology systems.

**Reviewing Manuscripts for the RSNA Journals (Sponsored by the RSNA Publications Council)**

Wednesday, 08:30 AM - 10:00 AM  •  S102D

**RC524 • AMA PRA Category 1 Credit ™:1.5**

Moderators:
Herbert Y Kressel, MD *
Jeffrey S Klein, MD

**LEARNING OBJECTIVES**
1) Discuss the similarities and differences in the peer review process for the RSNA journals. 2) Discuss the functions of the reviewer in the peer review process. 3) Enumerate the desired elements for peer review of a manuscript.

**ABSTRACT**
Peer reviewers are, in a major way, responsible for the quality of the manuscripts published in a given journal. In this refresher course, the Editors of both of the peer-reviewed journals published by the RSNA will discuss the peer review processes of their respective journals. The Editors will also emphasize the important functions served by the peer reviewers and will indicate the types of information which they would like the peer reviewers to consider when the peer reviewers review a given manuscript. There will be ample time for questions and answers.

**Quantitative Imaging: Quantitative Imaging in FDG-PET**

Wednesday, 08:30 AM - 10:00 AM  •  S102AB

**RC525 • AMA PRA Category 1 Credit ™:1.5  •  ARRT Category A+ Credit:1.5**

**Director**
Michael F McNitt-Gray, PhD *

**RC525A • Lessons Learned from Drug Development Trials Using Molecular Imaging**

Jeffrey L Evelhoch PhD (Presenter) *

**LEARNING OBJECTIVES**
1) Understand how pharma uses the information provided by FDG-PET. 2) Become familiar with site qualification and quality control methods used in clinical trial of an investigational therapeutic agent. 3) Understand why specific clinical trial imaging protocols may differ from clinical practice and importance of adhering to the clinical trial imaging protocol. 4) Realize which issues confound attempts to achieve more quantitative FDG-PET in the context of a clinical trial of an investigational therapeutic agent.

**RC525B • Examples of Multi-Center Molecular Imaging Trials: Trial Design and Quantitative Approaches**

David A Mankoff, MD, PhD (Presenter)

**LEARNING OBJECTIVES**
1) Describe applications of molecular imaging as a biomarker for cancer drug therapy. 2) Discuss elements of clinical study design for molecular imaging. 3) Contrast molecular imaging versus conventional imaging and therapy trials.

**RC525C • Understanding and Controlling Sources of Variability in Multi-Center PET Imaging**

Paul E Kinahan, PhD (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.
LEARNING OBJECTIVES
1) Use Adobe Photoshop to create and enhance images for publication. 2) Create podcasts and screencasts.

RC526B • OsiriX and File-sharing Technologies

Jonelle M Petscavage-Thomas MD, MPH (Presenter) *

LEARNING OBJECTIVES
1) Identify the applications of Osirix for image processing and formatting in publications, clinical consults, resident instruction, and scientific and educational exhibits. 2) Identify the educational applications of 3D Slicer as interactive visualization of images, triangulation of 3D surface models, and fusion and co-registering of data using rigid and non-rigid algorithms. 3) Recognize the current transition from print textbook to electronic publication. 4) Demonstrate understanding of the basics of ePub for creation of online radiology textbooks. 5) Perform basic functions of the technology for use in one’s own practice.

RC526C • Cool Research and Education Tools

Michael L Richardson MD (Presenter)

LEARNING OBJECTIVES
1) Tools for work (e.g. real-time consultations, note-taking technology). 2) Tools for teaching (e-publication and audience response technology). 3) Tools for health (exercise tracking and workplace exercise technology). 4) Tools for surviving RSNA (transportation, communication, weather and decision-making technology).

Critical Issues Facing the Profession of Radiology: An ACR Leadership Perspective (In Conjunction with the American College of Radiology)

Wednesday, 08:30 AM - 10:00 AM • S404CD

LEARNING OBJECTIVES
1) Major issues facing radiology today. 2) What steps the American College of Radiology is taking to address these issues. 3) The process of political advocacy and how organizations work with Congress and federal agencies.

ABSTRACT

Abdominal MRA Update

Wednesday, 08:30 AM - 10:00 AM • N230

LEARNING OBJECTIVES
1) Understand the underlying principles of non-contrast MRA. 2) Be familiar with the currently available methods for non-contrast MRA. 3) Be familiar with important applications and examples of non-contrast MRA. 4) Understand current limitations and pitfalls associated with non-contrast MRA.

ABSTRACT

RC529 • Non-contrast MRA of the Abdomen

Scott B Reeder MD, PhD (Presenter)

LEARNING OBJECTIVES
1) Learn how to image perforator vessels for autologous breast reconstruction. 2) Understand anatomic and surgical considerations for determining the optimum vessel/ donor sites for microsurgical breast reconstruction. 3) Review the perforator findings from a spectrum of cases. 4) See a systematic approach to post-processing and reporting perforator studies.

ABSTRACT

RC529C • Deep Inferior Epigastric Perforator MRA for Planning Breast Reconstruction

Nanda Deepa Thimmappa MD, MBBS (Presenter)

ABSTRACT

Managing Radiology IT in the EHR World

Wednesday, 08:30 AM - 10:00 AM • S404AB

LEARNING OBJECTIVES
1) Use Adobe Photoshop to create and enhance images for publication. 2) Create podcasts and screencasts.
ABSTRACT
The development and usage of electronic medical records has resulted in significant impact on radiology work flow both positive and negative. Moving from a paper driven to an electronic process allows for creative design and implementation of a variety of methods to improve radiologist efficiency and quality of patient care. The initial impact at our institution was felt most intensely in the areas of physician order entry of imaging studies and imaging study protocol selection. Although there are a number of off-the-shelf products available to support these functions, we chose to build our own systems within our RIS/EMR. The project required that we thoroughly understand the multiple components of our work flow in the EMR environment, something we had not paid sufficient attention to previously. The first step was to put together of a team with expertise in all aspects of this work flow. Utilizing the specific skills of team members, we were able to develop a template for improved data acquisition at the time of physician order entry and study protocol selection. A number of other quality and workflow enhancements spun out of these efforts. This presentation will review this process in order to provide current/future RIS/EMR users with guidance on optimizing their workflow and improving the quality of patient care.

LEARNING OBJECTIVES
1) Review differences between RIS driven, PACS driven, and EHR (RIS-EMR) driven workflow for diagnostic radiologists. 2) Discuss radiologist engagement in EHR implementation for radiology-centric optimization. 3) Present EHR driven workflow for the diagnostic radiologist at the speaker's institution. 4) Discuss impacts of EHR driven workflow on diagnostic radiologists' efficiency and quality of care delivery as well as user satisfaction.

ABSTRACT
Electronic Health Records (EHRs) are touted to improve the quality and efficiency of clinical care. As a result, EHR-meaningful use legislation has been passed in the U.S. to financially incentivize adoption of this technology. Still, some radiologists remain skeptical that the benefits of EHRs are applicable to their practice and some fear that the technology could even unnecessarily complicate their workflow. One newer model for integrating EHRs into radiologists' practice is is to use an EHR to drive diagnostic radiologist workflow, rather than the more traditional or widespread models of PACS driven or third-party RIS driven workflow. This newer model provides opportunity to leverage EHR technology and data for the benefit of radiology-related care delivery. This presentation shares a radiologist-centric viewpoint from one institution which has successfully adopted EHR-driven workflow for diagnostic radiologists. Though the process of implementation is touched upon, the presentation focuses on the resultant clinical workflow and the impacts on quality, efficiency, and radiologist satisfaction.

LEARNING OBJECTIVES
1) Identify EHR components relevant to radiology. 2) Understand how to assess and use those components to your advantage. 3) Discover potential and pitfalls of EHRs.

ABSTRACT
Potential and pitfalls of EHRs.

LEARNING OBJECTIVES
1) Identify EHR components relevant to radiology. 2) Understand how to assess and use those components to your advantage. 3) Discover potential and pitfalls of EHRs.
LEARNING OBJECTIVES
1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography, with specific focus on small part applications. 2) Define and discuss technical aspects, rationale, and pitfalls involved in musculoskeletal, breast, head and neck, and pediatric interventional sonographic care procedures. 3) Successfully perform basic portions of hands-on US-guided procedures in a tissue simulation learning model, to include core biopsy, small abscess coaxial catheter drainage, cyst and ganglion aspiration, lymphatic malformation macrocyst access, soft tissue foreign body removal, and intraarticular steroid injection. 4) Incorporate these component skill sets into further life-long learning for expansion of competency and preparation for more advanced interventional sonographic learning op.

ABSTRACT
Managing Conflicts of Interest
Wednesday, 08:30 AM - 10:00 AM • S403B

RC532 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

RC532A • Managing Multiple Accountabilities
Carolyn C Meltzer MD (Presenter) *

LEARNING OBJECTIVES
1) To provide a framework for understanding trends and variation in change of conflict of interest regulations guiding research and educational activities within academic medical centers, and how these have affected departments of radiology. 2) To compare and contrast processes of compliance, and discuss cost implications. 3) To examine how the academic-industry partnerships may proceed in this new, more restrictive environment.

RC532B • Industrial-Academic Collaborations: Managing Research Relationships
Jonathan S Lewin MD (Presenter)

LEARNING OBJECTIVES
1) Construct a framework for understanding industrial-academic relationships. 2) Describe common pitfalls in research partnerships. 3) Identify methods to mitigate conflicts of interest in research with industrial collaborators.

RC532C • Entrepreneurship and Commercial Venturing by Physicians: Appropriate or Not?
Richard L Ehman MD (Presenter) *

LEARNING OBJECTIVES
1) Discuss entrepreneurship and how commercialization of intellectual property may serve the mission of academic medical centers. 2) Examine the purpose of the Bayh-Dole act and its historic effect on commercialization activity by academic medical centers. 3) Review potential concerns about entrepreneurship at academic medical centers, including effects on academic freedom, delayed publication, IP congestion and conflict of interest.

Fallopian Tube Catheterization (Hands-on Workshop)
Wednesday, 08:30 AM - 10:00 AM • E260

RC550 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
Amy S Thurmond , MD *
Ronald J Zagoria , MD
Lindsay S Machan , MD *
Antoine J Maubon , MD
Arl Van Moore , MD
Anne C Roberts , MD *
David M Hovsepian , MD *

LEARNING OBJECTIVES
1) Obtain hands-on experience with fallopian tube catheterization using uterine models and commercially available catheters and guidewires. 2) Review the evolution of interventions in the fallopian tubes. 3) Learn safe techniques for fallopian tube recanalization for promoting fertility, and fallopian tube occlusion for preventing pregnancy. 4) Discuss the outcomes regarding pregnancy rate and complications. 5) Appreciate ways to improve referrals from the fertility specialists and expand your practice.

ABSTRACT
Fallopian tube catheterization using fluoroscopic guidance is a relatively easy, inexpensive technique within the capabilities of residency trained radiologists. Fallopian tube catheterization can be used to dislodge debris from the tube in women who do not desire fertility. The fallopian tube is the 1 mm gateway between the egg and the sperm. Noninvasive access to this structure for promoting, and preventing, pregnancy has been sought for over 160 years. This hands-on course allows participants use commercially available catheters and devices in plastic models for fallopian tube catheterization, and to speak directly to world experts about this exciting procedure.

Imaging in Practice: MRI of the GIT (How-to Workshop)
Wednesday, 08:30 AM - 10:00 AM • E261

RC551 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
Flavius F Guglielmo MD (Presenter)
LEARNING OBJECTIVES
1) To learn the clinical indications for MR Enterography (MRE) and an optimized MRE protocol. 2) To learn how to diagnose inflammatory bowel disease with MRE. 3) To learn the role of cine balanced steady state free precession series and diffusion weighted imaging series in MRE. 4) To understand if decreasing small bowel peristalsis is necessary when performing MRE.

ABSTRACT

RC551B • Imaging of the Anus: Anatomy, Fistulas and Incontinence
Joel G Fletcher MD (Presenter) *

LEARNING OBJECTIVES
1) To review the anatomy of the anal sphincter complex and pelvic floor. 2) To discuss how imaging acquisition methods are tailored to patient indication (e.g., perianal Crohn’s disease, incontinence, ileoanal pouch). 3) To review the justification and rationale for MR anal imaging in patients with perianal Crohn’s disease and fecal incontinence. 4) To describe time-efficient detection and classification of perianal fistulas. 5) To show how the appearance of perianal fistulas changes with treatment. 6) To review the appearance of traumatic sphincter tears, in addition to diffuse abnormalities of the internal and external sphincter.

ABSTRACT

RC551C • How to Use MRI for Rectal Cancer Staging
Gina Brown MD, MBBS (Presenter)

LEARNING OBJECTIVES
1) To appreciate optimal MRI techniques for accurate staging of Rectal Cancer. 2) To understand the implications for patient care from optimised staging. 3) To follow minimum reporting standards for reporting Rectal Cancers at baseline and after preoperative therapy.

ABSTRACT

Nerve Ultrasound Based on a Regional Approach: Shoulder and Neck (Hands-on Workshop)
Wednesday, 08:30 AM - 10:00 AM • E264

LEARNING OBJECTIVES
1) Describe the ultrasound anatomy and scanning technique for examination of neck (i.e. brachial plexus, spinal accessory, long thoracic, phrenic, vagus) and shoulder (i.e. suprascapular, axillary, musculocutaneous) nerves. 2) Illustrate the main anatomic landmarks to identify these nerves. 3) Master technical approaches to nerve ultrasound including the recognition of pitfalls.

ABSTRACT

In recent years, ultrasound of the musculoskeletal and peripheral nervous systems is becoming an increasingly imaging tool with an expanding evidence base to support its use. However, the operator dependent nature and level of technical expertise required to perform an adequate ultrasound assessment means that appropriate training is required. For this purpose, the present course will demonstrate the basic principles of musculoskeletal ultrasound with a special focus on the examination of small (Hands-on DICOM Metadata Manipulation (Hands-on Workshop)
Wednesday, 08:30 AM - 10:00 AM • S401CD

LEARNING OBJECTIVES
1) Get introduced to a variety of the available open source tools and have a chance to experiment and familiarize yourself with the software hand-on. 2) Understand how open source DICOM software can help solve common workflow issues. 3) Understand how open source DICOM software can be used in research and education. 4) Learn to use open source tools to address DICOM data management challenges.

Using RADIANCE for Dose Monitoring and Quality Assurance: A Hands-on Course
Wednesday, 08:30 AM - 10:00 AM • S401AB

LEARNING OBJECTIVES
1) Get introduced to a variety of the available open source tools and have a chance to experiment and familiarize yourself with the software hand-on. 2) Understand how open source DICOM software can help solve common workflow issues. 3) Understand how open source DICOM software can be used in research and education. 4) Learn to use open source tools to address DICOM data management challenges.
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 package 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 (CTDvol) and dose-length product (DLP). In addition, information about the patient, type of study, scanner and performing institution are obtained from the DICOM study header. This aggregate of dose and exam data is stored in a relational database which can be used to perform quality assurance measures. Using the RADIANCE dashboard and scorecards, facilities can closely monitor their dose data, generate monthly reports for individuals and administrators, identify and investigate outliers and evaluate dose reduction and protocol optimization measures. With the development of radiation dose structured reports (RDSRs or Dose SRs), which are generated by newer scanners, facilities can participate in the American College of Radiology’s Dose Index Registry (DIR). However, sites without the newest scanners or latest firmware, or those whose scanners will not be updated, can use RADIANCE to generate an RDSR from legacy (i.e., image-based) dose sheets and automatically send it to the DIR. Participants in this hands-on course will learn how to install and configure RADIANCE for optimal use at their facilities.

URL's
http://www.radiancedose.com
RESULTS
No significant interobserver variability was found for all variables derived from MDCT (ICC 0.45 to 0.93). However, there was significant disagreement for the following measurements derived from CACT: aortic annulus short and long axis diameters, area and circumference (ICC).

CONCLUSION
No significant interobserver variability was found with MDCT. Although, good agreement was found for the measurements above the aortic annulus with CACT, the measurements of the aortic annulus demonstrate greater variability compared to MDCT, possibly due to absence of contrast within the left ventricular outflow tract. Therefore sizing of TAVI/R valves may not reliably performed based on CACT measurements alone.

CLINICAL RELEVANCE/APPLICATION
CACI provides MDCT-like images, but measurements of aortic annulus are not reliable. Sizing of TAVI/R valves therefore continues to require MDCT or echocardiography.

VSCA41-04 • Assessment of the Aortic Annulus with TransEsophageal Echocardiography, Multidetector Computed Tomography and Magnetic Resonance to Direct Surgical Sizing: Can We Rely on Imaging
Leonardo Capitolo MD, Marco Gatti MD, Claudia Maria Berzovini MD, Riccardo Faletti MD, Stefano Salizzoni MD, Paolo Fonio MD, Mauro Rinaldi MD, Giovanni Gandini MD

PURPOSE
Precise sizing of the aortic annulus is crucial in order to properly select type and size prosthesis to avoid complication during TAVI procedures. We Evaluate aortic annulus sizing performed by TransEsophageal Echocardiography (TEE), MultiDetector Computed Tomography (MDCT) and Magnetic Resonance (MR) and compares the results to direct intra-operative sizing.

METHOD AND MATERIALS

RESULTS
All imaging techniques yield results in satisfactory agreement with one another and with the Hegar (R=0.70 for TEE; R=0.81 for MDCT and R=0.81 for MR), even if with different behaviors: MDCT and TEE suffer from overestimation for smaller diameters changing into underestimation for larger ones; MR overestimate the whole diameter. The measurements within ±2 mm around the Hegar sizing result in 71% for TEE, 76% for MR and 80% for MDCT.

CONCLUSION
MDCT and MR seem to be more accurate in annulus measurements, with different advantages and drawbacks, than TEE.

CLINICAL RELEVANCE/APPLICATION
The imaging and the assessment of “virtual tube” could accurately size the aortic annulus in order to properly select the most appropriate valve size for transcatheter aortic valve implantation (TAVI).

VSCA41-05 • Functional Anatomy and Measurements of the Aortic Root
Jonathan A Leipsic MD (Presenter) *

LEARNING OBJECTIVES
1) Discuss the most reproducible and accurate methods for annular assessment with CT with a focus on the dynamic changes throughout the cardiac cycle. 2) Provide a deeper understanding of proposed annular sizing strategies with MDCT with focus on recently published multicenter trial data. 3) Discuss the role of MDCT to identify potential adverse root features to help reduce the risk of annular injury.

VSCA41-06 • Intentional Computed Tomography-based Oversizing in Balloon-expandable Transcatheter Aortic Valve Replacement - Incidence of Paravalvular Regurgitation and Post-deployment Geometry
Philipp Blanke MD (Presenter); Eva Maria Spira MD; Gregor Pache MD; Mathias F Langer MD, PhD

PURPOSE
To evaluate the incidence of paravalvular regurgitation and post-deployment geometry of intentional computed tomography (CT)-based oversizing of Transcatheter Heart Valves (THV) in Transcatheter Aortic Valve Replacement (TAVR) using pre- and post-deployment dual-source CT.

METHOD AND MATERIALS
115 patients with severe aortic stenosis (mean age 81±7 years, mean aortic valve area 0.68±0.18cm²) underwent retrospectively gated dual source CT for THV sizing prior to TAVR. Aortic annulus dimensions were quantified by means of planimetry and area-derived diameter calculation (D = 2 x √(area/π)) at the level of the basal attachment points of the aortic cusps during systole. THV selection was CT-diameter-based (EdwardsSAPIEN XT 23mm THV for D 25mm). Post-deployment CT was performed in 95 patients. Stent-expansion was assessed planimetrically at the inlet, outlet and level of the native annulus. Relative oversizing and relative changes in annulus dimensions were calculated.

RESULTS
Average pre-deployment annulus diameter was 24.1±1.8mm, average post-deployment diameter was 23.9±1.5mm (p=n.s.). Average relative change in annulus diameter was -0.5±3.6%. Mean relative oversizing was 9.1±4.7%. Mean diameter at the THV outlet was significantly larger than at the THV inlet (24.3±1.8mm vs. 23.8±1.7mm, p<0.05). The relative change in diameter was -0.5±3.6%. The relative oversizing was 9.1±4.7%. The mean diameter at the THV outlet was significantly larger than at the THV inlet (24.3±1.8mm vs. 23.8±1.7mm, p<0.05).

CONCLUSION
Intentional oversizing of the THV on an area-derived annulus diameter in CT and an adapted incremental sizing scheme appears safe and is associated with a lower incidence of relevant paravalvular regurgitation, as compared to published landmark trial with echocardiography-based THV-sizing.

CLINICAL RELEVANCE/APPLICATION
Planimetric assessment of the aortic annulus by CT allows for intentional prosthesis oversizing in transcatheter aortic valve replacement to reduce the occurrence of paravalvular regurgitation.

VSCA41-07 • CT Angiography for Aortic Root Measurements in TAVR Patients: Comparison of High-pitch Dual-source CT Image Acquisition versus Retrospective ECG-Gating
Felix G Meinel MD (Presenter); U. Joseph Schoeppf MD *, Carlo Nicola De Cecco MD, Aleksander Krazinski MD, Maximilian F Reiser MD; Lucas L Geyer MD *, Daniel H Steinberg MD

PURPOSE
To compare the diagnostic value and robustness of high-pitch dual-source CT angiography versus retrospectively ECG-gated data acquisition for aortic root measurement during pre-procedural planning of transcatheter aortic valve replacement (TAVR).

METHOD AND MATERIALS
With IRB approval and in HIPAA compliance, data of 20 patients (77.5±12.8 years, 11 male, heart rate 69.4±15.5bpm) considered for TAVR were retrospectively analyzed. All patients had undergone both retrospectively ECG-gated cardiac CT (scan 1) as well as high-pitch dual-source CT angiography (scan 2) of the aorta. Scan 2 targeted the end-systolic phase at 35% of the RR’-cycle. A BMI-based contrast medium (CM) injection protocol was used with 70-144mL volume, injected at 3.0-5.5mL/s. For consistency, both scans were reconstructed with a section thickness of 1.5mm with 0.7mm increment. Image quality (IQ) was subjectively assessed. Aortic annulus...
dimensions were measured as area-derived diameters. Based on effective diameter, agreement for prosthesis selection between the high-pitch image acquisition (D\text{FLASH}) was compared with standard reconstructions at 30%-80% (D\text{30}-D\text{80}) of the RR’-cycle.

RESULTS
All patient studies had at least 150 HU CM attenuation at the level of the aortic root. In scan group 1, aortic annulus measurements could be successfully performed in all patients. Scan 2 resulted in 7 studies with non-diagnostic IQ. Patients with non-diagnostic IQ had a significantly higher body-mass index (38.5±10.1kg/m² versus 27.4±4.2kg/m², pFLASH 24.1±2.0mm, D\text{30} 24.6±2.2mm, D\text{40} 24.2±2.1mm, D\text{50} 24.1±2.2mm, D\text{60} 23.9±1.99mm, D\text{70} 23.8±1.98mm, D\text{80} 24.2±2.3mm. In patients with diagnostic IQ, the highest agreement in prosthesis sizing was found in 11 of 13 patients by D\text{30}(?=0.65) and 13 of 13 patients by D\text{70}(?=1.00) compared with D\text{FLASH}.

CONCLUSION
For TAVR planning, the use of high-pitch dual-source CT angiography is feasible in the majority of patients. However, retrospectively ECG-gated cardiac CT should be considered in problematic scenarios, such as obese patients or cardiac arrhythmia.

CLINICAL RELEVANCE/APPLICATION
High-pitch dual-source CTA requires appropriate patient selection for reliable measurements of the aortic annulus in TAVR patients compared with the more robust retrospectively ECG-gated approach.

VSCA41-08 • Accuracy of Aortic Root Annulus Assessment with Cardiac Magnetic Resonance in Patients referred for Transcatheter Aortic Valve Implantation: A Comparison with Multi-detector Computed Tomography

Gianluca Pontone MD (Presenter); Daniele Andreini MD; Erika Bertella; Saima Mushtaq; Paola Gipari; Monica Loguerco; Sarah Cortinovis; Andrea Baggiano; Edoardo Conte; Andrea Daniele Annoni MD; Alberto Formenti; Mauro Pepi

PURPOSE
Cardiac magnetic resonance (CMR) has distinct advantages over 2D echocardiography such as exceptional spatial resolution and does not need administration of contrast agents, provides similar 3D multi-slice images of the aortic root, so that it may be a valid alternative to MDCT. The aim of this study is to compare the accuracy of CMR evaluation of AoA as compared to MDCT in patients referred for TAVI.

METHOD AND MATERIALS
50 patients were studied with a 1.5-T scanner (Discovery MR450, GE Healthcare, Milwaukee, WI). Steady-state free precession cine acquisitions were acquired with following parameters: echo time 1.57 ms, repetition time 46 ms, slice thickness 8 mm, field of view 350mmx263mm, and pixel size 1.4mmx2.2 mm. Two long-axis view of the aortic root and ascending aorta were obtained. Thus, serial short-axis cines orthogonal to the AoA (3-mm thickness with 1.5-mm overlapping) were imaged. The following parameters were assessed with CMR and compared with those obtained with MDCT: AoA maximum diameter (AoA-Dmax), minimum diameter (AoA-Dmin), and area (AoA-A), length of the left coronary, right coronary, and non-coronary aortic leaflets, degree (grades 1 to 4) of aortic leaflet calcification and distance between AoA and coronary artery ostia.

RESULTS
AoA-Dmax, AoA-Dmin and AoA-A were 24.1±2.3 mm, 20.17±2.20 mm, 444.88±84.61 mm2 and 26.45±2.75 mm and 449.78±86.22 mm2 by MDCT and CMR, respectively. The length of left coronary, right coronary, and non-coronary leaflets were 14.02±2.27 mm, 13.33±2.33 mm, 13.99±1.97 mm, and 13.95±2.18 mm, 13.30±2.14 mm, 13.46±1.80 mm by MDCT and CMR, respectively. The core of left leaflet calcifications were 3.4.40.7 vs. 2.97±0.77. 77.7. Finally, the distance between AoA and left main and right coronary artery ostia was 21±3.07 mm, 16.2±4.29 mm and 16.14±4.36 mm by MDCT and CMR, respectively. There was close agreement between CMR and MDCT measurements, whereas aortic leaflet calcifications were underestimated by CMR.

CONCLUSION
Aortic root assessment with CMR including AoA size, aortic leaflet length and coronary artery ostia height is accurate in comparison to MDCT.

CLINICAL RELEVANCE/APPLICATION
CMR may be a valid imaging alternative in patients unsuitable for MDCT.

VSCA41-09 • Access Vessel Assessment
Dominik Fleischmann MD (Presenter) *

LEARNING OBJECTIVES
1) Review the possible percutaneous access sites for patients undergoing TAVR: femoral, transapical, transaortic, subclavian/axillary. 2) Explain the techniques for accurate vessel visualization, diameter measurements and curvature assessment. 3) Present the current recommendations for minimum access vessel diameters with clinical examples.

ABSTRACT
Treatment planning for TAVR requires meticulous assessment of access vessels to assure safe device delivery. A high-quality CTA dataset with 0.6-1.25mm section thickness is a prerequisite for accurate vessel visualization and measurement. While transverse source images provide a reasonably good ‘first look’, most patients require dedicated postprocessing with curved planar reformation and orthogonal images through the access vessels to determine the minimal vessel diameter, to assess for the presence of calcifications, and display the degree of tortuosity. The minimum arterial diameter necessary for TAVR depends on the valve type and size, as well as on the outer diameter of the delivery system. The outer diameter of the delivery system should not exceed 1.05 times the inner arterial diameter. If heavy calcifications are present, particularly circumferential or horse-shoe shaped, the delivery system should be smaller.

If peripheral arterial access is inadequate, a direct transaortic route can be chosen through a mini-sternotomy, or right mini-thoracotomy (2nd interspace). It is important to exclude heavy calcifications at a potential aortic access site (e.g. plaque of porcelain aorta), and to determine the distance between the aortic access and the valve plane to assure enough length for device delivery. Transapical access can be gained through a left lateral mini-thoracotomy (5th or 6th interspace).

VSCA41-10 • Low Volume, Low Iodine Concentration Contrast Medium Protocol for Comprehensive CT Planning of Transcatheter Aortic Valve Replacement
Aleksander Krazinski; Philipp Blanke MD; U. Joseph Schoepf MD *; Justin R Silverman; Carlo Nicola De Cocco MD; Lucas L Geyer MD (Presenter) *; Fabian Bamberg MD, MPH *; Daniel H Steinberg MD

PURPOSE
To investigate the feasibility of a dual-source CT angiography (CTA) protocol with a low volume of low iodine concentration contrast medium (CM) for comprehensive planning of transcatheter aortic valve replacement (TAVR) in a patient group with a high prevalence of chronic renal failure and atrial fibrillation.

METHOD AND MATERIALS
44 patients, considered for TAVR, underwent retrospectively ECG-gated CTA of the heart, immediately followed by high-pitch CTA of the femoro-iliac-aortic access route using two different injection protocols of low iodine concentration (320mgI/mL) ioxidanol: group A, iodine delivery rate (IDR)-based (target, 3.28gI/s), CM volume 60mL, flow rate 4.0mL/S; group B, BMI-based (routine protocol), CM volume range 144mL, flow rate range 3.6-5.5mL/S. All injections were followed by a 50mL saline chaser. Aortic root complex and iliofemoral dimensions were measured. Mean arterial attenuation, signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) were calculated. Subjective image quality was assessed at the level of the aortic root complex and the aortoiliac vasculature.

RESULTS

Influence of Left Ventricular Geometry and Body-surface Area on Aortic Annulus Dimensions in Patients prior to Transcatheter Aortic Valve Implantation: Assessment by Computed Tomography

Philipp Blanke MD (Presenter); Eva Maria Spira; Tobias Baumann MD; Gregor Pache MD; Mathias F Langert MD, PhD

PURPOSE
To investigate the influence of left ventricular geometry, left ventricular function, body surface area (BSA), and gender on aortic annulus dimensions by computed tomography (CT) in patients with severe aortic stenosis.

METHOD AND MATERIALS
ECG-gated cardiac dual-source CT data of 289 consecutive patients with severe aortic stenosis (mean age 81±7 years, 121 males, mean aortic valve area 0.68±0.18cm²) was included. Aortic annulus dimensions were quantified by means of planimetry and area-derived diameter calculation (D = 2 x √(area/π)) at the level of the basal attachment points of the aortic cusps during systole. End-diastolic left ventricular volume (LVEDV), left ventricular ejection fraction (LVEF) and left ventricular myocardial mass (LVM) were assessed by multiphasic cine image reconstructions. Pearson correlation analysis and a step-wise multi-linear regression model were performed.

RESULTS
Mean aortic annulus diameter was 24.4±2.4mm, mean LVEF 59.1±16.1%, mean LVEDV 145.6±51.5ml, mean LVM 181.8±54.2g, and mean BSA 1.8±0.2m². A positive and significant correlation (p < 0.05) was found between annulus diameter and BSA, gender, and end-diastolic left ventricular volume. Annulus dimensions were also significantly influenced by gender, BSA and left ventricular geometry. A larger end-diastolic left ventricular volume, as present in left ventricular dilation, is associated with a larger annulus diameter.

CONCLUSION
In patients with aortic stenosis, aortic annulus dimensions are influenced by gender, BSA and left ventricular geometry. A larger end-diastolic left ventricular volume, as present in left ventricular dilation, is associated with a larger annulus diameter.

Influence of Left Ventricular Geometry and Body-surface Area on Aortic Annulus Dimensions in Patients prior to Transcatheter Aortic Valve Implantation - Assessment by Computed Tomography

Influence of Post-implant SAPIEN XT Geometry on Conduction Disturbances, Hemodynamic Performance and Paravalvular Regurgitation

Cameron J Hague MD (Presenter); Jonathan A Leipsic MD*; John Webb MD, FRCP*; Stefano Toggweiler; Melanie Freeman; Ronald Binder; David Wood MD, FRCP*; Marco Barbanti MD; Donya A Al-Hassan MD

Complications and Incidental Findings

Gudrun Feuchtner MD (Presenter) *

LEARNING OBJECTIVES
1) To learn which imaging features are associated with complications related to TAVI procedure. 2) To understand morphology of aortic valve, annulus, calcifications and implications for procedure success. 3) To learn which incidental findings have impact on pre-procedural patient management and intraoperative complications.

ABSTRACT
Transcatheter aortic valve implantation (TAVI) is a modern innovative minimal invasive approach to treat patients with severe aortic stenosis effectively. Imaging plays a key role to ensure procedure success and to avoid complications. During this course, imaging features associated with complications will be discussed: 1) Major vascular complications occur at 15%. This rate can be cut when selecting patients carefully taking into account high-risk features on CT. 2) Aortic annular calcification are related to intraoperative complications, and high-risk characteristics will be shown. 3) Incidental findings having impact on patients managements will be identified.

The Impact of Post-implant SAPIEN XT Geometry on Conduction Disturbances, Hemodynamic Performance and Paravalvular Regurgitation

Cameron J Hague MD (Presenter); Jonathan A Leipsic MD*; John Webb MD, FRCP*; Stefano Toggweiler; Melanie Freeman; Ronald Binder; David Wood MD, FRCP*; Marco Barbanti MD; Donya A Al-Hassan MD
Morphology Using Dual-source Computed Tomography

VSCA41-17 • Tomography for the Detection of Prosthetic Heart Valve Endocarditis Implantation

The bicuspid aortic valve (BAV) is associated with aortic valve dysfunction and ascending aorta dilatation. The relationship between BAV morphology and ascending aorta dimensions remains unclear. We sought to characterize the aortic valve function and the ascending

RESULTS

89 patients (age 82 +/- 8 years, 54 male, 35 female) undergoing TAVR with an Edwards Sapien XT THV were analyzed. Analysis of post implant MDCTs demonstrate average THV stent frame placement as follows: outflow 0.3mm +/- 2.6mm below the left main ostium, and inflow (inferior aspect of stent) was 3.6 +/-2.2mm below the aortic annulus (basal insertion of the native aortic leaflets). Paravalvular regurgitation (PAR) as assessed by TTE was absent in 24.7%, mild in 67.4%, moderate in 5.6% and moderate to severe in 2.2%. As assessed by MDCT stent frame inflow area in relation to the native annular area, and the difference of the stent frame long-axis diameter to native annulus long axis diameter were the only measured parameters predictive of PAR (p=0.03 and p=0.023 respectively). 5.1% of subjects required a new PPM following TAVR. The MDCT derived THV inflow to annular distance was the strongest predictor of PPM placement post TAVR. (3.5 +/-2.0mm versus 7.1 +/-2.5mm, p=0.001).

CONCLUSION

MDCT measures of THV implantation depth and relationship of inflow stent area to native annular area are strong predictors of new onset conduction disturbances/PPM placement and PAR respectively, both important causes of morbidity and mortality post TAVR.

CLINICAL RELEVANCE/APPLICATION

MDCT measures of implantation depth and stent inflow area versus native annular area provide important predictors of complications TAVR (PPM placement and PAR respectively).

VSCA41-15 ● Contrast Induced Nephropathy after Contrast Enhanced Computed Tomography prior to Transcatheter Aortic Valve Implantation

Vera S Schneider BS (Presenter); Florian Schwarz MD; David Jochheim MD; Christian Kupatt MD, PhD; Maximilian F Reiser MD; Hans-Christoph R Becker MD; Philipp Lange MD; Julinda Mehilli MD; Frederik F Strobl MD

PURPOSE

Contrast induced nephropathy (CIN) is a common complication after contrast enhanced computed tomography (CT). Particularly, patients with aortic valve stenosis (AS) are at increased risk for CIN due to their high prevalence of chronic kidney disease. The aim of this analysis is to determine the rate of CIN in patients with AS following contrast enhanced CT scans prior to transcatheter aortic valve implantation (TAVI).

METHOD AND MATERIALS

RESULTS

Rates for CIN in patients with GFR under 30, 30 to 60 and over 60 ml/min, were 13.6 %, 10.9 %, 6.8 %, respectively. Average contrast volume in patients who developed CIN was 101 ml vs. 92 ml in those who did not (p < 0.05), supporting a strong relation between the development of CIN and the volume of contrast administered.

CONCLUSION

The incidence of CIN in high risk patients with AS undergoing contrast enhanced CT depends on the baseline GFR. We found a close relation between the amount of administered contrast media and the development of CIN.

CLINICAL RELEVANCE/APPLICATION

Low dose contrast protocols for CT angiography may help reduce the risk of CIN – particularly in high risk patients with AS in whom baseline renal function frequently is impaired.

VSCA41-16 ● Fusion of Cardiac Computed Tomography Angiography and 18F-Fluorodesoxyglucose Positron Emission Tomography for the Detection of Prosthetic Heart Valve Endocarditis

Wilco Tanis (Presenter); Asbjorn Scholten MD; Jesse Habets MD; Renee B Van Den Brink MD, PhD; Lex Van Herwerden *; Steven Chamuleau MD, PhD; Ricardo P Budde MD, PhD

PURPOSE

In prosthetic heart valve (PHV) endocarditis transthoracic and transesophageal echocardiography (TTE and TEE) may fail to recognize vegetations and peri-annular extensions, which is an indication for urgent surgery. Moreover, abnormal peri-annular anatomy after PHV implantation is not uncommon and differentiation between active or absent inflammation is difficult. The purpose of this study is to investigate the additional value of imaging with fused Computed Tomography Angiography (CTA) and 18F Fluorodesoxyglucose Positron Emission Tomography including low dose CT (FDG-PET/CT) providing high resolution anatomical and functional information.

METHOD AND MATERIALS

In our hospital PHV patients suspected for endocarditis undergo additional CTA and sometimes also FDG-PET/CT imaging when TTE and TEE are inconclusive. All PHV patients that underwent FDG-PET/CT were selected from the hospital database and assigned as cases or controls. Surgical inspection was the reference standard for cases.

RESULTS

Twelve PHV endocarditis cases and six normal functioning PHV controls were identified, which all underwent TTE, TEE, CTA and FDG-PET/CT. On surgical inspection 11/12 cases had peri-annular extension and 4/12 had a vegetation. CTA alone detected all vegetations but missed one peri-annular extension. FDG-PET/CT alone missed all vegetations, however all peri-annular extensions were detected correctly. Combined FDG-PET/CT and CTA detected all peri-annular extensions and vegetations correctly. Controls were all free of significant FDG uptake. SUV ratios around the PHV ring were significantly (p < 0.05) higher in cases than in controls.

CONCLUSION

Fused FDG-PET and CTA imaging is a promising tool to correctly diagnose PHV endocarditis in patients with an inconclusive echocardiography. SUV ratios may be of additional help for correct detection of peri-annular extensions.

CLINICAL RELEVANCE/APPLICATION

PHV endocarditis sometimes remains difficult to diagnose with echocardiography due to acoustic shadowing of mechanical valves. In those cases hybrid imaging wit CTA and FDG-PET/CT may guide treatment.

VSCA41-17 ● Characteristics of Aortic Valvular Function and Ascending Aorta Dimensions According to Bicuspid Aortic Valve Morphology Using Dual-source Computed Tomography

Tae Hyung Kim (Presenter); Sung Min Ko; Meong Gun Song; Hweung Gon Hwang; Jung Ah Park

PURPOSE

The bicuspid aortic valve (BAV) is associated with aortic valve dysfunction and ascending aorta dilatation. The relationship between BAV morphology and ascending aorta dimensions remains unclear. We sought to characterize the aortic valve function and the ascending
Interventional Radiology Series: Embolotherapy

Wednesday, 08:30 AM - 12:00 PM • E352

LEARNING OBJECTIVES

1) To learn about functional anatomy and flow changes during embolization. 2) To learn about the appropriate use of different materials. 3) To learn about technical tricks to minimize non-target embolization.

1) Non-Target Embolization: How To Prevent or Minimize?

Christoph A Binkert MD (Presenter) *

LEARNING OBJECTIVES

1) To learn about functional anatomy and flow changes during embolization. 2) To learn about the appropriate use of different materials. 3) To learn about technical tricks to minimize non-target embolization.

2) Liquid Embolic Agents

Robert A Morgan MD (Presenter) *

LEARNING OBJECTIVES

1) To learn about the indications, properties and techniques for the use of the different embolic agents.

ABSTRACT

Incidence and Clinical Management of Ruptured and Incidentally Diagnosed Visceral Aneurysms

Sebastian Schotten MD (Presenter) ; Evelyn Dappa ; Roman Kloeckner MD ; Jens Schneider ; Christoph Dueber MD ; Michael B Pitton MD

PURPOSE

Visceral arterial aneurysms (VAA) are a rare entity with a prevalence between 0.1 – 2% and have a high risk for rupture with mortality rates between 20-75%. We therefore reviewed and analyzed the institutional data base for diagnosis and management of VAA over a period of 10 years.

METHOD AND MATERIALS

An automatic analysis of the institutional database using the word “aneurysm” resulted in identification of 12,588 reports (CT, MRI, and Angiography). 239 of these patients could be identified suffering from VAA (mean age 65 years ± 12.5 years). VAA were analyzed with respect to location, size, true aneurysm or false aneurysms after surgery/intervention, rupture status, management, and clinical follow-up.

RESULTS

Diagnosis included VAA of the splenic artery (n=81), celiac trunk (n=46), renal artery (n=42), hepatic artery (n=37), superior mesenteric artery (n=15), gastroduodenal artery (n=10) and others (8). The overall size of the aneurysms was 17.8 ± 10.2mm; min. 4 mm, max. 112 mm). 44 VAA were rated as false aneurysms (18%), 25 of them after surgery and 11 after percutaneous interventions like biopsies or drainages. 58 of 239 cases were treated with transarterial intervention (n=47) or surgery (n=11). Interventions included embolization with coils (n=35) or glue (n=4), implantations of covered stents (n=4), and combinations of these (n=4). 40 patients were diagnosed at rupture and were treated at an emergency basis (hemoglobin 8.6±1.7mg/dl). There was no significant difference in size between ruptured and non-ruptured VAA (15.2 ± 8.4mm vs. 16.3 ± 10.1mm). The 30-day mortality in ruptured cases was 8.3% (12 of 36) after interventional treatment compared to 25% after surgery (1 of 4). No fatality occurred after interventional treatment of non-ruptured aneurysms (n=11). The conservatively treated patients presented a 30-day mortality of 6.1% (11 of 181).

CONCLUSION

The clinical impact of accidentally diagnosed VAA still remains unclear. However, symptomatic or ruptured VAA might be associated with a high mortality rate. There was no difference in size in ruptured and non-ruptured aneurysms. Interventional treatment seems to offer a beneficial approach in emergency cases compared to surgery.

CLINICAL RELEVANCE/APPLICATION

False aneurysms seem to have a considerably higher risk of rupture and should be promptly treated irrespective of the diameter.

3) Complex Visceral Aneurysms

Michael D Darcy MD (Presenter) *

LEARNING OBJECTIVES

View learning objectives under main course title.

4) A Comparison of the Results of Arterial Embolization for Bleeding and Non-bleeding Gastroduodenal Ulcers

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METHOD AND MATERIALS
Transcatheter embolization was performed in 57 patients (39 men, 18 women, mean age 69.8 years) who experienced acute bleeding from gastroduodenal ulcers. At the time of embolization active contrast extravasation was seen in 36 of 57 patients, while in the remaining 21 patients embolization was based on endoscopic findings. Patient demographics, clinical success, need for re-intervention secondary to re-bleeding, and 30-day complication and mortality rates were reviewed and compared between the two groups by using statistical analyses.

RESULTS
In the BU group, the gastroduodenal artery (GDA) was embolized in 31 patients (86.1%), the left gastric artery (LGA) in three patients (8.3%), and the left gastropiploic artery (LGEA) in two patients (5.6%). In the NBU group, the GDA was embolized in 18 patients (85.7%), and the LGA in three patients (14.3%). Clinical success (61.9 vs. 75.0%, P = 0.30), need for re-intervention (38.1 vs. 27.8%, P = 0.42), and 30-day complication (9.5 vs. 5.6%, P = 0.57), and mortality (28.6 vs. 25%, P = 0.77) rates were not statistically different between the two groups. Embolization in patients in NBU group did not have impact on clinical success (Odds Ratio, 0.54; 95%CI, 0.17-1.72; P = 0.30).

CONCLUSION
Arterial embolization in patients with angiographically NBU is as safe and effective as embolization in patients with BU.

CLINICAL RELEVANCE/APPLICATION
The practice of empiric arterial embolization for angiographically negative acute hemorrhage from gastroduodenal ulcers should be systematically used as it is efficient.

VSIR41-06 • Embolization of Obstetrical and Gynecologic Emergencies

Sue E Hanks MD (Presenter)

LEARNING OBJECTIVES
1) Identify appropriate patients for transcatheter embolization following gynecologic or obstetric procedures. 2) Choose effective embolic agents to treat hemorrhage from gynecologic malignancies. 3) Define angiographic approach to identification of hemorrhage from gynecologic and obstetric emergencies.

VSIR41-07 • Medium and Long Term Outcome of Prostatic Arterial Embolization to Treat Benign Prostatic Hyperplasia

Joao M Pisco MD (Presenter); Hugo A Rio Tinto MD *; Tiago Bilhim MD *; Lucia C Fernandes MD; Jose A Pereira MD; Luis C Pinheiro; Antonio Oliveira; Marisa Duarte MD

PURPOSE
To evaluate the medium and long term outcome of prostatic arterial embolization (PAE) to treat lower urinary tract symptoms associated with benign prostatic hyperplasia (BPH).

METHOD AND MATERIALS
Two hundred forty patients (age range, 62 – 82 years; mean age, 74.1 y) with BPH and moderate to severe lower urinary tract symptoms after failure of medical treatment underwent PAE between March 2009 and March 2012. Patients were followed between 1 and 4 years after PAE (mean 18 months). International Prostate Symptom Score (IPSS), quality of life improved (QoL), International Index of Erectile Function (IIEF), peak urinary flow (Qmax), prostate-specific antigen (PSA), prostate volume were evaluated every 6 months. Technical success: defined as embolization of at least one prostatic artery. Clinical success is considered when there is a reduction of the IPSS at least 25% of the total score and = 15, a reduction of the QoL at least 1 point of the total or = 3 and no need of medical or any other treatment.

RESULTS
There were 4 technical failures. From the 236 evaluated patients there were 39 (16.5%) short term clinical failure up to 1 year. Therefore there are 197 evaluated at medium term between 1 and 3 years. From this group of patients evaluated at medium term there were 17 clinical failures. The cumulative rate at 3 years was 23.7%. There are 17 patients followed at long term between 3 and 4 years, with 2 clinical failures. The cumulative rate at 4 years is 75.4%. There was a major complication a small area of bladder wall base ischemia. Surgery was required to treat that ischemia.

CONCLUSION
PAE is safe procedure with low morbidity as well as good short, medium and long term results.

CLINICAL RELEVANCE/APPLICATION
Prostatic Artery Ambolization can have a future place in urologic guidelines and it is important to report technical and clinical outcomes.

VSIR41-09 • Prostate Embolization

Jafar Golzarian MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

VSIR41-10 • Coil Embolization of the Splenic Artery: Impact on Splenic Volume and Factors Contributing to Volume Preservation

Stephen R Preece MD (Presenter); Paul V Suhocki MD; John Yoo; Tony P Smith MD; Charles Y Kim MD *

PURPOSE
Splenic artery embolization can be performed as an alternative to splenectomy in the setting of splenic injury or splenic artery pathology. However, the impact on splenic function is not well understood. The purpose of this study is to determine the impact of coil embolization of the splenic artery on splenic volume based pre- and post-embolization CT imaging as well as hemofiltration function.

METHOD AND MATERIALS
Splenic artery embolization was performed on 148 consecutive patients over an 8 year period for various indications in this IRB approved retrospective study. Sixty patients (36 males, mean age 49 years) had contrast-enhanced CT before and after coil embolization of the splenic artery. The mean time between embolization and last follow up CT was 355 days. Pre and post-embolization splenic volumes were calculated with volume rendering software. The presence of Howell-Jolly bodies was ascertained on lab tests.

RESULTS
Splenic artery embolization resulted in a mean decrease in splenic volume by 15% (range -88% to +158%). Splenic volumes on CT scans performed within 30 days of embolization did not change significantly after embolization but after 30 days the mean percentage reduction was 21% (p=0.004). Embolization of the distal splenic artery resulted in a 30% splenic volume reduction (p=0.003) whereas splenic volumes did not change significantly after proximal embolization. Both traumatic and nontraumatic indications resulted in similar degree of volume loss, although pre-embolization splenic volumes were significantly smaller in trauma patients (p=0.029), and more
trauma patients underwent distal embolization (p=0.005). Multivariate analysis revealed that only coil location significantly impacted splenic volume reduction. Three patients transiently had Howell-Jolly bodies after embolization. No patients required repeat embolization or splenectomy.

CONCLUSION
Coil embolization of the main splenic artery results in only a modest degree of splenic volume loss with retention of hemofiltration function. These findings support the growing body of literature that some degree of splenic function is maintained after splenic artery embolization.

CLINICAL RELEVANCE/APPLICATION
Splenic artery embolization for trauma and splenic pathology is likely preferable to splenectomy when feasible considering that at least some degree of splenic function is retained.

**VSIR41-11 • Prostatic Arterial Embolization as an Alternative Treatment for Patients with Benign Prostatic Hyperplasia for Patients with Benign Prostatic Hyperplasia and Acute Urinary Retention with Bladder Catheter**

Lucia C Fernandes MD (Presenter) ; Joao M Pisco MD ; Luis C Pinheiro ; Tiago Bilhim MD * ; Hugo A Rio Tinto MD * ; Marisa Duarte MD ; Jose A Pereira MD ; Antonio Oliveira

PURPOSE
To Access the results of prostatic arterial embolization (PAE) for patients with benign prostatic hyperplasia (BPH) and acute urinary retention (AUR) with bladder catheter.

METHOD AND MATERIALS
Fifty-three patients aged 48 to 82 years with BPH, AUR and bladder catheter underwent PAE. Prostate volume and Prostatic Specific Antigen (PSA) were evaluated before PAE. The prostate volume ranged between 44cc and 210cc (mean 95cc). Twenty-six patients had prostates larger than 100cc. PVA particles sized 100µm and 200µm were used as embolic material. International prostate symptom score (IPSS), Quality of life (QoL), International Index Erectile Function (IIEF), uroflowmetry, (Qmax - peak urinary flow and PVR - post voiding residual volume), Prostatic Specific Antigen (PSA) and prostate volume, were assessed after successful removal of bladder catheter, at 1, 3, 6 and every 6 months thereafter to access the clinical outcome. Patients were evaluated between 3 and 48 months (mean 15 months).

RESULTS
All patients were treated as outpatients. There was one technical failure (1.9%) and one patient was lost to follow-up. There was short-term clinical success at 3 months in 45/51 (88.2%). There were 46 (11.8%) patients which bladder catheter could not be removed and were considered short term clinical failures and PAE was repeated. In 4 of them the bladder catheter could be removed, therefore the secondary clinical success was shown in 49/51 (95.1%) patients. The 2 patients which catheter could not be removed were treated by TURP and open prostatectomy, respectively. At 18 months there were 4/51 (7.8%) mid-term clinical failures. Three of them were successfully treated with repeated PAE. The third was treated by open prostatectomy. In 5 patients controlled at long term between 3 and 4 years there was not any recurrence. There was not any major complication.

CONCLUSION
PAE in patients with BPH and AUR with bladder catheter is a safe procedure with successful removal of the bladder catheter and good short mid and long-term results.

CLINICAL RELEVANCE/APPLICATION
Applying a new technique (PAE) in patients with BPH and AUR and with bladder catheter

**VSIR41-12 • Panel Discussion: Unknown Cases and/or Complications. What Would You Do?**

**VSIR41-13 • Wrap Up and Discussion**

**NS**

Neuroradiology Series: Stroke

**VSIR41 • AMA PRA Category 1 Credit ™:3.25 • ARRT Category A+ Credit:4**

**Moderator**

Allan L Brook , MD *

**Moderator**

Padraig P Morris , MBBC

**VSIR41-01 • Stroke CT Protocols: Extracting Maximal Data in Minimal Time**

Mayank Goyal MD, FRCPC (Presenter) *

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**VSIR41-02 • Spot Sign Presence on 90 Second Delayed MDCCTA Improves Sensitivity for Hematoma Expansion and In-hospital Mortality: A Prospective Study**

Given all the recent literature in acute stroke including the recent publications from IMS3, it is clear that Time is brain. This means that very part of the process in the work up and treatment of an acute stroke patient needs to be speeded up. This includes the time taken for image acquisition, post processing and interpretation. There has been a recent move towards moving away from a plain and simple 'Non contrast CT' to rule out a bleed and extensive ischemic changes towards doing more extensive imaging. This talk discussed these options and weighs in the pros and cons of using various techniques and modalities. The limitations and advantages of various techniques would be discussed. In addition, there have been dramatic recent advances in the field of endovascular treatment of stroke. Using newer devices like stentievers, our ability to achieve fast, robust recanalization has significantly improved. However, the rate of good clinical outcomes has not improved to the same degree. This aspect will be further discussed and would be broadly broken down into two components: imaging based patient selection and the need for speed and efficiency without compromising patient safety.
To determine whether 90 second delayed multidetector computed tomography angiography (MDCTA), in addition to routine first-pass MDCTA in patients with spontaneous intracerebral hemorrhage (ICH) improves detection of the spot sign and increases sensitivity for predicting hematoma expansion and in-hospital mortality.

RESULTS
Of 86 consecutive patients, 25 (29%) had a positive spot sign on either first pass or delayed CTA (14/25 on first pass and 24/25 on delayed CTA). Median baseline hematoma volume was 29.6 mL (interquartile range 5.9 – 72.8 mL). Sensitivity for predicting hematoma expansion increased from 0.60 to 0.70 with addition of delayed CTA. The odds ratio (OR) of hematoma expansion if a spot sign was present on either first pass or delayed CTA was 13.67 (95% CI 2.84 – 65.83, p=0.0009). 18/25 (72%) of all patients with a spot sign died in hospital, versus 17/61 (28%) patients without a spot sign. Addition of delayed CTA improved sensitivity for predicting in-hospital mortality from 0.26 to 0.51. In multivariate analysis, baseline ICH volume and the spot sign were predictive of in-hospital mortality, however, the effect of the spot sign was only significant if present on first pass CTA.

CONCLUSION
 Addition of 90 second delayed CTA to the imaging workup of patients with spontaneous ICH captures additional patients with the spot sign and increases sensitivity for predicting hematoma expansion and in-hospital mortality, making it an attractive selection tool for targeting patients that may benefit from early surgical or medical intervention.

CLINICAL RELEVANCE/APPLICATION
Addition of 90 second delayed CTA to the imaging workup of patients with spontaneous intracerebral hemorrhage captures additional patients at risk for hematoma expansion and in-hospital mortality.

VSNR41-03 • CTA-doped Perfusion-CT (PCT): An Original Method to Increase Signal-to-noise, Contrast-to-noise and Reduce Noise in Ultra-low-dose PCT

Elizabeth Tong MD (Presenter); Max Wintermark MD *

PURPOSE
To use the information contained in CT-angiography data to improve the image quality of ultra-low-dose PCT.

METHOD AND MATERIALS
Dynamic PCT datasets were obtained at 80 kVp and decreasing mAs (100, 75, 50, 25, 10) in patients suspected of ischemic stroke, concurrently with static CTA of the cerebral and intracranial arteries. Fast-Fourier transforms (FFT) of both the PCT and CTA datasets were calculated. High spatial frequencies of the CTA FFT were combined with low spatial frequencies of the PCT FFT, and an inverse FFT was then applied to the combination to create a virtual PCT dataset. The real and virtual PCT datasets were compared at different mAs by assessing contrast-to-noise ratio (CNR), signal-to-noise ratio (SNR) and image noise, and by visual inspection of the processed real and virtual PCT parametric maps.

RESULTS
Virtual PCT attained CNR and SNR two- to three-fold superior to real PCT, and noise reduction by a factor 2-3 (p < 0.05).

CONCLUSION
We propose a new method to enhance PCT data by rectifying it with CTA. This method yields diagnostic PCT parametric maps from PCT acquired at 50 mAs.

CLINICAL RELEVANCE/APPLICATION
Using this new method and settings of 80 kVp and 50 mAs, the effective dose of a PCT study is approximately 1 mSv, which is less than half of a noncontrast head CT dose.

VSNR41-04 • Stroke MRI: Diffusion, Perfusion, and Beyond

Greg Zaharchuk MD, PhD (Presenter) *

LEARNING OBJECTIVES
1) Understand the concept of the diffusion-perfusion (DWI-PWI) mismatch concept in acute stroke. 2) Review the recent results of stroke trials using the DWI-PWI concept. 3) Appreciate the potential role of other markers, such as collateral flow, oxygenation, pH, and resting-state fMRI for assessing the ischemic brain.

ABSTRACT
Diffusion-weighted imaging (DWI) is an invaluable part of the workup of acute ischemic stroke, as it can be used to define tissue that is irreversibly infarcted, thus setting a lower bound on patient outcome. Often, the region outside of this "core" will demonstrate reduced diffusion, which can be measured with perfusion-weighted imaging (PWI). Typically, PWI is performed with contrast agents injected in a bolus, yielding multiple hemodynamic parameters, including relative CBF, relative CBV, mean transit time, and time-to-peak or Tmax. Earlier studies have suggested that tissue with prolonged Tmax>6 sec is incorporated into the final infarct in the absence of early reperfusion. Based on this, the idea of the DWI-PWI mismatch has arisen, which posits that patients with small DWI and large PWI lesions will benefit from early reperfusion, and that aggressive methods, including intra-arterial therapy, may be indicated. Several clinical trials have examined this hypothesis, including EPITHET, DEFUSE and DEFUSE-2, and MR-RESCUE. These studies have had variable outcomes, and it has been suggested that the DWI-PWI mismatch, while a useful concept, may be an oversimplification of the situation. Other biomarkers have been tested in exploratory studies, including the use of ASL, a non-contrast measurement that can measure quantitative CBF as well as collaterals. PET studies have suggested that elevated oxygen extraction fraction (OEF) is specific for identifying tissue at risk of infarction, and MRI-based measurements are being developed to assess tissue oxygenation. Finally, the use of resting-state fMRI (rs-fMRI), including both its use to identify core and penumbra as well as arterial arrival delays without contrast, and its ability to identify distant effects of focal ischemia upon larger brain connectivity networks will be discussed.

VSNR41-05 • Percent Insula Infarction at Admission Improves Prediction of Poor Clinical Outcome-Over That of DWI Lesion Volume Alone-in Anterior Circulation Occlusive Stroke Patients

Vincent M Timpone MD (Presenter); Michael H Lev MD *; Livia T Morais MD; Leticia C Souza MD; Shervin Kamalian MD, MMEdSc *; Pamela W Schaefder MD

PURPOSE
Large admission DWI infarct volume (>70ml) is an established biomarker for poor clinical outcome in acute stroke. Outcome is more variable in patients with small infarcts (< 70ml). It has been shown that percent insula ribbon infarct (PIRI) at admission can predict penumbral loss (poor tissue outcome). We hypothesized that PIRI can also help identify stroke patients likely to have poor clinical outcome, despite small admission DWI lesion volumes.

METHOD AND MATERIALS
We analyzed the admission NCCT, CTP, and DWI scans of 55 patients with proximal anterior circulation occlusion on CTA. The following parameters were determined: Percent insula ribbon infarct (PIRI, >50%, 2/3) were also recorded. Statistical analyses were performed to
Admission DWI > 70 ml (p = 50% (p = 50% (p = 0.045) and NIHSS (p = 50%), were not significant predictors of poor outcome. In patients with admission DWI infarct 50% (n = 31, median mRS 5, 95% CI = 2-5) compared to those with DWI-PIRI < 50% (n = 9, median mRS 2, 95% CI = 1-3; p = 0.036). In patients with admission DWI infarct > 70 ml, DWI-PIRI did not have added predictive value for poor outcome (p = 0.9308).

CONCLUSION
DWI-PIRI > 50% predicts poor clinical outcome, and can help identify stroke patients likely to have poor outcome despite small admission DWI lesion volumes. Because it facilitates direct visual estimation of the likelihood of poor outcome, the PIRI-score may help more accurately weigh the potential risks versus benefits of advanced stroke treatments than clinical assessment by NIHSS score alone.

CLINICAL RELEVANCE/APPLICATION
Consideration of DWI insula infarct involvement may be an additional tool for risk-benefit stratification and patient selection for reperfusion therapy.

VSNR41-06 • The Configuration of Willis Circle Influences Leptomeningeal Collaterals and Regional Perfusion Patterns in Acute Ischemic Stroke. A Standardized Approach

Georg Homann (Presenter) ; Uta Hanning ; Ludger Feyen ; Volker Hesselmann MD ; Thomas Niederstadt MD ; Andre Kemmling MD

PURPOSE
In proximal (M1) middle cerebral artery (MCA) occlusive stroke the primary feeding artery that supplies posterior leptomeningeal collaterals may arise from the ipsilateral anterior or posterior circulation depending on the configuration of the circle of Willis and presence of fetal variants. Aim of this study was to assess regional brain perfusion parameters and patterns of final tissue outcome subject to Willis’ circle variants.

METHOD AND MATERIALS
Prospectively, stroke imaging (native CT, CTA and dynamic CTP) was performed in 97 acute strokes. Type of vessel occlusion was matched in all cases (distal M1-occlusive strokes). The configuration of the Willis’ circle was rated according to a pattern favoring leptomeningeal supply from the anterior (Pcom > P1-PCA) or posterior (P1-PCA > Pcom) circulation. CTP-parameter maps were transformed to MNI-152 standardized space to calculate regional brain perfusion using a probabilistic atlas (Harvard-Oxford structural atlas). Final tissue outcome was segmented on follow up imaging targeted at 48h after onset.

RESULTS
Depending on Willis’ circle variants, the perfusion (blood flow) pattern of ischemia was different in fetal (P1-PCA > Pcom) versus normal (Pcom > P1-PCA) variants (ml/100mg/min): temporal pole (41.2 vs. 31.0), inferior temporal gyrus (36.5 vs. 31.0), subcallosal cortex (54.8 vs. 43.8), orbitofrontal cortex (42.6 vs. 36.9), mediofrontal cortex (54.9 vs. 47.8), cingulate gyrus (58.6 vs. 53.9). Final infarct volume was 14% lower in fetal variant (85.2 vs. 98.2 ml).

CONCLUSION
In acute MCA-occlusion the effectiveness of leptomeningeal collateralization to curb ischemia depends on the source of the primary feeding artery subject to Willis’ circle variants.

CLINICAL RELEVANCE/APPLICATION
Willis’ circle configuration contributes to leptomeningeal collaterals. This may be relevant for outcome prediction in the acute stroke setting and therapeutic decision making.

VSNR41-07 • T2* ð-CanSusceptibility Vessel Signï½? Demonstrates Clot Location and Length in Acute Ischemic Stroke

Olivier Naguza MD (Presenter) ; Jean Raymond MD ; Montserrat Domingo Ayllon MD ; Myriam Edjlali ; Sophie Gerber ; Emmanuel Touze ; Matthieu Zuber ; Jean-Francois Meder MD, PhD ; Jean-Louis Mas ; Catherine Oppenheim MD, PhD

PURPOSE
The purpose of this study was to evaluate, in acute stroke patients, the diagnostic accuracy of MR susceptibility vessel sign (SVS) against catheter angiography (DSA) for the detection of the clot and its value in predicting clot length.

METHOD AND MATERIALS
The study was approved by the local ethics committee. Informed consent was waived. The manuscript was prepared in accordance with STARD guidelines. We retrospectively identified consecutive patients (2006-2012) with: (1) pre-treatment T2* sequence; (2) delay from pre-treatment T2* sequence to catheter angiography (DSA) for the detection of the clot and its value in predicting clot length.

RESULTS
On DSA, a clot was present in all 85 included stroke patients, in 126 arteries and 175 segments. Sensitivity of SVS was 81.1% (69/85 patients), higher in anterior (55/63, 87.3%), than in posterior circulation stroke (14/22, 63.6%, p=0.02). Specificity/accuracy were 95.4% (72/75). Clot length was excellently (ICC: 0.88, 95%CI: 0.81-0.92; Passing & Bablok : 0.91).

CONCLUSION
SVS is a specific marker of acute clot in the anterior and posterior circulation. Clot length can be measured reliably on T2*. SVS could serve as a selection criteria for intra-arterial therapy in future randomized control trial.

CLINICAL RELEVANCE/APPLICATION
T2* sequence may allow the non-invasive assessment of the clot burden in acute ischemic stroke, a finding that may help the triage of patients for intravenous or intra-arterial therapy.

VSNR41-08 • Stroke Trials: Update and Perspective

Steven Warach, MD, PhD (Presenter)

VSNR41-09 • Perfusion-based Selection Limits Outcomes Compared with Time-based Selection for Endovascular Reperfusion Therapy in Acute Ischemic Stroke

Maryam Soltanolkotabi MD (Presenter) ; Shyam Prabhakaran MD, MS ; Farnoosh Feiz MD ; Michael C Hurley MBCh ; Ali Shaibani MD ; Richard Bernstein ; James Conners MD, MS ; Sameer A Ansari MD, PhD ; Yvonne Curran MD

PURPOSE
Controversy exists on the role of perfusion imaging-based selection of patients with AIS for endovascular therapy. Our hypothesis was that perfusion imaging based selection would improve functional outcomes at 3 months compared to time based selection alone.

METHOD AND MATERIALS
We reviewed data from consecutive AIS patients treated with ERT at 4 centers from 2006-2011. We excluded patients with initial NIHSS
RESULTS
185 patients (mean age 66.7 y; median NIHSS 19; MCA occlusion 73% and ICA occlusion 27%) were included. TICI 2b/3 reperfusion grade was achieved in 49.7% while symptomatic hemorrhage (PH1/PH2/perforation) occurred in 10.8%. Good outcome at 3 months was seen in 41.7%. Perfusion imaging was used in 69 (37.3%) patients (45 CT and 24 MRI) and was associated with increased onset-to groin puncture time (359 vs. 298 minutes, P=0.019). Patients who underwent perfusion imaging were also older (73 vs. 63 years, P

CONCLUSION
In this multicenter study, AIS patients who underwent perfusion imaging were over 2 fold more likely to have good outcome following ERT despite a delay in time to treatment and age imbalance between groups. Further studies should continue to address the optimal perfusion imaging thresholds for patient selection for ERT.

CLINICAL RELEVANCE/APPLICATION
Controversy exists on the role of perfusion imaging based selection of patients with acute ischemic stroke (AIS) for endovascular reperfusion therapy (ERT).

VSNR41-10 • Endovascular Stroke Device Update
Aquila S Turk DO (Presenter)

VSNR41-11 • Socioeconomic Disparities in the Utilization of Mechanical Thrombectomy for Acute Ischemic Stroke
Waleed Brinjikji (Presenter) ; Alejandro A Rabinstein MD ; Harry J Cloft MD, PhD

PURPOSE
Previous studies have demonstrated that socioeconomic disparities in access to treatment for cerebrovascular diseases exist. We studied the Nationwide Inpatient Sample (NIS) to determine if disparities exist in utilization of mechanical thrombectomy for acute ischemic stroke.

METHOD AND MATERIALS
Using the NIS for the years 2006-2010, we selected all discharges with a primary diagnosis of acute ischemic stroke. Patients who received mechanical thrombectomy for acute ischemic stroke were identified by using the ICD-9 procedure code 39.74. We examined the utilization rates of mechanical thrombectomy by race/ethnicity (white, black, Hispanic, and Asian/Pacific Islander), income quartile (1st, 2nd-3rd, and 4th) and insurance status (Medicare, Medicaid, self-pay and Private). We also studied thrombectomy utilization rates at hospitals which performed thrombectomy.

RESULTS
From 2006-2010, 2087017 patients were hospitalized with a primary diagnosis of acute ischemic stroke. 8946 patients (0.4%) received mechanical thrombectomy. When compared to white patients, Black patients had significantly lower rates of overall mechanical thrombectomy utilization (OR=0.59, 95%CI=0.55-0.64, P

CONCLUSION
Our study demonstrated that significant socioeconomic disparities exist in the utilization of mechanical thrombectomy for the treatment of acute ischemic stroke. Further studies are needed to study the underlying causes of these disparities and provide solutions to improve equitable access to the population.

CLINICAL RELEVANCE/APPLICATION
Minority patients as well as patients of lower socioeconomic status are less likely to receive mechanical thrombectomy for treatment of acute ischemic stroke.

VSNR41-12 • Carotid Artery Plaque Characterization on MRI and Stroke Risk: A Systematic Review and Meta-analysis
Hediyeh Baradaran MD (Presenter) ; Andrew D Schweitzer MD ; Allison Dunning ; Diana Delgado MS ; Ankur Pandya PhD, MPH ; Hooman Kamel MD ; Pina C Sanelli MD ; Ajay Gupta MD

PURPOSE
MRI-based characterization of carotid plaque composition has high accuracy compared to histopathology and has been recently studied as a potential tool to predict ischemic events in carotid atherosclerotic disease. Intraplaque hemorrhage (IPH), lipid-rich necrotic core (LRNC) and thinning/rupture of the fibrous cap (FC) are the three most studied plaque characteristics. We performed a systematic review and meta-analysis to summarize the association between these three plaque characteristics and future ischemic events in patients with carotid atherosclerotic disease.

METHOD AND MATERIALS
We performed a comprehensive literature search evaluating the association of MRI-based characterization of carotid plaque composition with stroke. The included studies were prospective or retrospective studies examining IPH, LRNC, or FC with mean follow-up of at least 1 month assessing for development of ipsilateral ischemic event (stroke or transient ischemic attack [TIA]). A meta-analysis using random and fixed-effects models with assessment of study heterogeneity and publication bias was performed.

RESULTS
Of the 3436 manuscripts screened, 10 met eligibility for systematic review including a total of 832 patients. 6 of the manuscripts studied IPH, 4 studied LRNC, and 3 studied thinning/rupture FC. The hazard ratio (HR) for IPH, LRNC, and thinning/rupture of the FC as predictors of future stroke/TIA are 4.61 (95% CI 3.02-7.02), 3.00 (95% CI 1.51-5.95) and 7.39 (95% CI 3.26-16.75), respectively. There was significant heterogeneity in the degree of stenosis, presence of prior symptoms, and MRI techniques amongst all included studies. Measures of heterogeneity showed mild heterogeneity only in the IPH meta-analysis and no statistically significant publication bias in any of the three meta-analyses.

CONCLUSION
The presence of IPH, LRNC, and thinning/rupture of the FC in carotid plaque increases the risk of future ipsilateral ischemic event in patients with carotid atherosclerotic disease.

CLINICAL RELEVANCE/APPLICATION
Dedicated imaging to characterize plaque composition may offer information beyond luminal stenosis to further risk stratify patients with carotid atherosclerotic disease.

DR Systems: A Strategy for Connecting With and Marketing To the e-Patient and e-Referrer

Wednesday, 10:30 AM - 11:15 AM • South Building Hall A Booth 3314

EPT09
Meaningful Use Product Manager DR Systems
Carol Osborne
Florent Saint-Clair *

LEARNING OBJECTIVES
DR Systems presents our vendor-neutral, cloud-based, approach for solving four of your most critical needs: Patient Engagement, Meaningful Use Compliance, Image Sharing, and Connectivity to referring doctors’ EMRs. Learn to use incentive payments to build your practice.
ICIA41 • AMA PRA Category 1 Credit ™:1.5
C. Carl Jaffe, MD
John B Freymann, BS
Justin Kirby
Fred W Prior, PhD *
Lawrence R Tarbox, PhD *

LEARNING OBJECTIVES
1) Learn how to find and download collections of clinical images from the multi-terabyte NIH/NCI Cancer Image Archive (TCIA). 2) Understand the index structure of the TCIA DICOM database. 3) Comprehend how the image archive is linked to the open access genomic data portal (The Cancer Genome Atlas – TCGA). 4) Use this tutored hands-on session to initiate institutionally independent leading edge bioinformatics research.

ABSTRACT
To accelerate clinical imaging research consistent with the principle of open-access "big data," the NIH/NCI provides an Web-downloadable massive DICOM clinical image archive entitled The Cancer Imaging Archive (TCIA). It contains a rich breadth of easily retrievable pre-indexed, but privacy compliant, cancer image collections from an intuitive interface. Of special significance, the TCIA archive acts as a repository of case collections that serve the increasingly important research frontier of "radiogenomics." Collections in TCIA designated "TCGA-xxxx" are diagnostic images obtained from individuals whose tissues were genetically profiled in the NHGRI/NCI cancer genome atlas project, TCGA. This tutored hands-on session will teach the basic skills needed to navigate the massive "Big Data" open-access downloadable image archive provided by the NCI Cancer Imaging Program. With this knowledge, interested cross-disciplinary researchers and radiologists can conduct their own leading-edge research to link clinical imaging to the genomics of various cancer tissue types.

URL's

Next Generation IT Requirements for Improving Quality and Safety for Radiology

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

ICII41 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

LEARNING OBJECTIVES
1) Broadly describe the role of IT in helping improve quality and safety for radiology. 2) Describe some of the next generation IT requirements for quality and safety improvement. 3) Use case examples to demonstrate the use of IT to improve access, appropriateness, report quality and results communication. Demonstrate how IT tools can help quantify measurable improvements in each function/process. 4) Use case examples to describe system integration requirements and strategies to enable quality and safety improvement.

ABSTRACT
Improving quality and safety in healthcare and reducing medical errors has become an important element of the national dialogue. A series of groundbreaking reports from the Institute of Medicine, including Crossing the quality chasm published in 2001 have helped frame the national debate. It has become apparent that working harder or smarter is not the answer. Broad system changes are sorely needed to enable the transformation of our healthcare system and creating a patient-centered, evidence-based care model. Information technology (IT) solutions are a critical element for this transformation.

In this session we will present some of the next generation IT requirements for improving quality and safety in radiology. Our speakers will use case examples to demonstrate how information technology tools can be used to improve appropriateness, access, 'value' of the radiology report, and results communication. Where relevant, our speakers will describe how metrics (e.g. with the use of dashboards, scorecards, or analytics tools) can be used to measure the improvements enabled with IT described in each presentation. Speakers will address the importance of system integration and suggest strategies to use existing IT standards to enable quality and safety improvements in our practices.

ICII41A • Using IT to Improve Appropriateness and Access
Keith D Hentel MD, MS (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

ABSTRACT

ICII41B • Using IT to Improve the 'Value' of Radiology Reports
Ramin Khorasani MD (Presenter) *

LEARNING OBJECTIVES
1) Describe some of the key attributes of a 'high value' radiology report. 2) Describe some of the existing performance gaps for creation of an optimal radiology report. 3) Using case examples, illustrate how health IT tools could improve the 'value' of radiology reports.

ICII41C • Using IT to Improve Results Communication, Including Critical Results
Luciano M Prevedello MD,MPH (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

Creating Radiology eBooks for the iPad: A Hands-on Introduction to iBooks Author

Wednesday, 10:30 AM - 12:00 PM • S401AB
ABSTRACT
The iPad is rapidly becoming the de facto learning tool used by radiology residents and fellows. iBooks Author, a free authoring tool from Apple, enables the creation of ebooks with a near-limitless number of high-resolution images, movies, and other interactive elements. Unfortunately, most radiologists lack the expertise to leverage the advantages of this application. This hands-on workshop will cover the basics of iBooks Author. During the course, attendees will create their own interactive radiology ebook and learn how to freely share it with anyone who has an iPad. iBooks author is only available for Mac OS and bringing your own Mac is required for the hands-on portion of the course. Attendees are encouraged to download iBooks Author prior to attending; the link is provided below. Attendees are also encouraged to come with an idea for their own iBook, ideally with a text file and folder of images they would like to turn into an ebook during the course. Sample text and images will be provided for those who do not bring their own material.

URL's

Clinical Imaging (Image Guided) (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

Wednesday, 10:30 AM - 12:00 PM • S105AB

MSAS42 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
Moderator
Richard Evans

MSAS42A • Ultrasound Guidance in Musculo-Skeletal Intervention

Alison Hall MSc (Presenter)

LEARNING OBJECTIVES
1) Improve basic knowledge in the practical use of ultrasound guidance in the delivery of therapeutic injections to the most common sites in rheumatology. 2) Appraise the most recent research articles on the subject of ultrasound guidance in musculoskeletal intervention. 3) Recognise the advantages and disadvantages of a multidisciplinary team approach for the provision of an ultrasound guided intervention service. 4) Evaluate the implementation of a training programme for a multidisciplinary team to learn ultrasound guided intervention including competency assessments, ongoing review and broadening of skills.

ABSTRACT
Corticosteroid joint injection therapy is still of great importance in the management of musculoskeletal disease and has been common in rheumatology and orthopaedic practice for the last 50 years. Most injections are delivered ‘blind’ using clinical skills and anatomical landmarks to determine the correct site but in recent years the use of imaging techniques has been proven to increase the accuracy of needle placement over clinical guidance. Ultrasonography is now recognised as one of the most useful imaging modalities for this, being radiation free and relatively inexpensive, but there is still conflicting evidence around expected improvements in patient outcomes following ultrasound guided injections in clinical practice. The variable accuracy reported in available studies may reflect the differences in the individual injectors’ skills in using ultrasound to locate the correct injection site and deliver the injectate accurately. Ultrasound is renowned for its operator dependence and appropriate training is essential to provide a safe and effective service. However, with the supervision of an experienced ultrasound practitioner, it is possible to introduce ultrasound guidance to an established nurse led joint injection service and to train appropriate health care professionals in focused techniques. This presentation will demonstrate some of the more common techniques used in this emerging field and aims to explore current evidence for and against the use of ultrasound to guide joint injections. The development of a Sonographer led ultrasound guided intervention service will be discussed, to include training, accreditation and on going competency assessment.

MSAS42B • Image Guided Intervention: A Radiologist Assistant Perspective

Cindy A Petree BS (Presenter)

LEARNING OBJECTIVES
1) Discuss radiologist assistant role in ultrasound guided procedures including paracentesis, thoracentesis, peripherally inserted central catheters, and central lines. 2) Discuss fluoroscopy guided procedures including lumbar punctures and arthrography. 3) Review procedural techniques/ indications/contraindications for procedures. 4) Recognize advantages of utilizing RA’s in this capacity.

ABSTRACT
Radiologist assistants are advanced level technologists who serve as radiologist extenders in the diagnostic and interventional radiology departments. RA’s can obtain history and physicals and obtain consents. RA’s can also perform noninvasive and minimally invasive procedures while radiologists are performing more invasive interventional procedures or interpreting images. Ultrasound guided procedures such as thoracentesis, paracentesis, PICCs, and central lines have become ‘bread and butter’ exams for many radiology departments. With proper training and supervision radiologist assistants can competently perform these exams to lessen the burden on radiologists. Proper patient positioning, anatomy and physiology, and lab evaluation are important steps to the procedure. Lumbar punctures are performed for CSF analysis, CSF pressure measurement, therapeutic purposes, and injection of intrathecal chemotherapy. Fluoroscopy guided joint injections of gadolinium, ionic contrast, or steroids have become another common radiologic procedure. Conventional arthrogram procedures have mostly been replaced by MRI arthropgrams.

Case-based Review of Musculoskeletal Radiology (An Interactive Session)

Wednesday, 10:30 AM - 12:00 PM • S406A

MSCS42 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5
Director
Lynne S Steinbach , MD

MSCS42A • Shoulder

Jon A Jacobson MD (Presenter)

LEARNING OBJECTIVES
1) Describe the imaging features of rotator cuff tears. 2) Recognize common shoulder pathology at imaging. 3) Understand the advantages and disadvantages of various types of shoulder imaging, such as radiography, CT, ultrasound, and MRI.

MSCS42B • Hip

Donna G Blankenbaker MD (Presenter)
LEARNING OBJECTIVES
1) To describe and review key topics in the patient with the painful hip. 2) Understand and describe the imaging appearance for different conditions affecting the hip. 3) To understand the treatment for specific hip conditions.

MSCS42C • Postoperative Imaging: Shoulder and Hip
Christine B Chung MD (Presenter)

LEARNING OBJECTIVES
1) Identify appropriate screening studies for evaluation of common post-operative conditions in the shoulder and hip. 2) Emphasize diagnostic criteria for commonly encountered complications in the post-operative shoulder and hip. 3) to review MR techniques that allow reduction of artifact in the post-operative state, particularly around orthopedic hardware.

ABSTRACT

Essentials of Musculoskeletal Imaging
Wednesday, 10:30 AM - 12:00 PM • S100AB

MSES42 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

MSES42A • Essentials of Elbow MRI
Michael J Tuite MD (Presenter)

LEARNING OBJECTIVES
1) Identify the normal anatomy of the elbow on MR images. 2) Analyze the commonly injured structures of the elbow, and identify injuries of the bones, tendons and ligaments. 3) Demonstrate understanding of the nerves around the elbow and the MR appearance of abnormalities.

ABSTRACT

MSES42B • Imaging Muscle Injury and It's Complications
Philip Robinson MBChB (Presenter)

LEARNING OBJECTIVES
1) Identify the application of basic anatomy, pathology, and physiology principles of muscle anatomy and function in relation to the patterns of injury seen. 2) Understand the physical principles and relative limitations of MRI and ultrasound in relation to imaging normal and injured muscle. 3) Describe the commonest muscle injury patterns that occur and understand the pathophysiology of subsequent complication development.

MSES42C • Characterizing Soft Tissue Tumors at MRI: What Is Realistically Possible?
David M Panicek MD (Presenter)

LEARNING OBJECTIVES
1) Describe how various features of a soft tissue mass may contribute to a more specific diagnosis at MRI. 2) Identify characteristic MRI features of certain soft tissue tumors. 3) Recognize strengths and limitations of MRI in characterizing soft tissue tumors.

ABSTRACT

BOOST: Genitourinary-Integrated Science and Practice (ISP) Session
Wednesday, 10:30 AM - 12:00 PM • S103CD

MSRO42 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

Co-Director
Fergus V Coakley, MD
Co-Director
Bruce G Haffty, MD
Moderator
Phuoc T Tran, MD, PhD *
Moderator
Martin Colman, MD

MSRO42-01 • Invited Speaker:
Ashesh B Jani MD (Presenter)

MSRO42-02 • Improved Dosimetry in Prostate Brachytherapy Using High Resolution Contrast Enhanced Magnetic Resonance Imaging
Karen Buch MD (Presenter); Tye Morancy; Irving Kaplan MD; Mustafa Qureshi; Ariel E Hirsch MD; Neil M Rosfsy MD; Edward J Holupka PhD; Renee Oismueller; Robert Hawliczek; Thomas H Helbich MD *; Boris N Bloch MD

PURPOSE
Postbrachytherapy prostate dosimetry data is generally derived from computed tomography (CT), however, studies have demonstrated superior delineation of prostate and periprostatic structures on magnetic resonance imaging (MRI). The purpose of this study was to evaluate dosimetry data from postbrachytherapy CT versus high resolution, contrast-enhanced MRI (HR-HR-CEMRI).

METHOD AND MATERIALS
Following institutional review board approval, 11 postbrachytherapy prostate cancer patients underwent HR-CEMRI and CT imaging. CT and HR-CEMRI images were randomized and 2 independent, expert readers created contours of prostate, intra- and peri-prostatic structures. Dosimetry data including V100, V90 and V100 was calculated based on these contours. Mixed-effect models were used to test for differences between the two modalities.

RESULTS
Mean (± standard deviation, SD) V100 values from CT and HR-CEMRI contours were as follows: prostate (98.5% ± 1.5 and 96.2% ± 3.6, P=0.003), urethra (81.0% ± 6.5 and 88.7% ± 7.8, P=0.027), anterior rectal wall (ARW) (8.9% ± 5.8 and 2.8% ± 1.7, P CONCLUSION
MSRO42-03 • Toward Contouring Guidelines for Prostate Cancer Focal Therapy Planning on MRI: Characterization of Tumor Boundary Contrast via Accurate Pathology Fusion

Eli Gibson MSc (Presenter) ; Mena Gaed MD ; Jose A Gomez ; Madeleine Moussa ; Cesare Romagnoli MD ; Suha Ghoul MBBS, MSc ; El-Akef W Cool MD, PhD * ; Matthew Bastian-Jordan MBBS, BSc ; Jonathan Mandel MD, FRCP ; Stephen E Pautler MD ; Joseph Chin MD ; Cathie Cruckley ; Glenn S Bauman MD * ; Aaron Fenster PhD * ; Aaron D Ward PhD

PURPOSE
Multi-parametric magnetic resonance imaging (MPMRI) is useful for detection and staging of prostate cancer (PCa); however, intra-prostatic lesion (GTV) focused therapy (e.g. radiation boost or ablative focal therapy) requires precise tumor delineation on T2-weighted (T2W) MRI. Our purpose was to measure the detectability (measured as intensity contrast with non-cancerous contralateral/non-neighboring tissue) and boundary localizability (intensity contrast with non-cancerous neighboring tissue) of Gleason score (GS) 7 tumors in the peripheral zone (PZ), contoured by a pathologist on prostatectomy specimens and deformably registered to T2W MRI with high accuracy.

METHOD AND MATERIALS
We acquired endorectal T2W MRI (3T GE Discovery MR750, FSE, TR=5434, TE=159) and histology from 6 subjects. Histology grading and contouring were approved by a genitourinary pathologist, identifying 7 PZ PCa foci with GS 7. To mitigate the bias toward high-contrast tumor boundaries inherent in qualitative consensus mapping of histology contours onto MRI, we used a histology–MRI deformable registration, blinded to the tumor locations, comprising a fiducial-based 3D histology reconstruction to ex vivo MRI followed by a deformable registration to in vivo MRI. For each focus mapped from histology to T2W MRI, we took 3 mean intensity measurements: T (tumor tissue), N (non-cancerous PZ tissue < 5 mm from the tumor), and C (non-cancerous contralateral PZ tissue). We characterized detectability as D = (T–C)/C and localizability as L = (T–N)/N; values < 0 denote tumor hypointensity and 0 indicates no contrast.

RESULTS
Detectability: All foci were hypointense relative to contralateral tissue (-0.53 < D < -0.15). Localizability: 3 of 7 foci had clear boundaries (L < -0.19); 4 had more poorly defined margins (-0.12 < L < 0.08). The mean target registration error was 2 mm.

CONCLUSION
Accurate deformable registration of pathology-defined GS 7 PZ tumors to T2W MRI shows tumor hypointensity but low boundary contrast, challenging accurate tumor boundary delineation for PCa treatment planning. Our preliminary results motivate further study to measure the performance of T2W MRI for tumor boundary delineation or augment it with MPMRI.

CLINICAL RELEVANCE/APPLICATION
Low tumor boundary contrast on T2W MRI for Gleason 7 peripheral zone prostate cancers suggests further assessment of T2W MRI is needed for contouring guidelines for focal/boosted therapy planning.

MSRO42-04 • MR Imaging of Ex Vivo Prostate Specimens for Predicting Resection Margin in Prostate Cancer: A Pilot Study

Martijn Hoogenboom MSc (Presenter) ; Iriego Kovacs ; Isabell Steinseifer ; Andor Veltien ; Iris Nagtegaal PhD ; Michiel Sedelaar MD, PhD ; Fred Witjes MD, PhD ; Jurgen J Futterer MD, PhD ; Jollee O Barentsz MD, PhD ; Arend Heerschap PhD ; Christina A Hulsbergen-Van De Kaa MD, PhD

PURPOSE
This study has been designed to explore if ex vivo 7T MR imaging can be used for identification of potential positive resection margins in radical prostatectomy specimens.

METHOD AND MATERIALS
Fresh radical prostatectomy specimens (n=6) underwent MR imaging immediately after surgery. Tubes filled with saline both in the urethra and next to the prostate were used as markers. The prostate was doped in gadolinium to highlight the surgical margins. All specimens were emerged in oil (fomblin) to eliminate susceptibility artifacts. High resolution T2-weighted (T2W) and diffusion weighted images (DWI) were acquired. After evaluation of the in vivo MRI, the tumor and position of possible positive resection margins were determined at the ex vivo images (T2, DWI). Histopathology slices, every 4mm, were made according to the ex vivo images in transversal direction. The ex vivo images were correlated with the histopathology.

RESULTS
In T2W MR images of ex vivo prostate zonal distinction (peripheral vs. transition) is less clear than in MRI of the prostate in vivo. In all patients the tumor was visible on the DWI images, however also benign lesions showed reduced ADC and high signal intensity on the b1200 images. The resection margin was free of tumor in all patients with a high intense border at T2W images and a border of high ADC values between tumor and the outside of the prostate. Two patients showed a positive resection margin at the MR images, which correlated with the histopathology. However, in two patients a positive resection margin seemed to be visible based on the MR images, while the histopathology showed a negative resection margin. Therefore in these cases a histopathology confirmation is needed (frozen section).

CONCLUSION
Ex-vivo MRI has the potential to identify benign and malignant structures and to predict resection margins. However, further optimization of the MR imaging protocol is required guided by information from fast frozen histopathology sections to confirm the presence or absence of positive regions.

CLINICAL RELEVANCE/APPLICATION
A fast method is necessary to determine the resection margins after radical prostatectomy for direct extended resection or brachytherapy, ex-vivo MR might be a solution.

MSRO42-05 • Evaluation of Artifacts Reduction Using Spectral CT Imaging after CT Guided Radioactive Seed 125I Implantation

Rui Gang Huang (Presenter) ; Alai Zhan ; Qinglong Shen

PURPOSE
To explore the clinical value of puncture needle artifacts reduction using Spectral CT Imaging after CT guided radioactive seed 125I implantation in treatment of liver cancer

METHOD AND MATERIALS
6 patients referred to CT guided radioactive seed 125I implantation in liver underwent GSI examinations using Discovery CT750 HD scanner. During the process of implantation, traditional CT scans were performed for comparison. All data were transferred to Workstation (AW4.5, GE Healthcare) to obtain one set of 140 kVp images (QC) and 11 sets of monochromatic images (40-140keV, interval of 10keV). Artifact was significant around particles and puncture needle. The CT value and variations were measured in the area with and without the most significant artifact while the background noise was measured in abdominal subcutaneous adipose tissue. The artifact index (AI) of the regions of interest is defined as the square root of the squared noise difference between the region with and without artifact of the same tissue. All the measurements were recorded and statistically compared.
RESULTS

CONCLUSION
Monochromatic images obtained from spectral CT imaging can substantially reduce metal artifacts caused by radioactive seed 125I and provide more accurate CT images for estimating the efficacy of the treatment.

CLINICAL RELEVANCE/APPLICATION
Spectral CT showed its potential applications in monitoring disease progressions after 125I radioactive particles implantation.

MSRO42-06 • Evaluation of Two Automatic Deformable Contouring Methods for Prostate Image-guided Adaptive Radiation Therapy (IGART) in Terms of Delivered Dose Values

Zhilei Shen; Sara Pirozzi BS (Presenter) *; Jon W Piper BEng *; Aaron S Nelson MD *

PURPOSE
Two deformable contouring methods for prostate CBCT, Adaptive and Multi-Adaptive, previously demonstrated good accuracy in terms of Dice coefficients. Now these methods are evaluated by comparing their delivered dose values with those from manual contouring.

METHOD AND MATERIALS
Twenty CBCTs were selected from 4 patients with prostate cancer. Prostate, bladder, rectum, left and right hip contours were manually defined on all the CBCTs. Adaptive contours were created by deforming manually defined Day 1 CBCT contours to subsequent CBCTs, for a total of 16 contour sets. Multi-Adaptive contours were generated by deforming the other 4 CBCTs to the remaining CBCT and combining contours using Majority Vote for a total of 20 contour sets. The daily dose values were measured from the deformed and manual contours. Bland-Altman analysis was used to analyze the 95% confidence limits of agreement (LOA) between manual and deformable contouring.

RESULTS
The mean±SD percentage differences and 95% LOA for Manual vs. Multi-Adaptive were: CTV Mean (-0.6±2.8%) [-0.12,0.09], D25 Bladder (-1.8±25.3%) [-0.54,0.46], D50 Bladder (-4.1±22.8%) [-0.39,0.31], D20 Rectum (0.3±8.3%) [-0.24,0.24], D40 Rectum (0.9±10.3%) [-0.21,0.22], D20 Left Hip (-0.1±0.7%) [-0.01,0.01], and D20 Right Hip (0.1±1.0%) [-0.02,0.02]. For Manual vs. Adaptive the results were: CTV Mean (-0.6±3.9%) [-0.16,0.13], D25 Bladder (-1.2±28%) [-0.71,0.45], D50 Bladder (-15.5±25.2%) [-0.75,0.36], D20 Rectum (1.0±9%) [-0.25,0.28], D40 Rectum (4.8±10.9%) [-0.18,0.29], D20 Left Hip (-0.1±0.6%) [-0.01,0.01], and D20 Right Hip (0.2±1.1%) [-0.02,0.02].

CONCLUSION
Multi-Adaptive showed increased agreement and decreased bias compared to Adaptive. The 95% LOA showed that there were no clinically significant differences for CTV Mean, Left Hip, and Right Hip indicating the deformable methods were as good as manual in delineating these structures. Although the 95% LOA were larger for the other structures, the rectum may fall within clinical tolerances.

CLINICAL RELEVANCE/APPLICATION
Tracking dose using deformable contouring of CBCTs has the potential to identify deviations from the planned treatment. Deformable methods have the potential to reduce the burden for contouring.

MSRO42-07 • Neurovascular Bundle Sparing Technique in Prostate Brachytherapy, and the Utility of Intraoperative Ultrasound Fusion with Day 30 CT

Daniel A Jones MD (Presenter)

ABSTRACT
Purpose/Objective(s): Reducing dose to the cavernous neurovascular bundles may be important in maintaining sexual potency after prostate brachytherapy. Last year, we reported the feasibility of the nerve sparing technique, and a significant 28% reduction of mean dose to the NVB associated with the non-cancerous lobe. Dose calculations in the initial study were based on intraoperative assessments. The purpose of this study was to report longer follow up of the cohort, and to integrate a novel fusion technique of the intraoperative ultrasound images, with that of the day 30 CT scan.

Materials/Methods: Of the previously reported cohort of fourteen patients in which intraoperative contouring of NVB was performed, six had bilateral NVB contoured, and were thus available for comparison. All were categorized as having unilateral prostate cancer. The non-cancerous lobe was implanted with the NVB sparing technique, placing no radioactive seeds within a 5 mm radius of the NVB. Implant standards for V100 and D90 were maintained. Sexual function was measured with the IIEF questionnaire. Intraoperative methods have the potential to reduce the burden for contouring.

RESULTS
Implantation.

CLINICAL RELEVANCE/APPLICATION
provide more accurate CT images for estimating the efficacy of the treatment.

Monochromatic images obtained from spectral CT imaging can substantially reduce metal artifacts caused by radioactive seed 125I and provide more accurate CT images for estimating the efficacy of the treatment.

CONCLUSION
The NVB sparing brachytherapy technique remains feasible, and does not appear to compromise oncologic outcomes. The dose reduction to the spared NVB was 145 Gy. The mean per-patient dose reduction to the NVB was 16.7% (p=.27) and therefore was no longer clinically significant.

The mean±SD percentage differences and 95% LOA for Manual vs. Multi-Adaptive were: CTV Mean (-0.6±2.8%) [-0.12,0.09], D25 Bladder (-1.8±25.3%) [-0.54,0.46], D50 Bladder (-4.1±22.8%) [-0.39,0.31], D20 Rectum (0.3±8.3%) [-0.24,0.24], D40 Rectum (0.9±10.3%) [-0.21,0.22], D20 Left Hip (-0.1±0.7%) [-0.01,0.01], and D20 Right Hip (0.1±1.0%) [-0.02,0.02]. For Manual vs. Adaptive the results were: CTV Mean (-0.6±3.9%) [-0.16,0.13], D25 Bladder (-1.2±28%) [-0.71,0.45], D50 Bladder (-15.5±25.2%) [-0.75,0.36], D20 Rectum (1.0±9%) [-0.25,0.28], D40 Rectum (4.8±10.9%) [-0.18,0.29], D20 Left Hip (-0.1±0.6%) [-0.01,0.01], and D20 Right Hip (0.2±1.1%) [-0.02,0.02].

CONCLUSION
Multi-Adaptive showed increased agreement and decreased bias compared to Adaptive. The 95% LOA showed that there were no clinically significant differences for CTV Mean, Left Hip, and Right Hip indicating the deformable methods were as good as manual in delineating these structures. Although the 95% LOA were larger for the other structures, the rectum may fall within clinical tolerances.

CLINICAL RELEVANCE/APPLICATION
Tracking dose using deformable contouring of CBCTs has the potential to identify deviations from the planned treatment. Deformable methods have the potential to reduce the burden for contouring.
LEARNING OBJECTIVES
1) To be familiar with traumatic brain injury demographics and classification schemes. 2) Be able to apply appropriateness criteria for head trauma imaging in children and adults. 3) Identify key imaging patterns and pitfalls in the evaluation of brain and neurovascular trauma.

ABSTRACT
This lecture on Acute Head Trauma is divided into 4 parts: Part 1 will briefly review TBI demographics. Part 2 will discuss the current imaging approach to acute TBI in today’s clinical practice. Part 3 will briefly describe the most common TBI classification schemes. Part 4 will illustrate the imaging manifestations of the different injuries located in the extra-axial space (e.g., scalp and skull injury; epidural, subdural, subarachnoid and intraventricular collections), and the intra-axial space (e.g., dysautoregulation, contusion, hematoma, penetrating TBI, axonal injury, fat emboli). Note that a common theme throughout the lecture will be “Lessons I’ve Learned Since Neuroradiology Fellowship”.

MSSR42B • CNS Non-Traumatic Emergencies
Marion Smits MD, PhD (Presenter)

LEARNING OBJECTIVES
1) To know the modalities (CT/MRI) and protocols for non-traumatic neurological emergencies. 2) To know and diagnose the main non-traumatic neurological vascular and non-vascular emergencies. 3) To be aware of the pitfalls and limitations of clinical presentation and imaging findings in non-traumatic neurological emergencies.

ABSTRACT
Neurological emergencies are often associated with high morbidity and mortality, and thus require prompt diagnostic and therapeutic action. Non-traumatic emergencies may however have a subacute onset, and radiological signs may be subtle, which can lead to delay in diagnosis.

MSSR42C • Interactive Case Discussion
Howard A Rowley MD (Presenter) *; Marion Smits MD, PhD (Presenter)

LEARNING OBJECTIVES
1) To review traumatic brain injury (TBI) and non-traumatic neurological emergencies respectively. Both lecturers will take the audience through several clinical cases, highlighting and emphasizing important issues from their lectures, such that the previously presented theory is placed in a clinical context. Preferably, the participants will have attended the two prior lectures, to optimally benefit from and participate in this interactive case discussion.

Breast Imaging (Digital Breast Tomosynthesis Screening Outcomes)

Wednesday, 10:30 AM - 12:00 PM • Arie Crown Theater

SSK01 • AAMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5
Moderator
Stephen L Rose, MD *
Moderator
Margarita L Zuley, MD

SSK01-01 • Breast Cancer Screening Pre and Post-tomosynthesis: Comparison of Recall Rate, Biopsy Positive Predictive Value, and Cancer Detection Rate

Marilyn A Barry-Brooks MD (Presenter) ; Ana P Lourenco MD ; Martha B Mainiero MD

PURPOSE
To compare the recall rate, biopsy positive predictive value, and cancer detection rate prior to and following the implementation of screening tomosynthesis.

METHOD AND MATERIALS
This retrospective analysis was IRB approved and HIPAA compliant. Results from all digital screening mammography exams performed without tomosynthesis from March through December 2011 and results from all digital screening mammography exams performed with tomosynthesis from March through December 2012 were reviewed. Diagnostic cases were excluded. All studies were interpreted by radiologists with fellowship training in breast imaging. Recall rates, biopsy positive predictive values, and cancer detection rates were determined. The biopsy positive predictive value was defined as the number of BI-RADS 4/5 biopsies positive for malignancy divided by the number of BI-RADS 4/5 cases that underwent biopsy. Cancer detection rate was calculated by dividing the total number of malignancies identified (including BI-RADS 3 cases undergoing biopsy that showed malignancy and high risk lesions at biopsy that were upgraded to malignancy at surgical excision) by the total number of screening exams. Statistical analysis was performed using a two-sample test of proportions.

RESULTS
A total of 11,818 patients underwent digital mammography screening and 11,794 patients underwent digital mammography plus tomosynthesis screening. The recall rate for the pre tomosynthesis group was significantly higher at 8.6%, compared with 6.0% for the tomosynthesis group (p < 0.05).

CONCLUSION
The addition of tomosynthesis to digital mammography in this screening population significantly reduced the recall rate without decreasing the biopsy positive predictive value or cancer detection rate.

CLINICAL RELEVANCE/APPLICATION
A 30% decrease in recall rate following the addition of tomosynthesis to mammography screening may result in decreased patient anxiety and healthcare costs.

SSK01-02 • Implementing Digital Breast Tomosynthesis (DBT) in a Screening Population: PPV1 as a Measure of Outcome

Emily F Conant MD (Presenter) *; Fei Wan; Mathew Thomas BS; Marie Synnestvedt; Susan P Weinstein MD; Susan G Roth MD; Despina Kontos PhD; Anne Marie McCarthy; Nandita Mitra

PURPOSE
DBT has been reported to decrease both false positive recalls from screening and to improve cancer detection rates. The purpose of this
Interpretation time with DBT decreases with experience approaching about 60 sec per exam after interpretation of 2000 examinations.

CONCLUSION
The implementation of DBT in a large screening program demonstrated a reduction in recall rates and an increase in cancer detection rates that varied by reader. The balance of these outcomes for each reader, as measured by PPV1, showed significant improvements for 5 of 6 readers and stability for 1 reader.

CLINICAL RELEVANCE/APPLICATION
Screening outcomes as measured by PPV1 improved with DBT implementation in a large, prospective population.

SSK01-03 • Recall Rates on Baseline Screening Mammography: Initial Experience Using Digital Breast Tomosynthesis (DBT)

Anabel M Scaranelo MD, PhD (Presenter) ; Karina Bukhanov MD ; Hadas Moshonov PhD ; Supriya R Kulkarni MD, DMRD ;

Pavel Crystal MD

PURPOSE
To determine differences in the recall rate between Digital Mammography with Breast Tomosynthesis (DBT) and standard 2D-view FFDM (2D) in baseline screening.

METHOD AND MATERIALS
REB approved study initiated March 2012 and lasting 362 days, informed consent obtained from all consecutive women scheduled for baseline mammography randomized to 2 clinical sites-teaching hospitals. One site performed DBT (Dimensions, Hologic, Bedford, MA) and the other 2D (Senograph 200D, GE Medical Systems, Milwaukee, Wis). Certified DBT radiologists reported all exams at both sites without the knowledge of the study. Recall rates were calculated for each site and stratified by lesion type, breast density and age. Fisher's exact tests used to determine statistically significant relationships.

RESULTS
853 women, (90% screening and 10% diagnostic baseline mammography); n=451 site withDBT; n=402 site with2D. Of 451 women, 37% declined tomosynthesis, where 245 had screeningDBT. The mean age was 44.33 (ranged 26-71) in the group withDBT and 43.51 (ranged 26-79) with2D screening (n=364). The DBT group recall rate was 13.1% compared to 18.7% for 2D (p=0.066) with a trend to statistical significance. Recall rates stratified by lesion type demonstrated significantly lower recall rates for asymmetries (21.9% vs. 60.3%, p=0.0001) but not for calcifications (18.8% vs. 8.8%, p=0.198) when comparing DBT to 2D. There was no significant difference in distribution of breast densities between the two cohorts (p=0.459). Lower recalls in DBT for non-dense breasts showed statistical trend (p=0.0672); fatty breasts (5.5% vs. 23.5%, p=0.1774), scattered densities (12.5% vs. 20.13%, p=0.1568), heterogeneously dense (14.2% vs. 20.2%, p=0.2086), and extremely dense (13% vs. 5%, p=0.3216), (DBT vs 2D, respectively). There was no significant difference in the mean age of patients with or without recall (p=0.591). Lower recall rates using DBT: for women older than 50 years (13.5% vs. 19.6%, p=0.4646) and aged 26-49 years (12.9% vs. 18.4%, p=0.1305) (DBT vs 2D respectively

CONCLUSION
A lower recall rate was found in the group of women undergoing DBT and the benefit using this technology for asymmetries was demonstrated.

CLINICAL RELEVANCE/APPLICATION
Baseline DBT significantly reduces recall rates for asymmetries. Not receiving recall for additional views reduces women anxiety, less radiation when considered all additional views associated.

SSK01-04 • Trends in Time to Interpretation of Tomosynthesis Based Screening Examinations with Increasing Experience

Per Skaane MD, PhD (Presenter) * ; Ellen B Eben MD * ; Ingvid N Jebsen * ; Unni Haakenaasen MD * ; Mona Krager MD * ; Mina Izadi MD * ; Gunnar Jahr * ; Ulrika Ekseth MD *

PURPOSE
Interpretation time using tomosynthesis (DBT) for breast cancer screening is longer than that required for FFDM. We assess trends in time to interpretation of tomosynthesis screening examinations during prospective batch readings as a function of radiologists' experience reading tomosynthesis.

METHOD AND MATERIALS
As an integral part of an ongoing prospective clinical trial we record time to interpretation of each case. Seven radiologists interpreted over 2000 examinations each. We computed the time to interpretation of these examinations as a function of their experience. We compared their interpretation time during the first and the last 200 cases and compared these times with the average time to interpretation of FFDM read similarly in a batch mode during the trial.

RESULTS
The average time to interpretation was 42.3 seconds for FFDM (over all cases). For the seven readers analyzed (reading between 2035 and 5532 tomosynthesis exams), average interpretation times for FFDM plus tomosynthesis were 84.5 +/- 24.5 seconds and 59.7 +/- 8.7 seconds during the first and last 200 cases, respectively (p

CONCLUSION
Interpretation time of tomosynthesis examinations is longer than that of FFDM. However it decreases with experience trending toward approximately 60 seconds after reading 2000 examinations.

CLINICAL RELEVANCE/APPLICATION
Interpretation time with DBT decreases with experience approaching about 60 sec per exam after interpretation of 2000 examinations. DBT interpretation time is acceptable for high-volume screening.

SSK01-05 • ACRIN PA 4006: Comparison of Dose in Digital Breast Tomosynthesis and Standard Two-View Mammography for Prospective Breast Cancer Screening

Mathew Thomas BS (Presenter) ; Yohei Matsutani ; Emily F Conant MD * ; Andrew D Maidment PhD *
SSK01-06 • Synthesized 2D Mammograms: A Review of Our First 100 Cases

Andres Alcazar Peral (Presenter); Olivia Benitez; Carmen Estrada; Slavina Mancheva; Alejandro Tejerina; Angeles Franco Lopez

PPURPOSE
Retrospectively, we compare synthesized 2D Mammograms combined with Digital Breast Tomosynthesis versus combination-mode imaging which include 2D Digital Full Field Mammography (DFFM) combined with Tomosynthesis.

METHOD AND MATERIALS
Two expert radiologists assessed 100 mammograms retrospectively in two different ways. The first aspect of interpretation consisted in using 3D Digital Tomosynthesis combined with 2D DFFM and the second one included 3D Tomosynthesis combined with reconstructed synthetic 2D Mammography. In both cases previous mammograms were provided and reviewed. All 100 mammograms were positive for some kind of findings; 69 patients were placed under BIRADS 2 category which showed lesions stable for two years, the rest 31 patients were classified as BIRADS 3, 4 or 5 with a proper histological correlation.

RESULTS
-In 97 cases nodules, microcalcifications and architectural distortions were diagnosed by both imaging techniques. - In 2 cases, the architectural distortion was the main finding and could only be detected with Digital 3D Tomosynthesis. - In 1 case, the architectural distortion was visualized on synthesized 2D Mammmography and Tomosynthesis but not on conventional DFFM. - Most sites of architectural distortions were more visible with synthesized 2D Mammography than DFFM - Our radiologists felt more confident in the detection of microcalcification and architectural distortion using the synthetic mode of imaging. - The use of synthesized 2D Mammography improves the characterization of the lesions compared to FDDM

CONCLUSION
- Synthesized 2D Mammography has at least the same sensitivity as the conventional 2D mammography. - More clinical trials are needed to evaluate better the specificity of the synthesized 2D mammography in different kind of lesions. - As other studies show, Digital Breast Tomosynthesis combined with 2D Mammography has better sensitivity than 2D Mammography alone.

Clinical relevance/application
Digital 3D Breast Tomosynthesis and Synthesized 2D Mammography increase the mammograms’ sensitivity and decrease the radiation dose compared to conventional 2D mammography and Tomosynthesis.

SSK01-07 • Radial Scar: A Diagnostic Challenge in Breast Cancer Screening Using Tomosynthesis

Per Skaane MD, PhD (Presenter) *; Randi Gullien RT *; Ellen B Eben MD *; Unni Haakenaasen MD *; Ingvild N Jebsen *; Mona Krager MD *; Jon Lomo MD

PURPOSE
Radial scar is a benign lesion presenting with distortion or spiculations on mammography that mimic cancer. Diagnosis requires open surgical biopsy. The purpose of the study was to analyse the number of mammographic findings later confirmed as radial scars on excisional biopsy in mammography screening comparing full-field digital mammography (FFDM) and combined FFDM plus digital breast tomosynthesis (DBT).

METHOD AND MATERIALS
From Nov 22, 2010 to Dec 31, 2012 (one screening round), a total of 34,742 women attended an organized population-based screening program, of which 25,547 (73.5%) underwent FFDM plus DBT. All exams (bilateral CC and MLO views) were prospectively interpreted by 4 independent readers using a 5-point rating scale for probability of cancer. The trial had 4 arms: Arm A FFDM only, Arm B FFDM plus CAD; Arm C FFDM plus DBT; and Arm D synthetic 2D plus DBT. Women with distortion suspected by at least one of the 4 independent readers were discussed at arbitration meeting before decision to recall for assessment or not. Diagnostic work-up included additional mammographic views, ultrasound, MRI as problem-solver, and needle biopsy or diagnostic surgical biopsy, if indicated. Open surgical biopsy was carried out in women with highly suspicious distortion when malignancy was not confirmed at needle biopsy.

RESULTS
A total of 31 radial scars were diagnosed at open surgery. One case having only FFDM (no DBT) was excluded in the comparison. Thus, at total of 30/25,547 (0.12%) of screened women with radial scar (“a false positive mammographic finding”) underwent surgical biopsies. In the 4 reading arms, the number of positive scores in these 30 women were: Arm A=7 (23%), Arm B=10 (33%), Arm C=25 (83%), and Arm D=23 (77%).

CONCLUSION
Radial scars (“complex sclerosing lesions”) are much better demonstrated on tomosynthesis than on FFDM and consequently these lesions will be more commonly found using DBT. Breast lesions presenting as highly suspicious distortions need open surgical biopsy if needle biopsy does not confirm malignancy. The problem is, however, minor and diagnostic surgical biopsy was only necessary in 0.12% of women in this study.

Clinical relevance/application
The benefits of tomosynthesis in breast cancer screening including higher cancer detection rates outweigh the adverse effect of false positive mammographic findings caused by radial scars.
SSK01-08 • Imaging and Histopathology Findings of Breast Lesions Detected by Tomosynthesis

Laurie L Fajardo, MD, MBA (Presenter) *; Limin Yang, MD, PhD; Jeong Mi Park MD

PURPOSE
To assess imaging characteristics, histopathology results, cancer detection rate and biopsy PPV3 for lesions detected only by digital breast tomosynthesis (DBT) when used in combination with 2D digital mammography (DM) in a general population-screening group.

METHOD AND MATERIALS
Beginning September 2012, we offered DBT in addition to conventional DM to all women presenting for screening. To compare characteristics of lesions detected by DM with those detected additionally by DBT, we prospectively gathered information from biopsy recommendations for each, including: age, BI-RADS breast density rating, final BI-RADS assessment, lesion type and size, type of biopsy performed and histopathology outcomes. For all cancers diagnosed, the pathologic size, grade and lymph node status were ascertained.

RESULTS
For 4350 women undergoing screening from 9/2012 through 3/2013, 50 biopsy recommendations were made, including 15 biopsies in 1260 women choosing to undergo DBT as part of their screening exam. Lesions recommended for biopsy by DM included: 19 calcifications of which 2 were invasive cancer, 5 DCIS and 12 benign; 14 masses of which 6 were invasive cancer and 8 were benign; and 2 focal asymmetries - both benign. Characteristics of DBT detected lesions recommended for biopsy included: 6 masses of which 5 were invasive cancers and 1 benign; and 8 architectural distortions of which 6 were invasive cancers and 4 were benign. All DBT detected lesions were visible by and biopsied using ultrasound guidance. The biopsy PPVs for 2D digital mammography and DBT were 0.37 and 0.73, respectively. Pathologically, cancers detected only by DBT comprised 7 invasive ductal carcinomas, 3 invasive lobular carcinomas and 1 mixed ductal-invasive carcinoma. A majority of DBT detected cancers were small (pathologic size: 5 = 10mm, 4 = 11-20mm, and 2 = 20mm); low or intermediate pathologic stage (6 = Elston-Ellis grade 1; 4 = grade 2; 1 = grade 3); and lymph node negative (9/11).

CONCLUSION
Fifteen additional cancers (30% increase) were detected and PPVs improved by DBT when combined with DM in our screening population. Our early experience with suspicious lesions seen only by DBT indicates the majority are clinically significant and curable.

CLINICAL RELEVANCE/APPLICATION
The addition of DBT to DM for screening improves cancer detection rate and biopsy PPV by detecting, additional small, early stage breast cancers beyond those detected by conventional DM.

SSK01-09 • How Tomosynthesis Optimizes Patient Work Up, Throughput, and Resource Utilization

Liane E Philpotts, MD (Presenter) *; Vivek B Kalra, MD; Jacqueline Crenshaw, RT; Reni S Butler, MD

PURPOSE
To examine patient throughput with 3D mammography (tomosynthesis) versus 2D mammography for screening and diagnostic exams in terms of number of images obtained per exam and room/resource utilization at a dedicated breast center.

METHOD AND MATERIALS
The number of mammogram exams for a one year period prior to (8/1/10 – 7/31/11) and after (3/1/12 - 2/28/13) tomosynthesis introduction was retrospectively assessed. The number of screening and diagnostic exams performed on 3 digital mammography units (Selenia, Hologic, Bedford, MA) versus the same 3 digital mammography units plus one tomosynthesis unit (Dimensions, Hologic) were compared to determine volumes for individual units. Given that the number of views per screening case is similar, the number of images obtained per diagnostic case was retrospectively assessed over a one week period for the 2D cases (7/22/11-7/27/11) and the cases performed with tomosynthesis (3/4/13-3/9/13).

RESULTS
For the one year prior to tomosynthesis, 9462 screening and 4611 diagnostic exams were performed on three digital mammography units, for a total of 14,073 exams, or 4,691 exams per unit. After the incorporation of tomosynthesis, 11,101 screening and 5357 diagnostic exams were performed, for a total of 11,507 exams, or 4,691 exams per unit. For the one year prior to tomosynthesis, 9462 screening and 4611 diagnostic exams were performed, for a total of 14,073 exams, or 4,691 exams per unit. After the incorporation of tomosynthesis, 11,101 screening and 5357 diagnostic exams were performed, for a total of 11,507 exams, or 4,691 exams per unit. For the one year prior to tomosynthesis, 9462 screening and 4611 diagnostic exams were performed, for a total of 14,073 exams, or 4,691 exams per unit. After the incorporation of tomosynthesis, 11,101 screening and 5357 diagnostic exams were performed, for a total of 11,507 exams, or 4,691 exams per unit. For the one year prior to tomosynthesis, 9462 screening and 4611 diagnostic exams were performed, for a total of 14,073 exams, or 4,691 exams per unit. After the incorporation of tomosynthesis, 11,101 screening and 5357 diagnostic exams were performed, for a total of 11,507 exams, or 4,691 exams per unit. For the one year prior to tomosynthesis, 9462 screening and 4611 diagnostic exams were performed, for a total of 14,073 exams, or 4,691 exams per unit. After the incorporation of tomosynthesis, 11,101 screening and 5357 diagnostic exams were performed, for a total of 11,507 exams, or 4,691 exams per unit. For the one year prior to tomosynthesis, 9462 screening and 4611 diagnostic exams were performed, for a total of 14,073 exams, or 4,691 exams per unit. After the incorporation of tomosynthesis, 11,101 screening and 5357 diagnostic exams were performed, for a total of 11,507 exams, or 4,691 exams per unit. For the one year prior to tomosynthesis, 9462 screening and 4611 diagnostic exams were performed, for a total of 14,073 exams, or 4,691 exams per unit. After the incorporation of tomosynthesis, 11,101 screening and 5357 diagnostic exams were performed, for a total of 11,507 exams, or 4,691 exams per unit. For the one year prior to tomosynthesis, 9462 screening and 4611 diagnostic exams were performed, for a total of 14,073 exams, or 4,691 exams per unit. After the incorporation of tomosynthesis, 11,101 screening and 5357 diagnostic exams were performed, for a total of 11,507 exams, or 4,691 exams per unit. For the one year prior to tomosynthesis, 9462 screening and 4611 diagnostic exams were performed, for a total of 14,073 exams, or 4,691 exams per unit. After the incorporation of tomosynthesis, 11,101 screening and 5357 diagnostic exams were performed, for a total of 11,507 exams, or 4,691 exams per unit.

CONCLUSION
Tomosynthesis results in decreased numbers of images necessary per diagnostic case. Such expedited work up translates to better patient throughput and resource utilization. Such information is important in factoring equipment purchases and resource scheduling.

CLINICAL RELEVANCE/APPLICATION
Tomosynthesis expedites patient diagnostic workup and results in better patient throughput and resource utilization.

SSK02 • Should Flat Epithelial Atypia Identified on Stereotactic Core Needle Biopsy of Calcifications Be Excised?

Erin I Neuschler, MD (Presenter); Alyssa Choate, MD; Megan Sullivan; Ellen B Mendelson, MD *; Elise E Saddleton, MD; Paula M Grabler, MD

PURPOSE
To assess the upgrade rate to malignancy for flat epithelial atypia (FEA) diagnosed on stereotactic core needle biopsy (SCNB) performed for calcifications and to determine if radiologic features or clinical history can be used to identify criteria for excision.

METHOD AND MATERIALS
An institutional review board-approved, HIPAA-compliant, retrospective review of 3919 consecutive SCNB procedures performed from 9/2008 through 12/2012 was performed. Pure FEA was present in 163 biopsies, with 146 biopsies included in the analysis. Biopsies excluded from the analysis comprised those from patients who did not have diagnostic mammography at our institution, calcifications associated with a mass or asymmetry or calcifications present in a patient with a known ipsilateral malignancy. Clinical data was collected from the patient’s medical record. Mammographic imaging prompting biopsy was re-reviewed in a blinded fashion by two dedicated...
The low upgrade rate of 4.1% for pure FEA demonstrated in this study suggests that mammographic follow-up may be a reasonable alternative to surgical excision for FEA diagnosed on SCNB for classifications. To the authors' knowledge, this is the largest study evaluating upgrade of FEA detected on SCNB where all imaging prompting biopsy was re-reviewed.

**CONCLUSION**

The low upgrade rate for pure FEA demonstrated in this study suggests that mammographic follow-up may be a reasonable alternative to surgical excision in patients with FEA detected on SCNB.

**SSK02-02 • Is the Risk of Malignancy at Surgery Greater When Flat Epithelial Atypia (FEA) and Lobular Neoplasia (LN) Are Found in Association at Biopsy?**

**Mona M El Khoury** MD (Presenter) ; **Isabelle Trop** MD, MPH ; **Lucie Lalonde** MD ; **Maude Labelle** MD ; **Julie David** MD

**PURPOSE**

1) To determine the frequency of malignancy at surgical excision of biopsy-proven pure FEA (2) to assess the significance of associated LN and residual microcalcifications at biopsy on the final upgrade at surgery.

**METHOD AND MATERIALS**

Retrospective review of 8907 core needle biopsies (CNB) (2009-2012) identified 110 cases of FEA (12%). Patients with associated atypical ductal hyperplasia (ADH) and ipsilateral breast cancer were excluded. Eighty-one women (mean age 54, range 38-80) of whom 5 had 2 biopsies were included. The 86 FEA lesions were pure or associated with LN in respectively 63/86 (73%) and 23/86 (27%). Overall, 63 (73%) lesions were excised and 23 (27%) were followed up (mean follow up 12 months).

**RESULTS**

Malignancy was documented at surgery in 9 /63 (14 %) patients (4 DCIS and 5 low-grade invasive cancers). The most frequent radiologic presentation was a cluster of microcalcifications (72/86 (84%) followed by a mass and distortion, in respectively 12/86 (14%) and 2/86 (2%). Biopsy was performed with a 10G vacuum-assisted device or a 14G spring-loaded needle in respectively 76/86 (88 %) and 10/86 (12 %) patients. The association of FEA with LN, the size of the cluster of microcalcifications and the presence of residual microcalcifications post biopsy were not significantly associated with final upgrade at surgery. There was a statistically significant association between the two parameters, needle size and radiologic presentation on one side and final upgrade at surgery on the other: FEA presenting as a mass was significantly more often upgraded to malignancy than microcalcifications (p= 0.0012) as was FEA diagnosed at biopsy with a 14G versus 11G vacuum assisted needle (p= 0.0015).

**CONCLUSION**

The 14 % upgrade rate of FEA was not significantly affected by concomitant LN at biopsy. Surgical excision of all FEA lesions, including the pure ones, is warranted. When FEA presented as a mass, it was more likely to be upgraded to malignancy.

**CLINICAL RELEVANCE/APPLICATION**

FEA is a risk lesion with no clear guidelines regarding its management. Our 14 % upgrade rate was not affected by concomitant LN or residual calcifications. We recommend excision of all FEA lesions.

**SSK02-03 • Impact of Biopsy Method and Tumor Localization on Sentinel Lymph Node Mapping**

**Julia Kramer** MD (Presenter) ; **Anja Dutschke** ; **Clemens G Kaiser** MD, BA ; **Andreas Schnitzer** MD ; **Stefan O Schoenberg** MD, PhD * ; **Klaus Wasser** MD

**PURPOSE**

This is the first study assessing the impact of both, method of biopsy (vacuum biopsy vs. core cut biopsy) and tumor localization on the evaluation of lymphscintigraphy for sentinel node biopsy in breast cancer patients.

**METHOD AND MATERIALS**

616 patients with lymphscintigraphy were included retrospectively from 2008 until 2012. 99mTc-labeled colloid was injected periareolary and the sentinel lymph node was located by gamma camera. Depending on the signal intensity the scintigraphy was defined as excellent, adequate, weak or absent by two readers experienced in radiology and nuclear medicine. 44 patients had a preliminary stereotactic vacuum biopsy and 572 patients received ultrasound guided core cut biopsy for histological proof of the tumor.

**RESULTS**

Using vacuum biopsy 6 of 25 patients (24%) with a tumor localization in the upper outer quadrant showed a weak or absent lymphscintigraphic signal. Only one of 19 patients (5%) with a tumor in another localization showed a weak or absent signal after vacuum biopsy (odds ratio 5.7). In terms of ultrasound guided core cut biopsy 33 of 315 patients (10%) showed only weak or absent signal on lymphscintigraphy with a tumor localization in the upper outer quadrant. This was the case in 30 of 257 patients (12%) with a tumor in other localizations (odds ratio 0.9).

**CONCLUSION**

Using vacuum biopsy especially in the upper lateral quadrant could lead to a substantial reduction of quality in sentinel lymph node mapping after periareolary radionuclide injection. A reason might be an extended trauma to the surrounding tissue constricting lymphatic circulation. Further studies should consider the impact of the interval between biopsy and sentinel lymph node mapping.

**CLINICAL RELEVANCE/APPLICATION**

Using vacuum biopsy especially in the upper outer quadrant could lead to a substantial reduction of quality in following sentinel lymph node mapping with periareolary radionuclide injection.

**SSK02-04 • Role of FDG PET-CT, Ultrasound and Ultrasound-guided Fine Needle Aspiration Biopsy in the Diagnosis of Axillary Lymph Nodes in Patients with Breast Cancer: Comparison of Their Diagnostic Performances**

**Yu Mee Sohn** PhD (Presenter) ; **II Ki Hong** MD ; **Han Na Lee** MD

**PURPOSE**

The aim of this study was to compare the diagnostic performance of FDG PET-CT and those of US and US-FNA in the preoperative evaluation of axillary lymph node (ALN) status and to evaluate the factors related to false negative results of PET-CT, US, and US-FNA in nodal staging of invasive ductal carcinoma (IDC).

**METHOD AND MATERIALS**

From March 2009 to July 2012, total 226 patients were diagnosed with primary breast cancer. Among them, 107 patients were composed of this study population after exclusion of transferred patients or patients with other breast cancer besides IDC. The diagnostic performances of FDG PET-CT, US and US-FNA were compared with a pathologic report regarding the presence and the number of ALN metastasis. The SUV of PET-CT to differentiate the metastatic lymph node were also evaluated. We assessed univariate and multivariate analyses for statistically significant predictor factors.
analysis to evaluate the relationship between the clinicopathologic factors (symptoms, T-stage, hormone receptor, histologic grade) and false negative results and true negative results of PET-CT, US, and US-FNA after review of medical and pathologic reports.

RESULTS
Among 107 patients, forty five patients (42.1%) showed positive results on final pathology. US-FNA had significantly higher specificity, PPV and accuracy than US and FDG PET-CT (p < 0.001). The area under the ROC curve value of US-FNA was also significantly higher than other modalities (p < 0.01). The cut off value of SUV of PET-CT to diagnose metastatic lymph node was 1.6 with sensitivity of 78.9% and specificity of 75.0%. Among these modalities, the false negative rate was highest in US (28.9%) and the false positive rate was highest in PET-CT (25.8%). And there was no significant clinicopathologic factors related to false negative results of three modalities.

CONCLUSION
US-FNA had the most excellent diagnostic tool for the preoperative evaluation of nodal status of IDC among three modalities. The cut off value of SUV of PET-CT to differentiate metastatic from benign lymph node was 1.6.

CLINICAL RELEVANCE/APPLICATION
Clinical relevance: US-FNA had the most excellent diagnostic tool for the preoperative evaluation of nodal status of IDC among FDG PET-CT, US and US-FNA.

SSK02-05 • Axillary Lymph Node Biopsy beyond Breast Cancer: What Are the Pathologic Findings of Suspicious Nodes Identified on Axillary Ultrasound?
Rakhee H Goel MD (Presenter); Alice S Rim MD; Melanie Chellman-Jeffers MD

PURPOSE
The widespread use of multimodality imaging has lead to the discovery of findings of unknown clinical significance, such as the identification of hypermetabolic axillary lymph nodes on PET/CT. Clinicians are increasingly turning to breast imagers in order to assess abnormal axillary lymph nodes and obtain pathology. Our aim is to report the pathologic results for axillary lymph node biopsy in patients with otherwise normal mammograms.

METHOD AND MATERIALS
A retrospective review was performed for all patients who obtained an axillary lymph node needle biopsy with otherwise normal mammogram between 2009 - 2012. Data collected and analyzed was: Demographics, comorbidities, ultrasound lymph node characteristics, CT/MR imaging findings, needle biopsy results, and surgical excision results if performed.

RESULTS
88 patients with normal mammograms underwent ultrasound guided needle biopsy of suspicious axillary lymph nodes (mean age = 58). Forty four patients had either normal or benign proliferative pathologic results, of which 15 patients had known autoimmune diseases including rheumatoid arthritis, Churg-Strauss, and angio-edema. Six patients were diagnosed with breast cancer. Lymphoma was found on biopsy for 16 patients (18%) (for 8 patients the abnormal nodes were first noted on mammogram). Only 5 of the 16 lymphoma patients demonstrated bilateral axillary adenopathy. Additional diagnoses included polyclonal gammapathy (3 patients), granulomatous inflammation (sarcoid, BCG-related, and Cat-scratch) (5 patients), dermatopathic changes (6 patients), ovarian cancer metastatic disease (2 patients), and reactive nodes (ie associated with breast hiradenitis suppurativa) (6 patients).

CONCLUSION
A large number of ultrasound guided axillary lymph node biopsies lead to actionable pathologic diagnoses, including lymphoma, breast cancer, infection/inflammation, and newly diagnosed metastatic disease; emphasizing the importance of thorough evaluation of suspicious axillary lymph nodes.

CLINICAL RELEVANCE/APPLICATION
Axillary lymph node ultrasound with biopsy is valuable in the evaluation of non-breast cancer pathology, including malignancy, infection, and auto-immune diseases.

SSK02-06 • Cancer Detection Rate on Short-term, as well as Long-term Follow-up MRI after a Benign Concordant MRI-guided Breast Biopsy
Elana I Den MD (Presenter); Susan P Weinstein MD; Susan G Roth MD

PURPOSE
To determine the cancer detection rate on short-term and long-term follow-up MRI after a benign concordant MRI-guided breast biopsy.

METHOD AND MATERIALS
A HIPAA-compliant, IRB-approved retrospective review of medical records at a large tertiary care institution was undertaken to identify all the benign concordant MRI-guided breast biopsies performed from January 2005 – December 2011 that received follow-up MRI. All malignant and discordant cases were excluded. All longitudinal MRI follow-up (as well as mammographic and ultrasound follow-up) was reviewed and recorded from January 2011 to February 2013. Any subsequent core needle or excisional biopsies of the MRI-guided biopsy sites were also reviewed. The overall cancer detection rate was determined based on the follow-up MRI studies and electronic medical records.

RESULTS
A total of 802 MRI-guided breast biopsies were performed from 2005-2011, of which 172 had benign concordant results and MRI follow-up. The mean age at biopsy was 53.5 years (range 24-78 years). Longest follow-up times were as follows: 4 patients had up to 6 months follow-up, 33 had 6-12 months of follow-up, 37 had 1-2 years of follow-up, 31 had 2-3 years of follow-up, and 67 had greater than 3 years of follow-up. Only one patient who had a benign MRI-guided biopsy was diagnosed with ductal carcinoma in situ on follow-up. Calcifications were detected at the MRI biopsy site on six-month mammography although the MRI remained negative, with only postbiopsy changes seen. No patients who had benign concordant MRI-guided biopsies were subsequently found to have pathology-proven invasive cancer.

CONCLUSION
The cancer detection rate on patients with MRI follow-up after a benign MRI-guided biopsy was 1/172 (0.6%). Our data suggests that there is low utility to either short-term or long-term MRI follow-up after a benign concordant MRI-guided biopsy.

CLINICAL RELEVANCE/APPLICATION
Short-term or long-term follow-up breast MRI does not appear to be useful for further cancer detection after a benign concordant MRI-guided breast biopsy.

SSK02-07 • Percutaneous Cryoablation (PCA) as Local Therapy for Patients with Breast Cancer and Bone Metastases (BCBM)
Claudio Pusceddu MD (Presenter); Luca Melis; Sara Pilleri; Barbara Sotgia; Rosa Maria Fele; Gianni Amuccano; Giovanni Battista Meloni

PURPOSE
The aim was to evaluate the safety and efficacy of PCA as local therapy for patients with breast carcinomas and bone metastases.

METHOD AND MATERIALS
PCA was used to treat fifteen breast lesions, mean size 2.4 (range 0.8-6.7 cm) in thirteen consecutive patients, mean age 52 (36-81) with core-needle biopsy-proven breast carcinoma and bone metastases. 11 patients had one lesion and two patients had 2 lesions. The tumour and surrounding breast tissue were ablated with percutaneous CT-guided cryoablation under local anesthesia and mild conscious sedation. Cryoablation consisted of 2 cycles each of 10 minutes of freezing followed by a 4-min active thawing phase and a 4-min passive...
RESULTS

All PCA sessions were successfully completed and all breast tumours were ablated. Morbidity consists in transient and mild ecchymotic changes and post-procedural oedema seen in six cases and alteration in skin pigmentation seen at the point of insertion of the cryoprobes in other two cases. The therapeutic outcomes were evaluated by contrast-enhanced CT or MRI at 1-, 3- and 6-month interval. The absence of contrast enhancement by the tumour on CT or MR image was considered complete tumour necrosis. During the mean follow-up of 11 months (3–24 months) none of the patients had shown local relapses. A patient died because of liver tumour progression after 16 months.

CONCLUSION

Our preliminary results suggest that cryoablation of breast carcinomas and bone metastases is a well-tolerated, safe and effective procedure. However, further follow up and a prospective controlled trial is necessary to validate the procedure.

CLINICAL RELEVANCE/APPLICATION

In patients with breast cancer and bone metastases cryoablation can be considered as a feasible and effective treatment as local therapy for the breast tumor.

SSK02-08 • Clinical Experience in Noninvasive Treatment of Focal Breast Cancer with Magnetic Resonance Guided High Intensity Focused Ultrasound (MRgFUS)

Luisa Di Mare MD (Presenter); Alessandro Napoli MD; Federica Pediconi MD; Michele Anzidei MD; Vincenzo Noce MD; Carlo Catalano MD

PURPOSE

To assess safety and feasibility of non-invasive high intensity 3T MR guided focused Ultrasound (MRgFUS) ablation of biopsy-proven invasive ductal breast cancer (IDC) (stage T1 MO NO) before surgical resection and sentinel lymph node biopsy

METHOD AND MATERIALS

Our retrospective study included 12 patients with unifocal biopsy-proven IDC, scheduled and consented to lumpectomy and sentinel lymph node biopsy. We use 3T MRI exam (Discovery 750, GE; Gd-BOPTA, Bracco) to confirm presence and treatable location of enhancing lesion (less than 2 cm). Patient underwent day-surgery single session MRgFUS treatment using ExAblate 2100 system (InSightec), under IRB approval. Post-surgery pathology evaluation test the efficacy of the treatment.

RESULTS

No significant complications were observed in all subjects during or immediately after the procedure. In 10 patients, multiparametric MRI no shows enhancement at breast treatment area. Post-surgery histological evaluation confirmed the absence of residual neoplastic foci in necrotic tissue area with at least 5 mm margins of normal breast tissue in all 10 patients. In 2 cases treatment failed due to transducer malfunction, and pathologist observed 15% of residual tumor. Results demonstrate excellent agreement between pathology and post-treatment MRI.

CONCLUSION

MRgFUS is a promise treatment to determines focal and noninvasive excision of unifocal breast cancer, according to histopathology findings.

CLINICAL RELEVANCE/APPLICATION

MRgFUS is an innovative incisionless technique to obtained reliable ablation of invasive breast cancer and successful clinical outcome.

SSK02-09 • Assessment of Breast Abscess Outcomes Following Ultrasound-guided Percutaneous Drainage

Christopher P Ho MD (Presenter); Sean Necessary MD; Bhavika K Patel MD; Rebecca L Seidel MD; Kathleen R Gundry MD; Michael A Cohen MD

PURPOSE

Breast abscesses have traditionally been managed surgically. There has been an increased role for minimally invasive management utilizing ultrasound-guided percutaneous drainage. We assessed those who received percutaneous drainage and examined outcomes to determine the efficacy and viability of managing breast abscesses with minimally invasive techniques.

METHOD AND MATERIALS

Consecutive patients with suspected breast abscesses were reviewed spanning a period from July 2011 to March 2013. Factors including abscess size, pre-existing patient conditions, volume of fluid aspirated, antibiotic use, and bacterial cultures were recorded. The procedure was termed “successful” if the abscess resolved following percutaneous drainage(s) and thus, surgery could be avoided.

RESULTS

81 patients had breast abscesses by imaging and underwent ultrasound-guided percutaneous drainage. The average age of the patients was 42.2 years, average maximal measured diameter of the abscess was 4.0 cm and the average volume of fluid/pus aspirated was 22.3 cc. Pre-disposing factors seen included: 7 patients with HIV, 4 smokers, 10 diabetic patients, 10 with history of previous breast surgical interventions. 65 (80.2%) of the 81 abscesses resolved following percutaneous drainage. Of the successful aspirations, 53 (81.5%) resolved after a single aspiration. 12 patients required additional drainages, ranging from 1 to 3 repeat examinations, however these abscesses did ultimately heal without surgery. 16 breast abscess required surgical intervention. Among the failures requiring surgical intervention, 4 patients had large volumes of fluid aspirated (range 50 – 290 cc) on initial aspiration and 3 patients had no fluid aspirated because the fluid was either too thick or predominantly solid/phlegmonous.

CONCLUSION

80% of breast abscesses can be managed with percutaneous drainage and antibiotics. The majority of patients require only a single aspiration. Large initial abscess size and the volume of fluid/pus aspirated appear to be factors that may predict percutaneous aspiration failure. Our experience would indicate that percutaneous drainage with concomitant antibiotics should be considered the first line of management for breast abscess.

CLINICAL RELEVANCE/APPLICATION

Given the successful management and patient outcomes of breast abscesses treated conservatively with percutaneous drainage, a shift in the traditional treatment paradigm should be considered.

Cardiac (Coronary CT/MR IV)

Wednesday, 10:30 AM - 12:00 PM • S504AB
SSK03-01 • Feasibility of Calcium Image Subtraction Using Second-generation 320-detector Row Coronary CT Angiography

Andreas Fuchs (Presenter); J. Tobias Kuhl; Marco Razeto *; Arakita Kazumasa *; Steffen Helqvist; Joanne Schuijf *; Marcus Y Chen MD; Andrew E Arai MD; Klaus Kofoed MD

PURPOSE
The reader confidence and diagnostic accuracy of Coronary CT angiography (CCTA) can be compromised by the presence of calcified plaques causing blooming artifacts. Compared to conventional invasive coronary angiography (CAG), this may cause an overestimation of stenosis severity leading to false positive results. We tested the feasibility of a new coronary calcium image subtraction algorithm in relation to reader confidence and diagnostic accuracy.

METHOD AND MATERIALS
Twenty-seven patients underwent both CAG and CCTA on clinical indication using a second-generation 320-detector row CT. Median Agatston score was 345 (interquartile range 110-1328). Two datasets were reconstructed: a conventional CCTA (conCCTA) and a subtracted CCTA (subCCTA), where calcifications detected on non-contrast images were subtracted from the CCTA. Reader confidence (1=poor, 2=partially diagnostic, 3=diagnostic) and concordance with CAG for identification of >50% stenosis (17 segment model) were recorded. We defined study lesions on conCCTA as motion free coronary segments with calcified plaque. The impact of coronary calcium image subtraction was assessed in these coronary segments.

RESULTS
A total of 130 study lesions were identified. Out of these, low reader confidence (less than 3) was found in 41 due to severe coronary calcification or stents. The use of coronary calcium image subtraction improved the reader confidence in 36% (13/36) of the segments with severe calcification and in 60% (3/5) of the segments with coronary stents. In 31 of the study lesions CAG found stenosis >50%. With conCCTA the false positive rate in study lesions was 18% (24/130) compared to 14% (19/130) with subCCTA.

CONCLUSION
Our initial experience with coronary calcium image subtraction suggests that it is feasible, and could lead to an improvement in reader confidence and diagnostic accuracy for identification of significant coronary artery disease.

CLINICAL RELEVANCE/APPLICATION
Coronary calcium subtraction may improve reader confidence and diagnostic accuracy in the presence of calcified plaques and stents, and thus may possibly improve overall diagnostic strength of CCTA.

SSK03-02 • Effect of Snapshot Freeze Motion Correction Algorithm on Image Quality of Prospective ECG-triggered Coronary CT Angiography

Lijuan Fan (Presenter); Jiwang Zhang; Donghai Fu; Liren Zhang MD

PURPOSE
We assessed Snapshot Freeze Motion Correction algorithm for its effect on image quality of coronary CT angiography (CCTA) with prospective ECG-triggered.

METHOD AND MATERIALS
Thirty consecutive patients undergoing coronary CTA with prospective ECG-triggered. We compared image quality and interpretability between standard (STD) and snapshot freeze motion correction (SSF) reconstructions. Coronary CTA images were interpreted with Likert 5-points score by two experienced radiologists. The image qualities and interpretability were respectively assessed on per-patient, per-artery and per-segment levels. Comparisons of variables were performed with Wilcoxon rank sum test and McNemar test.

RESULTS
CONCLUSION
The use of snapshot freeze motion correction algorithm improves image quality and interpretability in patients undergoing prospective ECG-triggered coronary CTA.

CLINICAL RELEVANCE/APPLICATION
The use of snapshot freeze motion correction algorithm improves image quality and interpretability in patients undergoing prospective ECG-triggered coronary CTA.

SSK03-03 • Association of Calcium Score and Coronary Artery Disease on CCTA according to the Presence and the Degrees of Diabetic Retinopathy: Preliminary Results

Eun Young Kim (Presenter); Joon-Won Kang MD; Dong Hyun Yang MD; Tae-Hwan Lim MD, PhD

PURPOSE
To compare the difference of coronary artery calcium (CAC) score, plaque characterization and coronary artery disease in diabetes mellitus (DM) patients according to the presence and the type of retinopathy using coronary CT angiography (CCTA).

METHOD AND MATERIALS
From 1 February 2009 to 31 July 2011, 172 consecutive patients (89 men, 83 women mean age, 65.4±9.3 years) diagnosed with type 2 DM and CCTA taken were enrolled. The patients were categorized according to the presence of diabetic retinopathy (DR) and the types of DR. Differences in CAC score, plaque score, segment score and degree of stenosis were compared, simultaneously using Chi-square test and T-test.

RESULTS
The study patients were divided into 3 groups; no retinopathy (n=37), non-proliferative (NPDR, n=91) and proliferative DR (PDR, n=44). The average of HbA1c (8.3±1.4, p=0.003), total cholesterol (163.0±42.3, p=0.014) and DM duration (20.7±6.5, p=0.000) were significantly high in PDR patients among three groups. Of 172 DM patients, 137 (80 %) showed DR. There was statistically significant difference in CAC score (p=0.002) between the presence and absence of retinopathy. Segment score (p=0.01) and plaque score (p=0.04) was significantly higher in patients with DR as well. In patients with PDR, compared with NPDR, all of CAC score (p=0.012), the presence of significant stenosis (p=0.003) and multivessel disease (p=0.013), segment score (p=0.000) and plaque score (p=0.000) was significantly higher.

CONCLUSION
CAC score, plaque burden is significantly higher in DR and it becomes clear that in addition to that result, significant stenosis is more common in PDR patients. At least, proliferative diabetic retinopathy patients need to identify coronary artery disease with CCTA.

CLINICAL RELEVANCE/APPLICATION
This study suggested that PDR could be a predictor for CHD in asymptomatic type 2 diabetic patient and PDR patients need to start screening test for CHD through the CCTA.

SSK03-04 • Combined Assessment of MR Flow Measurement of Coronary Artery Bypass Graft and Stress Perfusion MRI in Detecting Graft Stenoses

Tatsuro Ito MD (Presenter); Masaki Ishida MD, PhD; Kakuya Kitagawa MD, PhD; Hiroshi Nakajima MD; Kaoru Dohi; Shinji Kanemitsu; Hitotada Shimpo; Masaaki Ito; Hajime Sakuma MD *
Purpose
Stress myocardial perfusion MRI is useful for the detection of flow-limiting coronary stenosis. However, reduced sensitivity of stress myocardial perfusion MRI was reported in patients after coronary artery bypass grafts (CABG). MR flow measurement can provide functional assessment of CABG and permits non-invasive detection of significant graft stenoses. The purpose of this study was to evaluate the value of combined assessment of MR graft flow measurement and stress myocardial perfusion MRI for the detection of graft stenoses.

Method and Materials
Forty-eight patients (68±7 years) with CABG who had recurrent chest pain and underwent both coronary angiography and cardiac MRI including stress perfusion, late gadolinium enhancement (LGE) MRI and MR graft flow measurement within 3 months were studied. The observers recorded the presence or absence of myocardial ischemia using 4-point scale. The threshold of 24.8 ml/min, determined by ROC analysis, was used for identifying functional abnormality of the graft. Stenoses >70% in bypass grafts were considered significant.

Results
Ninety-nine grafts were eligible for the analysis. MR graft flow measurement was inconclusive due to metal artifact in 6 (6%) grafts, whereas stress perfusion MRI was diagnostic in all patients. When 93 areas with successful flow measurements were evaluated, the diagnostic performance assessed by the area under the ROC curve (AUC) was significantly higher with MR graft flow measurement (AUC 0.924; sensitivity 90%; specificity 85%) than with stress perfusion MRI (AUC 0.793; sensitivity 70%; specificity 74%) (p=0.040) (Figure 1). In the analysis of all 99 areas with bypass grafts, stress perfusion MRI yielded a sensitivity of 70% and a specificity of 75% in detecting significant graft stenoses. These values were improved to 87% and 86% by combining MR graft flow measurement and stress perfusion MRI, using MR flow measurement as a primary determinant.

Conclusion
MR graft flow measurement combined with stress perfusion MRI can provide excellent diagnostic accuracy for the detection of graft stenoses in patients after CABG.

Clinical Relevance/Application
MR graft flow measurement combined with stress perfusion MRI is highly valuable for the accurate detection of graft stenoses in patients after CABG.

SSK03-05 • Feasibility Study of the 100kVp and 400mA Coronary CTA

Kai Zhao (Presenter); Yuan Jiang; Jian-Xing Qiu MD; Xiaoying Wang MD

Purpose
To study the image quality and radiation dose of 100 kVp and 400 mA CT imaging in patients undergoing coronary CT angiography (CCTA).

Method and Materials
From September to December 2012, 101 patients suspected of coronary artery disease were scanned by GE CT 750HD with retrospectively ECG-gated reconstruction mode, whose weight was less than 80 kg. They were divided into 100 kVp group (n=65) and 120kVp group (n=36). The patients in 100 kVp group were scanned with 100 kVp and ECG modulation tube current (peak current 400 mA), while 120 kVp group were scanned with 120 kVp and ECG modulation tube current (peak current 500 mA). Contrast medium injection rate and volume were personalized by patients’ weight (370 mgI/ml, mean 40ml). CT image raw data sets were reconstructed with ASIR-FBP composite at 30%. The effective radiation dose (ED) and size specific dose estimate (SSDE) of each patient were calculated. CT attenuation of the main vessels were measured and the image quality (noise, CNR, SNR) were estimated. Subjective evaluation was assessed by an experienced radiologist. Independent samples T test and Mann-Whitney U test were performed to compare the difference between the 2 groups.

Results
To those whose body weight is less than 80 kg, CCTA obtained by 100 kVp, may obtain diagnostic image quality with more than half of the radiation dose reduction.

Clinical Relevance/Application
High radiation exposure for CCTA is a concern and a limitation for its use, 100kVp and 400mA provide a feasible way to solve the problem for most people.

SSK03-06 • Accuracy of Coronary Plaque Detection Using a Semiautomatic Plaque Analysis Software in Computed Tomography Coronary Angiography

Azien Laqmani (Presenter); Thorsten Klink MD; Marcus Quitzke; Domenique-Daniel Credner; Gerhard B Adam MD; Gunnar K Lund MD

Purpose
To assess the accuracy of coronary plaque detection with a semiautomatic plaque analysis software in computed tomography coronary angiography (CTCA) with a 256-MSCT scanner.

Method and Materials
The software automatically identified 114 structures as plaques. 32 (28%) of the automatically marked lesions complied with plaques (true-positive). 82 (72%) of the lesions did not correspond with visually detectable plaques (false-positive). 20 plaques were manually detected by observers but not by the software (false-negative). For 82 false-positive detected plaques the following potential reasons were noticed by the observers: high density in pericoronary fat (59%), vessel ramification (24%), contrast in adjacent veins (6%), artery kinking (4%) and falsely contured vessel (7%).

Conclusion
The evaluated semiautomatic plaque analysis software demonstrates a very high false-positive detection rate of coronary plaques.

Clinical Relevance/Application
Detection of coronary plaques with a semiautomatic plaque analysis software is not reliable. A revision of the software marked lesions as plaques is indispensable.

SSK03-07 • Restriction of Referral to CTCA by Clinical Evaluation Combined with Calcium Score

Aoieshka S Dharampal MD (Presenter); Alexia Rossi MD; Admir Dedic MD; Annick C Weustink MD, PhD; Mohamed Ouhlous MD, PhD; Filippo Cademartiri MD, PhD *; Eric H Boersma PhD; Koen Nieman MD; Pim Feyter MD, PhD; Gabriel P Krestin MD, PhD *

Purpose
To investigate the value of calcium score (CaSc) in addition to clinical evaluation to restrict referral to CTCA by reducing the number of patients with intermediate probability of CAD.

Method and Materials
We retrospectively included 2042 symptomatic stable patients who underwent clinical evaluation, unenhanced CT-scan for the calculation...
of CaSc and CTCA. Obstructive CAD (=50% lumen diameter narrowing) assessed by CTCA was the outcome. We investigated 2 models, first, clinical evaluation consisting of chest pain typicality, female sex, age, risk factors and ECG) and second model consisting of clinical evaluation with CaSc. The model discrimination of CAD was compared by using area under the receiver operating characteristic curves. We assessed the net reclassification improvement (NRI) that allows both models to reclassify patients into low (\(^2\))

**RESULTS**

Discrimination of CAD was significantly improved by addition of CaSc to clinical evaluation (AUC: 0.80 vs. 0.90, \(p < 0.001\)). The NRI using both model to reclassify all patients was 56%. The clinical net reclassification improvement by model 2 of patients first classified by model 1 having intermediate risk was 66%. Unenhanced CT-scan and CTCA could be avoided in 12% using model 1 and an additional 32% of CTCA’s could be avoided using model 2 subsequently.

**CONCLUSION**

Calcium score provides incremental discrimination of CAD compared to clinical evaluation. Implementation of calcium score model can reduce referral to CT coronary angiography by 44%.

**CLINICAL RELEVANCE/APPLICATION**

Risk stratification of stable angina patients can be improved by using the calcium score model.

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**SSK03-08 • Effect of a Novel Motion Correction Algorithm (SSF) on the Image Quality of Coronary CTA with Higher Heart Rates: In Comparison with Bi-sector Reconstruction**

Qianwen Li (Presenter); Xiangying Du MD; Peng-Yu Li; Xiaoguang Yang; Kuncheng Li MD

**PURPOSE**

SnapShotFreeze (SSF) is a novel vendor-specific motion correction algorithm based on non-rigid registration in coronary CTA. The purpose of this study is to assess the effect of SSF algorithm on image quality in comparison with bi-sector reconstruction in higher heart rates.

**METHOD AND MATERIALS**

Retrospective ECG-gated coronary CTA was performed on 15 patients with higher heart rates (65-75bpm, mean 69.7 ± 3.2bpm) using a 64-row CT scanner (GE Discovery CT750 HD). The optimal SSF images were generated following the reconstruction protocol for SSF. Multi-phase bi-sector images were reconstructed as well and the optimal phase was selected for comparison with SSF images. The images were interpreted in an intent-to-diagnose fashion by 2 experienced readers using a 5-point scale with 3 point as diagnostically acceptable.

**RESULTS**

SSF algorithm can provide superior image quality than bi-sector reconstruction in coronary CTA of patients with higher heart rates.

**CLINICAL RELEVANCE/APPLICATION**

For higher heart rates patients, bi-sector reconstruction may be neglected by using the motion-correction algorithm, avoiding the higher radiation dose related to small pitch required by bi-sector.

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**SSK03-09 • Role of an Intracycle CT Motion Correction Algorithm in the Coronary CT Angiography Accuracy**

Patricia M Carrascosa MD (Presenter) *; Carlos Capunay MD; Alejandro Deviggiano MD; Gaston Rodriguez Granillo; Jorge M Carrascosa MD

**PURPOSE**

The purpose of this study is to demonstrate that coronary CT angiography (CCTA) employing a novel intracycle motion compensation algorithm (SnapShot Freeze [SSF]) will be superior to CCTA without intracycle motion compensation algorithm (“conventional” CCTA) for diagnostic accuracy and image quality.

**METHOD AND MATERIALS**

Twenty patients with known or suspected coronary artery disease were studied with MSCT and ICA. CCTA were performed on a 128-slice CT scanner (Discovery CT750 HD, GE Medical Systems). Studies were done using prospective or retrospective ECG-gating depending on the heart rate of the patients. In the prospective scan a padding of 100 msec was used, while in the retrospective scans, cardiac x-ray modulation was performed (centered 45 % to 75% of the R-R interval). First images were analyzed without the motion compensation algorithm and 2 weeks later in a random and blinded way with the algorithm.

The per-vessel and per-segment diagnostic interpretability and image quality of CCTA with and without motion compensation algorithm was calculated.

**RESULTS**

From the 20 patients studied, 299 segments were analyzed. In 215 of 299 segments, the motion compensation algorithm showed similar evaluation than conventional CCTA. In 84 segments, the motion compensation algorithm allowed a better evaluation.

In relation to vessel analysis, SSF showed improvement of vessel visualization in 30% of DA, 75% of CX and 40% of RCA. SSF had only 1 segment non evaluable whereas conventional CCTA 15. The assessability was 99.6% versus 95 % for both modalities WC had an average segment analysis of 3.1 versus 3.7 of SSF.

**CONCLUSION**

SSF allowed better visualization of the coronary arteries as well as lesser non evaluable segments in comparison to conventional CCTA.

**CLINICAL RELEVANCE/APPLICATION**

Correction of coronary arterial motion on coronary CTA using an Intracycle CT Motion Correction Algorithm would be of clinical significance.
SSK04-02 • Idiopathic Pulmonary Fibrosis: Comparison of a Quantitative Fibrosis Score and CT Indexes from Histogram as Biomarkers of Disease Severity and Surrogate Endpoints in Assessing Change

Hyun J Kim PhD (Presenter) ; Matthew S Brown PhD * ; Daniel Chong BS ; Peiyun Lu ; Heidi Coy ; Jonathan G Goldin MBChB, PhD

PURPOSE
To be a useful Quantitative Imaging Biomarker (QIB) of treatment efficacy, it should be capable of assessing severity and change of time of the disease process. CT quantitation can be based on histogram analysis of lung density or a classifier-model derived score from a set of texture features. The purpose of the study is to compare two published approaches, kurtosis of histogram analysis and the Quantitative Fibrosis Score based on a classification model to assess baseline severity and change over time in patients with idiopathic pulmonary fibrosis (IPF).

METHOD AND MATERIALS
From imaging database of standardized CT scans obtained on patients with well characterized IPF, 60 patients (29 Male with mean of Forced Vital Capacity (FVC) 63%±12) with at least baseline and paired follow-up scans were selected. After semi-automated lung segmentation, indexes of kurtosis, mean lung attenuation, variance, and skewness were derived from histogram at whole lung. Quantitative Lung Fibrosis (QLF) and Quantitative Interstitial Lung Disease (QILD) scores and volumes were calculated from a classification algorithm with denoise technique. Spearman rank correlations were used to assess associations between CT indexes and quantitative scores comparing with FVC (percent predicted) at baseline and change in FVC on follow-up.

RESULTS
At baseline, mean (±SD) of kurtosis, mean lung attenuation, variance, and skewness were 2.43 (±1.83), -760HU (±54), 44220 (±42,425), and 52L (±6.4) in volumes. All baseline histogram indexes of QLF and QILD scores were correlated with the baseline FVC (e.g. \(r = 0.57\)) but not with histological fibrosis grade.

CONCLUSION
Kurtosis is associated with physiologic measure of baseline severity but not useful for assessing change over time. A classifier-model derived score based on a set of texture features is associated with both baseline disease extent and a sensitive measure of change over time.

CLINICAL RELEVANCE/APPLICATION
For patients’ selection based on extent of disease and for measuring longitudinal changes in patients with IPF, a quantitative score derived from a classification algorithm can be used as a QIB.

SSK04-03 • Atypical UIP: Prevalence and Genetic Associations

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

PURPOSE
To determine the frequency of atypical UIP and to evaluate whether there was an association between atypical UIP and the MUC5B promoter site SNP (rs35705950), which has been strongly associated with IPF and familial PF.

METHOD AND MATERIALS
HRCT scans of 1,764 subjects with known interstitial lung disease were scored. Of these subjects, 250 subjects had both histologic and rs35705950 SNP data (GG, GT, TT). Atypical UIP was defined as subjects in whom UIP was not possible, probable, or definite on imaging diagnosis and was scored as definitely present on histology. A two-tailed Fisher’s exact test and t-test were used to compare proportions and means, respectively.

RESULTS
There were 25 atypical UIP cases and 52 typical UIP cases. The rate of atypical UIP relative to all subjects in whom UIP was not considered was 22.7%. Though the total extent of fibrosis was similar in typical and atypical UIP (19.6%, +/-17.7% vs 11.7% +/-12.2%, \(p=NS\), atypical UIP cases had a significantly higher prevalence of ground-glass opacity (19.6% +/-17.7% vs 11.7% +/-12.2%, \(p=0.019\) a lower rate of honeycombing (20% compared to 53.8%), and less subpleural preponderance (20% compared to 58%, \(p=\) CONCLUSION
A substantial percentage of subjects with an imaging pattern inconsistent with UIP have a high-confidence diagnosis of UIP on histopathology. Atypical UIP cases most commonly mimic NSIP and chronic HP. The prevalence of the rs35705950 SNP is substantially higher in typical UIP than atypical UIP.

CLINICAL RELEVANCE/APPLICATION
Exclusion of a pathologic UIP diagnosis cannot be made accurately based purely on chest CT. Optimal treatment and prognosis may differ between atypical and typical UIP patients.
SSK04-04 • Combined Pulmonary Fibrosis and Emphysema: What Are the Prognostic Factors of Survival in Symptomatic Subjects Compared with Asymptomatic Subjects?

Yong Seek Kim (Presenter) ; Kum Ju Chae ; Gong Yong Jin MD, PhD ; Young Min Han MD ; Su Bin Chon ; Young Sun Lee ; Keun Sang Kwon

PURPOSE

The aim of this study was to identify prognostic indicators among pulmonary function tests, clinical and CT features in symptomatic combined pulmonary fibrosis and emphysema (CPFE) compared with asymptomatic subjects.

RESULTS

FVC and FEV1/FVC of symptomatic patients were lower than those of asymptomatic subjects; 87.8 ± 16.7 vs. 95.7 ± 23.6, p=0.032, 72.2 ± 10.2 vs. 77.6 ± 4.1, p < 0.001. The overall sensitivity and specificity, respectively, of each reader for the diagnosis of IPF was as follows: senior attending radiologist (84%, 75%), junior attending radiologist (81%, 75%) and 1st year radiology resident (73%, 85%). Similar results were obtained when subset analysis only included patients with HRCT signs of fibrosis or patients ≥50 years of age. 6 false positive “definite UIP” interpretations were made by the senior attending radiologist whereas 22 false positive interpretations were made by the junior attending radiologist, including 14 connective tissue disease, 4 hypersensitivity pneumonitis, 1 drug toxicity and 3 idiopathic nonspecific interstitial pneumonia patients. The senior radiologist described mosaic perfusion/air trapping more often and honeycombing less often than the other two readers.

CONCLUSION

The radiologist with greater experience had a lower sensitivity and greater specificity in the HRCT diagnosis of IPF using ATS/ERS/JRS/ALAT criteria. Most false positive interpretations were in patients with connective tissue disease and hypersensitivity pneumonitis.

CLINICAL RELEVANCE/APPLICATION

Experience improves the specificity of a HRCT diagnosis of IPF. Since a “definite UIP” pattern on HRCT is often considered sufficient for a HRCT diagnosis of Idiopathic Pulmonary Fibrosis according to ATS/ERS/JRS/ALAT criteria.

SSK04-05 • Performance and Interobserver Variability in Diagnosis of Idiopathic Pulmonary Fibrosis (IPF)

Hriday Shah MD (Presenter) ; David M Naeger MD ; Joyce Lee ; Harold Collard MD ; Brett M Elicker MD

PURPOSE

To determine the performance and interobserver variability of radiologists with different levels of experience for the high-resolution CT (HRCT) diagnosis of Idiopathic Pulmonary Fibrosis according to ATS/ERS/JRS/ALAT criteria.

METHOD AND MATERIALS

HRCT scans of 219 randomly selected patients from the UCSF interstitial lung disease database were analyzed by a senior attending radiologist, a junior attending radiologist and a 1st year radiology resident according to ATS/ERS/JRS/ALAT criteria. Each case was interpreted as 'definite UIP', 'possible UIP' or 'inconsistent with UIP'. In cases that were 'inconsistent with UIP', the inconsistent criteria were identified. Agreement was assessed with a Kappa statistic and a 1-tail test against the null (p-value of 0.05 considered significant).

RESULTS

Overall agreement for “definite UIP” was 0.639 (p < 0.001). The overall sensitivity and specificity, respectively, of each reader for the diagnosis of IPF was as follows: senior attending radiologist (48%, 96%), junior attending radiologist (81%, 84%) and 1st year radiology resident (73%, 85%). Similar results were obtained when subset analysis only included patients with HRCT signs of fibrosis or patients ≥50 years of age. 6 false positive “definite UIP” interpretations were made by the senior attending radiologist whereas 22 false positive interpretations were made by the junior attending radiologist, including 14 connective tissue disease, 4 hypersensitivity pneumonitis, 1 drug toxicity and 3 idiopathic nonspecific interstitial pneumonia patients. The senior radiologist described mosaic perfusion/air trapping more often and honeycombing less often than the other two readers.

CONCLUSION

The radiologist with greater experience had a lower sensitivity and greater specificity in the HRCT diagnosis of IPF using ATS/ERS/JRS/ALAT criteria. Most false positives in the radiologists with less experience were in patients with connective tissue disease and hypersensitivity pneumonitis.

CLINICAL RELEVANCE/APPLICATION

Experience improves the specificity of a HRCT diagnosis of IPF. Since a “definite UIP” pattern on HRCT is often considered sufficient evidence for diagnosing IPF, maintaining specificity is paramount.

SSK04-06 • Radiographic Interstitial Lung Abnormalities in Advanced NSCLC Patients during Platinum-based Chemotherapy: A Systematic Study in a Cohort with Wild-type EGFR, ALK, BRAF, and KRAS

Mizuki Nishino MD (Presenter) ; Stephanie Cardarella ; Tetsuro Araki MD ; Christine Lydon ; Michael S Rabin MD * ; Hiroto Hatafu MD, PhD * ; Bruce E Johnson

PURPOSE

Investigate the frequency of radiographic interstitial lung abnormalities (ILA) during first-line platinum-based chemotherapy in advanced NSCLC patients who are genomically characterized as wild-type for EGFR, ALK, BRAF, and KRAS, and provide reference data to assess lung toxicity of newer agents targeting specific mutations of lung cancer.

METHOD AND MATERIALS

65 advanced NSCLC patients (31 males, 34 females; age:26-76), who underwent genomic characterization between 7/09 and 7/12 and were wild type for EGFR, ALK, BRAF, and KRAS were studied. The patients were treated with first-line platinum-based chemotherapy, and had baseline CT and at least one chest CT during therapy. Baseline and all CT scans during therapy were visually scored for ILA, using a sequential reading method by 3 readers with a 4-point scale [0=no evidence of ILA, 1= equivocal for ILA, 2= suspicious for ILA, and 3=ILA]. A total of 311 chest CT scans in 65 patients were scored. On baseline CT before therapy, 9 of 65 patients (14%) were positive for ILA (score 2 in 7, score 3 in 2 patients). Six patients developed ILA during therapy (score 2 in all 6 patients), accounting for 11% of 56 patients without baseline ILA. The median time from the initiation of therapy to the first scan showing ILA was 5.0 months [range: 1.3-7.8 months]. Time from the initiation of therapy to the last CT did not differ between patients who developed ILA and those who did not (median: 7.1 vs. 5.0 months, respectively, p=0.17). Clinical variables including age, gender, stage, smoking, and pathology were not associated with baseline ILA (P>0.07), or development of ILA (P>0.2).

CONCLUSION

ILA was present at baseline in 14% of the total population. 11% of the patients without baseline ILA developed ILA during platinum-based chemotherapy in genomically characterized advanced NSCLC patients. The data serve as reference for the frequency of ILA in newer anti-cancer agents developed for lung cancer.

CLINICAL RELEVANCE/APPLICATION
SSK04-07 • Ultra-low-Dose (ULD) Chest CT in Immunocompromised Patients - A Prospective and Intraindividual Evaluation regarding Detection of Infiltrates

Niklas Lutzen (Presenter) ; Tobias Baumann MD ; Jonas Burk ; Stefan Bulla MD ; Markus Wilhelm ; Isabelle Dorr ; Gregor Pache MD ; Mathias F Langer MD, PhD

PURPOSE
Pneumonia is a potentially fatal complication in immunocompromised patients. Therefore, low-dose (LD) CT of the chest is widely applied in these patients. It is unclear, however, to what extent radiation exposure can be lowered while still maintaining diagnostic accuracy. Thus, it was the aim of this study to evaluate the diagnostic properties of an ULD CT protocol by intraindividual comparison with an established LD CT protocol.

METHOD AND MATERIALS
102 immunocompromised patients with an hematologic disease underwent 118 paired ULD and LD CT examinations with the following scan parameters. Tube voltage 120 kV, reference tube current for LD: 75mAs, fixed tube current for ULD: 10 mAs (BMI < 25/kg/m²) or 15 mAs (BMI > 25/kg/m²). Four experienced radiologists, blinded to patient data and scan parameters, prospectively rated the presence of micronodules, nodules with halo-sign, grouped micronodules, ground-glass opacity, consolidations and cavities on a five-point Likert scale for the interpretation and side separately. Variance and mean of the four ratings were calculated for each side, patient, and dose. These values were subjected to generalized linear model (mean) and logistic regression (variance=0 or variance>0) with dose and side as fixed effects and patient as random effect.

RESULTS
Mean effective dose was 3.38±0.81 mSv for LD examinations and 0.44±0.09 mSv for the ULD approach, corresponding to dose reduction of 87% with ULD. All studies were considered as diagnostic. With an effect size of 0.09 and a t-value of 2.94 the mean rating for ground-glass opacities was slightly but significantly lower in the ULD group. Logistic regression demonstrated a significantly increased interreader variance for grouped micronodules in ULD studies. Dose settings revealed no significant effect for all other imaging criteria and parameters.

CONCLUSION
The proposed ultra-low-dose chest CT protocol allows for a considerable decrease in radiation exposure even compared to existing low-dose approaches. Despite this decrease, the diagnostic properties could largely be maintained, yet with an increased interreader variance for the detection of micronodules and a slightly lower sensitivity for ground glass opacities.

CLINICAL RELEVANCE/APPLICATION
Immunocompromised patients are commonly subjected to repeated chest CTs, Ultra-low-dose CTs might allow for a considerable decrease in radiation exposure without demise in the diagnosis of pneumonia.

SSK04-08 • Probable UIP Is Still a Necessary Diagnostic Category on HRCT in Fibrosing Interstitial Pneumonia

Jonathan H Chung MD (Presenter) * ; Ashish Chawla MD, MBBS ; Steve Greshong MD ; Carlyle Cool MD ; David Mckean ; David A Lynch MBCh * ; Janet Talbert ; Anna Peljto ; Gregory Cosgrove MD ; Kevin K Brown MD ; Marvin Schwarz ; David Schwartz

PURPOSE
Recent international guidelines support 3 classes of UIP diagnosis on CT: Definite UIP, possible UIP, and inconsistent with UIP; the probable UIP class is not included in this diagnostic scheme. The purpose of this study was to evaluate the importance of the probable UIP imaging classification, using histological correlation.

METHOD AND MATERIALS
HRCT scans from 1,764 subjects in a large multicenter database of subjects with known or suspected interstitial lung disease were scored by two thoracic radiologists. CT findings and UIP diagnosis with level of confidence (not UIP, possible, probable, definite) were recorded. Definite UIP was defined as peripheral predominant, basal predominant reticular abnormality with honeycombing. Probable UIP was defined as peripheral predominant, basal predominant reticular abnormality without honeycombing. Possible UIP was defined as reticular abnormality with features not sufficiently characteristic to reach definite or probable levels. 258 subjects had histological scoring. Histological findings and UIP diagnosis with level of confidence were recorded by two pulmonary pathologists. Two-tailed Fisher exact test was used to compare proportions of histological scores for each UIP category.

RESULTS
In those with probable UIP on CT, UIP was histologically scored as definite, possible/probable, and not considered in 48.8% (20/41), 41.5% (17/41), and 9.8% (4/41) of subjects, respectively, compared with 30.7% (23/75), 37.3% (28/75), and 32.0% (24/75) for those with probable UIP on CT (p=.004). Corresponding histologic diagnoses for those with definite UIP on CT were 46.4% (13/28), 39.3% (11/28) and 14.3% (4/28) of subjects, respectively, very similar to the distribution of diagnoses in probable UIP (p=.285). The proportions of histological scores for probable UIP and not UIP on CT were significantly different (p<.0001).

CONCLUSION
In those with probable UIP on CT, the distribution of histological diagnoses is significantly different from those with possible UIP, but very similar to those with definite UIP.

CLINICAL RELEVANCE/APPLICATION
Patients with a probable UIP diagnosis on CT should not be categorized as possible UIP.

SSK04-09 • The Definition of Traction Bronchiectasis on CT Remains Unclear: Evaluation by 48 Observers with Various Specialties and Countries

Junya Tominaga PhD (Presenter) ; Takeshi Johkoh MD, PhD * ; Kiminori Fujimoto MD, PhD ; Hiroaki Arakawa MD ; Satoshi Noma MD, PhD ; Kazuya Ichikado MD, PhD ; Masanori Akira MD ; Fumikazu Sakai MD, PhD *

PURPOSE
To analyze interobserver variability in the definition of traction bronchiectasis on CT.

METHOD AND MATERIALS
Seven core members evaluated 50 CT images showing traction bronchiectasis and its mimics. They scored the probability of traction bronchiectasis using a 3-point scale (1 = low, 2 = moderate, 3 = high) as a reference standard with consensus. Forty-eight observers from various specialties and countries also independently evaluated the same images in the same manner in two sessions: first, according to "Fleischner Society: Glossary of Terms for Thoracic Imaging" criteria, and second, with additional criteria (observed exclusively in interstitial pneumonia). Weighted (?w) values of the scores compared to the reference standard were calculated and changes in ?w in the two sessions were evaluated by the paired t-test. The images were classified into the following 4 categories to analyze imaging features based on the mean and standard deviation (SD) of the scores: agreed presence of traction bronchiectasis (mean ≥ 2.5; SD ≤ 0.7); agreed absence of traction bronchiectasis (mean ≤ 1.5; SD ≤ 0.7); disagreement (mean, 1.5 – 2.5; SD > 0.7); and "others". ?w was found to be lower than 0.05 in the two sessions (p<0.001). In the first session, there was agreed presence for 11, agreed absence for 12, disagreement for 19, and eight "others" cases. Ten (91%) of the agreed presence cases
had chronic interstitial pneumonia with reticular opacity/honeycombing. Ten (83%) of the agreed absence cases had airway disease or emphysema. Six (32%) of the disagreement cases and two (25%) "others" had acute/subacute interstitial lung diseases with airspace consolidation.

CONCLUSION
Although the definition of traction bronchiectasis in chronic interstitial pneumonia appears to be congruent between observers, disagreement is often seen in cases with acute/subacute interstitial lung diseases.

CLINICAL RELEVANCE/APPLICATION
To improve interobserver agreement, traction bronchiectasis should be used as a finding of dilated bronchi only in areas with radiological evidence of interstitial fibrosis.

Gastrointestinal (CT Colonography)

Wednesday, 10:30 AM - 12:00 PM • E351

RESULTS
Of 1272 colon polyps =6 mm in diameter that went to endoscopy, 1153 (89.7%) were confirmed and 119 (10.3%) were discordant. For polyps detected at screening CTC, there were significant differences seen in polyp morphology, polyp location, and diagnostic confidence. Polyps confirmed were more likely to be sessile (63.1% vs 46.2%, p=1.5). Of 1272 colon polyps =6 mm in diameter that went to endoscopy, 1153 (89.7%) were confirmed and 119 (10.3%) were discordant.

CONCLUSION
Polyps confirmed were more likely to be sessile (63.1% vs 46.2%, p=1.5). Of 1272 colon polyps =6 mm in diameter that went to endoscopy, 1153 (89.7%) were confirmed and 119 (10.3%) were discordant.

METHOD AND MATERIALS
CTC cases performed within a randomized multi-center screening trial were included in this study. The trial enrolled asymptomatic persons aged 58-60 years undergoing low-dose CTC screening without contrast material. CTCs were prospectively read by experienced radiologists; positive patients (ie, polyps >5-mm) were referred for colonoscopy. All ECFs reported in the initial report were reviewed by two radiologists and were classified as being of high/moderate significance (E4 or E3) vs. minor (E2). Any ambiguity regarding clinic significance of ECFs was resolved with meeting consensus. ECFs assigned to E4 or E3 category were referred for additional workup. Costs of diagnostic procedures due to these ECFs were evaluated. Regression analysis was also performed to assess the related factors in ECF detection.

RESULTS
Of the 1652 (851 men) included subjects, 71 ECFs were found in 68 (4.1%) patients, with 31 (1.9%) of minor significance; 26 (1.5%) moderate and 11 (0.7%) high. The most common E4 findings were ovarian mass (n=2), urinary tract mass (n=2) and, pulmonary nodule >9mm (n=2). Further diagnostic workup was recommended in 37 (2.2%; one per 45 patients) of patients, including 3 patients having previously identified ECFs. Additional testing included: ultrasound (n=19); CT scan (n=6) and other diagnostic imaging (n=8). The mean costs for additional evaluation were $2 (95% CI: $1.3-$3.0) per participant and $101 (95% CI: $78-$126) per individual with detected high/moderate ECFs. Detection of important ECFs was not related to patient gender (P=0.31) and age (P=0.13). However, important ECFs were more likely to be detected in positive screening results vs. negative screening results (ORs, 4.1; 95% CI:1.8-8.1; P<0.01). Of the 1652 (851 men) included subjects, 71 ECFs were found in 68 (4.1%) patients, with 31 (1.9%) of minor significance; 26 (1.5%) moderate and 11 (0.7%) high. The most common E4 findings were ovarian mass (n=2), urinary tract mass (n=2) and, pulmonary nodule >9mm (n=2). Further diagnostic workup was recommended in 37 (2.2%; one per 45 patients) of patients, including 3 patients having previously identified ECFs. Additional testing included: ultrasound (n=19); CT scan (n=6) and other diagnostic imaging (n=8). The mean costs for additional evaluation were $2 (95% CI: $1.3-$3.0) per participant and $101 (95% CI: $78-$126) per individual with detected high/moderate ECFs. Detection of important ECFs was not related to patient gender (P=0.31) and age (P=0.13). However, important ECFs were more likely to be detected in positive screening results vs. negative screening results (ORs, 4.1; 95% CI:1.8-8.1; P<0.01). Of the 1652 (851 men) included subjects, 71 ECFs were found in 68 (4.1%) patients, with 31 (1.9%) of minor significance; 26 (1.5%) moderate and 11 (0.7%) high. The most common E4 findings were ovarian mass (n=2), urinary tract mass (n=2) and, pulmonary nodule >9mm (n=2). Further diagnostic workup was recommended in 37 (2.2%; one per 45 patients) of patients, including 3 patients having previously identified ECFs. Additional testing included: ultrasound (n=19); CT scan (n=6) and other diagnostic imaging (n=8). The mean costs for additional evaluation were $2 (95% CI: $1.3-$3.0) per participant and $101 (95% CI: $78-$126) per individual with detected high/moderate ECFs. Detection of important ECFs was not related to patient gender (P=0.31) and age (P=0.13). However, important ECFs were more likely to be detected in positive screening results vs. negative screening results (ORs, 4.1; 95% CI:1.8-8.1; P<0.01).

CONCLUSION
About 2% of asymptomatic subjects participating in a public organized CTC screening program will present important ECFs (one per 45 examinations). Early detection of important diseases may add benefit to screening intervention outweighing the incremental costs for diagnostic procedures (mean cost, $2 per participant).

CLINICAL RELEVANCE/APPLICATION
Our results provide information regarding the estimate of important ECFs rate in an organized CTC screening program and should be considered carefully to evaluate ECFs related costs and benefit.

SSK05•02 • Initial Endoscopy Following Screening CT Colonography: Confirmed versus Discordant Polyps

Bryan D Pooler MD (Presenter) ; Perry J Pickhardt MD * ; David H Kim MD *

PURPOSE
Endoscopy (optical colonoscopy or flexible sigmoidoscopy) with polypectomy is recommended following significant findings at CT colonography (CTC). Our purpose was to analyze the difference between colon polyps detected at screening CTC that were subsequently confirmed at initial endoscopy and those that were discordant (not found).

METHOD AND MATERIALS
We collected data from 7157 consecutive adult patients (mean age 56.6±7.2 years, M:F 3285:1051) undergoing first-time screening CTC over an eight-year period at a single academic center. A total of 1051 patients were positive for polyps =6 mm at CTC. Of these, 751 patients with a total of 1272 polyps =6 mm went to endoscopy. Characteristics of all polyps detected at CTC--including size, location, morphology, and diagnostic confidence--were recorded, and those polyps confirmed at endoscopy were compared against those that were discordant.

RESULTS
Of 1272 colon polyps =6 mm in diameter that went to endoscopy, 1153 (89.7%) were confirmed and 119 (10.3%) were discordant. Polyps confirmed were more likely to be sessile (63.1% vs 46.2%, p<0.01). Of 1272 colon polyps =6 mm in diameter that went to endoscopy, 1153 (89.7%) were confirmed and 119 (10.3%) were discordant. Polyps confirmed were more likely to be sessile (63.1% vs 46.2%, p<0.01). Of 1272 colon polyps =6 mm in diameter that went to endoscopy, 1153 (89.7%) were confirmed and 119 (10.3%) were discordant. Polyps confirmed were more likely to be sessile (63.1% vs 46.2%, p<0.01).

CONCLUSION
Discordant polyps at initial endoscopy following screening CTC are more likely to be flat lesions, right-sided, and called with low diagnostic confidence.
Purpose
To suggest the optimal timing for follow-up colonoscopy of the proximal colon after surgical resection of an occlusive cancer when pre-surgery CT colonography (CTC) was negative in the proximal colon.

Method and Materials
461 consecutive patients with occlusive colorectal cancer underwent CTC for proximal colonic evaluation, of which 304 patients were negative in the proximal colon on adequately performed CTC. Excluding those who underwent surgical removal of the proximal colon or palliative ostomy (n=88) and those whose post-surgery colonoscopy was absent (n=42), 174 patients (M:F, 86:88; age, 58±11 years) operated on between January 2006 and March 2010 constituted the cohort for this study. Results of all post-surgery colonoscopic examinations were reviewed. Pathology, size, and the time from CTC to colonoscopic identification of proximal colonic lesions were collected. The time from CTC to the first discovery of any clinically relevant lesions (i.e. adenoma 6 mm or greater, advanced adenoma, or cancer) in the proximal colon was analyzed using Kaplan-Meier method and the cumulative risk of the clinical relevant lesions across the follow-up time was calculated.

Results
Length of the colonic follow-up was 3-81 months (median, 33), during which 1-8 colonoscopies per patient (median, 2) were performed (a total of 5444 patient-months and 368 colonoscopies). The probability (standard error) of not having any clinically relevant lesions in the proximal colon at 6 months and at 1, 1.5, and 2 years was 97.6% (1.2%), 96.4% (1.5%), 91.2% (2.3%), and 89.5% (2.6%), respectively. 152 patients did not develop any clinically relevant lesions for 3-76 months (median, 31). 15 patients were found having nonadvanced adenomas 6 mm or greater at 4-68 months (median, 18). 7 patients presented with advanced adenomas at 6-43 months (median, 13). None was postsurgically identified as having cancers in the proximal colon.

Conclusion
If the colon proximal to an occlusive cancer was negative on adequately performed CTC, the probability of finding clinically relevant lesions in the proximal colon post-surgically was fairly low until 1 year after the CTC (cumulative risk of 3.6%) although advanced adenoma was found as early as at 6 months.

Clinical Relevance/Application
Additional colonoscopy at 3-6 months post surgery for evaluating the colon proximal to occlusive cancer currently recommended may not be necessary if preoperative CTC was well performed and negative.

SSK05-04 • Feasibility of Ultra-low kVp CT Colonography: Effect of Different Iterative Reconstruction Algorithms on Radiologists’ Performance Using Anthropomorphic Colonic Phantoms
Cheong-I Shin MD (Presenter); Se Hyung Kim; Eun Sun Lee MD, PhD; Dong Ho Lee MD; Eui Jin Hwang; Se-Yeong Chung; Jeong-Min Lee MD *; Joon Koo Han MD; Byung Ihn Choi MD, PhD *

Purpose
To analyze the effect of a decrease in tube voltage from 100~120kVp to 80kVp in CT colonography (CTC) on dose, image noise, and diagnostic performance using anthropomorphic phantoms and to assess the effect of two different iterative reconstruction algorithms on radiologists’ performance.

Method and Materials
Seven colon phantoms with 68 simulated polyps =6mm were scanned at different kVp settings (80, 100, and 120kVp) and 10mAs. Images were reconstructed using filtered back projection (FBP), statistical model-based iterative reconstruction (iDOSE®), and knowledge-based iterative reconstruction algorithm (IMR). Nine datasets for each phantom according to 3 kVp settings and 3 reconstruction algorithms yielded 63 CTC datasets. Volume CTDI dose index (CTDIvol) and image noise were recorded and compared. Two readers (blinded to the image noise and reconstruction algorithm) independently reviewed CTC using primary 3D method. Per-polyp sensitivity was compared among the datasets.

Results
Decreasing tube voltage from 100 and 100 to 80kVp resulted in 70.7% and 50.5% significant reduction in CTDIvol, respectively (P=0.014). Effective radiation dose of 80kVp CT was 0.17mSv. With FBP reconstruction, image noise in 80kVp was significantly increased by 67.8% and 45.5%, respectively (P=0.018) and per-polyp sensitivity of both reviewers (14.7%, 7.4%) was significantly lower than those in 100kVp (57.4%, 39.7%) and 120kVp (85.3%, 83.8%) (P<0.05). Image noise in 80kVp was significantly drop to 52.6% compared with that in 100kVp (P=0.018) but, per-polyp sensitivity (79.4%, 66.2%) in 80kVp was still significantly lower than those in 100kVp (95.6%, 86.8%) and 120kVp (98.5%, 89.7%) (P<0.05) and CTDIvol was not significantly different from those in 100kVp (100%, 96.5%) and 120kVp (100%, 95.6%) for both reviewers (P>0.05).

Conclusion
A decrease in tube voltage to 80kVp results in a significant reduction of radiation dose to 0.17mSv at a cost of significant deterioration in image noise and diagnostic performance. With application of knowledge-based iterative reconstruction algorithm, radiologists’ performance of 80kVp CTC is acceptable and is on par with 100 or 120kVp CTC.

Clinical Relevance/Application
Ultra-low kVp CT colonography with 80 kVp can be feasible with an application of knowledge-based iterative reconstruction algorithm, significantly lowering the radiation dose with sub-mSv.

SSK05-05 • Reduce CTC Colonography (CTC) Radiation Dose Using Model Based Iterative Reconstruction (MBIR) while Maintaining Image Quality
Patrick Miller MD (Presenter); Wendy L Stiles MD; C. Daniel Johnson MD *; Jeffrey T Lund MD; Robert G Paden; Qing Wu; Amylou Dueck PhD; Amy K Hara MD *

Purpose
Reduce CTC Colonography (CTC) radiation dose using model based iterative reconstruction (MBIR) while maintaining image quality.

Method and Materials
After colon prep w/ stool tagging, 20 patients (11M/9F; 40–95 yrs, Ave. BMI=31.6) underwent CTC standard dose (SD) and reduced dose (RD). 2 acquisitions at SD in supine and prone positions: 120 kVp, Auto mA (M/M 30/450), Noise Index (NI)=65, yield ave. dose 4 mSv. Additional single supine acquisition at RD: NI=92, other parameters unchanged, expected 50% reduced radiation dose. All images reconstructed with 3 algorithms: filtered back projection (FBP), adaptive statistical iterative reconstruction (ASIR), MBIR. Image noise quantified using ROI to measure HU standard deviation at 5 locations (liver, kidney, both psoas muscles, aorta) in each patient. Also, images reviewed by 2 experienced radiologists (>500 CTC cases) blinded to scan technique. Observers independently scored image quality and noise at 3 sites (cecum, rectosigmoid, splenic flexure). Image noise was graded on a scale from 0 to 4 (nondiagnostic to no perceptible noise). Image quality was scored from 0 (nondiagnostic) to 4 (high confidence of detecting =5 mm lesion).

Results
Ave. CTDI decreased 60% from 6.7 mGy on SD to 2.7 mGy on RD. As expected, measured average image noise level increased from SD (FBP 58.6, ASIR 35.8, MBIR 16.6) to RD (FBP 97.2, ASIR 60.6, MBIR 21.9); all algorithms improved measured noise levels. Importantly, noise was less on RD MBIR compared to SD ASIR images (p CONCLUSION
60% RD 2D and 3D CTC reconstructed with MBIR had less visual noise both objectively and subjectively compared to SD ASIR. Image quality on RD MBIR 2D and 3D CTC was not perceived to be significantly different compared to SD ASIR, but RD MBIR images were...
SSK05-06 • Effect of Different Reconstruction Algorithms on Computer-aided Diagnosis (CAD) Performance in Ultra-low Dose CT Colonography

**Eun Sun Lee** MD, PhD (Presenter); **Se Hyung Kim**; **Jong Pil Im**; **Sang Gyun Kim**; **Cheong-Il Shin** MD; **Joon Koo Han** MD; **Byung Ihn Choi** MD, PhD *

**PURPOSE**
To assess the effect of different reconstruction algorithms on computer-aided diagnosis (CAD) performance in ultra-low dose CT colonography (CTC).

**METHOD AND MATERIALS**
Twelve patients who underwent same-day CTC and colonoscopy were prospectively enrolled. Non-contrast CTC was performed with 120kVp/10mAs in supine and 100kVp/10mAs in prone. Fecal tagging was done with 50ml of iodinated contrast agent (gastrografin®). CTC images were reconstructed with three different reconstruction algorithms: filtered back projection (FBP), 80% adaptive statistical iterative reconstruction (ASIR80), and model-based iterative reconstruction (MBIR, VEO) algorithm. Commercial CAD (ColonCAD®, Philips Medical Systems) was applied to CTC dataset. Per-polyp sensitivity and the number of false-positives (FP) were recorded and compared among the reconstruction algorithms using McNemar test and Friedman test, respectively.

**RESULTS**
Mean effective radiation dose of CTC was 1.02 mSv (range, 0.94 ~ 1.12 mSv). Forty-seven polyps were detected and removed by colonoscopy. Of them, 27 polyps were detected in each supine and prone CTC dataset. Therefore, 24 CTC datasets of 12 patients contain 54 visible polyps (8 polyps

**CONCLUSION**
Per-polyp sensitivity of CAD was not acceptable in ultra-low dose CTC with FBP reconstruction. However, it can be improved with an application of iterative reconstruction algorithm with insignificant increase in false-positive. Between the two iterative reconstruction algorithms, ASIR might be more beneficial than MBIR on CAD performance in terms of both per-polyp sensitivity and the number of false-positives.

**CLINICAL RELEVANCE/APPLICATION**
With application of hybrid-iterative reconstruction algorithm, CAD can show acceptable per-polyp sensitivity for polyps =10mm and number of false-positive even in ultra-low dose CT colonography.

SSK05-07 • Computer-aided Detection for Laxative-free Non-cathartic CT Colonography: Standalone Performance in a Screening Population

**Janne J Nappi** PhD (Presenter) *; **Minh Phan**; **Michael E Zalis** MD *; **Hiroyuki Yoshida** PhD *

**PURPOSE**
To evaluate the standalone detection performance of a fully automated computer-aided detection (CAD) scheme in a laxative-free (non-cathartic) CT colonography (ICTC) screening population.

**METHOD AND MATERIALS**
A total of 605 asymptomatic men and women (age: 50–85 years) were prepared for an ICTC examination (3.75-mm maximum slice thickness, 120 kVp, and 50 mAs effective) at 4 medical centers with two-day dietary fecal tagging by non-ionic iodine. The precise spatial locations of lesions that were confirmed by segmentally unblinded colonoscopy were identified in the CTC data prospectively and retrospectively. A fully automated CAD scheme was trained to detect polyps by use of an independent set of 204 cathartic and non-cathartic CTC cases with 263 lesions. The CAD scheme was tested with the 605 ICTC cases. The per-lesion and per-patient sensitivities were evaluated by use of bootstrap analysis. The maximum number of CAD detections was limited to 15 per patient to avoid indication fatigue.

**RESULTS**
There were 21 (61) biopsy-confirmed retrospectively visible carcinomas or adenomas =10 mm (6–9 mm) in size in 21 (54) patients, and there were 6 hyperplastic lesions =10 mm. The CAD detected 95% (95% CI: 81–100%) of =10 mm lesions/patients at a median/average of 7 false-positive (FP) detections per patient. The CAD detected all cancers (n=3) and all but one of the hyperplastic lesions. For 6–9 mm lesions, the average per-lesion sensitivity was 61% (46–73%) and the per-patient sensitivity was 63% (50–78%). The principal source of FP CAD detections was poorly tagged feces imitating soft-tissue lesions.

**CONCLUSION**
CAD provided high detection sensitivity for =10 mm lesions in an ICTC screening population, but for 6–9 mm lesions the detection sensitivity was relatively low.

**CLINICAL RELEVANCE/APPLICATION**
CAD could be used to realize an effective laxative-free CTC examination for improving patient adherence to colorectal screening, but its performance has not been evaluated in a screening population.

SSK05-08 • Computer-aided Detection of Non-polypoid Flat Lesions in CT Colonography: Observer Performance Study

**Yasuji Ryu** MD (Presenter); **Janne J Nappi** PhD *; **Minh Phan**; **Wenli Cai** PhD; **Daniele Regge** MD; **Hiroyuki Yoshida** PhD *; **Yin Wu**

**PURPOSE**
To evaluate the effect of optimized computer-aided detection (CAD) on the performance of human readers in the detection of non-polypoid flat lesions in asymptomatic patients from a large multi-center CT colonography (CTC) clinical trial.

**METHOD AND MATERIALS**
A total of 200 cathartic CTC cases including colonoscopy-confirmed, morphologically flat lesions and normal examinations were sampled from a European multi-center CTC trial for asymptomatic patients at increased risk of colorectal cancer. Iodine tagging without or with barium was used in 1/3 of the cases. An expert radiologist who did not otherwise participate in the study annotated the precise locations of flat lesions in the CTC data based on prospective CTC and segmentally unblinded colonoscopy reports. The case reading order was randomized. The positive CTC cases were evenly divided between quartiles. Two readers (expert and non-expert) reviewed the 200 CTC cases and recorded all detected lesions using primary 3D interpretation and a CAD second read paradigm, where the CAD that was developed at our institution had been trained with cases independent from this study. The per-patient sensitivities for flat lesions were compared between unassisted and CAD-assisted readings.

**RESULTS**
There were 34 patients (17%) with morphologically flat lesions: 17 patients had 18 flat lesions =10 mm and 17 had 27 flat lesions 6–9 mm, of which standalone CAD yielded 94% per-patient (89% per-polyp) sensitivities at 4 false positives per patient. For the flat lesions =10 mm per-patient (per-polyp) sensitivities of the expert reader were 59% (56%) and 71% (67%), respectively, whereas those of the non-expert reader were 41% (39%) and 47% (44%), respectively. For 6–9 mm flat lesions, the corresponding per-patient (per-polyp) sensitivities of the expert reader were 59% (48%) and 71% (59%), respectively, whereas those of the non-expert were 47% (37%) and 71% (63%), respectively.
The study population comprised 100 patients (64 men and 36 women) with 43 hepatocellular carcinoma (HCC), 36 metastasis, 17 tumors.

**METHOD AND MATERIALS**

To determine the feasibility of using blood oxygenation level–dependent (BOLD) MR imaging at 3T in the characterization of hepatic malignant lesions.

**PURPOSE**

To assess the diagnostic accuracy of dynamic susceptibility contrast-enhanced perfusion images in differentiation between benign and malignant focal liver lesions by the assessment of tumoural perfusion kinetics.

**RESULTS**

All the diagnosis were established either by histopathology or imaging follow-up (size increase of over a period of time). Perfusion mean values calculated in benign lesions were: RAE 15,98%, RVE 89,17%, RLE 121,12%, ME 1103,94%, MRE 130,64%, TTP 169,4 sec for colangiocarcinoma. A statistical difference (p < 0,05) was achieved in all the perfusion parameters calculated between benign lesions and malignant focal liver lesions by the assessment of tumoural perfusion kinetics.

**CONCLUSION**

Our novel CTC software enables reproducible detailed quantitative analysis of colonic morphology. Significant differences found between the genders in tortuosity, compactness, volumes, and sigmoid apex height may explain differences in optical colonoscopy performance. This software may have other beneficial applications for CTC.

**CLINICAL RELEVANCE/APPLICATION**

Detailed quantitative assessment of colonic morphology is both feasible and reproducible, and may help us to identify patient groups who are at increased risk for incomplete optical colonoscopy.
Feasibility, Imaging Considerations and Preliminary Experience

SSK06-04 •

We analyzed 262 hepatic metastatic lesions identified in 58 adult patients who underwent upper abdominal MRI with diffusion technique. Few studies have evaluated the factors affecting the quantitative analysis of ADC and no studies have correlated the variation of the ADC obtained through DW-MRI. This technique has been studied for detection, characterization and even to assess therapeutic response, but few studies have evaluated the factors affecting the quantitative analysis of ADC and no studies have correlated the variation of the ADC with the dimensions of metastatic liver lesions.

RESULTS

The mean (± SD) T2* values (ms) of hemangiomas (97.3 ± 20.2) were highest, followed by HCC (48.4 ± 12.7), metastasis (37.1 ± 10.5), cholangiocarcinoma (36.6 ± 11.1) with a significant difference between hemangioma and others tumors (P < 0.0001), and between HCC and metastasis (P = 0.0002) or ICC (P = 0.0008). R2* values showed opposite trend to T2*. The agreement between T2* color map and dynamic images imaging regarding signal intensity pattern were moderate (k = 0.544) for all tumors, good (k = 0.666) for tumors > 2.0 cm, and fair (k = 0.334) for tumors of 2.0 cm or smaller. The sensitivities of BOLD MR imaging for displaying tumor hypervascularity were 75.6 % and 73.2% for both observers.

CONCLUSION

Liver BOLD MR imaging at 3 T is feasible to predict hypervascularity and vascular pattern of various hepatic tumors because T2* and R2* values are different among hepatic tumors according to tumor vascularity and color map of T2* values also well reflect tumor vascularity when compared to contrast-enhanced MR imaging, particularly in hepatic tumors > 2.0 cm.

CLINICAL RELEVANCE/APPLICATION

Liver BOLD MR imaging at 3 T could be an alternative tool to gadolinium-enhanced MR imaging to predict vascularity of hepatic tumors for patients who cannot receive gadolinium-based contrast agents.

SSK06-03 • Characterization of Benign Liver Lesions with Ultrasound Quantitative Supersonic Shear Wave Elastography

Maxime Ronot MD (Presenter) ; Sara Di Renzo ; Bettina Gregoli MD ; Simon Lambert ; Rafael Duran MD ; Valerie Vilgrain MD

PURPOSE

To prospectively assess the stiffness of a consecutive series of benign focal liver lesions (FFL), using supersonic Shear Wave Elastography (SWE).

METHOD AND MATERIALS

Between January 2012 and March 2013, all focal liver lesions (FLL) fortuitously discovered during an ultrasound (US) examination were prospectively included. Patients with underlying chronic liver disease and malignant lesions were excluded. On all patients and for each lesion a quantitative elastographic image was acquired. The largest possible region of interest was placed in the lesion to quantitatively assess its stiffness, measured in kPa. Characterization of the lesion relied either on a combination of MR imaging, CT, and contrast enhanced US features, or on biopsy. Tumor elasticity was analyzed using ANOVA and non-parametric Mann-Whitney tests.

RESULTS

112 FLL in 76 patients were analyzed. For 10 lesions (9%) in 6 patients (8%), SWE data could not be obtained due to patient motion (n=4), major steatosis (n=2) or a deep lesion (n=2). 102 lesions were successfully evaluated in 70 patients (61 women, 87%) with a mean age of 44.8 (range: 20-75). The mean stiffness was 33.3±12.7kPa for the 60 focal nodular hyperplasia (FNH), 19.7±9.8kPa for the 17 hepatocellular adenomas (HCA), 17.1±7kPa for the 20 hemangiomas, and 11.3±4.3kPa for the 5 focal fatty sparing (p<0.001). The shearwave velocities of benign and malignant groups of lesions (P<0.001) and were similar in size(88%). The shearwave velocities were: benign lesions 1.3±0.35 m/s; malignant lesions 2.9±0.74 m/s; metastatic lesions 2.77±0.90 m/s. Statistically significant differences exist between the shearwave velocities of benign and malignant groups of lesions (p<0.0001).

CONCLUSION

SWE provides additional information for the characterization of benign FFL, and helps in in differentiating FNH from HCAs, and in the subtyping of HCAs.

CLINICAL RELEVANCE/APPLICATION

Quantitative elastography using SWE may help in improving the characterization of benign FFL, particularly FNHs.

SSK06-04 • Role of Acoustic Radiation Force Impulse Elastography in Characterization of Focal Solid Hepatic Lesions: Feasibility, Imaging Considerations and Preliminary Experience

Harshavardhan Nagolu MBBS (Presenter) ; Sudhakar Kattoju DMRD, MD ; Meera Krishnakumar DMRD, MD ; Chidambaranathan Natesan MD, PhD

PURPOSE

To analyze if solid focal liver lesions can be characterized as benign and malignant based on their appearance on ARFI Elastogram images in relation to conventional grayscale ultrasonography images. To assess the accuracy of ARFI Elastometry in characterization of solid liver lesions based on differences in their shearwave velocities.

METHOD AND MATERIALS

In this prospective study, 52 patients with 60 focal solid liver lesions were single blindedly analyzed on ARFI Elastography, which included 25 benign (21 hemangiomas, 2 abscesses, 1 adenoma and one granulomas), 27 malignant (22 HCCs, 3 adenocarcinomas of gall bladder, one fibrolamellar carcinoma and one leukemic infiltrates) and 8 metastases (3 from colonic adenocarcinoma, one each from gallbladder, liver, small intestine, lung and bone). The size and stiffness of the lesions were analyzed with respect to grayscale US images. The shearwave velocities were quantified in these lesions. All the findings were correlated with histopathology of the lesions.

RESULTS

Malignant liver lesions were found to be predominantly stiffer (88%) and larger (74%), while benign lesions were predominantly similar in stiffness to background liver (44%) or softer (40%) and were similar in size(88%). The shearwave velocities were: benign lesions 1.3±0.35 m/s; malignant lesions 2.9±0.74 m/s; metastatic lesions 2.77±0.90 m/s. Statistically significant differences exist between the shearwave velocities of benign and malignant groups of lesions (P<0.0001).

CONCLUSION

ARFI elastography can be useful addition to Conventional US in improving the characterization of benign and malignant solid liver lesions. Further studies with larger population and diverse pathologies is necessary to prove its clinical implication in their characterization.

CLINICAL RELEVANCE/APPLICATION

As conventional US features are non specific in characterization of solid liver lesions, addition of ARFI elastography might help in early and accurate characterization of focal solid liver lesions.

SSK06-05 • Correlation between Size and ADC Value in Liver Metastasis

Maria Luiza Testa MD (Presenter) ; Rubens Chojniak MD, PhD ; Leticia S Sene MD

PURPOSE

To prospectively study the influence of the size of liver metastases in the quantitative value of the apparent diffusion coefficient (ADC) obtained through DW-MRI. This technique has been studied for detection, characterization and even to assess therapeutic response, but few studies have evaluated the factors affecting the quantitative analysis of ADC and no studies have correlated the variation of the ADC with the dimensions of metastatic liver lesions.

METHOD AND MATERIALS

We analyzed 262 hepatic metastatic lesions identified in 58 adult patients who underwent upper abdominal MRI with diffusion technique.
Lesions with at least 5 mm or greater in diameter were evaluated. The sequence of diffusion was performed with normal breathing, two values of b (200 and 600 sec/mm²) for detection and characterization of liver lesions. The apparent diffusion coefficient (ADC) of each lesion was obtained using the ROI (Region of Interest) positioned centrally and occupying about 50% of the lesion. Quantitative evaluation was performed by measuring the ADC value of each lesion. ADC values were correlated with the size of the lesions.

RESULTS
The average ADC of all metastatic liver lesions analyzed (n=262) was 1.1 x 10⁻³ mm²/sec [standard deviation (SD) =0.1], [confidence interval (CI) 95%: 1.0–1.2 x 10⁻³ mm²/sec]. The average size of metastatic liver lesions was 19.8 mm (SD =13.6) and a median of 16.5 mm, with a minimum of 5.0 mm and a maximum of 104.8 mm. In our study we observed that the mean ADC of metastatic liver lesions smaller than the median of 16.5 mm (n=130) was 1.0 x 10⁻³ mm²/sec ± 0.1 [CI 95%: 0.9–1.1 x 10⁻³ mm²/sec], while lesions with dimensions equal or superior than 16.5 mm (n=132), the ADC value was 1.2 x 10⁻³ mm²/sec ± 0.1 [CI 95%: 1.1–1.4 x 10⁻³ mm²/sec], with statistical significance (p<0.05).

Larger metastatic liver lesions have higher ADC values. The increase in the size of lesions is normally associated with progression of disease but could be paradoxically accompanied by increased the ADC value, usually associated with reduced cellularity and response to therapy.

CLINICAL RELEVANCE/APPLICATION
The ADC value increases with the size of the liver metastases. It may have an impact on the utilization of DW-MRI for lesion characterization and for monitoring of therapeutic response.

SSK06-06 • 'Extended Washout' - A New Sign for Distinguishing Hepatic Metastases from Hemangiomas on Gadoxetate Disodium-enhanced MRI
Sheela Agarwal MD, MS (Presenter) ; Seyed Mahdi Abtahi MD ; Azadeh Elmi MD ; Jason J Carroll MD ; Mukesh G Harisinghani MD ; Peter F Hahn MD, PhD *
PURPOSE
To describe the enhancement pattern of hemangiomas with gadoxetate disodium and propose a new sign—the “extended washout sign” to diagnose hemangiomas on hepatobiliary phase imaging.

METHOD AND MATERIALS
In this retrospective study, quantitative and qualitative image analysis of 45 hemangiomas and 37 metastases in 77 patients was performed. Gadoxetate-enhanced MR imaging was obtained during arterial and portal-venous phase, and delays of 3, 8, and 20 minutes. During each phase, signal intensities were measured for the lesion, liver, and aorta, and were normalized using paraspinous muscle. Quantitatively, extended washout was defined as a 10% change in signal intensity from 8 to 20 minutes. Statistical analysis was performed using paired Student’s t-test. Qualitative analysis was also performed by one blinded reader, who assessed the appearance of all lesions on T2-weighted images alone, dynamic images alone, and combined early (8 min) and late (20 min) hepatobiliary phases. Extended washout was defined as a perceptible change in signal from 8 to 20 minutes. ROC analysis was used to estimate the diagnostic accuracy of the various sequences to distinguish hemangioma from metastasis.

RESULTS
On quantitative analysis, 84% of hemangiomas demonstrated a positive extended washout sign while only 18% of metastases did. Hemangiomas demonstrated a mean change in signal intensity of 18.4% as compared to 4.1% for metastases (p<0.05).

Majority of hemangiomas demonstrate a positive extended washout sign, which is not seen with most metastases. This sign, particularly when combined with T2 signal intensity, can be used to increase accuracy of differentiating hemangiomas from metastases on gadoxetate-enhanced MRI.

CLINICAL RELEVANCE/APPLICATION
Extended washout sign, particularly when used in conjunction with T2 signal intensity, can be used to increase accuracy of differentiating hemangiomas from metastases on gadoxetate-enhanced MRI.

SSK06-07 • Diagnostic Dilemma: Hepatic Angiomyolipoma versus Hepatocellular Carcinoma in Non-cirrhotic Liver on Gd-EOB-DTPA-enhanced MR
So Jung Lee (Presenter) ; So Yeon Kim MD ; Kyoung Won Kim MD ; Jin Hee Kim MD ; Yong Moon Shin ; Moon-Gyu Lee MD
PURPOSE
To describe imaging characteristics of hepatic angiomyolipoma (AML) on Gd-EOB-DTPA-enhanced MR and to identify imaging features helpful to differentiate it from hepatocellular carcinoma (HCC) in non-cirrhotic liver

METHOD AND MATERIALS
We retrospectively identified 18 patients with pathologically proven hepatic AML who underwent Gd-EOB-DTPA-enhanced MR. We randomly chose 36 patients from 91 patients who had single HCC in non-cirrhotic liver on Gd-EOB-DTPA-enhanced MR during the same period. Two readers in consensus reviewed all the images to assess the size, the presence of fat component, enhancement profile, tumor capsule, tumoral vessels and early draining veins. For the quantitative analysis, contrast enhancement ratio (CER) and SI ratio of lesions were measured on the dynamic and hepatobiliary phases. These features and measurements were compared between the AML and HCC groups.

RESULTS
No significant difference in the size between AML (3.4 cm) and HCC (4.5 cm) (P=0.15). Intratumoral fat component was more common in AML (44.4%) than HCC (22.2%) but not statistically significant (P=0.11). Dynamic enhancement profile was similar between the two groups: in particular, arterial hypervascularity and wash-out on the portal or delayed phases were common in both HCC (97.2%) and AML (83.3%) (P=0.10). Almost all AML (100%) and HCC (94.4%) were hypointense on the hepatobiliary phase (P=0.54). However, they differed significantly for tumor capsule on the delayed phase (no tumor capsule: AML vs. HCC, 94.4 vs. 55.5%, P=0.04), the presence of tumoral vessels (44.4 vs. 8.3%, P=0.04) and early draining vein (38.8 vs. 11.1%, P=0.03). In the quantitative analysis, arterial enhancement for AML was stronger than that of HCC (CER, 140.1% vs. 89.6%, P<0.05).

On Gd-EOB-DTPA-enhanced MR of non-cirrhotic liver, it is often difficult to differentiate AML from HCC, since they share similar enhancement characteristics. However, AML is more commonly without tumor capsule but contains intratumoral vessel and early draining vein. Qualitative analysis can facilitate the differentiation of AML from HCC.

CLINICAL RELEVANCE/APPLICATION
On Gd-EOB-DTPA-enhanced MR of non-cirrhotic liver, AML is often indiscernible from HCC with the enhancement characteristics alone. Capsule, tumoral vessel and early draining vein can be helpful clues.

SSK06-08 • Rapidly Enhancing Hemangioma versus Hypervascular Hepatocellular Carcinoma Showing Washout Appearance on Gadoxetic Acid-enhanced Hepatic MRI: Usefulness of Diffusion-weighted Imaging for Differential Diagnosis
Sejin Nam MD (Presenter) ; Jeong-Sik Yu MD ; Eun-Suk Cho ; Jae-Joon Chung MD ; Joo Hee Kim ; Ki Whang Kim MD
PURPOSE
To validate the diffusion-weighted imaging (DWI) in the differential diagnosis of rapidly enhancing hemangiomas showing washout appearance on gadoxetic acid-enhanced hepatic MRI from hypervascular hepatocellular carcinomas (HCCs).

METHOD AND MATERIALS
For 54 hemangiomas (0.3 to 1.9 cm, mean 0.7 cm; in 44 consecutive patients) showing homogeneous enhancement on the arterial dominant phase images during the gadoxetic acid-enhanced dynamic MRI and showing hypointensity on late phase imaging, DWI (b=50 and 800 s/mm²) with apparent diffusion coefficient (ADC) map were retrospectively analyzed and compared with 113 hypervascular HCCs (0.4 to 2.0 cm, mean 0.9 cm; in 66 consecutive patients) showing similar pattern of contrast enhancement. In addition to measurement of mean ADC by drawing region-of-interest in each lesion on the ADC map, qualitative analysis of DWI was performed using a five-grade scale by two independent observers.

RESULTS
Mean ADC of hemangioma was significantly larger than HCC (1.94 versus 1.00 x 10^-3 mm²/s, p

CLINICAL RELEVANCE/APPLICATION
Quantitative and qualitative analysis of diffusion-weighted imaging can provide a determinative information to characterize these atypical hemangiomas distinguished from small hepatocellular carcinoma

**SSK06-09 ● Delayed Enhancement of Colorectal Metastases with MR Hepatobiliary Contrast Agent**

**Rahul A Sheth MD (Presenter) ; Mukesh G Harisinghani MD ; Sheela Agarwal MD, MS**

**PURPOSE**
Hepatobiliary contrast agents provide accurate detection of hepatic metastases particularly on hepatobiliary phase owing to the high level of enhancement of the background hepatic parenchyma. Parenchymal uptake is mediated by a family of cell surface transporters known as OATPs that were previously believed to be expressed only by hepatocytes. Recently, however, the overexpression of these transporters has been demonstrated in up to 80% of colorectal cancers. The purpose of this study was to evaluate for delayed enhancement within hepatic colorectal cancer (CRC) metastases following the administration of a hepatobiliary contrast agent.

**METHOD AND MATERIALS**
We performed a single institution, retrospective study of all patients with pathologically proven hepatic metastases who underwent MRI with gadoxetic acid (Eovist, Bayer, NJ) between 2010-2012. Gadoxetate-enhanced MR imaging was obtained during arterial phase, portal-venous phase, and delays of 3 minutes, 8 minutes, and 20 minutes. During each phase, signal intensities were measured for the lesion, adjacent liver parenchyma, and spleen, and were normalized using signal intensity of the paraspinal musculature. Delayed enhancement was determined by calculating the percent relative enhancement between the 3 minute and 20 minute time points.

**RESULTS**
A total of 35 patients were identified, of which 24 (69%) had CRC metastases and 11 (31%) had non-CRC metastases including pancreatic, breast, neuroendocrine, or sarcoma metastases. There was a statistically significant difference in the percent relative enhancement within CRC metastases than non-CRC metastases (p < 0.05), with 42% (10/24) CRC metastases demonstrating > 10% percent relative enhancement compared to 0% of non-CRC metastases.

**CONCLUSION**
CRC metastases can demonstrate delayed hyperintensity with gadoxetate. This may reflect extracellular accumulation; however, given that OATP overexpression has been shown in CRC, this finding may indicate specific intracellular uptake.

**CLINICAL RELEVANCE/APPLICATION**
Metastases may demonstrate hyperintensity on delayed imaging with hepatobiliary agents. This should not be misinterpreted as a specific finding for a benign lesion such as focal nodular hyperplasia.

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**Gastrointestinal (Pancreas Benign Disease)**

**Wednesday, 10:30 AM - 12:00 PM ● E353B**
To evaluate the accuracy of a novel noninvasive scoring system, the MRI Chronic Pancreatitis Severity Index (CPSI), in the diagnosis and grading of patients with suspected chronic pancreatitis (CP), as compared to endoscopic ultrasound (EUS).

**RESULTS**
On EUS, 12 patients were diagnosed with CP, 15 patients were rendered normal, and 5 patients had equivocal findings. There was no statistically significant correlation \((p = 0.357)\) between the CPSI score derived from the MRCP studies without secretin administration and EUS. Excellent correlation, however, between sMRCP and EUS was present. ROC analysis demonstrated an area under the curve of 0.983 \((p=0.008)\), with a cutoff value of 3.5 having sensitivity of 83% and specificity of 100% for the diagnosis of CP.

**CONCLUSION**
There was excellent correlation between the novel 10-point-scale, CPSI score derived from sMRCP and EUS for the diagnosis of CP. However, the score performance was poor when MRCP was performed without the use of secretin.

**CLINICAL RELEVANCE/APPLICATION**
The MRI Chronic Pancreatitis Severity Index (CPSI) can be used as a noninvasive alternative to EUS for the diagnosis of chronic pancreatitis, with comparable results when secretin is used.

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**SSK07-03 • Correlation between Secretin-enhanced MRCP Findings and Histopathologic Severity of Chronic Pancreatitis in a Cat Model**

**Tingting Zhang** (Presenter); **Li Wang**; **Dengbin Wang** MD, PhD; **Zhijun Huang**; **Yuhua Li**; **Jianping Lu** MD

**PURPOSE**
Secretin-enhanced magnetic resonance cholangiopancreatography (S-MRCP) is a noninvasive medical imaging technique that has been successfully used to evaluate pancreatic exocrine function in patients with chronic pancreatitis (CP). However, no detailed description of how S-MRCP findings relate to the severity of CP as determined by histopathology is currently available in the literature. The purpose of this study was to characterize this association in a cat model of CP.

**METHOD AND MATERIALS**
Thirty-two cats were divided into control \((n = 8)\) and experimental \((n = 24)\) groups. Cats in the experimental group underwent ligation of the pancreatic duct to induce CP, while the control group received a sham operation. MRCP was performed prior to, and 5 and 15 min after, secretin stimulation in all cats. All cats were then euthanized and pancreatic samples were processed for HandE and Sirius red staining to evaluate histopathological changes. The cats were then divided into four groups depending on the severity of CP as determined by histopathology: normal, minimal, moderate, or advanced. The S-MRCP parameters, consisting of the increasing degree of fluid volume \((IDFV)\) and the apparent diffusion coefficient \((ADC)\) of the pancreas were measured. Degrees of pancreatic fibrosis and expression of activated pancreatic stellate cells \((PSCs)\) were histopathologically determined. MR imaging parameters were correlated with the severity of CP as determined by histopathology: normal, minimal, moderate, or advanced.

**RESULTS**
Significant differences were observed in both IDFV and PDC between sham-operated \((control)\) cats and those with either moderate or advanced CP \((IDFV: P = 0.001, 0.000, \text{respectively}; PDC: P = 0.013, 0.001)\). There were no significant differences in the two parameters between the controls and those whose CP was minimal \((IDFV: P = 0.195; PDC: P = 0.964)\), although the minimal CP did show a downward trend.

**CONCLUSION**
IDFV and PDC measured with S-MRCP correlated with the histopathological severity of induced CP. S-MRCP could be used to evaluate the severity of CP, although it is somewhat insensitive for depicting very early disease.

**CLINICAL RELEVANCE/APPLICATION**
The assessment of exocrine pancreatic function by S-MRCP can contribute to select the appropriate medical treatment for chronic pancreatitis.

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**SSK07-04 • Fibrosis and Postoperative Fistula of the Pancreas: Correlation with MR Imaging Findings-Preliminary Results**

**Haruo Watanabe** MD (Presenter); **Satoshi Goshima** MD, PhD; **Hiroshi Kondo** MD; **Yoshifumi Noda** MD; **Masayuki Kanematsu** MD

**PURPOSE**
To assess the potential value of magnetic resonance \((MR)\) imaging to help assess pancreatic fibrosis and predict development of postoperative pancreatic fistula \((POPF)\).

**METHOD AND MATERIALS**
This retrospective study had institutional review board approval, and the requirement for informed consent was waived. MR images obtained in 29 consecutive patients \((15 \text{ men}, 14 \text{ women}; \text{mean age}, 64.9 \text{ years}; \text{range}, 21–80 \text{ years})\) who underwent pancreatectomy were evaluated. The pancreas-to-muscle signal intensity \((SI)\) ratio on unenhanced T1- and T2-weighted, dynamic contrast-enhanced, and diffusion-weighted images and the apparent diffusion coefficient \((ADC)\) of the pancreas were measured. Degrees of pancreatic fibrosis and expression of activated pancreatic stellate cells \((PSCs)\) were histopathologically determined. MR imaging parameters were correlated with the degrees of pancreatic fibrosis and activated PSC expression and the development of POPF.

**RESULTS**
Multiple regression analysis showed that the pancreas-to-muscle SI ratio on T1-weighted images and ADC value were significantly correlated with pancreatic fibrosis \((r^2 = 0.66, P < .001)\) and with activated PSC expression \((r^2 = 0.67, P < .001)\). The mean pancreas-to-muscle SI ratio on T1-weighted images was higher \((P = .0029)\) for patients with POPF \((1.6 \pm 0.2)\) than for those without \((1.2 \pm 0.2)\).

**CONCLUSION**
The pancreas-to-muscle SI ratio on T1-weighted images of the pancreas may be a potential biomarker for assessment of pancreatic fibrosis and prediction of POPF.

**CLINICAL RELEVANCE/APPLICATION**
The pancreas-to-muscle SI ratio on T1-weighted images may be a potentially useful biomarker for preoperatively predicting the progression of pancreatic fibrosis and development of POPF.

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**SSK07-05 • Single Centre Experience of Extending Indications for Percutaneous Intra-portal Islet Auto-transplantation (PIPIAT) after Pancreatic Surgery to Prevent Diabetes: Feasibility, Technical Aspects, Complications, and Clinical Outcome**

**Massimo Venturini** MD (Presenter); **Gianpaolo Balzano**; **Lorenzo Piemonti**; **Paola Maffi**; **Giulia Agostini**; **Alessandro Del Maschio** MD
PURPOSE
Percutaneous islet allo-transplantation, needing immunosuppression, is a traditional less invasive alternative to surgical pancreas transplantation for brittle type-1 diabetes, while PIPIAT, not needing immunosuppression, is usually performed after pancreatic surgery for chronic pancreatitis to prevent diabetes. Our aim was to assess feasibility, technical aspects, complications and clinical outcome of PIPIAT following pancreatic surgery, not only for chronic pancreatitis but also for benign and malignant nodules.

METHOD AND MATERIALS
From 2008 to 2012, 41 patients were enrolled for PIPIAT 24/48 hours after pancreatic surgery (total pancreatectomy, distal pancreatectomy for benign/borderline neoplasms of pancreatic body-neck). PIPIAT was performed using a combined US and fluoroscopy-guided technique (4-F catheter): portography and portal vein pressure assessment were performed before and after islet transplantation. Intrahepatic tract embolization was performed before final catheter removal. PIPIAT feasibility, complications, median follow-up, metabolic (insulin independence rate, graft function based on AIC score, marker of islet function) and oncologic (malignant and metastatic diseases) outcomes were recorded.

RESULTS
PIPIAT wasn’t performed in 7/41 patients (4 for inadequate islet mass, 2 for hemodynamic instability, 1 for islet cell culture contamination), while it was successfully performed in 34/34 patients. PIPIAT-related complications occurred in 8 patients (23.5%): 4 bleedings (2 requiring transfusions), 3 portal thromboses (1 complete, 2 partial), 1 sepsis. Median follow-up duration was 546 days. Insulin independence was achieved in 15/34 patients (44%), partial graft function in 16/34 patients (47%), no function in 3/34 patients (6%). Seventeen patients had malignancy; none of them developed liver metastases during follow-up.

CONCLUSION
PIPIAT, performed under a combined US and fluoroscopy guidance and not requiring immunosuppression, is feasible, with a relatively low complication rate and a better metabolic outcome than allo-transplantation.

CLINICAL RELEVANCE/APPLICATION
PIPIAT indications can be extended to selected patients with neoplasm, both benign and malignant. An increased islet mass may lead to the improvement of the metabolic outcome.

SSK07-06 • Feasibility and Reproducibility of Pancreatic Iron Overload Measurement Using Direct MR T2* Evaluation in Î²-Thalassemia Population

Carlo Liguori (Presenter); Francesca Pitocco; Ilenia Di Giampietro; Aldo Eros De Vivo; Francesco Sorrentino; Bruno Beomonte Zobel MD

PURPOSE
To assess feasibility of pancreatic iron accumulation in Thalassemia patients in course of MRI using T2* technique. To establish preferential patterns of overload among head, body and tail of the pancreas. To quantify intra-interobserver and interstudy variability in course of pancreatic T2* assessment. To assess normal ranges of pancreatic T2* values in Thalassemia subjects compared to non transfusion dependent population.

METHOD AND MATERIALS
In a setting of 210 TM patients we performed T2* MRI using gradient multi-echo sequences (12 echo range: 0.99-16.5 ms; slice thickness 10 mm) on pancreatic head, body and tail using three different acquisitions. Image analysis was performed using a dedicated software (CMR Tools, London, UK) and truncation method was used to account for background noise. Images were examined by two observers (obs) to assess interobserver variability and obs1 performed a double evaluation of same dataset for intraobserver variability. Each acquisition was repeated during the same exam to evaluate interstudy variability. Image quality (IQ) was assessed using a 5 point grading scale (o-very poor quality; 5-excellent quality).

RESULTS
Mean pancreatic T2* in normal subjects was 41±8.8 and significant difference (p Mean pancreatic T2* in TM value was 24.9±15.6 and significant difference (p Measurement in all three portions of the gland showed good intra-observer (p Image quality score resulted superior for pancreatic head (mean score 4.2) compared to body (3.6) and tail (2.8).

CONCLUSION
Direct assessment of pancreatic iron overload is feasible and can be considered a robust technique in terms of inter-observer and inter-study reproducibility. These data allow routinely gland assessment in course of MRI performed for iron burden in TM patients.

CLINICAL RELEVANCE/APPLICATION
Despite growing interest in to endocrine evaluation in thalassemia patients, Pancreatic iron overload assessment is still not widely adopted. Present study clarifies technical aspects in this field.

SSK07-07 • Free Breathing Dynamic Contrast MR Imaging with Navigator Technique for the Evaluation of the Pancreas

Takayuki Masui MD (Presenter); Motoyuki Katayama MD; Kimihiko Sato MD; Yuji Iwadate *; Kazuma Terauchi; Kei Tsukamoto; Kenichi Mizuki MD; Masayoshi Sugimura; Hiroyuki Kasabawa; Harumi Sakahara MD

PURPOSE
In elderly patients who cannot hold their breaths, information of dynamic contrast study may be limited. Navigator technique can be utilized for dynamic contrast studies with repeated acquisitions. The purpose was to evaluate feasibility of dynamic contrast study during free-breathing with navigator technique for evaluation of pancreatic lesions.

METHOD AND MATERIALS
The study was approved by IRB. 48 patients (23 men, 25 women, mean 73 years old), who underwent contrast MR imaging for pancreas at 3T between March 2011 and November 2012 were included. Pathologies were IPMN in 25 cases, other cystic in 7, solid in 2, and others in 14. After T2WI and MRCP, with navigator technique, pre and 5 phases of dynamic contrast images (Gd-chelate 0.1mmol/kg, slice thickness 3/4mm) in axial plane were obtained using 3DFSPGR (LAVA) under free-breathing followed by imaging without navigator. Image quality, blurring, recognition of each organ and lesions were evaluated using a five-point scale (1 undiagnostic-5 excellent). Imaging time, contrast ratio (SI on post/precontrast image) of each organ and lesions in the pancreas, sizes of lesions and number of the lesions were evaluated. Existence or absence of septa and nodules in lesions was evaluated. All evaluations were performed by two radiologists in consensus.

RESULTS
Imaging time tended to be prolonged in postcontrast phases (38-46sec). The enhancement was observed initially in the aorta followed by spleen and pancreas. All images in dynamic phases with navigator technique were diagnostic (Image quality; 4.4-4.7, Blurring 4.3-4.7, Lesion recognition 4.5-4.6). On images without navigator, blurring was prominent. Cystic (73 lesions in 35 cases, Fig), and solid lesions (2 lesion) were identified (mean diameter 15.5mm from 1mm to 57mm). Five lesions were missed and one serous cystic tumor was falsely recognized as solid. Septa in cysts were recognized in 31 of 45 cases. There was no nodule in cystic lesions.

CONCLUSION
With navigator technique, free breathing dynamic contrast MR imaging of the pancreas can be successfully obtained with acceptable quality and lesion recognitions. However, temporal resolution of each phase was not sufficient to evaluate solid lesions and faster imaging in combination should be considered.
**SSK07-08 • CT Depicted Pancreatic Parenchymal Attenuation as a Potential Screening Biomarker for Predicting Glucose Intolerance and Patient Body Habitus**

**Surabhi Bajpai** MBBS, DMRD (Presenter); **Yasir Andrabi** MD, MPH; **Andrew P Wright** MD; **Debra A Gervais** MD*; **Dushyant V Sahani** MD

**PURPOSE**
The purpose of this study was to investigate the correlation between pancreatic parenchymal attenuation measured on CT with patient body habitus and glucose intolerance.

**METHOD AND MATERIALS**
We retrospectively evaluated unenhanced abdominal CT scans performed in 120 patients (86M: 34F, mean age: 55.9 yrs, age range: 23-86 yrs) between 2008 and 2011 and found to have evidence of hepatic steatosis on CT scans. The patient cohort was categorized based on BMI (normal: =24.9, overweight: 25-29.9, mild obesity: 30-34.9, moderate obesity: 35-39.9, morbid obesity: >40). The CT scans were reviewed for pancreatic parenchymal attenuation (HU), pancreatic size and thickness of perirenal fat. The CT findings were compared with review of patient medical records for presence of glucose tolerance, diabetes, degree of hepatic steatosis and body habitus.

**RESULTS**
Pancreatic parenchymal attenuation showed a linear decrease in HU with increase in patient body habitus (Normal: 44.2±6HU vs morbid obesity: 22±1 HU, p

**CONCLUSION**
Pancreatic parenchymal attenuation decreases with increasing body weight and is a predictor for occurrence of impaired glucose tolerance and occurrence of diabetes.

**CLINICAL RELEVANCE/APPLICATION**
Excess pancreatic fat can have negative correlation to beta cell function, leading to glucose intolerance and diabetes. Imaging can be a potential screening biomarker for detection of pancreatic fat.

**SSK07-09 • Whole-organ CT Perfusion of the Pancreas: Impact of Iterative Reconstruction on Image Quality, Perfusion Parameters and Radiation Dose in 256-slice CT-preliminary Findings**

**Qian Xie** (Presenter); **Zonghui Liang**; **Juan Wu**; **Yafang Dou**; **Ying Tang**; **Xiaoyuan Feng** MD; **Feijia Xu**

**PURPOSE**
This study was to assess whether iterative reconstruction algorithm can reduce the radiation dose while maintaining acceptable image quality, and to investigate whether perfusion parameters vary from conventional filtered back projection (FBP) at the low-tube-voltage(80kVp) during whole-pancreas perfusion examination using a 256-slice CT.

**METHOD AND MATERIALS**
76 patients with known or suspected pancreatic mass underwent whole-pancreas perfusion by a 256-slice CT. High- and low-tube-voltage CT images were acquired.120-kVp image data(protocol A) and 80-kVp image data(protocol B) were reconstructed with conventional FBP algorithm, and 80-kVp image data were reconstructed with iDose4(protocol C) iterative reconstruction technique. The image noise; contrast-to-noise ratio(CNR) relative to muscle for the pancreas, liver, and aorta; and effective dose of each protocol were assessed quantitatively. Overall image quality was assessed qualitatively. Among 76 patients, 23 were eventually proven to have normal pancreas. Nine of 23 patients received 120-kVP CT perfusion scans and 14 of 23 received 80-kVP CT perfusion scans. Perfusion parameters of normal pancreas in each protocol including blood volume(BV), blood flow(BF), and permeability-surface area product(PS) were measured.

**RESULTS**
In the quantitative study, protocol C reduced image noise by 36.8% than protocol B/P

**CONCLUSION**
Low-tube-voltage and iDose4 iterative reconstruction technique can dramatically decrease radiation dose with acceptable image quality during whole-pancreas CT perfusion and have no significant impact on the perfusion parameters of normal pancreas compared to the conventional FBP reconstruction in the use of 256-slice CT scanner.

**CLINICAL RELEVANCE/APPLICATION**
Iterative reconstruction technique yields a significant improvement in image quality, decrease in radiation dose and appears not to impede calculation of healthy pancreas perfusion parameters.

**Genitourinary (Prostate Cancer: Multimodality Diagnosis and Staging of Disease)**

**Wednesday, 10:30 AM - 12:00 PM • E353C**

**SSK08 • AMA PRA Category 1 Credit ™: 1.5 • ARRT Category A+ Credit: 1.5**

**Moderator**
**Steven C Eberhardt**, MD

**Moderator**
**Antonio C Westphalen**, MD

**SSK08-01 • Comparison of Re-biopsy with Preceded MRI and Re-biopsy without Preceded MRI in Patients with Previous Negative Biopsy and Persistently High PSA**

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

**PURPOSE**
Still, it is unclear whether MRI performed prior to a repeated biopsy helps to detect more cancer in patients with preceded MRI than in patients without preceded MRI because there is rare comparative two-arm study. The purpose of our study was to retrospectively evaluate the value of a pre-biopsy MRI using a large population of patient and control groups.

**METHOD AND MATERIALS**
Between January 2007 and May 2011, a total of 709 patients underwent a transrectal ultrasound (TRUS)-guided biopsy. Of these patients, 179 (age range, 40 – 91; mean, 63.3) underwent MRI examination (MRI group) before repeat biopsy and 530 (age range, 38 – 85; mean, 64.5) did not (Non-MRI group). Cancer detection rate and positive core rate was performed between these groups. The odds ratios were also obtained.

**RESULTS**
Of 709 patients, 129 were histologically confirmed as adenocarcinoma. These cancer-proven patients consisted of 57 in the MRI group and 72 in the non-MRI group. Cancer detection rates of MRI and non-MRI groups were 31.8% (57/179) and 13.6% (72/530), respectively (p=0.000). Positive core rates of MRI and non-MRI groups were 8.9% (167/1877) and 3.0% (179/5903), respectively. The odds ratios of cancer detection rate and positive core rate were 3.0 and 3.1, respectively.
SSK08-02 • Quantitative Shear Wave Ultrasound Elastography for Prostate Cancer Imaging: Correlation to Pathology

Jean-Michel Correas MD *; Ahmed Khairoune *; Anne-Marie Tissier MD; Olivier Helenon; Richard G Barr MD, PhD (Presenter) *

PURPOSE
To prospectively evaluate in two independent centers the diagnostic performance of real-time quantitative Shear Wave Elastography (SWE) in detecting and characterizing prostate lesions in patients with increased PSA and/or abnormal digital rectal examination, by using histologic biopsy results scoring system as the reference method. Correlation between elasticity and Gleason Score (GS) was also performed to analyse the relation between tumor stiffness and pathology.

METHOD AND MATERIALS
The IRB approved this prospective, HIPAA-compliant study in both institutions. Written informed consent was obtained from 184 men undergoing ultrasonic guided systematic and targeted biopsies. Two blinded radiologists independently measured stiffness of prostate sextants and lesions depicted in ultrasound imaging. Biopsy core pathology analysis (GS) of corresponding sextants and lesions constituted the reference standard. The diagnostic performance at the sextant level and lesion detection sensitivity for lesions was calculated. The correlation between GS and tissue stiffness was investigated using Student T-test and Pearson's correlation coefficient.

RESULTS
A total of 184 patients were enrolled in the study, providing a total of 1176 peripheral zone regions including 1039 sextants and 137-targeted lesions. A total of 188 foci of cancer (size>2mm and GS=6) were detected in 65 patients. On the basis of the ROC curve analysis and to maximize the negative predictive value, a cutoff value of 35 kPa for the elasticity or 3.42 m/s for the shear wave velocity was chosen to differentiate benign and malignant regions (p

CONCLUSION
SWE might provide additional information for the biopsy guidance and differentiation of aggressive prostate cancers.

CLINICAL RELEVANCE/APPLICATION
Prostate tissue stiffness using Shear Wave Elastography could be used to guide prostate biopsy and significantly improve prostate positive biopsy rate.

SSK08-03 • Comparison of 1.5T vs. 3.0T Multiparametric MR Imaging in the Detection of High Grade Prostate Cancer

Daniel A Moses MBBS, FRANZCR (Presenter) ; Ronald C Shnier MBBS ; James Thompson MBBS ; Lee E Ponsky MD ; Phillip Brenner MBBS ; Warick Del Prado ; Andrew Hayen PhD ; Phillip Stricker MBBS

PURPOSE
Compare the efficacy of 1.5T and 3.0T mp-MRI in the detection/exclusion of high grade prostate cancer.

METHOD AND MATERIALS
A prospective study (for 300 men) was approved by the ethics board. 122 men had been randomised for mp-MRI at either 1.5T or 3T before a planned transperineal biopsy. The MR protocol included high resolution T2-weighted, diffusion and perfusion sequences without the use of an endorectal coil. Two uro radiologists used the PI-RADS reporting system independently for each scan. A combined score was attained by taking the average.

RESULTS
A total of 91/122 men received a average PI-RADS score of 2.5 or greater (intermediate to high risk of significant PCa), with 47/54 of men on the 1.5T MRI, and 44/68 of men on the 3T MRI being classified in the same way. On biopsy 48/122 [28/54 on 1.5T and 20/68 on 3T] had Gleason 7 or greater prostate cancer. 11/122 [6/54 on 1.5T and 5/68 on 3T] had Gleason 8 or higher prostate cancer. The positive biopsy rate was higher at 1.5T vs 3T for both Gleason thresholds. This equalised [1.5T 30% vs 3T 33%] with a threshold of Gleason 8 disease and above for significant disease.

CONCLUSION
MP-MRI, without an ER coil, can achieve very high NPV for significant prostate cancer (in our case 100%). There was no difference between the NPV when using a 1.5T or 3T MR system. The positive predictive value was higher for 1.5T (60%) vs 3T (45%) when choosing a threshold of Gleason 7 for significant disease. This equalised [1.5T 30% vs 3T 33%] with a threshold of Gleason 8. The false positive rate was higher at 1.5T vs 3T for both Gleason thresholds.

CLINICAL RELEVANCE/APPLICATION
Given the different costs and availability, knowing the relative strengths and limitations of assessment on 1.5T and 3.0T scanners allows planning in their use in the diagnosis of prostate cancer.

SSK08-04 • The Cost-effectiveness of MR-guided Targeted Biopsy versus Systematic TRUS-guided Biopsy in Diagnosing Prostate Cancer: A Modeling Study

Maarten De Rooij MD (Presenter) ; Simone Crienen ; Fred Witjes MD, PhD ; Jelle O Barentsz MD, PhD ; Maroeska M Rovers PhD ; Janneke P Grutters PhD

PURPOSE
To develop and apply a decision analytic model to determine whether multiparametric magnetic resonance imaging (mp-MRI) and targeted magnetic resonance guided biopsies (MRGB) are cost effective in the diagnosis of prostate cancer compared with standard systematic transrectal ultrasound guided biopsies (TRUSGB).

METHOD AND MATERIALS
A combined decision tree and Markov model was used to evaluate the quality-adjusted life years (QALYs) and healthcare costs of the MRI strategy (mp-MRI and targeted MRGB) compared with the standard strategy of systematic TRUSGB for a cohort of patients with clinical suspicion of prostate cancer. Input data were derived from systematic literature searches, including meta-analyses, and expert opinion. Probabilistic and threshold analyses were performed to assess uncertainty.

RESULTS
Expected costs of the MRI strategy per patient (€2349) were similar to those for the TRUSGB strategy (€2356). The corresponding QALYs were higher for the MRI strategy (6.57 versus 6.74). Threshold analysis revealed MRI is the dominant strategy (less costly and more effective) when the sensitivity of MRGB is 60% or higher. Probabilistic sensitivity analysis showed that in 92% of simulations, the MRI strategy was most effective. In 52% of the simulations MRI was more effective and less costly. The probability that the MRI strategy is cost effective is 90% at willingness to pay thresholds over €1,000/QALY.

CONCLUSION
When the sensitivity of mp-MRI and targeted MRGB for the detection of prostate cancer is proven to be 60% or higher, this new diagnostic strategy appears to be more efficient in detection of prostate cancer when compared with the current standard of systematic TRUSGB.

**Clinical Relevance/Application**
When sensitivity of this new diagnostic MRI strategy is proven to be satisfactorily high, it appears to be more efficient in diagnosing prostate cancer compared with the standard systematic TRUSGB.

**SSK08-05 • Validation of the European Society of Urogenital Radiology Score System for Prostate Cancer Diagnosis on Multiparametric MRI in a Cohort of Primary Biopsy Patients**

**Raphaële M Renard Penna** (Presenter) ; **Pierre Mozer** MD, PhD ; **Daniel Portalegre** MD ; **Francois Cornud** MD ; **Eva Comperat** ; **Bernard Malavaud** PhD, MD

**Purpose**
To assess the ESUR score system in the context of primary biopsies.

**Method and Materials**
IRB-approved, bicentric prospective study. 119 consecutive patients referred for primary prostate biopsies with normal DRE but elevated PSA (4-20ng/ml). Transfer of mpMRI suspicious areas on 3D-Transrectal ultrasound images by three-dimensional elastic surface registration (Koelis, UroStation, France) random systematic and targeted cores followed by core-by-core analysis of pathology and mpMRI characteristics. Relationships between ESUR scores and biopsy results were assessed by the Mann-Whitney U test. A teaching set was randomly drawn to construct the ROC curve of the ESUR sum of scores (ESUR-S). The threshold to recommend biopsy was obtained from the Youden J-statistics and tested in the remaining validation set.

**Results**
Higher T2-weighted, Dynamic Weighted Imaging and Dynamic Contrast Enhanced ESUR scores were observed in areas yielding cancer-positive cores. The proportion of positive cores increased with the ESUR sum of scores aggregated in five increments from less to more suspicious (percentage and 95%CI): 2.3% (1.2-3.3), 5.8% (3.5-8.0), 24.7% (18.3-31.1), 51.8% (42.4-61.1) and 72.1% (66.2-77.9) for increasing increments of ESUR-S, p for trend p.

**Conclusion**
In primary prostate biopsies, the ESUR score system was shown to provide clinically relevant stratification of the risk of showing prostate cancer in a given location.

**Clinical Relevance/Application**
MRI-TRUS fusion technology could provide optimal method to sample the prostate gland, reduce the number of cores needed to demonstrate cancer.

**SSK08-06 • The Role of Multi-parametric MRI for Assessment of Detection in Patients with a Low-risk Prostate Cancer**

**Jin Young Kim** (Presenter) ; **See Hyung Kim**

**Purpose**
To assess the diagnostic performance of multi-parametric MRI in cancer detection categorized by cancer volume and Gleason grade in clinically low-risk prostate cancer.

**Method and Materials**
One hundred consecutive patients with clinically low-risk cancer received multi-parametric MRI before radical prostatectomy, including T2-weighted (T2W), diffusion-weighted (DW) and dynamic contrast enhanced (DCE) MRI. By using scoring systems, two radiologists independently assessed likelihood of cancer per sextant on multi-parametric MRI. Cancer lesions of = 0.5cm3 identified on whole-mount step-section were correlated with multi-parametric MRI. The diagnostic performance of multi-parametric MRI was assessed for cancer volumes and Gleason grades.

**Results**
The inter-observer agreement for detection at the sextant level was in perfect agreement. In detecting pathologic cancer volume of = 0.5cm3, DW MRI and DCE MRI had a higher accuracy than T2W MRI. The accuracy of detection for cancers volume > 1cm3 or Gleason grade = 7 was significantly higher than cancers of volume 0.5 to 1cm3 or Gleason grade = 6, and multi-parametric MRI had a significantly higher diagnostic performance than T2W+DW MRI and T2W+DCE MRI. The multi-parametric MRI was more accurate with high pathologic cancer volume and Gleason grades. For lesions of cancer volumes > 1cm3 and Gleason grades = 7, the accuracy was significantly higher than with cancers of volume 0.5 to 1cm3 and Gleason grade = 6 (82.3% vs. 90.2%, P < 0.05).

**Conclusion**
In clinically low-risk cancer, the detection of multi-parametric MRI is significantly dependent on cancer volumes and Gleason grades. The higher cancer volumes and Gleason grades have high sensitivity, specificity and accuracy in detection.

**Clinical Relevance/Application**
In clinically low-risk cancer, the detection of multi-parametric MRI is significantly dependent on cancer volumes and Gleason grades.


**Matthias J Eiber** MD (Presenter) ; **Matthias Heck** ; **Michael Souvatuzoglou** ; **Tobias Maurer** ; **Markus Schwaiger** MD * ; **Ernst J Rummeny** MD ; **Bernd Krause**

**Purpose**
Computed tomography is of limited value for lymph node (LN) staging in prostate cancer (PCa) patients scheduled for radical prostatectomy (RP). To prospectively compare computed tomography (CT), diffusion-weighted magnetic resonance imaging (DWI) and [11C]choline positron emission tomography/computed tomography ([11C]choline PET/CT) for LN staging in PCa patients undergoing RP and extended pelvic lymph node dissection (ePLND).

**Method and Materials**
Between June 2010 and May 2012, we preoperatively performed CT, DWI and [11C]choline PET/CT in 33 intermediate and high risk PCa patients without neoadjuvant treatment. All patients underwent open RP and ePLND including the LN-fields obturator fossa, external, internal, common iliac vessels. Patient- and field-based performance characteristics for all 3 imaging techniques in comparison with histopathology are reported. Imaging techniques were compared by AUC-analyses (area under the curve).

**Results**
LN metastases were detected in 92 of 1012 (9%) LNs from 14 of 33 (42%) patients. ePLND achieved a median of 30 dissected LNs per patient (range 9-61). On a patient-based analysis, sensitivity for CT, DWI and [11C]choline PET/CT were identical (57.1%, 57.1% and 57.1%, respectively), but specificity was best for [11C]choline PET/CT (68.4%, 78.9% and 89.5%, respectively). On a LN-field-based analysis, sensitivity was best for [11C]choline PET/CT followed by DWI and CT (61.8%, 55.9% and 47.1%, respectively) whereas specificity was similar for all 3 imaging techniques (96.5%, 96.0% and 94.3%, respectively). However, neither DWI nor [11C]choline PET/CT performed better than CT in a pair-wise comparison of AUCs of patient- and field-based results (p>0.05, respectively).

**Conclusion**
Neither DWI nor [11C]choline PET/CT perform statistically significant better than CT for preoperative detection of LN-metastases in PCa...
patients scheduled for RP and ePLND. All 3 imaging techniques have a low sensitivity with less than two thirds of LN metastases being detected on a patient-/ or LN-field-based analysis.

CLINICAL RELEVANCE/APPLICATION
Our data indicate that neither [11C]choline PET/CT nor DWI can be recommended to replace adequate ePLND for determining a patient’s LN status or to define the extent of a PLND on an individual basis.

SSK08–08 • Dynamic Contrast Enhanced MR Imaging Features of the Normal Central Zone of the Prostate

Barry G Hansford MD (Presenter) ; Ibrahim Karademir MD ; Yahui Peng PhD ; Yulei Jiang PhD ; Gregory S Karczmar PhD * ; Stephen Thomas MD ; Ambereen Youssuf MBBS ; Tatjana Antic ; Scott Eggener * ; Aytekin Oto MD *

PURPOSE
Evaluate qualitative dynamic contrast enhanced magnetic resonance imaging (DCE-MRI) characteristics of normal central zone (CZ) based on recently described CZ MR imaging features.

METHOD AND MATERIALS
Retrospective, HIPAA compliant study with Institutional Review Board approval. Evaluated 82 patients with prostate cancer (PCa) who underwent pre-operative, multi-parametric endorectal MR before radical prostatectomy. 19 patients with tumor involving portions of the CZ or prostate base on histopathology were excluded, as were four patients with MR artifacts. Final cohort of 59 patients: mean age, 59.9 years; age standard deviation (SD), 7.0; age range, 43-72; average serum prostate-specific antigen (PSA) level, 8.7 mL/ng; PSA SD, 8.0; and PSA range, 1.7–40.9. Two readers independently reviewed T2-weighted images and ADC maps to identify normal CZ based on its low signal intensity and characteristic location. Next, two readers drew bilateral CZ regions of interest on DCE-MRI images in consensus and then independently recorded enhancement curve types as: type 1 (progressive enhancement), type 2 (plateau) and type 3 (wash-out). Identification rates of normal CZ and enhancement curve type were recorded and compared for each reviewer.

RESULTS
CZ identified in 92% to 93% of patients on T2-weighted images and 78% to 88% on ADC maps without a significant difference between identification rates (p=0.63 and p=0.15 and Inter-reader agreement, χ=0.64 and 0.29, for T2-weighted images and ADC maps, respectively). All CZs rated as either curve type 1 or 2 by both radiologists. Type 1, progressive enhancement (24/104 or 23% of curve types), type 2, plateau enhancement (80/104 or 77% of curve types) and type 3, wash-out (0/104 or 0% of curve types). No statistically significant difference between the two radiologists (p = 0.19) and inter-reader agreement was χ = 0.37.

CONCLUSION
Normal CZ demonstrates type 1 or type 2 enhancement curves on DCE-MRI which can potentially be useful to differentiate CZ from PCa which classically demonstrates a type 3 (wash-out) curve. CZ identified in majority of patients based on characteristic location and low signal on T2-weighted images and ADC maps.

CLINICAL RELEVANCE/APPLICATION
Our study shows that the normal CZ demonstrates either type 1 or type 2 enhancement time-curves on DCE-MRI, which can be potentially used to differentiate the CZ from PCa.

SSK08–09 • Dynamic Active Surveillance¿½? for Low-to-Intermediate Risk Prostate Cancer: Combined Results of a Phase I/II Trial of MRI-guided Focal Laser Ablation, Feasibility and Features Predictive of Recurrence

Tristan Barrett MBBS, BSc (Presenter) ; Sangeet Ghai MD * ; Eugen Hlasny PhD ; Sean R Davidson PhD ; Masoom A Haider MD * ; Mark R Gertner PhD ; Jeremy Cepek PhD ; Aaron Fenster PhD ; John Trachtenberg MD

PURPOSE
To assess the feasibility of MRI-guided focal laser ablation therapy for prostate cancer and evaluate predictors of a successful treatment outcome.

METHOD AND MATERIALS
Institutional review board approval was granted for prospective recruitment. Inclusion criteria: biopsy-proven intermediate, or less, risk PCa; exclusion-criteria: high-risk disease, or prior PCa treatment. All patients underwent diagnostic MRI, with target lesions outlined. A modified brachytherapy MR-guidance template was used for transperineal placement of catheter/s, with Indigo-Optima® laser fibres placed within. The zone of ablation was monitored in real-time by MRI thermography. Post-procedure coagulation volume was determined by contrast-enhanced T1-weighted imaging.

RESULTS
Treatment was successfully completed in all 40 patients. Two patients were lost to follow-up. Mean follow-up was 671 days (range 150–1,157). At 4-6 month or subsequent biopsy, 13/38 patients (34.2%) had residual/recurrent cancer in the region treated, 25 patients (65.8%) had no recurrence. Between these groups there was no significant association between baseline Gleason-grade, PSA, risk category, number of positive biopsy cores or %core involvement, or tumor size/location/marginal extension. The likelihood of tumor on diagnostic MRI (P=0.004) and complete lesion coverage by thermal ablation zone (P

CONCLUSION
Focal laser ablation is a feasible and effective therapy for patients with low-to-intermediate risk PCa. Predictors of successful therapy include confident presence of the lesion on diagnostic MRI and full peri-procedural coverage of the target.

CLINICAL RELEVANCE/APPLICATION
We show the feasibility of focal laser ablation therapy. Focal therapy is an option for lower risk PCa patients uncomfortable with the risks of active surveillance or side effects of radical therapy.

Genitourinary (Functional and Anatomical Imaging in Staging and Follow-up of Gynecologic Cancers)

Wednesday, 10:30 AM - 12:00 PM • N228

SSK09 • AMRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

Moderator
Andrea G Rockall , MRCP, FRCR *

Moderator
Elizabeth A Sadowski , MD

SSK09–01 • Anatomical and Functional Volume Concordance between FDG-PET, T2 and Diffusion Weighted MRI for Cervical Cancer: A Hybrid PET/MRI Study

Hongzan Sun (Presenter) ; Jun Xin MD ; Shaomin Zhang ; Qiyong Guo MD

PURPOSE
To evaluate the concordance of imaging by [18F] fluorodeoxyglucose (FDG) - positron emission tomography (PET), T2 weighted imaging (T2WI) and apparent diffusion coefficient (ADC) maps with diffusion-weighted imaging (DWI) in cervical cancer using hybrid whole-body PET/MRI.

Back to Top
METHOD AND MATERIALS
Cervical cancer patients (N=35) were prospectively recruited to undergo pretreatment 18FDG-PET/MRI. 18FDG-PET and MRI images were fused using standard software. The percent of the maximum standardized uptake value (SUVmax) was used to contour tumors on PET images and volumes were auto calculated. Tumor volumes measured by T2WI and DWI were calculated with standard techniques of tumor area multiplying slice profile. Data analysis used parametric statistics.

RESULTS

CONCLUSION
Hybrid PET/MRI showed strong concordance between FDG-PET, T2WI and DWI in cervical cancer. Cutoff at 35% or 40% of SUVmax is recommended during 18FDG PET-MRI SUV-based tumor volume estimation. Tumor subvolumes with increased metabolic activity on FDG-PET also have greater cell density by DWI.

CLINICAL RELEVANCE/APPLICATION
Hybrid PET/MRI was demonstrated a reliable method in cervical cancer imaging, and will benefit its clinical decision making by combining accordant anatomical and functional information together.

SSK09-02 • Radiologists’ Adherence to the 2010 Society of Radiologists in Ultrasound Guidelines for the Management of Incidental Adnexal Cysts Imaged at Ultrasound: Frequency and Associated Factors

Andrea S Kierans MD (Presenter) ; Andrew B Rosenkrantz MD

PURPOSE
To evaluate adherence to the 2010 Society of Radiologists in Ultrasound (SRU) guidelines for management of incidental adnexal cysts imaged at ultrasound.

METHOD AND MATERIALS
398 adnexal cysts initially detected at ultrasound were included; all studies had been performed after publication of the SRU guidelines and guideline review at departmental conferences. The ultrasound reports were retrospectively reviewed to determine whether the management recommendations were adherent to the guidelines. Non-adherent cases were categorized as over-management, under-management, or as incomplete in their recommendation. Impact of categories determining appropriate recommendation (menopausal status, cyst size, and other cyst imaging features) was assessed via the chi-square test, and the primary cause for non-adherence (over- vs. under-management) in each sub-category was identified.

RESULTS
Among all 398 adnexal cysts, the frequency of adherence was 55%, over-management was 27%, under-management was 12%, and incomplete recommendation was 6%. Menopausal status, cyst size, and other cyst imaging features all significantly impacted adherence rate (all p<0.05). Lesions adherent in most instances were simple cysts (55%), para-ovarian cysts (71%), corpus luteums (88%), and cysts suggestive of a hemorrhagic cyst, endometrioma, or dermoid (57%). Lesions with under-management in most instances were cysts with multiple thin septations (83%), thick irregular septations (33%), or an avascular nodule (67%), and dermoids (78%). Lesion with over-management in most instances was cyst with one thin septation (64%).

CONCLUSION
Radiologists at our institution adhered to the SRU guidelines for incidental adnexal cysts at ultrasound in 55% of cases. Non-adherence was greater in post-menopausal patients, larger cysts, and cysts with greater complexity.

CLINICAL RELEVANCE/APPLICATION
Our findings will be used to direct future efforts to improve adherence to the SRU guidelines, which in turn will improve patient care. Causes of both under- and over-management will be addressed.

SSK09-03 • Early Response Assessment to Concurrent Chemoradiotherapy in Cervical Cancer: Value of Diffusion-weighted and Dynamic Contrast-enhanced MR Imaging

Sohee Song (Presenter) ; Chan Kyo Kim MD, PhD ; Jung Jae Park MD ; Sung Yoon Park ; Byung Kwan Park MD ; Seung Jae Huh PhD

PURPOSE
To prospectively investigate the value of diffusion-weighted (DWI) and dynamic contrast-enhanced MR imaging (DCEI) as early and reproducible response predictors in cervical cancer patients who received concurrent chemoradiotherapy (CCRT).

METHOD AND MATERIALS
Sixteen consecutive patients with biopsy-proven cervical cancer who treated with CCRT were evaluated with MR imaging at 3T, including DWI and DCEI. Four serial MR examinations were performed before CCRT (preTx), after 1 week of therapy (postTx1), after 4 weeks after therapy (postTx2), and after 1 month after the end of therapy (postTx3). At each time point, apparent diffusion coefficient (ADC) and DCEI parameters were calculated in the tumor, gluteus muscle and normal uterus and the results were compared. Tumor response at postTx2 or postTx3, as determined by changes in tumor size or volume using MRI was correlated with tumor ADC or DCEI parameters at preTx and postTx1, or correlated with changes in tumor ADC and DCEI parameters between preTx and postTx1. For reproducibility of ADC and DCEI parameters measurement, 10 patients had two separate pretreatment DWI and DCEI at an interval of < 2 weeks.

RESULTS
At each time point, ADC and DCEI parameters (i.e., $k_{trans}$ and $v_e$) in the tumors showed consecutive increase (all $P<0.05$), while those of gluteus muscle and normal uterus did not reveal a significant difference (all $P>0.05$). At postTx1 tumor ADCs showed a significant correlation with tumor size response at postTx2 ($P=0.003$). Changes in tumor ADCs between preTx and postTx1 had a significant correlation with tumor size ($P=0.001$) and volume response ($P=0.021$) at postTx2. At preTx, tumor $k_{trans}$ showed a significant correlation with tumor volume response at postTx3 ($P=0.033$); tumor $k_{ep}$ and $v_e$ had a significant correlation with tumor size response at postTx2 ($P=0.043$ and $P=0.019$, respectively). Reproducibility of ADC versus DCEI parameters measurements in the tumor, gluteus muscle and normal uterus was confirmed with a mean difference of 0.3% versus 0.6%–16.6%, 1.7% versus 0.5%–12.3%, and 2.2% versus 0.9%–17.8% in sequence, respectively.

CONCLUSION
DWI and DCEI, as early and reproducible biomarkers, have the potential to evaluate therapeutic response to CCRT in patients with cervical cancer.

CLINICAL RELEVANCE/APPLICATION
As imaging biomarkers, ADC and DCEI parameters may aid in the development of more individualized, effective therapy regimens for the patient group.

SSK09-04 • Clinical Application of Diffusion-weighted MR Imaging in Uterine Cervical Cancer

Ying Liu (Presenter) ; Zhao Xiang Ye

PURPOSE
To investigate the application value of apparent diffusion coefficient (ADC) values in evaluating the histological type as well as pathologic grade of uterine cervical cancer; and to investigate whether ADC values could reflect tumorcellularity density.

METHOD AND MATERIALS
Cancer SSK09-07 •

Endometrial Carcinomas

Gradient echo images were measured in the tumor and normal uterus using manufacturer-supplied software (PRIDE Relaxation Maps Tool, preTx); after 1 week of therapy (postT1); and after 4 weeks after therapy (postT2). BOLD MRI was performed using a multiple fast field echo (mFFE) sequence with 8, 12, 16 and 20 gradient echoes. At each time, the rate of spin dephasing (R2*) values at 4 different gradient echoes were measured in the tumor and normal uterus using manufacturer-supplied software (PRIDE Relaxation Maps Tool, version 2.1.1, Philips Healthcare), and the results were compared. For reproducibility of R2* measurements, 8 patients had two separate

RESULTS

Both mean ADC value and minimum ADC value of squamous cell carcinoma were significantly lower than that of adenocarcinoma (P=0.001; P=0.000). Using mean ADC criteria (>0.965×10^{-3}mm^2/s) and minimum ADC criteria (>0.844×10^{-3}mm^2/s), the sensitivity and specificity for differentiating squamous cell carcinoma from adenocarcinoma were 83.5% and 76.9%, 77.6% and 92.3%, respectively. The AUC of mean ADC was not statistically greater than minimum ADC (P=0.990). Tumor cellularity density, mean ADC value and minimum ADC value of different pathological grade varied significantly (P=0.000, P=0.000, P=0.000). There was a significant positive linear correlation between tumor cellularity density and the pathological grade of tumor (P=0.000). Both mean ADC value and minimum ADC value correlated negatively with cellularity density (P=0.000, P=0.000) and the pathological grade of tumor (P=0.000, P=0.000). Comparisons of correlation coefficients showed no significant differences (P=0.656, P=0.631).

CONCLUSION

DWI has a potential ability to indicate the histologic type of uterine cervical cancer. ADC measurements of uterine cervical cancer can represent cellularity density, thus providing a new method for evaluating the pathological grade of tumor. Mean ADC value instead of minimum ADC value was recommended to fully reflect the whole tumor.

CLINICAL RELEVANCE/APPLICATION

DWI with ADC measurement may be helpful for the noninvasive and preoperative prediction of the histologic type and degree of differentiation of uterine cervical cancer.

SSK09-05 • Tumor ADC Value Is Associated with Depth of Myometrial Invasion and Is Negatively Correlated to Tumor Volume in Endometrial Carcinomas

Jenny A Husby MD (Presenter); Inger J Magnussen; Jone Trovik MD; Oyvind Salvesen; Line Bjorge; Helga Salvesen MD, PhD; Ingrid S Haldorsen MD

PURPOSE

Explore possible correlations between tumor apparent diffusion coefficient (ADC) values, morphological imaging findings and clinical and pathological patient and tumor characteristics in endometrial carcinomas. To investigate interobserver agreement between readers on preoperative staging by MRI, including diffusion weighted imaging (DWI).

METHOD AND MATERIALS

RESULTS

CONCLUSION

Low tumor ADC value is associated with presence of deep myometrial invasion and the ADC value is negatively correlated to tumor volume in endometrial carcinomas. Preoperative staging by MRI with DWI is prone to considerable interobserver variability. Calculation of tumor ADC values may aid in the prediction of deep myometrial invasion in endometrial carcinomas.

CLINICAL RELEVANCE/APPLICATION

Low tumor ADC value is associated with presence of deep myometrial invasion, and DWI may aid in the prediction of deep myometrial invasion in endometrial carcinomas.

SSK09-06 • Temporal Changes of Imaging Parameters of MRI and FDG-PET/CT during Treatment in Cervix Cancer

Saba N Elias MSc (Presenter); Guang Jia PhD; Nina A Mayr MD; William T Yuh MD; Jun Zhang PhD; Michael V Knopp MD, PhD; Nathan C Hall MD, PhD *

PURPOSE

To prospectively assess the temporal changes of multi-imaging parameters from MRI and PET/CT, including ADC, tumor size, and standardized uptake value (SUV) for early therapy monitoring in cervix cancer patients.

METHOD AND MATERIALS

Ten cervical cancer patients with stage IB2-IVA underwent: 4 multi-parametric 1.5 T MRI (pre-, early-, mid- and post-therapy) and 3 PET/CT using 18F-fluorodeoxyglucose (FDG), (pre-, early-, and mid-therapy). A total dose of 4500 cGy was given with external beam radiation therapy, as well as concurrent weekly chemotherapy with cisplatin (25-40 mg/m²). 3-dimensional tumor region of interest were identified using MIM software. ADC map values and T2W based tumor size were calculated using MIAPAV software for the four sequential MRIs. Max SUV body weight (bw) was calculated using MIM software for the 3 sequential PET/CT scans.

RESULTS

Multi-parametric MRI showed gradual reduction in tumor size and an increase in the ADC values while PET/CT SUV decreased from pre-therapy to mid-therapy; the mean values of these parameters are: pre-therapy ADC 0.0010 ± 0.0002 mm²/s, tumor size 47.8±34.6 cm³ and max SUVbw 15.8±5.4, early-therapy ADC 0.0011±0.0002 mm²/s, tumor size 34.4±24.3 cm³ and max SUVbw 11.8±2.3, and post-therapy ADC 0.0012±0.0002 mm²/s, tumor size 6.3±3.8 cm³. A negative correlation between pre-therapy ADC and max SUV was found (r=-0.56). A tumor size reduction rate from pre-therapy to post-therapy is negatively correlated to ADC increase rate (r=-0.73).

CONCLUSION

Imaging parameters from the MR and PET/CT, standard modality for the assessment of treatment response in cervical cancer, correlate significantly and our limited data suggest both modalities are efficacious during early treatment. Our research establishes an opportunity to further investigate the comparative effectiveness of each parameter at different treatment time points and further augment the potentials of these parameters for the early responsiveness assessment and long-term outcome prediction.

CLINICAL RELEVANCE/APPLICATION

Current research paves the foundation for cost-effective analysis of the presumed "expensive" MR and PET/CT and potential augmentation of these parameters for the early responsiveness assessment and long-term outcome prediction.

SSK09-07 • Blood Oxygenation Level-Dependent MR Imaging: Early Changes to Concurrent Chemoradiotherapy in Cervical Cancer

Jungmin Bae (Presenter); Chan Kyo Kim MD, PhD; Seung Hee Choi; Sung Yoon Park; Byung Kwan Park MD

PURPOSE

To investigate the feasibility of blood oxygenation level-dependent (BOLD) MR imaging (MRI) in assessing early changes to concurrent chemoradiotherapy (CCRT) in patients with cervical cancer.

METHOD AND MATERIALS

This prospective study was approved by our institutional review board. 15 consecutive patients with biopsy-proven cervical cancer who treated with CCRT were evaluated with MRI at 3T, including BOLD MRI. Three serial MR examinations were performed before CCRT (preTx); after 1 week of therapy (postT1); and after 4 weeks after therapy (postT2). BOLD MRI was performed using a multiple fast field echo (mFFE) sequence with 8, 12, 16 and 20 gradient echoes. At each time, the rate of spin dephasing (R2*) values at 4 different gradient echoes were measured in the tumor and normal uterus using manufacturer-supplied software (PRIDE Relaxation Maps Tool, version 2.1.1, Philips Healthcare), and the results were compared. For reproducibility of R2* measurements, 8 patients had two separate
Whole-body 18F-FDG PET/MRI may be applied as a stand-alone staging technique for patients with suspected pelvic malignancies.

**RESULTS**

The mean R2* values of the tumors from preTx to postT2 tended to have consecutive increase at 8 echoes (20.7, 22.4 and 34.1), 12 echoes (20.9, 22.7 and 32.1), 16 echoes (21.3, 22.5 and 34.1) and 20 echoes (20.9, 22.8 and 33.3); however, compared with preTx, postT2 showed a significant increase in R2* values (P < 0.001), while postT1 had no significant difference (P > 0.05). At each time, the mean R2* values of the normal uterus were not significantly different at 4 different gradient echoes (P > 0.05). At 4 different gradient echoes, the reproducibility of R2* measurements in the tumor and normal uterus was confirmed with a mean difference of 0.1%–2.8% and 0.2%–7.6%, respectively.

**CONCLUSION**

BOLD MRI is a feasible, reproducible technique and may demonstrate early physiologic changes to CCRT in patients with cervical cancer.

**CLINICAL RELEVANCE/APPLICATION**

As a noninvasive, reproducible biomarker, BOLD MRI can be used to evaluate early therapeutic response to CCRT in patients with cervical cancer.

**SSK09-08 • Diagnostic Accuracy of PET/MRI in Gynaecological Malignancies: Initial Results**

Patrick Veit-Halbach MD (Presenter) *; Nik Hauser MD; Bianca Chilla MD; Gustav K Von Schulthess MD, PhD *; Rahel A Kubik-Huch MD

**PURPOSE**

To assess and to compare the diagnostic accuracy of PET/CT and PET/MRI in primary and metastatic gynaecological malignancies.

**METHOD AND MATERIALS**

13 patients (13 female, mean age: 64, range 55–76 years) with different primary and recurrent gynaecological diseases underwent a contrast-enhanced tri-modality PET/CT-MRI examination (PET/CT D 690 and 3T MRI 750W, GE Healthcare). Patients were first injected with an average of 320 MBq F18-FDG and then rested for 30 minutes. Then, a full diagnostic, contrast-enhanced MRI of the abdomen and pelvis, based on the current guidelines, was acquired with the following sequences: coronal T2 SSFSE pelvis, axial T2 SSFSE liver, axial T1 LaveFlex whole abdomen, axial diffusion pelvis, sagittal/axial T2 propeller pelvis, sag/axial T1 LavaFlex post contrast whole abdomen.

After the MRI, patients were transferred on a dedicated shuttle to the PET/CT. Here, a standard PET/CT with/without intravenous contrast media was acquired (FOV: mid-thigh to the vertex of the skull. CT: 50–79 mAs/slice, automated dose modulation 120 kVp, 3.75 mm slice thickness, PET: 3D mode, 2 minutes/bed, iterative reconstruction with 3 iterations, 18 subsets). All data were evaluated on a commercially available workstation and can be displayed as PET, CT, PET/CT and PET/MRI. PET/MRI and PET/CT were evaluated concerning detection and conspicuity of the primary tumor, lymph node metastases and distant metastases. Readers also evaluated if the PET/MRI revealed relevant additional information compared to PET/CT.

**RESULTS**

Acquisition of PET/CT-MRI and PET/CT vs. PET/MRI evaluation was feasible in all patients. Concerning the primary tumour, the PET/CT was superior in 2 cases, PET/MRI in 5 cases, concerning lymph nodes PET/CT was superior in 2 cases, PET/MRI in 2 cases, in abdominal metastases PET/CT was superior in 2 cases, PET/MRI in none. PET/CT overall showed additional relevant additional information in 9 cases mainly concerning distant metastases, while PET/MRI showed relevant additional information in 3 cases concerning the primary tumour.

**CONCLUSION**

PET/MRI is well feasible within a tri-modality PET/CT-MRI system. The PET/MRI shows mainly advantages concerning the evaluation of the primary tumor/local pelvic situation while the PET/CT has advantages concerning distant metastases.

**CLINICAL RELEVANCE/APPLICATION**

PET/MRI might be eligible to replace PET/CT in the work-up of OB-Gyn cancers.

**SSK09-09 • 18F-FDG PET/MRI versus MRI Alone for Whole Body Staging of Patients with Recurrent Malignancies of the Female Pelvis**

Karsten J Beiderwellen MD (Presenter) ; Johannes Grueneisen; Verena Hartung; Philipp Heusch MD; Rainer Kimmig; Thomas C Lauenstein MD; Lale Umutlu MD *

**PURPOSE**

To evaluate the diagnostic benefit of integrated 18F-FDG PET/MRI for whole-body staging of female patients with recurrent pelvic malignancies compared to MRI alone.

**METHOD AND MATERIALS**

In 10 of 13 patients malignant lesions were present. A total of 41 lesions, comprising 29 malignant and 12 benign lesions were detected. PET/MRI offered correct and respectively superior identification of all 10 patients with cancer lesions, compared to MRI (without DWI, 6/10; including DWI 8/10). Additionally, 18F-FDG PET/MRI exhibited higher conspicuity (PET/MRI: median: 4, range: 3-4; MRI: median: 4, range: 2-4) and diagnostic confidence (PET/MRI: median: 3, range 2-3; MRI: median: 2, range 1-3, MRI +DWI: median: 3, range 1-3) in the detection of malignant lesions (p

**CONCLUSION**

Our results demonstrate the superiority of 18F-FDG PET/MRI in detecting malignant lesions compared to MRI alone. Thus, whole body PET/MRI may be utilized as a stand-alone imaging technique for staging of patients with suspected pelvic malignancies, allowing for significant time reduction due to omission of T2w and DWI MRI.

**CLINICAL RELEVANCE/APPLICATION**

Whole-body 18F-FDG PET/MRI may be applied as a stand-alone staging technique for patients with suspected pelvic malignancies.
SSK10-03 • Assessing Competence of Non-physician Providers Trained in Point-of-Care Obstetrical Ultrasound in Under-resourced Settings of Western Kenya

H. B Harvey MD, JD (Presenter); Daniel Price MD; Roy Ahn MPH; Garry Choy MD, MS; Giles W Boland MD; Thomas Burke MD *

PURPOSE
Hand-held ultrasound machines have the potential to positively impact infant and maternal mortality in the developing world by identifying patients with high risk conditions that should deliver in a hospital setting. However, due to the paucity of radiologists in the developing world, training of non-radiologist clinicians in point-of-care ultrasound is essential. We trained a select group of nurse midwives in resource-limited areas of Western Kenya and empowered them to implement antenatal ultrasound screening programs in their hospitals and clinics. At least six months after training, we evaluated their retained obstetrical ultrasound skills.

METHOD AND MATERIALS
From February 2011 through August 2012, nine nurse midwives underwent an intensive one-week training course to perform and interpret point-of-care ultrasound examinations followed by a few weeks of supervised on-the-job training. Approximately six months after completion of training, fellowship trained sonographers subjected the providers to an objective structured clinical examination (OSCE). The OSCE graded their ability to assess gestational number, gestational age, fetal heart rate, fetal position, placental position, and amniotic fluid index on a 3 point scale (0 = inadequate, 1 = adequate, 2 = excellent). The maximum score for the OSCE was 12.

RESULTS
The ultrasound screening programs were set up in three hospitals and six clinics. The average age of the providers was 36.9 y (28-60yrs, stdev 12.9 yrs). The providers performed an average of 9.3 scans per month (4-15, stdev 4.6) in their home clinics and hospitals. All of the providers achieved at least a score of 1 (adequate) on all the assessed OSCE measures with an average per skill score of 1.6. The average total OSCE score per provider was 9.9 (8-12, stdev 1.3).

CONCLUSION
The findings suggest that non-physician clinical providers retain basic skills in point-of-care maternal ultrasound after one week of intensive training. Confident with the quality of the service provided, we next hope to begin the process of evaluating the potential longitudinal impact of these maternal ultrasound screening programs on patient management and maternal and infant outcomes.

CLINICAL RELEVANCE/APPLICATION
Non-physician clinical providers can be trained to reliably perform and interpret point-of-care obstetrical ultrasound examinations in resource-limited areas of the developing world.

SSK10-04 • Radiologist Compliance with Institutional Guidelines for Use of Non-routine Communication of the Results of Radiologic Examinations

H. B Harvey MD, JD (Presenter); Tarik K Alkasab MD, PhD; Gloria M Salazar MD; Daniel I Rosenthal MD; G. Scott Gazelle MD, PhD *

PURPOSE
Failure to appropriately communicate the results of radiologic examinations in urgent or non-routine clinical situations is a common source of medical malpractice liability in radiology. In 2009, the Departments of Radiology across our large integrated health system came together and developed guidelines for non-routine communication of diagnostic imaging findings based on the urgency of the findings and in view of existing guidelines and requirements. We study radiologist compliance with the guidelines nearly three years after implementation.

METHOD AND MATERIALS
From July 2012 through March 2013, 6,716 randomly selected radiology reports with images across all sections were reviewed in a peer-review conference format by at least three radiologists. The reviewing radiologists were asked to reach a consensus on two questions of non-routine communication: (1) “Does the report contain a finding which requires non-routine communication to the patient’s physicians?” and (2) if so, “Were departmental guidelines for non-routine communication followed?” Consensus judgments were subsequently aggregated and analyzed based on section, level of acuity per the guidelines (i.e. Level 1, 2 or 3), and type of communication employed.

RESULTS
Of the 6,716 studies reviewed, 718 (10.7%) were deemed to require non-routine communication of results and 17 (0.3%) resulted in no consensus as to whether non-routine communication was required. Out of the 718 studies deemed to require non-routine communication, 20 cases (3%) resulted in a consensus that the guidelines were not followed: 4 of these were level 1 findings, 4 were level 2 findings, and 12 were level 3 findings. Neurological imaging accounted for the majority of the failures of non-routine communication with 60% of the
CONCLUSION
Guidelines for non-routine communication are appropriately applied in the vast majority of clinical cases at our large academic medical institution years out from their introduction.

CLINICAL RELEVANCE/APPLICATION
Non-routine communication of radiologic results is an important aspect of the radiology quality and safety landscape and efforts to ensure that it occurs consistently and effectively remain essential.

SSK10-05 • Second-opinion Consultations in Musculoskeletal Radiology

Majid Chalian MD (Presenter); Filippo Del Grande MD, MBA; Rashmi S Thakkar MD; Sahar J Farahani MBBS; Avneesh Chhabra MD *; Shadpour Demehri MD; Laura M Fayad MD; John A Carrino MD, MPH *

PURPOSE
To assess the patient care benefit of an institutional policy requiring official second-opinion consultation for all imaging examinations performed outside the institution.

METHOD AND MATERIALS
The institutional review board approved the retrospective review of patient data for this HIPAA-compliant study and waived the need for individual informed consent. Two trained radiology fellows compared the second-opinion consultation reports for outside musculoskeletal radiology exams within calendar years 2010 and 2011 with the outside original reports. The reports were categorized by using a five-point ordinal rating scale: 1, no difference in interpretation; 2, clinically unimportant difference in detection; 3, clinically unimportant difference in interpretation; 4, clinically important difference in detection; and 5, clinically important difference in interpretation. Clinically important differences were defined as those likely to change patient care or diagnoses. Inter-observer reliability was assessed using linear-weighted kappa.

RESULTS
Of 3165 exams, 2326 (73.5%) had an outside report for comparison. There were 472 (20.3%) instances with clinically important differences. Of these 472 discrepancies, 214 (45.3%) were category 4 and 258 (54.7%) were category 5. When definitive diagnoses was obtained, pathology reports (580 exams), 102 (17.4%) studies had clinically important discrepancies between inside and outside reports. There was a very good agreement (kappa=0.93) between readers in scoring the discrepancies.

CONCLUSION
A 20.3% rate of discrepant interpretations (472 of 2326 studies) was noted for a service offering second-opinion consultations for outside examinations. Most were discrepancies in interpreting identified abnormalities rather than in detecting abnormalities. When a definitive diagnosis was obtainable, there was clinically important discrepancy in 17.4% of studies between the second-opinion consultation and the outside reports.

CLINICAL RELEVANCE/APPLICATION
Results of this study could be helpful for health care decision makers regarding second-opinion subspecialty consultation value in musculoskeletal radiology.

SSK10-06 • The Effect of Increasing Imaging Volumes on Radiologist Fatigue: The eFatigue Phenomenon

Robert J McDonald MD, PhD (Presenter); Kara M Schwartz MD; Felix E Diehn MD; Laurence J Eckel MD; Christopher H Hunt MD; Bradley J Erickson MD, PhD *; David F Kalimes MD *

PURPOSE
Cross-sectional imaging utilization has dramatically increased over the past two decades. Driven by technical innovations that have improved anatomic resolution, acquisition time, and applicability of CT and MRI, cross sectional modalities have supplanted use of conventional radiographs in many clinical practice guidelines. Rising utilization coupled with innovation has increased Radiologists’ workload through with respect to the total number of studies and images that must be interpreted. In the current study, we quantified changes in imaging workload over time as a surrogate measure of fatigue.

METHOD AND MATERIALS
Monthly counts of CT and MRI studies performed at our institution from1999-2010 were identified. Total numbers of images per exam were also extracted from the associated studies. Imaging workload data were normalized to the number of dedicated CT and MRI daily work assignments to determine the average radiologist workload assuming a 253-work day calendar and 8-hour workday. Temporal trends in institutional and individual workload were assessed by Sen’s slope analysis (Q) using a normal Z-test statistic.

RESULTS
From 1999-2010, a total of 1,517,149 cross-sectional imaging studies (CT=994,471; MRI=522,678) comprised of 539,210,581 images (CT=339,830,947; MRI=199,379,634) were evaluated at our institution. Total numbers of annual cross-sectional studies steadily increased from 84,409 in 1999 to 147,336 in 2010, representing a two-fold increase in workload (Q=6465/yr, Z=4.2, p<0.001).

CONCLUSION
Imaging volumes have grown at a rate out of proportion to increasing imaging utilization at our institution. The average radiologist must now interpret 1 image every 2-3 seconds in a given 8-hour workday to keep up with workload demands.

CLINICAL RELEVANCE/APPLICATION
Growing imaging volumes, and to a lesser extent increasing utilization, are likely major contributors to Radiologist fatigue.

SSK10-07 • Tension between Quality Metrics: The Case of Radiation Dose and Diagnostic Yield in Suspected Chronic Stable Angina

Saurabh Jha MD (Presenter)

PURPOSE
Radiation dose and proportion of negative coronary catheter angiograms (CCA) are potential quality metrics in the management of patients with suspected chronic stable angina. The tension between achieving the metrics when using various gatekeeper tests for coronary artery disease (CAD) is explored.

METHOD AND MATERIALS
Decision model capturing the diagnostic strategies utilizing various gatekeeper tests, either singly or in combination, in a cohort of patients suspected of chronic stable angina was constructed. CCA was assumed to be the gold standard. Patients with positive and non-diagnostic tests were assumed to receive CCA. The outcomes included total radiation dose in the diagnostic pathway and the proportion of negative catheter angiograms.

The pre-test probability of obstructive CAD in the base case was determined by the model of Diamond and Forrester that uses age, sex and nature of chest pain.

The gatekeeper tests included exercise ECG, stress echocardiogram, stress MRI, SPECT, cardiac CT and PET.

The test characteristics, equivocal test rate and mean radiation dose were abstracted from the literature.

RESULTS
The typical patient in the cohort is a 55 year old female with atypical chest pain who has 30 % pre-test probability of obstructive CAD.
Cardiac CT achieved one of the lowest negative CCA rate of 33% (desirable) but the highest radiation dose of 15.04 msv (undesirable). Exercise ECG led to the highest negative CCA rate (undesirable) of 54% but one of the lowest radiation doses (desirable) of 3.36 msv. A combination of stress echo followed by cardiac CT for the non-diagnostic tests was optimal achieving a negative CCA rate of 26% and a radiation exposure of 3.93 msv.

CONCLUSION
A strategy employing stress echo and cardiac CT achieved the lowest negative CCA rate and relatively low radiation exposure; both outputs are plausible quality metrics. The scenario highlights that quality metrics can sometimes be oppositional, even if united by a singular underlying goal of improved patient care.

CLINICAL RELEVANCE/APPLICATION
Metrics will become ubiquitous in adjudicating quality and determining value and reimbursement in healthcare.

SSK10-08 • Abdominopelvic MRI for Lesion Characterization: Factors Associated with Likelihood of Added Value

Andrew B Rosenkrantz MD (Presenter); Laura Heacock MS, MD; James S Babb PhD

PURPOSE
To evaluate factors associated with the likelihood that abdominopelvic MRI examinations performed for characterization of lesions identified on other imaging modalities will provide information with potential to add value to patient management.

METHOD AND MATERIALS
1,132 abdominopelvic lesions in 863 patients in which MRI was performed for further characterization following detection by an alternate imaging modality were included in this retrospective study. Reports of the MRI examinations and of the prior studies were reviewed to classify lesion status in terms of patient, examination, and lesion related factors. The MRI reports were also classified in terms of various measures reflecting inclusion of content with potential to add value to patient management. Data was analyzed using logistic regression for correlated data.

RESULTS
MRI provided a definitive diagnosis (DD) for 79.2% (897/1132) of lesions, upgraded the severity of the favored diagnosis in 6.2% (70/1132) of lesions, downgraded the severity of the favored diagnosis in 34.5% (390/1132) of lesions, and showed an absence of the suspected lesion in 12.0% (136/1132) of lesions. Provision of a DD was significantly associated with the organ containing the lesion (p CONCLUSION
Abdominopelvic MRI examinations performed for further lesion characterization may add value to clinical management in a high fraction of cases, the likelihood of which is influenced by factors related to the given examination.

CLINICAL RELEVANCE/APPLICATION
Policy decisions that impact MRI utilization should recognize factors impacting likelihood of added value, rather than the historical approach of treating all utilization in a homogeneous fashion.

SSK10-09 • Improved Accuracy of Gadoxetate Disodium-Enhanced MRI Using a Double Reading Paradigm for Detection and Characterization of Liver Lesions

Sheela Agarwal MD, MS (Presenter); Sandeep S Hedge MD; Elkan F Halpern PhD *; Mukesh G Harisinghani MD; Pari Pandharipande MD, MPH; Debra A Gervais MD *; Peter F Hahn MD, PhD *; Sanjay Saini MD

PURPOSE
To evaluate the incremental clinical value of double reading gadoxetate liver MRIs for detection and characterization of liver lesions and incidental findings.

METHOD AND MATERIALS
During the 6 month period from 8/1/2012-1/31/2012, 489 patients underwent 544 liver MRIs with the relatively new contrast agent gadoxetate disodium. Each study was read primarily by a fellowship trained staff abdominal radiologist and over-read by a second abdominal radiologist. Change in diagnosis was confirmed by characteristic radiologic findings with consensus review (74%), imaging follow-up (12%), or histopathology (14%). Any interpretive changes were classified by clinical significance and potential change in patient management. Rates of change in diagnosis were analyzed with logistic regression analysis, including reader factors (experience level, percent of workload dedicated to MRI), exam factors (indication, scanner brand, magnet strength) and work related factors (weekend vs weekday read, presence of preliminary read by trainee).

RESULTS
Changes in interpretation occurred on 50 examinations (9.2%) with 23 (4.2%) leading to a potential change in clinical management. On multivariate logistic regression analysis, weekend interpretation was an independent predictor increasing likelihood of a change in interpretation (p < 0.01). In step-wise logistic analysis, reading the study alone (without the preliminary read of a trainee) was also found to be a predictor of an interpretive change (p < 0.02). On univariate logistic analysis, less experience with liver MRI as measured by a smaller percentage of one's workload dedicated to MRI was a significant factor predicting a miss (p < 0.05). Common interpretative discrepancies included omission of one metastasis in the setting of multiple metastases (13), misinterpretation of HCC (9), misinterpretation of hemangiomas (6) and misinterpretation of FNH and adenomas (8).

CONCLUSION
Double reading of gadoxetate-enhanced liver MRI results in improved detection and characterization of liver lesions, with a significant effect on clinical management of patients. This may be considered for better clinical practice in divisions with varying levels of reader experience with hepatobiliary contrast agents.

CLINICAL RELEVANCE/APPLICATION
Radiologists initiating use of gadoxetate for liver MRI should consider a period of double reading until all staff have acquired full familiarity with this new contrast agent.

ISP: Informatics (Quality and Safety)

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

SSK11 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1

Moderator
Woojin Kim, MD *

Moderator
David S Hirschorn, MD

SSK11-01 • Informatics Keynote Speaker: Informatics and Quality

Woojin Kim MD (Presenter) *

SSK11-02 • Crying 'Wolf' about Unsatisfactory Study Quality: A Potential Rift in Communication between Radiologists and Referring Clinicians
METHOD AND MATERIALS

Using software to search 130,733 radiology reports (Montage, Philadelphia, PA), we retrospectively identified studies (CR, US, and CT) describing TUIQ. Search terms included: limited, suboptimal, sub-optimal, and poor. Study date, modality, radiologist, indication, limitation(s), and retake recommendations were recorded. "Retakes" were defined as follow-up exams obtained based on negative remarks about a study's quality, whether or not the radiologist recommended a repeat study. An additional 954 consecutive CR, CT, and US studies were manually reviewed to determine the rate of TUIQ studies and to serve as a control group.

RESULTS

7% of diagnostic imaging reports included at least one comment implying TUIQ. CR had the lowest percentage of TUIQ. Relative to these, the rate of TUIQ was 1.7 times higher for CT and 3.7 times higher for US. 52% of all TUIQ cases underwent no follow up imaging; 29% had a follow up study for clinical reasons other than technical quality and only 19% of cases had follow up imaging performed because of TUIQ (i.e., retake cases). Of these 19%, 52% had a radiologist's recommendation for retake. Conversely, retake occurred in only 36% of total cases where the radiologist recommended one be performed.

CONCLUSION

One in 14 radiology reports contain comments or disclaimers related to TUIQ with US and CT having relatively higher rates than CR. Descriptions of technical issues are often vague and difficult to discern such as poor, limited, and suboptimal and should be avoided when possible. Descriptions result in retakes, they are usually performed without an explicit recommendation by the radiologist. In instances when the radiologist recommends a retake, it is performed only about a third of the time.

CLINICAL RELEVANCE/APPLICATION

This study is of interest to all radiologists seeking to improve communication with referring clinicians regarding the diagnostic quality of imaging studies and need for repeat imaging.

SSK11-03 • Updating Radiation Dose Rate in Fukushima Two Years after Severe Accident of Fukushima Nuclear Power Plant

Shoichi D Takekawa MD (Presenter); Takahiro Kato PhD

CONCLUSION

The RDR in Fukushima residence area is decreasing by the effort of eradication by removing the surface soil and leaves of trees contaminated by fallout. However, some radiation is still remaining and further observation and effort to remove contaminated materials in the residence areas are necessary.

Background

It is important to assess the effect of radiation from fallout after accident of Nuclear Power Plant to keep our health. This is to report the current radiation dose rate(RDR) in various sites in Fukushima Prefecture after severe accident(Level 7) of Fukushima Nuclear Power Plant(FNPP), and also to report the effort to eradicate radiation in soil and trees contaminated by fallout.

Evaluation

Data were collected from the public announcements of Japanese Government of Education and Science and Fukushima City. The dose rate at 1 meter above the ground was measured also by Airplane on June 28 and November 16, 2012. The results of RDR before and after removal of soil and leaves of trees contaminated by radiation were announced by Fukushima City. The RDR measured 4 to 30.5 Sv/hr in the northwest areas within 20km from FNPP even in March, 2013. It measured 0.24 to 1.117Sv/hr in Fukushima City(ca.70km from FNPP) on 3-8-13, whereas it measured 11 to 15.0 Sv/hr on 5-25-11. The RDR at measuring posts on the ground of FNPP measured 3.1 to 6.77Sv/hr on 3-3-13. The RDR at the chimney for ventilation of capsule measured over 200 Sv/hr.

Discussion

It was estimated that early decrease of Radiation dose rate in the residence areas was due to the decay of $^{131}I$ and some influence was due to $^{137}Cs$ (HL: 2.06 years) and washing effect of rains. The rate of decrease of RDR was exceeding the half life of $^{137}Cs$(HL: 30.1 years). When effort to eradicate excess radiation in the residence areas was being made, and it was euthanized in 0 to 10% in Fukushima City by August 2012. The procedure to remove some of contaminated soil and plants is going to be started from April, 2013 in Koriyama City, which is the second largest city in Fukushima Prefecture and about 60 km from FNPP. It was estimated that RDR in the soil seems to have been reduced by 20 to 40 %, when compared with that of RDR in May, 2011.

SSK11-04 • Evaluation of Non Commercial DICOM De-identification Tools Freeeware

K. Y. E. Aryanto; Matthys Oudkerk MD, PhD; Peter M Van Ooijen (Presenter)

PURPOSE

To compare freeware DICOM toolkits for their ability to de-identify sensitive elements in the DICOM header that may contain patient's personal health information (PHI).

METHOD AND MATERIALS

Ten non commercial DICOM toolkits were selected and tested to be compared for their de-identification utility. The selection was made through an internet search to get as many tools as possible. The tests were performed in two scenarios. First, de-identification was performed by using tool's default setting and then by using the best possible customized settings. The toolkits were also examined for their de-identification profiles and how the configuration could be customized.

RESULTS

The DICOM toolkits were tested to eliminate fifty elements in the DICOM header which are considered to contain private information that may be used to reveal the identity of a patient. Not all of the toolkits provide a full customizable de-identification profile. Two tools use a fixed configuration. In the other eight tools, changes can be made by giving input through user interface, manually into a configuration text file, or providing the appropriate command arguments or options. Using the first scenario, there was only one tool which, by default, was configured to de-identify all selected elements. In the second scenario, three other DICOM toolkits could perform the task after manual adjustment.

CONCLUSION

Only four out of ten selected free DICOM toolkits could de-identify the defined DICOM elements properly. Free DICOM toolkits should therefore be used with extreme care when de-identifying sensitive data since they can have a high risk of disclosing PHI, especially when using the default configuration. In case optimal security is required, one of the four toolkits is proposed.

CLINICAL RELEVANCE/APPLICATION

Guidance to select the proper tool to de-identify DICOM data is important to ensure the security and confidentiality of patient’s personal health information in order to prevent patient data breach

SSK11-05 • CT Dose Variability for Patients Undergoing Repeat Identical CT Scans: A Retrospective Analysis of 2606 Patients Undergoing 12,632 CT Scans

Douglas G Larson MD (Presenter); Daniel T Boll MD *; Olav Christianson; Rendon C Nelson MD *
PO<p>URPOSE<br>To evaluate the intrinsic variability in radiation dose delivery of CT scanners in clinical use, independent of patient-specific factors.</p><p>METHOD AND MATERIALS<br>We identified colon cancer, lung cancer, and renal stone patients who underwent the same CT protocol at least twice between 1/2007 and 2/2013. Evaluating patients undergoing multiple scans with identical protocols allowed us to control for any patient- and protocol-specific factors which could affect CT dose. Patient and dose data was taken from DICOM headers and dose sheets in PACS. We performed multivariate analysis to characterize the dose variation for each patient, and to identify any significant cofactors in this variability. We used the total exam Dose Length Product (DLP) in our analyses. CT protocols were: (a) Abdomen/Pelvis with IV contrast (A/P), (b) Chest/Abdomen/Pelvis with IV contrast (C/A/P), (c) Renal Stone, and (d) Chest without IV contrast.</p><p>RESULTS<br>2606 patients underwent 12,632 repeat CT scans (mean 4.8, range 2-33 repeat scans/patient). There were 875 A/P, 4620 C/A/P, 1053 Renal Stone, and 6084 Chest CT scans. The pre-patient dose variation was identified, then normalized using coefficients of variation, and ratios of maximum dose to minimum dose. In both cases, a higher value indicates higher dose variability. There was statistically significant variation across all patients and protocols (p < 0.05). In Group 1 (50% reduction), IMR L1 was better than iDose4 in lesion sharpness and low contrast detectability (P < 0.05; 3.04±0.59, 2.98±0.65, 3.03±0.58, 2.97±0.65). In Group 2 (70% reduction), IMR L1 was better than iDose4 in lesion sharpness and low contrast detectability (P < 0.05; 3.04±0.59, 2.98±0.65, 3.03±0.58, 2.97±0.65). There was a statistically significant variation in the radiation dose delivered to a single patient undergoing repeat identical CT scans which varies by scanner and is higher in large patients. The data suggests that there are opportunities to reduce this variability by careful monitoring of key factors, CT table height being one example.</p><p>CLINICAL RELEVANCE/APPLICATION<br>Evaluation and scrutiny of CT dose delivery in clinical practice allows for determination of the intrinsic and controllable variability in an attempt to achieve more consistent patient care.</p>SSK11-06 • Simulation of Adverse Contrast Reactions - An Educational Tool for Team Training<br>Taj Kattapuram MD (Presenter) ; Gloria M Salazar MD ; Elkan F Halpern PhD * ; Preston D Stingley MA, MBA ; Shawn Bonk ; Emily Hayden ; Margaret Sande ; James Gordon MD ; Bethany L Niell MD<br><p>PURPOSE<br>Successful management of a serious adverse reaction to contrast media requires prompt recognition and treatment, as well as effective team dynamics among radiologists, technologists, and nurses. Our radiology department implemented an educational simulation program in which teams of nurses, technologists, and physicians are required to manage simulated adverse contrast reactions. This study evaluates whether simulation training emphasizing team dynamics improved an individual’s self-actualization of the management of an adverse contrast reaction.</p><p>METHOD AND MATERIALS<br>Following IRB approval, 56 physicians, 7 nurses, and 56 technologists worked in interprofessional teams of four to manage two cases of simulated adverse contrast reactions. A standardized debriefing occurred immediately following each simulated case, focusing on medical management of adverse contrast reactions, an institutional adverse contrast reaction kit, and team dynamics including role clarity, closed-loop communication, event managers, etc. Participants individually completed pre- and post-simulation questionnaires which included knowledge-based questions regarding the appropriate management of contrast reactions, as well as questions about participants’ perception of their ability to manage adverse contrast reactions. Self-actualization was measured with a 6-point Likert scale. Statistical significance was calculated using McNemar’s test with a p value</p><p>RÉSULTS<br>Following completion of simulation training, radiologists, technologists, and nurses reported a statistically significant improvement in their ability to function as a team during a medical emergency, including an adverse contrast reaction (p-value < 0.05). This simulation training program with its emphasis on team training and adverse contrast reaction management was perceived by the participants as an effective tool to improve the self-actualization of radiology personnel managing adverse contrast reactions.</p><p>CLINICAL RELEVANCE/APPLICATION<br>Simulation training is recommended to educate radiology personnel on effective team dynamics in the management of adverse contrast reactions.</p>SSK11-07 • Comparison of Image Quality and Lesion Detectability between Knowledge Based Iterative Reconstruction (IMR-L1) and iDose4 with 50% and 70% Reduced-dose CT Scan in Evaluation of Small Abdominal (≤3cm) Lesions<br>Yuying Gao (Presenter)<br><p>PURPOSE<br>To compare the image quality and lesion detectability of a new reconstruction algorithm IMR-L1 and iDose4 iterative reconstruction technique on a 256-slice CT in low-dose abdomen scans, with focus on small (≤3cm) lesions detection and evaluation.</p><p>METHOD AND MATERIALS<br>Two sets of images were obtained during arterial phase scanning: standard-dose filtered back projection (FBP) for each, and low-dose scans were performed randomly on 24 patients (10 male and 14 female; mean age 51.3 years) with acknowledged small lesions. (Group 1, 50% dose reduction for 11 patients), (Group 2, 70% dose reduction for 13 patients). Image quality of the iDose and IMR Level 1 (L1) images was evaluated according to these features: lesion sharpness, low contrast detectability, overall diagnostic confidence (1 [poor] to 5 [excellent]). The CNRs for lesions were measured in CT images reconstructed by iDose4 and IMR, and compared using the paired-t test.</p><p>RESULTS<br>Group 1 (50% reduction), IMR L1 was better than iDose4 in lesion sharpness and low contrast detectability (P0.05; 3.04±0.59, 2.98±0.65, P>0.05). In Group 2 (70% reduction), IMR L1 was better than iDose4 in lesion sharpness and low contrast detectability (P0.05</p><p>CORCLUSION<br>IMR-L1 enhances lesion’s sharpness, and thus improves small lesion’s detectability both in 50% and 70% dose-reduced group.</p><p>CLINICAL RELEVANCE/APPLICATION<br>IMR does enhance the interface contrast between different tissues and Sharpen the edges of Small lesions, thus improved the low contrast lesions’ detectability.</p>SSK11-08 • CT Protocol Optimization Using an Automated IT Solution Provided Size Specific Patient Doses, Automatic Tube Current Modulation Information, and Radiologist Feedback<br>Timothy P Szczyzkutowicz PhD (Presenter) * ; Frank N Ranallo PhD ; Walter W Peppler PhD * ; Richard J Bruce MD * ; Myron A Pozniak MD *

CONCLUSION<br>Monitoring the radiation dose and image quality of CT examinations is essential to ethical patient care. This work represents a large stride in giving an institution’s CT protocol optimization team the tools it needs to carry out that task.

Background<br>CT protocol optimization for a large multi center institution is complex due to: variations in CT architecture; the wide array of clinical sections using CT; the large number of required protocols to service each clinical section; and highly varied patient populations (i.e. size and age). To side in this process, our institution has developed an automated system that collects information about patients, the
scanner output and configuration for each patient, and a radiologist quality assessment report. All of this information is gathered digitally, and is fully automated. Patient information is taken from DICOM headers. Scanner output information is extracted from structured dose reports and the configuration of the scanner is taken from the DICOM images from individual image series. Patient sizes are measured using the scout images and every axial image slice. All of this information is used to guide protocol development, monitor the function of the automatic mA control, and identify outliers in terms of low or high dose, which may help identify reoccurring errors in patient scanning.

Evaluation
Prior to using the automated system, small subsets of patients were examined individually by medical physicists. This was a laborious task in which patient sizes, DICOM data, the maximum and minimum mA values, and dose information were manually recorded. Compared to this older method, the new automated method provides more information and requires little to no user input. The automated patient sizing information was found to agree to the manual method within the uncertainty of the manual method.

Discussion
The creation of this system at our institution required IT staff, medical physicists, CT technologists, and radiologist support. The implementation of such a system at a center without a CT protocol optimization team would likely be limited.

SSK11-09 • ACR Dose Index Registry Pilot Project: Comparing Digital Radiography Exposure Indices across Facilities

**Steven Don** MD (Presenter) *; **Mythreyi Bhargavan** PhD; **J. Anthony Seibert** PhD; **Stephen M Moore** MS; **Scott R Steingall** ARRT; **Richard L Morin** PhD

**PURPOSE**
To describe a new digital radiography (DR) national database registry using standardized, automated data collection methods.

**METHOD AND MATERIALS**
The Dose Index Registry (DIR) DR pilot project collects and compares exposure indices across both adult and children's facilities nationwide. The new International Electrotechnical Commission exposure index standard for digital x-ray systems (IEC 62494-1) is used, eliminating proprietary indices. Elements from DICOM Structured Reporting (SR) are extracted by the American College of Radiology (ACR) Triad software. Captured elements include age, gender, body part, technique factors (kVp, tube current), Exposure Index, Target Exposure Index, and Deviation Index. The information is de-identified and automatically transmitted to the ACR.

**RESULTS**
Three vendors (Agfa, Fujifilm, and Siemens) currently have equipment that uses the IEC terminology and the DICOM SR with more vendors adding equipment in the near future. Six adult and three children's facilities are participating in the pilot project. To avoid the problems associated with individual institutional examination naming convention, each study is mapped to the new RadLex Digital Radiography Lexicon Playbook. Experiences learned from the DIR CT are used to overcome problems associated with the new DIR DR.

**CONCLUSION**
A DIR DR national database using standard methods of data collection to monitor changes in exposure indices over time is urgently needed. The ability to track trends in exposure indices is useful to individual practices wishing to compare their own exposure indices against established benchmarks or national practice patterns. This data is useful to advisory radiation safety bodies. The data can be used to document exposure and variability for common examinations nationally and to create diagnostic reference levels for DR.

**CLINICAL RELEVANCE/APPLICATION**
Exposure creep is common with DR. By participating in national registries, a practice can monitor their DR exposures, monitor trends, and compare their exposures with other centers.

**ISP: Molecular Imaging (Oncology II)**

**Wednesday, 10:30 AM - 12:00 PM • SS04CD**

**SSK12 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**

**Moderator**
**David A Mankoff**, MD, PhD

**Moderator**
**Michael S Gee**, MD, PhD

**SSK12-01 • Molecular Imaging Keynote Speaker: Molecular Imaging and Biomarkers in Cancer**

**David A Mankoff**, MD, PhD (Presenter)

**SSK12-02 • Molecular Ultrasound Imaging Using Microbubbles Targeted to Endoglin, VEGFR2 and Integrin**

**Ingrid Leguerney** (Presenter) ; **Jean-Yves Scoazec**; **Laure D Boyer**; **Nicolas Gadot**; **Sandra Robin**; **Nathalie B Lassau**

**MD, PhD * **

**PURPOSE**
The aim of this study was to investigate the use of targeted contrast-enhanced high-frequency ultrasonography for molecular imaging to determine the expression levels of endoglin, αv integrin and vascular endothelial growth factor receptor 2 (VEGFR2) biomarkers in murine melanoma tumor models.

**METHOD AND MATERIALS**
Melanoma-bearing nude mice (B16F10) were explored using dynamic contrast-enhanced ultrasonography with a VEVO2100 imaging system (Visualsonics, Canada). Microvasculature and expression levels of biomarkers were investigated at 20 MHz using specific contrast agents (CA) (MicroMarkerTM, Visualsonics). The lyophilized CA were conjugated with biotinylated rabbit anti-mouse endoglin, αv integrin, and VEGFR2 monoclonal antibodies. Specificity of these functionalized CA was evaluated in comparison with an isotope control antibody (immunoglobulin G) which was bounded on the surface of the CA. Boluses injections of each targeted CA were performed and ultrasound signal intensity from bounded CA was evaluated on the different groups of mice. Two groups of mice were evaluated, control and treated with sorafenib with a daily dose of 62 mg/kg. Tumor samples were harvested for analysis of endoglin, integrin and VEGFR2 expression levels by immunohistochemistry.

**RESULTS**
The mean ultrasound signal intensity amplitude caused by backscatter of the retained endoglin/integrin/VEGFR2-targeted ultrasound CA after fixation into the vasculature was assessed. Endoglin biomarkers were more expressed than αv integrin and VEGFR2 in the tumor model. Endoglin tend to increase with time in the control group whereas a decrease in the level expression was observed in the sorafenib group between D0 and D3. These differences in biomarkers expression were also observed by immunostaining.

**CONCLUSION**
Targeted ultrasound CA coated with antibodies enable in vivo molecular imaging of biomarkers expression on the tumor vascular endothelium and may be used for noninvasive evaluation of tumor angiogenesis during growth or therapeutic treatment in preclinical studies. Endoglin protein which plays an important role in angiogenesis seems to be a target of interest for detecting cancer and for predicting therapy efficacy.
**SSK12-03 • Radiolabeled Antibody to gp41 HIV Glycoprotein Kills ART-treated Lymphocytes from HIV Patients and HIV-infected Monocytes in Human Blood Brain Barrier Model**

Ekaterina Dadachova PhD (Presenter); Dina Tsukrov; Alicia McFarren

**PURPOSE**

Eliminating virally infected cells is an essential component of HIV eradication strategy. In addition, many patients on antiretroviral therapy (ART) suffer from HIV-associated neurocognitive disorders as the brain becomes a reservoir for infection. Thus, the drugs that can enter into the CNS and eradicate the infection are needed.

**METHOD AND MATERIALS**

Radioimmunotherapy (RIT), a clinically established method to kill cells using radiolabeled monoclonal antibodies (mAbs), was recently used to target the HIV gp41 glycoprotein expressed on the surface of infected cells. As gp41 expression by the infected cells is downregulated in patients on ART, we evaluated the ability of RIT to kill infected cells treated with ART in vitro using patients lymphocytes. We also tested the ability of the same radiolabeled mAb 2556 to gp41 to cross the blood brain barrier (BBB) and kill HIV infected monocytes in the CNS.

**RESULTS**

We found that RIT was able to specifically kill ART-treated lymphocytes and to reduce HIV p24 to undetectable levels. ART and RIT worked in concert to decrease viral production when compared to ART or RIT alone, indicating that expression of gp41 under ART was still sufficient to allow 2556 mAb binding and killing infected cells. A 4 µCi dose of 213Bi-2556 successfully killed over 80% of PBMCs (p<0.01 compared to isotype control) in 1418 mAb pl of 8. 213Bi-2556 killed significantly more HIV infected than uninfected monocytes on the astrocyte side of the BBB in dose response manner (p<0.01).

**CONCLUSION**

In conclusion, RIT in concert with ART eliminated infected cells. Co-treatment was effective in both Atripla and tenofovir-emtricitabine/atazanavir cohorts. We demonstrated the unique ability of 213Bi-2556 mAb to cross the BBB and specifically kill HIV infected monocytes. These findings demonstrate the feasibility of an RIT-based strategy for use with ART to achieve HIV eradication systemically and in CNS.

**CLINICAL RELEVANCE/APPLICATION**

HIV/AIDS remains an incurable disease. Our goal is to develop RIT-based strategies for therapy of systemic and CNS HIV for use with other anti-retroviral strategies to achieve complete HIV eradication.
**SSK12-06 • A Hybrid Radioactive and Fluorescent Tracer for Sentinel Node Biopsy in Melanoma Patients**

**Nynke S Van Den Berg** MSc; **Gijs Kleinjan** MD; **Martin Klop**; **Omgo Nieweg**; **Renato Valdes Olmos**; **Fije Van Leeuwen** (Presenter)

**PURPOSE**  
The purpose of this study was to explore the value of the hybrid tracer indocyanine green (ICG)-99mTc-nanocolloid for the sentinel biopsy in a large cohort of melanoma patients. A comparison was made with optical detection of blue dye (conventional approach).

**METHOD AND MATERIALS**  
One-hundred-and-four patients with melanoma of the head and neck (n=53), trunk (n=33) or an extremity (n=18) were evaluated. Lymphoscintigraphy with subsequent SPECT/CT was performed after intradermal administration of ICG-99mTc-nanocolloid. The operation was performed 3-27 hours after tracer injection. Patent blue dye was injected prior to the start of surgery, except in patients with a melanoma in the face (n=35). Intraoperatively, sentinel nodes were pursued via gamma ray tracing, followed by optical verification using fluorescence and/or blue dye. A portable gamma camera was used to confirm removal of all radioactive sentinel nodes.

**RESULTS**  
Preoperative imaging revealed at least one sentinel node in all patients. Intraoperatively, in 17 patients (16%) a sentinel node could only be located using fluorescence imaging; these sentinel nodes were mainly located near the injection site or in the parotid area. Of all harvested sentinel nodes (n=300), 97% of sentinel nodes exhibited fluorescence intraoperatively. In the patients in whom blue dye was used, only 60% of sentinel nodes were stained blue at the time of excision (p < 0.001).

**CONCLUSION**  
ICG-99mTc-nanocolloid allowed for preoperative lymphoscintigraphy and SPECT/CT imaging as well as intraoperative radio- and fluorescence-guided sentinel node detection in all 104 included patients. Optical fluorescence-based identification of the sentinel node was particularly useful in head and neck melanoma with nodes located close to the injection site and/or in the parotid area.

**CLINICAL RELEVANCE/APPLICATION**  
Fluorescence imaging, in addition to the conventional radioguided approach, may allow the accuracy with which sentinel nodes can be removed, possibly improving the false-negative rates.

**SSK12-07 • Novel Fluorescent Nanoparticle Imaging Allows Non-invasive Assessment of Immune Cell Modulation within the Esophageal Tumor Microenvironment**

**Peiman Habibollahi** MD (Presenter); **Todd Waldron**; **Pedram Heidari** MD; **Hoon Sung Cho**; **David Alcantara** PhD; **Timothy C Wang**; **Anil Rustgi**; **Umar Mahmood** MD, PhD

**PURPOSE**
Repeat endoscopic imaging combined with administration of fluorescent nanoparticles highly phagocytized by subpopulations of immune cells in the tumor microenvironment allows for their temporal evaluation. We employed this approach to understand changes in the myeloid derived suppressor cell (MDSC) immune cell subpopulation, a central modulator of tumor initiation and progression.

**METHOD AND MATERIALS**
A novel imaging probe (FH-CyAL5.5) was developed based on Feraheme, a monocrystalline dextran coated iron oxide nanoparticle, conjugated to a near infrared (NIR) fluorochrome, CyAL5.5. Two groups of L2Cre;p120cnfnlox/flox mice (n=5 each), a transgenic mouse model of esophageal squamous cell carcinoma, were imaged simultaneously for white light and fluorescent NIR signal using a custom-built dual channel upper GI endoscope 3 hrs after receiving the imaging probe, with or without dexamethasone (dex) pretreatment. Immune cell modulation was quantified by means of immunophenotyping (FACS), confocal microscopy and compared to the signal intensity during fluorescent endoscopy.

**RESULTS**
A high level of uptake of the fluorescent nanoparticles was observed in the esophageal lesions of L2Cre;p120cnfnlox/flox mice which significantly decreased after dex treatment (TBR 2.65±0.15 vs. 1.98±0.09, p < 0.001). A high level of uptake of the fluorescent nanoparticles was observed in the esophageal lesions of L2Cre;p120cnfnlox/flox mice which significantly decreased after dex treatment (TBR 2.65±0.15 vs. 1.98±0.09, p < 0.001).

**CONCLUSION**
These observations suggest that FH-CyAL5.5 is highly taken up by the MDSC immune cell component of the esophageal tumor microenvironment and can be used for assessment of specific immune cell modulation in response to targeted or non-targeted therapies.

**CLINICAL RELEVANCE/APPLICATION**
This translatable technology may be used for the early detection of dysplastic changes as well as the serial assessment of immune-modulatory therapy in the esophageal tumor microenvironment.

**SSK12-08 • 18F-fluorocholine PET/CT Detecting Prostate Cancer Recurrence: Is Dual-phase Imaging Really Beneficial?-Singapore Experience**

**Aaron K Tong** MBBS, MRCP; **Zoe X Zhang** PhD; **Sean X Yan** MD (Presenter)

**PURPOSE**
In the last decade, choline PET/CT scan has been evaluated in diagnosing prostate cancer, particularly recurrence. The ability of choline PET/CT to detect prostate cancer recurrence may be enhanced by dual-phase acquisition presumably due to the different kinetics of choline in cancer tissue and in benign tissues. However, for this young imaging modality, the optimal protocol and the added value of performing dual-phase scan are still debatable. This study aimed to better define the imaging protocol for 18F-fluorocholine PET/CT.

**METHOD AND MATERIALS**
A total of 34 patients with suspected prostate cancer recurrence were scanned during the period of 04/2010 to 02/2013 in our hospital and were followed up for an average of 16 months. Final diagnosis was made on biopsy, correlating with other imaging modalities, PSA trend and clinical course. Each patient was given 5-10 mCi 18F-fluorocholine. Immediate acquisition (early phase, 2’ post injection) of the pelvis and subsequent whole body acquisition (late phase, 30’ post injection) were performed. Two blinded physicians read the scans independently with final consensus achieved in all cases. Standard Uptake Value (SUV) in the dominant lesions was recorded. Statistical analysis was done by SPSS program.

**RESULTS**
The accuracy of 18F-fluorocholine PET/CT for diagnosing prostate cancer recurrence was 85% with sensitivity of 81% and specificity of 100%. Uptrend change of SUV on the late phase vs early phase was significantly associated with recurrent cancer (P=0.05). The PSA level is closely associated not only with the likelihood of a positive scan (P=0.001), but also with the SUV (R2=0.51, P=0.000) and the change in SUV between two phases (R2=0.25, P=0.014).

**CONCLUSION**
18F-fluorocholine PET/CT is a useful imaging modality in evaluating prostate cancer recurrence. The dynamic change of SUV between early and late phase images facilitates differentiating malignancy from benignity. The value of dual-phase imaging in improving the performance of 18F-fluorocholine PET for detecting prostate cancer recurrence is confirmed.

**CLINICAL RELEVANCE/APPLICATION**
Dual-phase 18F-fluorocholine PET/CT scan is more accurate than single phase scan and is recommended in detecting prostate cancer.
**RESULTS**

Diminished [18F]-FLT PET was observed in 3/4 of patients following cetuximab treatment alone and in all patients following combination therapy. Reduced [18F]-FLT PET following combination therapy predicted disease free status at surgery. Overall, [18F]-FLT PET imaging agreed with Ki67 immunoreactivity from biopsy samples and surgically resected tissue and was predictive of treatment-induced p27 levels.

**CONCLUSION**

To our knowledge, this study represents the first clinical evaluation of [18F]-FLT PET to predict response to neoadjuvant therapy that included EGFR blockade with cetuximab in patients with rectal cancer. Our results suggest that [18F]-FLT PET is a promising imaging biomarker of treatment response in this setting.

**CLINICAL RELEVANCE/APPLICATION**

This study reports the utilization of [18F]-FLT PET to predict early response to neoadjuvant therapy in patients with rectal cancer. Early detection of therapeutic efficacy can improve clinical outcome.

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**SSK13-01 • Musculoskeletal Keynote Speaker: Update in Cartilage Imaging**

**Christine B Chung (Presenter)**

**PURPOSE**

To evaluate changes of T2 value of articular cartilage in patients of meniscus transplantation on serial follow up images.

**METHOD AND MATERIALS**

From 2010 to 2011, 26 patients (mean age, 29.6±10.3) who underwent meniscus allograft transplantation of lateral meniscus were prospectively evaluated by using a 3T MR imaging at 2 days, 6 weeks, 3, 6 and 12 months after the surgery. All patients showed no retear in the transplanted meniscus and no aggravation of chondromalacia. Quantitative T2 maps of femoral condyle and tibial plateau were obtained at the operation compartment. Mean T2 values were calculated at the deep and superficial layers of three allocated areas in femoral condyle and tibial plateau (the anterior and posterior meniscal coverage areas, and the weight bearing area). T2 value in each area was measured twice at the sagittal slice 6mm medially and laterally away from the central articulation (12 points). The grading of the chondromalacia was evaluated at each location with reference to the arthroscopic grading. All images were quantified using Relaxation Maps Tool. Statistical software (SAS® Version 9.2; SAS institute Inc., Cary, NC) was used.

**RESULTS**

The T2 values in both femoral and tibial articular cartilage were significantly decreased after meniscal transplantation on the serial follow-up MR scans for up to 1 year in both superficial and deep layers (p

**CONCLUSION**

T2 quantification showed the subclinical changes of articular cartilage after meniscus allograft transplantation over time and demonstrated the differences of T2 value according to the chondromalacia grade on serial follow up MR.

**CLINICAL RELEVANCE/APPLICATION**

T2 quantification is a useful tool in monitoring the treatment response of meniscus allograft transplantation.
A positive correlation was identified between the baseline mean T2 RV’s and the pain score (r=0.42; p

CONCLUSION
MSC therapy could be a valid alternative treatment for knee osteoarthritis and MRI T2-mapping might be a useful tool for its cartilage assessment follow up

CLINICAL RELEVANCE/APPLICATION
Stem cells therapy could become a new effective, feasible and safe treatment for chronic osteoarthritis, whether MRI technique might be the monitoring tool for its assessment.

SSK13-04 • The Value of T2 Color Maps in the Patellar Cartilage Grading Injury
Qian Cui (Presenter) ; Shao Wu Wang ; Yue Dong ; Shaowei Zheng ; Qingwei Song

PURPOSE
To investigate value of T2 color maps in assessment of patellar cartilage injury grading.

METHOD AND MATERIALS
62 patients who underwent knee MR and arthroscopic surgery patients were collected, including 32 males and 30 females, aged 30-51 years, mean 40.7 years. GE Company Signa 3.0T MR was used. The scan sequence include: FSE-T1WI, T2WI, FS-FSE-PDWI and T2mapping. T2mapping images were sent to the GE-ADW 4.3 workstation to generate T2 color maps of patellar cartilage. Arthroscopic patellar cartilage grading standards, to explore T2 color maps value of the patellar cartilage grading injury.

RESULTS

CONCLUSION
T2 color maps would be reliable in classification of patellar cartilage damage assessment.

CLINICAL RELEVANCE/APPLICATION

SSK13-05 • Incidental Findings and Their Clinical Relevance Magnetic Resonance Imaging (MRI) of the Knee in an Open Population-based Study of Middle-aged Females
Edwin H Oei MD, PhD (Presenter) ; J. H. J. M. Bessem MD ; Dieuwke Schipphof PhD ; Abida Z Ginai MD, PhD ; Jan Heerenga MD, PhD ; Gabriel P Krestin MD, PhD *; Albert Hofman MD, PhD ; Meike W Vernooij MD ; Sita Bierna-Zeinstra PhD

PURPOSE
MRI of the knee is increasingly applied in population-based studies, particularly on osteoarthritis (OA). Little is known on incidental knee MRI findings in an unselected ageing population. Our purpose was to describe the prevalence and clinical relevance of incidental findings on knee MRI in females of the Rotterdam Study, an ongoing open population-based study of middle-aged and elderly.

METHOD AND MATERIALS
891 female participants aged 45-60 (mean 55) from the Rotterdam Study underwent MRI of both knees (1.5 T scanner (GE)) independent of OA status. All participants gave written informed consent, including a section on incidental findings. Incidental findings were assessed by trained researchers, reviewed with an experienced musculoskeletal radiologist and classified into findings that did or did not require referral, based on clinical relevance, expected health benefit and evidence based therapeutic consequences. Age-related changes were not considered findings that needed referral because these were primary study outcomes. In accordance with informed consent, findings that required referral were reported to participants and their GP.

RESULTS
In 1782 MRI scans we identified 54 incidental findings (3.0%) in 52 participants, 17 of which (1.0%) in 17 participants required referral: 16 lesions suspicious of a chondroid lesion with uncertain benign characteristics and 1 large atypical cystic intraosseous abnormality. In all referrals, additional dynamic contrast-enhanced MRI was performed. Although this did neither demonstrate malignant tumor characteristics nor necessitated specific treatment in any, all referred participants are still followed-up clinically and radiologically. Among findings that did not require referral were 37 chondroid lesions in 35 participants with unequivocal benign features (central metadiaphyseal lesion

CONCLUSION
Our findings suggest that in the general middle-aged female population incidental findings are present in 3% of knee MR scans. While referral and additional MRI were deemed necessary in 1% of MRIs, this demonstrated that incidental findings virtually all consist of chondroid tumors with low suspicion of high tumor grade.

CLINICAL RELEVANCE/APPLICATION
Incidental findings are present on 3% of knee MRI scans in the general middle-aged female population and virtually all consist of chondroid tumors with low suspicion of high tumor grade.

SSK13-06 • Comparison of Quantitative Magnetization Transfer Parameters of Patellar Cartilage in Asymptomatic Volunteers and Patients with Early Osteoarthritis
Nade Sritanyaratana (Presenter) ; Pouria Mosassaheb MS ; John Wilson MD, MS ; Alexey A Samsonov PhD ; Walter F Block PhD * ; Richard Kijowski MD

PURPOSE
Quantitative magnetization transfer (qMT) imaging utilizes the magnetization transfer effect to probe macromolecular tissue composition typically inaccessible by conventional magnetic resonance (MR) techniques. qMT can be used to measure the fraction of protons bound to macromolecules (f), the exchange rate between mobile protons and macromolecular bound protons (k), and the T2 relaxation time of macromolecules (T2).

METHOD AND MATERIALS
An MRI examination through the patellofemoral joint was performed in the axial plane at 3.0T on 14 young asymptomatic volunteers and 11 patients with Kellgren-Lawrence grade 1 (N=6) and grade 2 (N=5) patellofemoral OA. Nine spoiled gradient recall-echo (SPGR) volumes were acquired with different MT offset frequencies and MT powers, 2 SPGR volumes were acquired for B1 error correction using actual flip angle imaging (AFI), and 4 SPGR volumes were acquired for T1 mapping using variable flip angle imaging (VFI). Total scan time was 25 minutes. The qMT parameters f, k, and T2 were iteratively fitted in MATLAB using a previously described model and then measured in regions of interest placed around the entire patellar cartilage. Mann-Whitney-Wilcoxon tests were used to compare qMT parameters between groups of subjects.

RESULTS
Mean f, k, and T2 within patellar cartilage for asymptomatic volunteers were 14.00±0.71%, 5.61±0.71sec⁻¹, and 6.53±0.15µs respectively. Mean f, k, and T2 within patellar cartilage for patients with OA were 14.30±0.85%, 5.63±0.80 sec⁻¹, and 6.83±0.14µs respectively. Patients with OA had similar f (p=0.26), significantly lower k (p=0.006), and significantly higher T2 (p=0.00006) within patellar cartilage than asymptomatic volunteers.

CONCLUSION
Patients with early patellofemoral OA have lower k and higher T2 within patellar cartilage than young asymptomatic volunteers. Additional studies are needed to investigate the mechanisms behind the observed changes in k and T2 within early cartilage degeneration.
SSK13-08 • Magnetic Resonance Imaging of Knee Changes in Psoriatic Patients without Arthritic Symptoms

Yasser Ragab MBCh, MSc (Presenter) ; Yasser F Emad MD, PhD ; Hosny M Hamza MD, FRCR

PURPOSE
To evaluate magnetic resonance imaging (MRI) findings of knee joints in patients with psoriasis without clinical peripheral or axial joint involvement, and to correlate MRI findings with disease and demographic variables

METHOD AND MATERIALS
196 subjects from the Multicenter OA Study subcohort had baseline and 30-month knee MRIs, quantitative cartilage thickness measurement, and semiquantitative scoring (Whole Organ OA Score) of cartilage, bone marrow, meniscus, effusion synovitis, and Hoffa synovitis at both time points. Presence of radiographic joint space narrowing (JSN) was noted at baseline. Knees were classified into progressors (those who lost cartilage thickness above thresholds) and non-progressors (those who did not). All MRI predictors were dichotomized into present (score=2 for cartilage, =1 for others) or absent. Differences in baseline scores of ipsicompartmental predictor variables were compared between progressors and non-progressors by logistic regression adjusting for covariates. Odds ratios (OR) and 95%CI were calculated for medial (MFTC) and lateral femorotibial compartment (LFTC) cartilage loss, respectively. We combined MFTC and LFTC to calculate ORs of ipsicompartmental cartilage loss across compartments using Generalized Estimating Equations.

RESULTS
Of 196 knees (mean age 59.8±6.3, BMI 29.5±4.6), 46 knees had radiographic OA at baseline. Compared to non-progressors (n=149), progressors (n=47) had higher adjusted OR (aOR) for having baseline medial meniscal damage (aOR 2.4 [95%CI 1.2-5.1]), medial meniscal extrusion (aOR 2.5 [1.2-5.3]) and effusion synovitis (aOR 3.2 [1.2-8.2]) in MFTC. In LFTC, baseline JSN (aOR 7.0 [1.8-27.1]), lateral meniscal damage (aOR 8.1 [2.5-26.6]) and lateral meniscal extrusion (aOR 4.1 [1.4-12.5]) predicted cartilage loss. For analysis combining MFTC and LFTC, results were similar to those of LFTC, with baseline compartment specific JSN, meniscal damage and extrusion predicting cartilage loss.

CONCLUSION
Among MRI and radiographic features, meniscal damage/extrusion and effusion synovitis most strongly predict quantitatively assessed cartilage thickness loss over 30 months.

CLINICAL RELEVANCE/APPLICATION
Knees with meniscal damage and extrusion are likely to have cartilage thickness loss over time in the same FTC and should be a therapeutic target in knee OA.

SSK13-09 • Osgood-Schlatter Disease and Patella Alta on MRI: Is There Any Association?

Olavo K Nakamura MD (Presenter) ; Yves Costa MD ; Juliana F Guimaraes MD ; Luciana S Timbo MD ; Luiz Guilherme Hartmann MD ; Durval D Santos MD ; Carlos H Longo MD ; Laercio A Rosemberg MD ; Marcelo B Funari MD

PURPOSE
To evaluate the association between Osgood-Schlatter disease and patella alta using MRI.

METHOD AND MATERIALS
A retrospective case-control study included patients evaluated by MRI of the knee performed in the period from January 2009 to December 2011 at our hospital. We included 103 patients with late sequel of Osgood-Schlatter disease (94 males and 9 females, average 37 years-old) and 393 controls without Osgood-Schlatter disease (326 males, and 67 females, average 41 years-old). Patients with Osgood-Schlatter disease in acute phase, patients younger than 15 years, prior surgery, fracture and bone deformities of the knee, and quadriceps and patellar tendon injuries were excluded.

RESULTS
In the comparison between cases and controls, there was association with statistical significance between Osgood-Schlatter disease and patella alta (p < 0.005).

CONCLUSION
As demonstrated in the study, there was a statistical significant association between Osgood-Schlatter disease and patella alta and a good interobserver concordance. This fact highlights the importance of the evaluation for patellar height by Insall-Salvati index technique on MRI of the knees in patients with sequelae of Osgood-Schlatter.
**SSK14 • ARA Prediction Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**

**Moderator**

Kambiz Motamedi, MD

Mark J Kransdorf, MD

**SSK14-01 • Diagnostic Performance of Tomosynthesis for Evaluation of Suspicious Bone Tumors: Comparison with Radiography and CT**

**Jihyun Bae** MD (Presenter) ; **In Sook Lee** ; **You Seon Song** ; **Jeung Il Kim** MD, PhD ; **Jong Woon Song**

**PURPOSE**

To compare tomosynthesis with radiography for evaluation of suspicious bone tumors, using multidetector computed tomography (CT) as the reference method.

**METHOD AND MATERIALS**

The study was approved by the institutional review board of our institution and written consent was obtained from all patients. From January 2012 to March 2013, 24 consecutive patients with suspicious bone tumors underwent radiography, tomosynthesis, and CT within 3 days. Two radiologists analyzed the presence or absence of periosteal reaction, space occupying lesion (SOL), mineralization and fracture on each three imaging modality.

**RESULTS**

Fourteen patients had benign bone tumors, nine had malignant bone tumors and one had only cortical fracture. The overall sensitivity, specificity, and accuracy of tomosynthesis were, respectively, 88.9%, 100%, and 95.8% about the SOL and mineralization, and 87.5%, 100% and 91.7% about the fracture. Those of radiography were, respectively, 88.9%, 100%, and 95.8% about the periosteal reaction, 81.8%, 100% and 83.3% about the SOL, 83.3%, 100%, and 95.8% about the mineralization, and 43.7%, 100%, and 62.5% about the fracture. The degrees of agreement between CT and tomosynthesis were 0.909 about periosteal reaction, 1 about the SOL and mineralization and 0.824 about the fracture (p < 0.05). Those between CT and radiography were respectively 0.909, 0.429, 0.882, and 0.341 (p < 0.05).

**CONCLUSION**

The diagnostic performance of tomosynthesis for evaluation of suspicious bone tumors was significantly greater than radiography and comparable to CT.

**CLINICAL RELEVANCE/APPLICATION**

The imaging qualities of tomosynthesis in the cases of suspicious bone tumors may comparable to those of CT images, with relatively lower radiation dose.

**SSK14-02 • Treatment Response Evaluation of Patients with Malignant Bone Tumors; Correlation of ADC from 3.0T MR Imaging and SUV from FDG PET/CT**

**So-Yeon Lee** MD (Presenter) ; **Won-Hee Jee** MD ; **Joon-Yong Jung** MD ; **Jin-Kyeong Sung** MD ; **Soo Ah Im** ; **Jin Hyoung Kang** ; **Je Ryung Yoo**

**PURPOSE**

To retrospectively determine whether the apparent diffusion coefficients (ADC) at 3T diffusion-weighted MR imaging (DWI) correlate with the standardized uptake values (SUV) at positron emission tomography (PET)/computed tomography (CT) for evaluating treatment response in malignant bone tumors.

**METHOD AND MATERIALS**

The institutional review board approved this HIPAA-compliant study and informed consent was waived. Twenty-two patients with 27 malignant bone tumors underwent 3T MR imaging including DWI with b value of 0, 800 sec/mm2 and whole-body fluorine 18 fluorodeoxyglucose PET/CT before and after treatment. Minimum ADC (ADCmin) of the tumor was measured by two independent musculoskeletal radiologists and correlated the maximum SUV (SUVmax) of the tumor. The percentage changes of ADCmin and SUVmax were calculated by the difference between the initial and follow-up values divided by the initial value. The change ratios of ADCmin and SUVmax were defined as the ratio of the follow-up value to the initial value. The Spearman rank correlation were obtained for statistical analysis.

**RESULTS**

There was significant correlation between the differences between the initial and follow-up values of ADCmin and SUVmax (r = 0.573 for reviewer 1 and r = 0.597 for reviewer 2, P < .005), the change ratios of ADCmin and SUVmax (r = 0.457, r = 0.491, P < .05), and percentage changes of ADCmin and SUVmax (r = 0.457, r = 0.491, P < .05). DWI and PET CT showed treatment response in 18 lesions: the ADC was increased by 103% (interquartile range, 61-166) and SUVmax was decreased by 56% (37-83). The ADCs of two responded lesions returned to the range of normal bone marrow and resulted in a decrease of the ADCmin (65% and 32%, respectively) and decrease of SUVmax (71% and 87%, respectively). There was no response in six lesions: the ADC was decreased by 23% (13-30) and SUVmax was increased by 55% (26-90). There was one lesion with a discrepancy in changes of ADCmin (decreased by 29%) and SUVmax (decreased by 13%).

**CONCLUSION**

There was significant correlation between the ADC and SUV for evaluating treatment response in malignant bone tumors.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative DWI is comparable to PET/CT for evaluating treatment response in malignant bone tumors.

**SSK14-03 • Negative Relationship between CT Attenuation Values and ADC Values in Densely Sclerotic Bone Metastases from Prostate Cancer**

**Usman Bashir** MBBS (Presenter) ; **Nina Tunariu** MD ; **David J Collins** BSC, BA ; **Diletta Bianchini** ; **Andrea Zivi** ; **Dow-Mu Koh** MD, FRCR

**PURPOSE**

To investigate relationship between CT attenuation and ADC value of skeletal metastasis in prostate cancer.

**METHOD AND MATERIALS**

26 patients of prostate cancer with bone metastases, who underwent contemporaneous whole body diffusion-weighted MRI (WB-DWI) and fluorodeoxyglucose PET/CT before and after treatment. Minimum ADC (ADCmin) of the tumor was measured by two independent musculoskeletal radiologists and correlated the maximum SUV (SUVmax) of the tumor. The percentage changes of ADCmin and SUVmax were calculated by the difference between the initial and follow-up values divided by the initial value. The change ratios of ADCmin and SUVmax were defined as the ratio of the follow-up value to the initial value. The Spearman rank correlation were obtained for statistical analysis.

There was significant correlation between the differences between the initial and follow-up values of ADCmin and SUVmax (r = 0.573 for reviewer 1 and r = 0.597 for reviewer 2, P < .005), the change ratios of ADCmin and SUVmax (r = 0.457, r = 0.491, P < .05), and percentage changes of ADCmin and SUVmax (r = 0.457, r = 0.491, P < .05). DWI and PET CT showed treatment response in 18 lesions: the ADC was increased by 103% (interquartile range, 61-166) and SUVmax was decreased by 56% (37-83). The ADCs of two responded lesions returned to the range of normal bone marrow and resulted in a decrease of the ADCmin (65% and 32%, respectively) and decrease of SUVmax (71% and 87%, respectively). There was no response in six lesions: the ADC was decreased by 23% (13-30) and SUVmax was increased by 55% (26-90). There was one lesion with a discrepancy in changes of ADCmin (decreased by 29%) and SUVmax (decreased by 13%).

**CONCLUSION**

There was significant correlation between the ADC and SUV for evaluating treatment response in malignant bone tumors.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative DWI is comparable to PET/CT for evaluating treatment response in malignant bone tumors.
CT were retrospectively reviewed. WB-DWI was performed on a 1.5T system using b-values 50, 900 s/mm². CT of chest, abdomen and pelvis was acquired at 65s post-contrast. Slice-by-slice synchronization was obtained between CT and MRI data-sets by careful use of anatomical landmarks. A lucent and a sclerotic metastasis were chosen on CT, when present, at each of the following skeletal sites: thoracic spine, lumbar spine, sacrum, right pelvis and left pelvis. A maximum of 10 lesions were evaluated per patient. Lesion signal intensity on b900 image was recorded as hyperintense or iso/hypointense to skeletal muscle. A region of interest (ROI) was drawn on CT around each lesion to record the mean CT value (HU) and copied on the matching b900 image to derive lesion’s mean ADC value (× 10-3 mm²/s). The relationship between lesion CT HU and ADC values was evaluated by Spearman’s correlation. The mean CT HU and ADC values of hyperintense versus iso/hypointense lesions were compared using t-test. A p-value of

RESULTS
212 lesions were evaluated. The mean CT HU was 481 (33-1152); the mean ADC value was 0.91 (0.18-2.13), 140/212 (66%) lesions appeared hyperintense; 73/212 (34%) were iso/hypointense on DWI. The mean CT HU of hyperintense metastases was significantly lower than iso/hypointense lesions (371 vs 681, p = 0.05); n=57), a highly significant negative correlation was observed between CT HU and ADC (r=-0.60, p

CONCLUSION
Densely sclerotic prostate cancer bone metastases (CT HU=650) showed a strong negative correlation between CT HU and ADC values, but this was not observed for less sclerotic/lytic disease.

CLINICAL RELEVANCE/APPLICATION
Understanding the interplay of DWI signal intensity, ADC, marrow fat fraction and CT attenuation value of prostate bone metastases can help characterize lesions for response evaluation to treatment.

SSK14-04 • Differentiation of Osteogenic Bone Metastases and Bone Islands Using Conventional Single-energy CT Value and Monochromatic CT Value from Spectral CT in Patients with Bronchogenic Carcinoma
Yue Dong (Presenter); Shaowei Zheng; Bing Wang; Ruxin Wang; Lifei Sun

PURPOSE
To evaluate the diagnostic efficacy of single-energy CT and single-source Dual-energy CT in the identification of osteogenic bone metastases and bone islands in patients with bronchogenic carcinoma.

METHOD AND MATERIALS
45 cases of osteogenic metastases in patients with pathologically proven bronchogenic carcinoma and 43 cases of bone islands were confirmed via MRI, single-photon emission computed tomography (SPECT) and one year follow-up. All subjects underwent dual-energy spectral CT imaging using a high definition CT (Discovery CT750 HD, GE). The means, standard deviation (SD) and coefficient variation (CV) of 140kVp-quality check (QC) CT values and virtual monochromatic (40-140 keV) CT values of osteogenic metastases and bone islands were measured and compared with independent-samples t-test. The lesion center was selected as ROI (20-30mm²). ROC curves were used to compare the diagnostic efficacies of conventional single-energy CT and monochromatic CT in the identification of osteogenic bone metastases and bone islands.

RESULTS
The mean mono-energy CT values (40-140 keV) and QC CT value of osteogenic bone metastases were all significantly lower than that of bone islands (p

CONCLUSION
Both conventional single-energy CT and monochromatic CT were reliable for differential diagnosis of osteogenic bone metastases and bone islands. SD of monochromatic CT value at higher keV has better diagnostic efficacies.

CLINICAL RELEVANCE/APPLICATION
SD of monochromatic CT value at higher keV has better diagnostic efficacies for differentiation of osteogenic bone metastases and bone islands.

SSK14-05 • Can IDEAL-MR Imaging of Multiple Myeloma Be Used as a Biomarker for Predicting Symptomatic Myeloma?
Miyuki Takasu MD (Presenter) ; Yoko Kaichi ; Miho Ishikawa MD ; Shuji Date ; Yuji Akiyama ; Kazuo Awai MD * ; Yoshiaki Kuroda ; Akira Sakai

PURPOSE
Asymptomatic multiple myeloma is an asymptomatic plasma-cell proliferative disorder associated with a high risk of progression to symptomatic multiple myeloma. Predictive factors for the progression of this disease are unclear. This study was performed to evaluate the effectiveness of the iterative decomposition of water and fat with echo asymmetric and least-squares estimation (IDEAL) MRI to predict symptomatic myeloma in patients without visible focal lesions.

METHOD AND MATERIALS
The lumbar spine was examined with 3T-MRI in 47 patients with multiple myeloma (asymptomatic myeloma, 23; symptomatic myeloma, 24). The fat-signal fraction (FSF) obtained by IDEAL sequence was calculated as the mean value from three vertebral bodies. We evaluated factors predictive of symptomatic myeloma. They included sex, age, FSF, MR signal intensity pattern (MR pattern), bone marrow plasma cell percentage (BMPC%) obtained from a biopsy specimens, presence of IgA monoclonal protein, serum monoclonal protein level (M protein), serum albumin level, serum ?2-microglobulin (?2m) level, the ?2m/albumin ratio, reductions in levels of uninvolved immunoglobulins, and the kappa/lambda ratio. For data analysis, univariate and multivariate logistic regression analyses, as well as receiver operating characteristic curves, were used. A difference with P < .05 was considered significant.

RESULTS
Univariate analysis demonstrated that MR pattern, FSF, BMPC%, M protein, the reduction in uninvolved immunoglobulins, ?2m, and the ?2m/albumin ratio were significantly associated with symptomatic myeloma. Results of multivariate analysis demonstrated that ?2m, FSF, and the reduction in uninvolved immunoglobulins had significant effects in differentiation between asymptomatic and symptomatic myeloma. The area under the curve was 0.805 for FSF, 0.844 for ?2m, and 0.793 for BMPC%. 

CONCLUSION
Fat quantification results using the IDEAL sequence in MRI were significantly different in patients with symptomatic- and asymptomatic myeloma. The FSF and ?2m facilitated the discrimination of symptomatic- from asymptomatic myeloma.

CLINICAL RELEVANCE/APPLICATION
Predictive factors for the progression to symptomatic myeloma included FSF and ?2m. The discriminative performance of FSF is comparable to that of BMPC% obtained from biopsy specimen.

SSK14-06 • Magnetic Resonance Imaging Differentiation between Malignant Marrow Replacing Lesion and Benign Red Marrow Deposition of Vertebra Using T2*-corrected Fat Fraction Map Imaging Based on Three-point Dixon-VIBE Sequence
Yong Pyo Kim (Presenter); Sungjun Kim MD ; Tae Sub Chung ; Yaena Kim MD ; Munyoung Paek ; Choon Sik Yoon MD ; Young Han Lee MD ; Ho-Taek Song MD ; Jin-Suck Suh MD

PURPOSE
To assess feasibility of T2*-corrected fat fraction map using three-point Dixon-VIBE sequence as a tool for differentiation between malignant marrow replacing lesion and benign red marrow deposition of vertebra.

METHOD AND MATERIALS
From Mar. 2012 to Feb. 2013, magnetic resonance imaging was performed for consecutive 33 patients who were referred for vertebral marrow abnormality assessment. Twenty two pathologically confirmed malignant marrow replacing lesions and 11 benign red marrow
lesions from the patients were subjects of this study. Three sequences were applied using a 1.5-T MR imaging scanner like follows: three-point Dixon-volume interpolated breath-hold GRE sequence (VIBE) for fat fraction (FF) measurement; conventional T1 weighted imaging (T1WI); pre- and post-contrast enhanced fat-suppressed T1WI (CE). To measure fat fraction or signal intensity (SI), region of interest (ROI) was placed at the target lesions. Average measurements from consecutive three slices of the target lesions were used for data analysis. Three parameters from the measurements were obtained like follows for each lesion: FF from VIBE; LDR (lesion-disc ratio; SI of marrow lesion / SI of disc)*100 for T1WI; CER (contrast enhancement ratio; [LDR of post-contrast T1WI-LDR of pre-contrast T1WI]*100 / LDR of pre-contrast T1WI) for CE. To evaluate diagnostic performance of the three parameters, receiver operating characteristic (ROC) curves were obtained and areas under curves (AUCs) of the parameters were compared to each other. The sensitivity and specificity at the most ideal cut off values for the parameters were obtained.

RESULTS
AUCs of FF, LDR, CER were 0.96, 0.83, 0.74. FF showed superior AUC than CER with statistical significance. The optimal cut-off value and the corresponding sensitivity/specificity in percentage were like follows: 16, 0.81/1 in FF; 116.2, 1/63.6 in LDR; 93.4, 0.68/0.81 in CER.

CONCLUSION
T2*-corrected fat fraction measurement using a three-point Dixon-VIBE sequence showed superior diagnostic performance than contrast enhanced T1WI, and it showed excellent specificity in differentiation between malignant marrow replacing lesion and benign red marrow deposition of vertebra.

CLINICAL RELEVANCE/APPLICATION
T2*-corrected fat fraction measurement using a three-point Dixon-VIBE sequence is expected to play an important role to differentiate benign red marrow from malignant marrow lesion.

SSK14-07 • Diagnostic Efficacy of Whole-body Ultra Low Dose CT (WBULDCT) in Comparison with Spinal Magnetic Resonance Imaging (SMRI) in the Assessment of Disease in Patients with Multiple Myeloma (MM)

Valeria Besostri MD (Presenter) ; Davide Ippolito MD ; Pietro A Bonaffini MD ; Valentina Bartolo ; Alessandra Cuccia ; Sandro Sironi MD

PURPOSE
To compare the diagnostic value of Whole-Body Ultra Low-Dose CT (WBULDCT) with dedicated Spinal Magnetic Resonance Imaging (SMRI) in the identification of bone marrow involvement of patients with Multiple Myeloma (MM).

METHOD AND MATERIALS
A total of 30 patients (17 males and 13 females; mean age 68 years, range 52-83 years), with histologically proven MM, undergoing WBULDCT and a dedicated SMRI (9/30 for staging, 21/30 during follow-up), were evaluated in our study. Unenhanced WBULDCT was performed on a 256-slice scanner (ICT, Philips), with the following parameters: tube voltage 120 kV, tube current time product 40 mAs, collimation 128x0.65. Spine MRI was performed on a 1.5T magnet (Achieva, Philips), with the following protocol: T1 TSE and T2 STIR performed on a 256-slice scanner (iCT, Philips), with the following parameters: tube voltage 120 kV, tube current time product 40 mAs, collimation 128x0.65. Spine MRI was performed on a 1.5T magnet (Achieva, Philips), with the following protocol: T1 TSE and T2 STIR acquired on sagittal plane. WBULDCT was compared to spine MRI in terms of lesion detection, pattern of bone marrow involvement and risk fractures.

RESULTS
In 21/30 patients (70%), WBULDCT and SMRI were concordant, detecting (14/21) or excluding (7/21) involvement of the axial skeleton. In 9/30 patients (30%) WBULDCT and SMRI were discordant in terms of axial skeleton involvement: in 2/9 patients SMRI was positive and WBULDCT was negative, while in 7/9 patients only WBULDCT was positive. The corresponding sensitivity for lesion detection in the spine was 73% for WBULDCT and 53% for SMRI, respectively. Only one patient with a negative WBULDCT scan showed multifocal lesions on SMRI. Moreover, in 22/30 of cases (73%) WBULDCT detected additional osteolytic lesions in other extra-assial districts (skull, sternum and ribs, pelvis, upper and lower limbs).

CONCLUSION
WBULDCT demonstrated superior capability as compared to SMRI, for the detection of disease in the axial skeleton and also offers detailed information about extra-assial involvement, which could be potentially missed with dedicated SMRI alone.

CLINICAL RELEVANCE/APPLICATION
WBULDCT imaging appears to be helpful in detecting spinal involvement in patients with MM, reserving SMRI in case of negative results in symptomatic patients.

SSK14-08 • Appearance of Monoclonal Plasma Cell Diseases in Whole-body MRI and Correlation with Parameters of Disease Activity

Jost Kloth (Presenter) ; Jens Hillengass MD ; Karin Listl MD ; Stefan Delorme MD ; Hans-Ulrich Kauczor MD * ; Marc-Andre Weber MD * ; Hartmut Goldschmidt MD

PURPOSE
To examine a possible association of the presence of focal lesions (FL) or a diffuse infiltration pattern of bone marrow in whole-body MRI (WB-MRI) with the disease stage and established markers of disease activity in patients with monoclonal plasma cell disease.

METHOD AND MATERIALS
Institutional review board approval was obtained. We examined the WB-MRI scans in 547 consecutive, unselected and untreated patients with monoclonal gammopathy of undetermined significance (MGUS, n=138), smoldering multiple myeloma (SMM, n=157) and multiple myeloma (MM, n=252) on two identical 1.5 Tesla MRI-scanners with body array coils. Assessment was done by two experienced radiologists blinded to the diagnosis of the patients in consensus.

RESULTS
We found focal lesions in 23.9% (MGUS), 34.4% (SMM) and 81.3% (MM), respectively. A diffuse infiltration pattern was detected in 39.4%, 48.9%, and 71% of the corresponding patients. Infiltration patterns were significant (p

CONCLUSION
The frequency of focal or diffuse bone marrow abnormalities as well as the severity of diffuse signal changes in bone marrow are significantly associated with the stage of plasma cell disease as well as established markers of disease activity.

CLINICAL RELEVANCE/APPLICATION
Considering nearly riskless application and non-invasiveness of wb-MRI its future application in the prognostic evaluation of MM and its asymptomatic precursors MGUS and SMM is promising.

SSK14-09 • Whole-body MRI for Diagnosing Multiple Myeloma and Evaluating Treatment Efficacy

Min Zong MD, PhD (Presenter) ; Dehang Wang MD ; Si-Guang Zhu MD ; Li-Juan Chen

PURPOSE
To investigate the initial diagnostic value and treatment efficacy of the whole-body MRI for Multiple Myeloma.

METHOD AND MATERIALS
Forty-seven Multiple Myeloma patients confirmed with histopathology were enrolled in the study. All patients underwent whole-body MRI before chemotherapy, and follow up scan at 3 and 6 months after the first and second rounds of chemotherapy treatment, respectively. The lesions found by whole-body MRI of each patient were counted at different time points and compared by one-way ANOVA statistic analysis.
RESULTS
Five imaging patterns were identified on whole-body MRI, which were smoldering type (5 patients), diffuse type (7 patients), focal type (25 patients), mixed type (3 patients), and salt-and-pepper type (7 patients). Out of the 47 patients, there were 42 patients with visible lesions on follow up whole-body MRI scans during chemotherapy. The mean number of lesions was 113.90±45.71 on whole-body MRI before chemotherapy and decreased to 28.00±22.49 and 10.04±9.02 at the third and sixth month on follow-up whole-body MRI. Statistically significant differences were confirmed between either two of the three groups (P<0.001).

CONCLUSION
Whole-body MRI is a valuable tool for initial Multiple Myeloma diagnosis and monitoring treatment efficacy after chemotherapy.

CLINICAL RELEVANCE/APPLICATION
Whole-body MRI is a valuable tool for initial Multiple Myeloma diagnosis and monitoring treatment efficacy after chemotherapy.

Neuroradiology/Head and Neck (Head and Neck Tumors)
Wednesday, 10:30 AM - 12:00 PM • N229

SSK15-01: Using SRU Recommendations for Workup of Imaging-detected Incidental Thyroid Nodules: What Types of Cancers Would We Miss?

Manisha Bahl MD, MPH (Presenter); Julie A Sosa MD; Hasan A Hobbs MD; Nathan Wnuk MSc, BSc; Rendon C Nelson MD *; Jenny K Hoang MBBS *

PURPOSE
To apply the Society of Radiologists in Ultrasound (SRU) recommendations to incidental thyroid cancers detected on imaging and to describe cancers that do not meet the workup criteria.

METHOD AND MATERIALS
We performed a retrospective review of 1721 patients who underwent thyroidectomy or lobectomy from 2003 to 2012 to identify thyroid cancers that were detected incidentally on imaging. Imaging-detected incidental cancer was defined as cancer in asymptomatic patients presenting with incidental thyroid nodules (ITN) on imaging with no other risk factors. The SRU recommendations were applied to nodules with ultrasound for review. SRU positive nodules include solid nodules or nodules with coarse calcifications =15 mm, nodules with microcalcifications =10 mm, and solid-cystic nodules =20 mm. Tumor characteristics for SRU- and SRU+ groups were compared.

RESULTS
Of 1721 patients who underwent surgery, 578 (34%) patients had thyroid cancer and 86 (5%) patients had thyroid cancer first detected incidentally by imaging studies. Incidental cancers were first detected on ultrasound in 21 patients. Other cancers were seen incidentally on CT, MRI, PET, octreotide scan, echocardiogram, and radiographs. The SRU recommendations were applied to 72 patients, of which 21 had ultrasound-detected ITN and an additional 51 who had ultrasound workup of ITN detected on other imaging modalities. 15/72 (21%) patients did not meet SRU recommendations for workup and would not have undergone FNA if the recommendations had been used at the time of diagnostic ultrasound. The SRU- group represented 3% of all malignancies. SRU- cancers had a mean size of 1.1 cm (range 0.9-1.4 cm) compared to 2.4 cm (range 1.0-7.6 cm) for SRU+ cancers. Histology was papillary in 3/15 SRU- and 50/57 SRU+ cancers. 5/15 SRU- patients had nodal metastases (all micrometastases detected on central compartment neck dissection). 16/57 SRU+ patients had nodal metastases (11 confined to central compartment).

CONCLUSION
Imaging-detected incidental thyroid cancer is uncommon. 3% of malignancies would be missed using the SRU recommendations for workup of ITN. SRU- tumors were more likely to be papillary carcinoma and less likely to have nodal metastases.

CLINICAL RELEVANCE/APPLICATION
SRU recommendations could reduce the biopsy rate of imaging-detected ITN. Missed malignancies would be uncommon (3%) and more likely to be nonaggressive papillary carcinoma.

SSK15-02: Thyroid Nodules: A Total Malignancy Score (TMS) for Ultrasound (US) - A Validation Pilot Study

Giovanni G Pompili MD (Presenter); Silvia Tresoldi MD; Alessandra Primolevo; Stefania Rossi; Gaetano Bulfamante PhD; Gianpaolo Cornalba MD

PURPOSE
The aim of our study was to validate a malignancy score of thyroid nodules (Total Malignancy Score – TMS) based on their ultrasound features. Pilot study

METHOD AND MATERIALS
Based on a retrospective analysis of 102 patients with follicular pattern at US we recently suggested an US score for the characterization of thyroid nodules [a score from 0 (most likely benign) to 2 (most likely malignant) was assigned to each nodule feature – number, margins, colour-flow, structure, echogenicity, halo, calcifications, dimensional increment – leading to a total score (TMS) ranging from 0 to 11]. The malignancy score system is shown in Figure 1. In the present study we prospectively apply that score to all the patients undergoing a thyroid nodule fine needle aspiration cytology (FNAC) at our Institution. The score results are then compared to the cytological diagnosis.

RESULTS
between September 2012 and April 2013 59 consecutive patients entered the study. Among patients with TMS 3 (20/59) 8 had non-negative cytological results. Patients with non-negative cytological results (n=9) were diagnosed with malignancy (TMS 4 n=3; TMS 6 n=1); follicular proliferation (n=2; both follicular adenomas at surgery; TMS 5 and 3 respectively) or high cellularity lesion (TMS 4 n=1; TMS 5 n=2).

CONCLUSION
The preliminary results of this pilot study confirms what previously suggested: the identification of a predictive US score would allow a more accurate estimation of risk. Nodules with a TMS>3 should undergo FNAC, nodules with a score CLINICAL RELEVANCE/APPLICATION
Our US-TMS, when validated, will be useful in the management of patients with thyroid nodules avoiding useless FNAC when benign features are recognized, and suggesting cytology in potential malignancy.

SSK15-03: Can Ultrasound Features of Thyroid Nodules Predict Outcomes after a Non-diagnostic Fine Needle Aspiration?

Thomas J Anderson MD (Presenter); Michael K Atalay MD, PhD; David J Grand MD; Michael D Beland MD

PURPOSE
To test the hypothesis that ultrasound features of thyroid nodules can predict outcomes after a non-diagnostic FNA.

METHOD AND MATERIALS
We performed a retrospective review of 150 patients with non-diagnostic FNA of thyroid nodules at our institution from 2008 to 2012. Ultrasound features were assessed by two independent observers. The primary outcome was malignancy on final histology. Secondary outcomes included benignity and indeterminate outcome. The study was approved by the institutional review board.

RESULTS
Of the 150 patients, 67 (44.7%) had malignancy, 52 (34.7%) had a benign outcome, and 31 (20.6%) had an indeterminate outcome. The malignancy rate was significantly higher in patients with solid nodules (73.3%) compared to those with cystic nodules (42.9%, p<0.001). Other ultrasound features, such as microcalcifications, were not predictive of malignancy. The overall accuracy of ultrasound for predicting malignancy was 69.3%, sensitivity was 60.6%, specificity was 77.4%, positive predictive value was 70.6%, and negative predictive value was 73.8%.

CONCLUSION
Ultrasound features of thyroid nodules can predict outcomes after a non-diagnostic FNA. Solid nodules are more likely to be malignant, while cystic nodules are more likely to be benign. This information can be used to guide further management decisions.

CLINICAL RELEVANCE/APPLICATION
Ultrasound features of thyroid nodules can help in the management of patients with non-diagnostic FNAs, guiding whether to follow-up with repeat FNAs or surgical excision.

SSK15-04: Whole-body MRI is a valuable tool for initial Multiple Myeloma diagnosis and monitoring treatment efficacy after chemotherapy.

Back to Top
Ultrasound characteristics of thyroid nodules are notoriously poor predictors of malignancy. The purpose of this study was to identify reproducible ultrasound characteristics that could indicate benignity to avoid repeat biopsies when the initial FNA is non-diagnostic.

**METHOD AND MATERIALS**

We identified 5399 nodules that were biopsied under ultrasound guidance in our radiology department between 2004 and 2012. Of these, 454 were initially non-diagnostic and met inclusion criteria with adequate cytological, surgical, or ultrasound follow up. Three independent, board-certified radiologists who were blinded to outcomes scored the ultrasound features of each nodule. Nodule size, composition, border, calcifications, comet tail, and central vascularity were recorded. Outcomes data were collected through review of the medical record.

**RESULTS**

Of the 454 initially non-diagnostic thyroid FNAs, 10 malignancies (2.2%; 3 follicular, 7 papillary) were diagnosed by subsequent FNA (3, 0.7%) or surgery (7, 1.5%). There were no cancers detected in nodules with a spongiform or cystic composition, with a comet tail, or with eggshell or indeterminate calcifications. The minimum diameter of any malignant nodule was 0.8cm, with an average of 2.2cm, compared to 0.3cm and 1.5cm in the benign group (p=0.049).

**CONCLUSION**

The incidence of malignancy after initial non-diagnostic FNA is very low (0.7%), particularly when the nodule is cystic, spongiform, or in the presence of a comet tail, or eggshell or indeterminate calcifications. In the setting of a non-diagnostic FNA with these features, clinical and ultrasound follow-up are more appropriate than repeat FNA, particularly in smaller nodules.

**CLINICAL RELEVANCE/APPLICATION**

Clinical and ultrasound follow-up may be more appropriate than repeat FNA in thyroid nodules with a non-diagnostic result and reassuring ultrasound characteristics.

**SSK15-04 • Is Repeat FNA after a Non-diagnostic Thyroid Nodule FNA Necessary?**

**PURPOSE**

Fine needle aspirates (FNA) of thyroid nodules have a diagnostic yield of 85-90%, but optimal management of non-diagnostic results is unknown. The aim of this study was to identify demographic features predictive of malignancy after an initially non-diagnostic FNA and the role of subsequent FNA.

**METHOD AND MATERIALS**

We identified 5399 nodules that were biopsied under ultrasound guidance in our radiology department between 2004 and 2012. Of these, 454 were initially non-diagnostic and met inclusion criteria with adequate cytological, surgical, or ultrasound follow up. Demographic and laboratory data were correlated with outcomes through review of the medical record.

**RESULTS**

Of the 454 initially non-diagnostic thyroid FNAs, 10 malignancies (2.2%; 3 follicular, 7 papillary) were diagnosed by subsequent FNA (3, 0.7%) or surgery (7, 1.5%). 373 (82.2%) were benign at subsequent FNA (279, 61.5%) or surgical pathology (94, 20.7%), and 71 (15.6%) were stable or decreased in size by serial ultrasound examinations (mean follow up: 2.7 years). In 77 males (17%), 4 (5.2%) cancers were detected; in 377 females (83%), 6 (1.6%) cancers were detected (p=0.07). The average age of this cohort was 55.7 years, while patients with malignancies averaged 62.3 (p=0.02). No malignancies were detected in patients less than 47 years of age. 27 (5.9%) patients were noted to have a papillary cancer elsewhere in the thyroid either at the time of surgery or by FNA of a separate nodule.

**CONCLUSION**

The likelihood of a malignant FNA after a non-diagnostic FNA is very low (0.7%), and therefore clinical and ultrasound follow up may be more appropriate than repeat FNA, particularly in female patients under the age of 45.

**CLINICAL RELEVANCE/APPLICATION**

Clinical and ultrasound follow up of non-diagnostic thyroid FNAs may be more appropriate than repeat FNA, particularly in younger female patients, due to the very low rate of malignancy.

**SSK15-05 • Repeat Fine Needle Aspiration Biopsy for Nondiagnostic Thyroid Nodules with Short Interval Does Not Increase Atypical Cytologic Result**

**PURPOSE**

To evaluate which factors affected atypia with undetermined significance (AUS) results of thyroid nodules with initial nondiagnostic (ND) result and to determine whether repeat fine needle aspiration biopsy (FNAB) with short interval increases AUS result.

**METHOD AND MATERIALS**

A retrospective review of 128 nodules from 126 patients with initial ND results was performed from January 2009 to December 2012. Demographic and clinical factors; age; sex; and time interval of FNAB, and ultrasonographic factors; size, location, consistency, suspicious malignant finding, and thyroiditides were recorded. Time interval was subdivided into < or = 5, 10, 15, and 20 weeks after initial FNAB. Their effects on AUS result were analyzed using Fisher’s exact test and Mann-Whitney U test.

**RESULTS**

None of the demographic, clinical, and ultrasonographic variables was significantly related with AUS result of repeat FNAB. Time interval of repeat FNAB was not related with AUS result (p=0.63, 0.57, 0.23, 0.48 for 5, 10, 15, 20 weeks, respectively).

**CONCLUSION**

Timing of repeat FNAB for the ND nodules did not influence the AUS result of repeat FNAB, and other clinical and US characters were not correlated with AUS result. Repeat FNAB for ND nodules could be performed without waiting for 3 months following to the need of patients and referring clinicians.

**CLINICAL RELEVANCE/APPLICATION**

1. To determine the recommended waiting period of 3 months is neccessary or not.
2. To provide clinical evidence for management of thyroid nodules with initial nondiagnostic results.

**SSK15-06 • Thyroglobulin Measurement in Fine Needle Aspirates from Neck Lesions after Total Thyroidectomy: Is It a Reliable Tool for Post-surgical Follow-up Regardless of TSH Stimulation?**

**PURPOSE**

Thyroglobulin (Tg) measurement in needle washout fluid has been reported to increase diagnostic accuracy of fine needle aspiration for sonographically suspicious neck lesions encountered in postoperative follow-up. Although TSH stimulation is needed to improve the diagnostic accuracy of serum Tg for detection of recurrence, it is not clear whether stimulated or suppressed TSH status affect FNA-Tg.

**METHOD AND MATERIALS**

A total of 104 consecutive patients with papillary thyroid carcinoma initially treated by total thyroidectomy followed by remnant iodine ablation were retrospectively enrolled. They were sonographically evaluated for cervical recurrence by FNA-Tg and cytology during recent
SSK15-08 • Improved Zoomed EPI-DWI of the Head and Neck Using Two-dimensional Spatially-selective Radiofrequency Excitation Pulses

**Inseon Ryoo** MD (Presenter) ; **Ji-Hoon Kim** MD ; **Soo Chin Kim** MD ; **Tae Jin Yun** MD ; **Seung Hong Choi** MD, PhD ; **Chul-Ho Sohn** MD ; **Jisang Park** MD ; **Koung Mi Kang** ; **Eun Kyoung Lee** MD

**PURPOSE**
Recent publications reported the contradictory results of pretreatment diffusion-weighted MR imaging (DWI) for the prediction of chemoradiotherapeutic response in primary head and neck squamous cell carcinomas (HNSCC). The purpose of this study was to evaluate the diagnostic performance of DWI with both standard (b=1000 s/mm²) and high (b=2000 s/mm²) b-values for predicting treatment response to induction chemotherapy in primary HNSCC.

**METHOD AND MATERIALS**
Twenty seven patients with primary HNSCC who underwent DWI with both b=1000 and 2000 s/mm² prior to treatment were included in this study, and corresponding apparent diffusion coefficient (ADC) maps were calculated. Regions of interest containing the tumor were drawn on every section of ADC map and summated to make volume based data of the entire tumor. Histogram parameters were correlated with treatment response using unpaired student t-test.

**RESULTS**
Among 27 patients, 14 showed good response (complete remission or partial response) and 13 showed poor response (stable disease or progressive disease) to induction chemotherapy. The mean ADC values of good responders ([252.7±91.4 s/mm² at b=1000 and 625.36±36.9 s/mm² at b=2000]) were lower than those of poor responders ([1294±19.5 s/mm² at b=1000 and 746.5±41.8 s/mm² at b=2000]). But statistically significant difference was achieved only at high b-value ADC map. (p=0.04) The 75th percentiles of cumulative ADC histogram of good responders (807.3±54.9 s/mm²) also showed statistically significant lower values than those of poor responders (963.7±48.7 s/mm²) at only high b-value ADC map. (p=0.04)

**CONCLUSION**
Pretreatment DWI with high b-value may facilitate and be better in predicting treatment response to induction chemotherapy than DWI with standard-b-value in primary HNSCCs.

**CLINICAL RELEVANCE/APPLICATION**
Based on our study results, high-b-value DWI has the potential to facilitate pretreatment prediction of the response to induction chemotherapy in primary head and neck squamous cell carcinomas.

SSK15-09 • Role of Sonoelastography in Differentiating Benign and Malignant Salivary Gland Tumors: A Systematic Review and Meta Analysis

**Mahsa Ghajarzadeh** MD, MPH (Presenter) ; **Mehdi Mohammadifar** ; **Kamran Azarkhish** MD ; **Seyed Hassan Emami-Razavi**

**PURPOSE**
to evaluate accuracy of sonoelastography in differentiating benign and malignant salivary gland tumors

**METHOD AND MATERIALS**
A highly sensitive search for sonoelastography and salivary glands tumors was performed in MEDLINE, Cochrane Library, ACP Journal Club, EMBASE, Health Technology assessment, and ISI web of knowledge for studies published prior to December 2012. The criteria for eligibility were:
1. Studies evaluated diagnostic accuracy of sono-elastography in differentiating malignant and benign salivary glands tumors. 2. Using appropriate reference standard test such as Fine-Needle Aspiration (FNA), histological assessment of specimens obtained by surgery. 3. Diagnostic measures on sonoelastographic evaluation results such as sensitivity, specificity, positive and negative predictive values.
CONCLUSION
Sono-elastography has high accuracy in differentiating benign and malignant salivary gland tumors.

CLINICAL RELEVANCE/APPLICATION
applying sonoelastography for differentiating benign and malignant salivary tumors.

Neuroradiology (Advanced Neuroimaging of Alzheimer’s Disease)

Wednesday, 10:30 AM - 12:00 PM • N230

SSK16-01 • Prediction of Conversion from MCI to AD: Integration and Relative Values of Brain Atrophy Patterns, Clinical Scores, CSF Biomarkers, and APOE Genotype

Xiao Da (Presenter); Jon B Toledo MD; Jarcy Zee; David A Wolk MD; Sharon X Xie; Yangming Ou PhD; Amanda Shacklett MS; Paraskevi Parmpi MS; Leslie Shaw PhD; John Trojanowski; Christos Davatzikos

PURPOSE
We evaluate the individual, as well as relative and joint values of indices obtained from MRI patterns of atrophy, cerebrospinal fluid (CSF) biomarkers, APOE genotype, and cognitive performance for prediction of clinical progression of MCI patients, on an individual person basis.

METHOD AND MATERIALS
The SPARE-AD index, a previously characterized imaging biomarker capturing spatial patterns of brain atrophy, was first tested for sensitivity and specificity as a biomarker of Alzheimer’s disease (AD), in a training set of 411 participants. SPARE-AD, and a related mild cognitive impairment (MCI)-specific index called SPARE-MCI, were then evaluated at baseline in 212 MCI patients who either converted to AD within 18 months or remained stable for at least 3 years. Baseline predictive value of SPARE-AD, SPARE-MCI, CSF biomarkers (total and phosphorylated tau and A?), MMSE, ADAS-Cog, and APOE genotype were then evaluated using a support vector machine classifier.

RESULTS
SPARE-AD offered excellent diagnostic accuracy of AD (AUC between 0.96-0.98). Excluding CSF biomarkers, MRI-derived SPARE scores offered the highest predictive power for MCI conversion to AD (AUC=0.76), followed by ADAS-Cog (AUC=0.74). Their combination offered the best accuracy (AUC=0.76). Other cognitive and APOE4 markers did not add any predictive power beyond them. In a subset (112 MCI patients) who also had CSF biomarkers, SPARE had the best predictive power (AUC=0.73), being enhanced by CSF biomarkers (AUC=0.76), which by themselves were relatively poorer predictors (AUC=0.68). In amyloid-negative MCI patients, SPARE-AD had high predictive power.

CONCLUSION
MRI patterns of atrophy, quantified via advanced pattern analysis methods, offer the highest predictive power of conversion from MCI to AD, but are slightly better than ADAS-Cog. Combination of MRI and CSF biomarkers improves predictive power. High predictive value of SPARE in negative amyloid MCI is not expected under the amyloid hypothesis and merits further investigation.

CLINICAL RELEVANCE/APPLICATION
A highly sensitive and specific imaging biomarker of AD is evaluated as an earlier predictor of clinical progression from MCI to AD, which can become an AD-specific marker for diagnosis and treatment.

SSK16-02 • MR Elastography of Alzheimer’s Disease and Frontotemporal Dementia

John Huston MD (Presenter); Matthew C Murphy PhD; Kevin J Glaser *; Clifford R Jack MD *; Richard L Ehman MD *

PURPOSE
Several MR imaging biomarkers exist to measure various disease processes associated with Alzheimer’s disease (AD) and frontotemporal dementia (FTD). Patterns of hippocampal and whole brain atrophy, MR spectroscopy, perfusion, diffusion and functional MRI have been reported. Magnetic resonance elastography (MRE) is a noninvasive technique to measure tissue stiffness, akin to manual palpation. Our purpose was to investigate the effect of AD and FTD on brain stiffness.

METHOD AND MATERIALS
We examined 59 subjects with brain MRE including 39 age and gender matched cognitively normal controls (NC), 15 subjects with AD and 5 subjects with behavioral variant FTD. MRE data were collected with a modified spin-echo EPI pulse sequence on a 3.0T MR imager including full head coverage in just less than 7 minutes. Shear waves were introduced with a soft pillow-like vibration source operating at 60 Hz using a pneumatic actuator. The wave data underwent a curl operation to remove contributions of the longitudinal waves and a 3D direct inversion algorithm calculated the elastogram. In subjects with 3 mm isotropic sampling we measured age adjusted global brain stiffness (entire brain excluding cerebellum), in 8 regions.

RESULTS
Global stiffness was decreased in AD subjects (2.20 kPa) compared to NC (2.37 kPa). Group-wise differences in stiffness were demonstrated within the lobes of the brain that contain association cortices (p

CONCLUSION
We have demonstrated that AD and FTD alter the mechanical properties of the brain in a way that can be measured in vivo by MRE, following the known topography of the diseases. Measures of brain elasticity have the potential to offer insights into the ultrastructural alternations of brain tissue that occur with AD and FTD, how these change with time and the clinical expression of the diseases.
SSK16-03 • Different Post Label Delay Cerebral Blood Flow Measurements in Patients with Alzheimer’s Disease Using 3D Arterial Spin Labeling

Ying Liu MD (Presenter) ; Huishu Yuan MD ; Xiangzhu Zeng MD ; Zheng Wang MS

PURPOSE
To evaluate cerebral blood flow (CBF) and find out differences in patients with Alzheimer’s disease (AD) and healthy control group (HC) using 3D Arterial Spin Labeling (ASL) on 3.0T MR. Changing the label time in 3D ASL in order to obtain two CBF maps. To observe the analysis of different label time for CBF map result and explore the 3D ASL in the display of brain perfusion factor and its clinical significance.

METHOD AND MATERIALS
Thirteen AD patients (5men and 8women; age range, 58-88years, mean age 75.00±7.36 years) and fifteen healthy control subjects (4 men and 11 women; age range, 56-84 years, mean age 71.20±7.89 years) were recruited. All MRI examinations were performed using a 3.0T scanner, pseudo-continuous ASL scanning was conducted with 36 label/control images acquired on a GE750 3T scanner. The acquisition parameters were: TR/TE = 4632/10.5ms, voxel size = 2×2×4mm3. High-resolution T1SPGR images were acquired as well. ASL sequence was obtained twice with different post label delay (PLD) which were 1.5s and 2.5s. Comparing CBFAQD1.5 with CBFAQC1.5 and CBFAQD2.5 with CBFAQC2.5, and CBFAQD1.5 with CBFAQD2.5. ASL and structural images were coregistered using SPM8.

RESULTS
1. SPM analyses revealed focal hypoperfusion in areas over the bilateral parietal lobe, temporal lobe and posterior cingulate gyrus in AD patients in comparison with control subjects with PLD1.5.

CONCLUSION
1. revealed patterns of regional hemodynamic impairment typical of mild AD Centain hypoperfusion areas in AD patients in comparison with control subjects with PLD1.5. 2. When the labeling time was set with 2.5s, the areas of CBF map were reduced significantly to nearly zero. Therefore, short labeling time could discover perfusion abnormal earlier.

CLINICAL RELEVANCE/APPLICATION
3D ASL is a useful noninvasive MRI sequence to identify the Alzheimer’s disease and the PLD of 1.5s was probably better than that of 2.5s.

SSK16-04 • The Correlation of Hippocampal T2-mapping with Neuropsychology Test in Patients with Alzheimer’s Disease

Zhu-Ren Luo (Presenter) ; Xiong-Jie Zhuang

PURPOSE
1) To deduce T2, the inverse of the transverse relaxation rate (R2), in the hippocampus of healthy adults; 2) to investigate the brain iron deposition in Alzheimer’s disease (AD) patients and age-matched healthy controls using T2-values.

METHOD AND MATERIALS
T2-weighted data from the bilateral hippocampi of ten AD patients and sixty healthy controls were collected using multi-slice multi-echo turbo spin echo (MSME-TSE) imaging on a 3.0T MR-scanner, followed by the neuropsychological testing. The correlations between T2-values and Mini-Mental-State-Examination (MMSE) score were investigated on group-wise basis (gender, age, side and healthy/AD).

RESULTS
There were no significant differences in hippocampal T2-values on intra-gender and inter-gender basis (P > 0.05). Hippocampal T2-values of both sides were similar (right: 85.17±2.44 milliseconds; left: 85.28±2.51 milliseconds). The bilateral hippocampal T2 values correlated moderately with age (right: r = -0.59; left: -0.58; P < 0.001). Mean hippocampal T2-values from ten controls correlated strongly (r = -0.90, P < 0.001) with reference brain iron concentrations for healthy adults. The AD-group had significantly lowered T2-values in the hippocampus when compared to normal controls (P < 0.001) and had a strong positive correlation with the MMSE score (R2 = 0.97; P < 0.05).

CONCLUSION
Patients with AD showed significantly iron depositions in the hippocampus resulting in the decreased T2 values. A positive correlation between T2-values and cognition/ memory scores, suggests that quantitative T2 can be used in the early diagnosis of AD and monitoring of the treatment response.

CLINICAL RELEVANCE/APPLICATION
In vivo proton transverse relaxation rate imaging is capable of quantitatively measuring the iron deposition in the hippocampus in AD patients, consistent with incipient AD pathogenesis.

SSK16-05 • GABA-edited Magnetic Resonance Spectroscopy in Alzheimer’s Disease at 3T

Xue Bai BA (Presenter) ; Guangbin Wang MD

PURPOSE
Gamma-aminobutyric acid (GABA) is the essential inhibitory neurotransmitter in human brain. It is considered that reduced neuronal GABA concentration and neurotransmission results in cognitive impairments in Alzheimer’s disease (AD). However, few in vivo studies have directly certified this hypothesis. In this study, we used magnetic resonance spectroscopy at high field to measure GABA levels, aiming to investigate whether there is a regional GABA level decline in AD.

METHOD AND MATERIALS
Twelve untreated AD patients (5 males and 7 female; range 56-79, mean = 67.6±8.4 years) and twelve age-and sex-matched healthy control subjects were recruited. AD patients were diagnosed according to National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer’s Disease and Related Disorders Association. 1H-MRS was performed in a 3-tesla MR scanner (Philips Achieva TX, Best, The Netherlands). The voxel was set (3 cm×3 cm×3 cm) in the frontal lobe and the parietal lobe (Fig 1), using high resolution T1-weighted three-dimensional TFE images as a localizer. The GABA concentration was measured using a MEGA-PRESS sequence (TR = 2000ms; TE = 68 ms; 320 averages; acquisition bandwidth = 1000 Hz; scan duration 11 minutes). All the metabolite quantitation was performed with time-domain fitting algorithm AMARES by jMRUI v.4.0. Each pixel in the brain images was segmented as to gray matter, white matter, or cerebrospinal fluid using the FSL package.

RESULTS
According to the result of segmentation result, there was no significant difference in the proportions of each part between AD patients and controls. Fig 2 shows the typical GABA-edited spectra from the MEGA-PRESS sequence in the frontal lobe of an AD patient. Significant differences of GABA/Cr ratio were found in parietal lobe between AD patients and Controls (t=-2.212, p=0.038), but not found in frontal lobe (t=0.799, p>0.05).

CONCLUSION
In this study, GABA-edited MRS technique was successfully applied in AD patients to assess GABA level in vivo, and the brain GABA level in parietal lobe is decreased in AD. GABA may be a potential biomarker for early detection of AD, and could be used to assess the prognosis after treatment.

CLINICAL RELEVANCE/APPLICATION
Disorders Using Volumetric MRI

SSK16-08 • SSK16-07 •

Using such data, including from other regions of the brain, probabilities are easily derived for hippocampal volume for the three diagnoses. Using the attached figure shows the distribution of cognitive impairment, and 79 with age-related non-neurodegenerative memory loss. The 669 patients scanned with volumetric MRI were divided into three diagnoses: 328 were with Alzheimer’s dementia, 262 with mild cognitive impairment, and 102 with late MCI. All global and local AV45 amyloid burden measures were significantly associated with RAVLT, MMSE, and ADAS-cog (p < 0.05). The strongest associations between amyloid burden and structural connection metrics were in the posterior cingulate and precuneus (node degree; p < 0.05). The strongest associations between structural connection metrics and clinical dementia scores were in the precuneus, superior parietal, and superior temporal regions (node degree vs. MMSE and ADAS-cog; p < 0.05).

CONCLUSION
Brain amyloid burden has significant associations with clinical cognitive status in all regions analyzed, consistent with globally increased amyloid burden as an important condition for AD. The strongest associations between amyloid burden and structural connection metrics were in the posterior cingulate and precuneus (node degree; p < 0.05), suggesting that these regions are most likely to have structural changes related to amyloid deposition in AD.

CLINICAL RELEVANCE/APPLICATION
The combination of quantitative amyloid PET and DTI tractography can provide information about global and local structural changes in AD, aiding in diagnosis and disease tracking.

SSK16-07 • Voxel-based Analysis of Quantitative Susceptibility Data Obtained from Subjects with AD and MCI

Hye Soo Koo MD (Presenter); Seong Jong Yun; Kyung Mi Lee MD; Eo Jin Hwang; Heok Gi Kim; Chang-Woo Ryu MD; Hak Young Rhee; Yi Wang PhD; Tian Liu PhD; Geon-Ho Jahng PhD

PURPOSE
To investigate quantitative susceptibility in three groups of subjects with cognitive normal (CN), mild cognitive impairments (MCI) and Alzheimer’s disease (AD). Because AD is expected to have the most iron plaques, we expected that the AD brains would produce the least signals in comparison to the CN and MCI brains.

METHOD AND MATERIALS
Subjects of 20 CN, 21 MCI, and 21 AD participated after informed consent. A fully first-order flow-compensated three-dimensional (3D) gradient echo sequence ran to obtain magnitude and phase images, which were later used to produce final quantitative susceptibility mapping (QSM). Furthermore, 3D T1-weighted images were acquired for the brain tissue segmentation, image registration, and masking-out of non-brain tissues, including CSF and vessels. The QSM images were produced by implementing the Morphology Enabled Dipole Inversion (MEDI) method. After the QSM images were smoothed using isotropic 4 mm Gaussian kernel, the differences of QSM data among the three groups were investigated by performing a voxel-based statistical analysis using a one-way analysis of variance (ANOVA) test with subject age and gender as covariates.

RESULTS
QSM values would decrease from CN to MCI and to AD. Compared with MCI subjects, QSM values in CN subjects were high in the left superior frontal gyrus and the left superior temporal gyrus. The lower signals were also found in the left superior frontal gyrus and the left superior temporal gyrus compared with the AD group. The QSM values in CN subjects were high in the left parahippocampal gyrus and the left inferior frontal gyrus, but low in the right cingulate gyrus. Compared with AD patients, QSM values in MCI subjects were high in the right superior temporal and the left superior temporal, but low in the left middle frontal gyrus.

CONCLUSION
We were able to identify the brain regions in which the susceptibility changes occurred among the different groups. More differences were found when CN and AD groups were compared than when CN and MCI groups were compared.

CLINICAL RELEVANCE/APPLICATION
The local variations in amyloid plaque can cause local magnetic susceptibility variations. Quantifying iron concentrations in vivo is instrumental for understanding the role of iron in AD.

SSK16-08 • Quantitative MRI Discrimination of Alzheimer’s Dementia, Mild Cognitive Impairment, and Other Memory Disorders Using Volumetric MRI

Zachary T Berman BA (Presenter); Shamseldeen Y Mahmoud MD; Alexander Rae-Grant MD; Jennifer Bullen MSc; Nancy A Obuchowski PhD; Stephen E Jones MD, PhD

PURPOSE
To investigate whether automated quantitative MRI may be useful in discriminating AD, MCI, and other memory disorders in a cognitive disorders clinic.

METHOD AND MATERIALS
The clinical records were reviewed of 669 consecutive patients at the Lou Ruvo Center for Brain Health who underwent quantitative MRI using NeuroQuant (Cortech Inc), which computes the brain volumes of 48 regions. These numbers were compared with the presence and type of dementia, whose gold standard was the clinical diagnosis made by neurologists, geriatricians, or general practitioners. Other clinical data collected included factors such as age, age of onset, and various test scores. These data were used to form a library to compare future patients whose dementia diagnosis is unknown. Specifically, a new patient’s quantitative MRI is compared with the library of prior scans, and probabilities are provided associating the patient to either the presence of dementia or dementia type.

RESULTS
The 669 patients scanned with volumetric MRI were divided into three diagnoses: 328 were with Alzheimer’s dementia, 262 with mild cognitive impairment, and 79 with age-related non-neurodegenerative memory loss. The attached figure shows the distribution of hippocampal volume for the three diagnoses. Using such data, including from other regions of the brain, probabilities are easily derived for any new patient with a quantitative volumetric MRI but without a diagnosis. These probabilistic maps may be useful in determining if a patient fits the profile for one of these three diagnostic categories given a specific set of MRI measures. We plan to apply this analysis.
CONCLUSION
A center specific library of quantitative brain measures may be useful in categorizing patients with cognitive disorders. We review the initial results of our quantitative analysis and probabilistic maps generated during this analysis.

CLINICAL RELEVANCE/APPLICATION
Using institution specific libraries, quantitative volumetric MRI can be used to distinguish different cognitive disorders.

SSK16-09 • The Pattern of Metabolic Heterogeneity in the Hippocampus by 3T Multi-voxel Proton Spectroscopy in Alzheimer’s Disease

Fei Chen MS (Presenter) ; Bing Zhang PhD ; Ming Li ; Xin Zhang MD, MS ; Yun Xu ; Bin Zhu ; Weibo Chen MSc

PURPOSE
We explore the metabolic changes in the head, body and tail of hippocampal in Alzheimer’s disease (AD) compared with normal control. We also investigate the distribution rules of metabolites concentration among different parts of the hippocampus for more accurate clinical diagnosis of AD.

METHOD AND MATERIALS
Thirty patients with AD and 30 cognitively normal person (CN) were scanned by a 3.0 T magnetic resonance (MR) by Multivoxel proton spectroscopy (Achieva, Philips Medical Systems, Netherlands). The 8channels-HEAD coil was employed. The data was processed by commercially available postprocessing workstation (Extended Workspace (EWS), Philips Medical Systems, Netherlands). The hippocampus was divided equally into three parts (head, body and tail). N-acetylaspartate (NAA)/creatinine (Cr), myoinositol (MI)/Cr and MI/NAA ratio were calculated separately from each part. We compared each metabolites concentration data of AD and CN groups and analyzed the anteroposterior metabolic profile in hippocampus.

RESULTS
The mean value of NAA/Cr is decreased and that of MI/Cr, MI/NAA are elevated in the bilateral hippocampal and hippocampal body and tail in AD group (p < 0.01). MI/NAA in the head of left hippocampus is also increased statistically (p < 0.01). Fig.1 shows NAA/Cr in the bilateral hippocampal from head to tail have the gradually rising trend (p < 0.01) and MI/NAA gradually declines in CN group (p < 0.01). MI/Cr in CN group and each metabolite concentration in AD group have no anteroposterior metabolic heterogeneity in bilateral hippocampal. (Fig.1).

CONCLUSION
The anteroposterior metabolic heterogeneity is dismissed in AD, which might be helpful on the early clinical diagnosis of AD.

CLINICAL RELEVANCE/APPLICATION
Application in the early diagnosis of AD.

Nuclear Medicine (PET/MRI for Oncology)

Wednesday, 10:30 AM - 12:00 PM • S505AB

SSK17 • AMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5

Moderator
Terence Z Wong , MD, PhD *

Moderator
Farrokh Dehdashti , MD *

SSK17-01 • Effects of Ferumoxytol on Quantitative Accuracy of PET in Simultaneous PET/MR Imaging - A Validation Study

Ronald J Borra MD (Presenter) ; Ulrike I Attenberger MD * ; Spencer L Bowen PhD ; Ciprian Catana MD, PhD ; Grae E Arabasz ARRT ; Bruce R Rosen MD, PhD * ; Jacob M Hooker PhD ; Alexander R Guimaraes MD, PhD *

PURPOSE
Simultaneous PET/MR imaging depends on MR-derived attenuation maps (mu-maps) for accurate attenuation correction (AC) of the PET data. MRI Contrast agents (MRCA) have the potential to affect obtained mu-maps and in turn reduce the quantitative accuracy of the PET measurements. Currently, the effects of i.v. administered ferumoxytol, which is FDA approved for iron replacement and is a MRCA belonging to the class of ultrasmall superparamagnetic iron oxides (USPIO), are unknown. The purpose of this study is to study the possible effects of ferumoxytol on simultaneously obtained PET/MR data.

METHOD AND MATERIALS
An agarose phantom was constructed with homogeneous concentrations of ferumoxytol (Feraheme®, AMAG Pharmaceuticals, Inc.) ranging from 0-20 mg/kg. The phantom was scanned on a Siemens Biograph mMR PET/MR scanner, using a 2-point DIXON 3-D (VIBE) sequence. The default algorithm for reconstruction of the mu-map was used, including selection of the “lung compartment” option. In addition, repeated in-vivo PET/MR 18F-FDG studies were performed in a 13.2 kg male baboon, in an animal committee approved protocol, at four different time points: baseline (before and after injection of 10mg/kg ferumoxytol i.v.), 1, 3 and 5 weeks after the baseline scan. All studies were performed using a body Matrix coil and the built-in spine coil as the receiving coil elements.

RESULTS
Phantom experiment: Misclassification was observed in the mu-maps of the phantom regions with ferumoxytol concentrations of 10 mg/kg and higher. Baboon imaging: In data obtained later than 5 minutes after the i.v. ferumoxytol injection, significant signal loss was observed in the mu-maps, particularly in the liver, resulting in liver tissue being misclassified as lung. This translated in a decrease of observed standard uptake value (SUV) of liver tissue from 1.23 to 0.54 (~57%) within the first 57 minutes. This change persisted over the next 5 weeks (SUV 0.48, ~61% compared to baseline).

CONCLUSION
Our data suggests that ferumoxytol, when used as an MRCA (at FDA approved clinical doses (e.g. 10 mg/kg Fe)) in simultaneous PET/MR imaging, has the potential to cause misclassification of tissues on AC maps resulting in >50% changes in observed SUV.

CLINICAL RELEVANCE/APPLICATION
Ferumoxytol has good vascular, lymph node and macrophage activity, however, our data suggests that PET/MR AC algorithms and dose response need improvement prior to its utilization for cancer staging.

SSK17-02 • Performance of Whole-body Integrated 18F-FDG PET/MR for Evaluation of Malignant Bone Lesions in Comparison to PET/CT

Matthias J Eiber MD (Presenter) * ; Marius E Mayerhoefer MD, PhD ; Michael Souvatzoglou ; Markus Schwaiger MD * ; Ernst J Rummeny MD ; Ambros J Beer MD *

PURPOSE
Whole-body PET/MR offers potential advantages compared to PET/CT for evaluation of bone lesions due to a higher soft tissue
119 patients with FDG-avid malignancies underwent a single-injection/dual-imaging protocol on a PET/CT-scanner and a subsequent PET/MR-scan (biograph mMR) with a T1w VIBE Dixon for attenuation correction (AC) and coronal T1w TSE sequence. Three sets of images (CT with PET [from PET/CT; set A], T1w VIBE Dixon with PET [set B] and T1w TSE with PET [from both PET/MR; set C]) were analyzed. Every lesion was rated using a 4-point-scale for conspicuity of PET, a 4-point-scale for anatomical allocation of PET positive lesions and a 5-point-scale for the nature dignity. For all lesions and regions of normal bone SUV-analysis was performed for PET/MR and PET/CT.

RESULTS
98 bone lesions were identified in 33 pts. 630 regions of normal bone were analyzed. Visual lesion conspicuity in PET was comparable (PET/CT: mean rating 2.82±0.45; PET/MR: 2.75±0.51; p=0.3095). Anatomical delineation and allocation of suspicious lesions was significantly superior in T1w TSE (mean rating 2.84±0.42) compared to CT (2.57±0.54, p=0.0001) and T1w VIBE Dixon (2.57±0.54, p=0.0002). No significant difference could be found for correctly classifying all malignant bone lesions for set A (85/90), set B (84/90) and set C (86/90), respectively. For bone lesions and regions of normal bone a highly significant correlation could be found between the SUVs (R=0.950, R=0.917, respectively, p<0.0001). A higher rate of concordant findings between T1w and PET in PET/MR could improve diagnostic certainty.

CLINICAL RELEVANCE/APPLICATION
Neglecting bone in AC for PET/MR is clinical not relevant for bone lesions. A higher rate of concordant findings between T1w and PET in PET/MR could improve diagnostic certainty.

FDG PET/CT in the Detection and Characterization of Pulmonary Lesions: Technical and Diagnostic Evaluation in Comparison to PET/CT

119 patients with FDG-avid malignancies underwent a single-injection/dual-imaging protocol on a PET/CT-scanner and a subsequent PET/MR-scan (Biograph mMR) with a T1w VIBE Dixon for attenuation correction (AC) and coronal T1w TSE sequence. Three sets of images (CT with PET [from PET/CT; set A], T1w VIBE Dixon with PET [set B] and T1w TSE with PET [from both PET/MR; set C]) were analyzed. Every lesion was rated using a 4-point-scale for conspicuity of PET, a 4-point-scale for anatomical allocation of PET positive lesions and a 5-point-scale for the nature dignity. For all lesions and regions of normal bone SUV-analysis was performed for PET/MR and PET/CT.

RESULTS
98 bone lesions were identified in 33 pts. 630 regions of normal bone were analyzed. Visual lesion conspicuity in PET was comparable (PET/CT: mean rating 2.82±0.45; PET/MR: 2.75±0.51; p=0.3095). Anatomical delineation and allocation of suspicious lesions was significantly superior in T1w TSE (mean rating 2.84±0.42) compared to CT (2.57±0.54, p=0.0001) and T1w VIBE Dixon (2.57±0.54, p=0.0002). No significant difference could be found for correctly classifying all malignant bone lesions for set A (85/90), set B (84/90) and set C (86/90), respectively. For bone lesions and regions of normal bone a highly significant correlation could be found between the SUVs (R=0.950, R=0.917, respectively, p<0.0001). A higher rate of concordant findings between T1w and PET in PET/MR could improve diagnostic certainty.

CLINICAL RELEVANCE/APPLICATION
Neglecting bone in AC for PET/MR is clinical not relevant for bone lesions. A higher rate of concordant findings between T1w and PET in PET/MR could improve diagnostic certainty.

FDG PET/CT in the Detection and Characterization of Pulmonary Lesions: Technical and Diagnostic Evaluation in Comparison to PET/CT

119 patients with FDG-avid malignancies underwent a single-injection/dual-imaging protocol on a PET/CT-scanner and a subsequent PET/MR-scan (Biograph mMR) with a T1w VIBE Dixon for attenuation correction (AC) and coronal T1w TSE sequence. Three sets of images (CT with PET [from PET/CT; set A], T1w VIBE Dixon with PET [set B] and T1w TSE with PET [from both PET/MR; set C]) were analyzed. Every lesion was rated using a 4-point-scale for conspicuity of PET, a 4-point-scale for anatomical allocation of PET positive lesions and a 5-point-scale for the nature dignity. For all lesions and regions of normal bone SUV-analysis was performed for PET/MR and PET/CT.

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CLINICAL RELEVANCE/APPLICATION
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CLINICAL RELEVANCE/APPLICATION
Neglecting bone in AC for PET/MR is clinical not relevant for bone lesions. A higher rate of concordant findings between T1w and PET in PET/MR could improve diagnostic certainty.
SSK17-05 • Whole-body PET/MRI: The Effect of Ignoring Bone during MR-based Attenuation Correction in Oncology Imaging

Thomas Beyer PhD (Presenter) *; Rachida Sersar; Julie Sabyee; Johan Lofgren; Claes Ladebag; Flemming L Andersen MSc, PhD; Rasmus Larsen; Marianne C Aznar MS

PURPOSE
Standard PET attenuation correction (AC) in integrated PET/MRI is based on tissue segmentation following in-/opposed phase MR imaging (ACin_op) and does not account for bone tissue. We evaluate PET quantification in whole-body (WB)-PET/MRI following MR-AC without and with accounting for bone tissue using separate CT.

METHOD AND MATERIALS
20 oncology patients referred for a PET/CT were injected with [18F]-FDG or [18F]-NaF and scanned on PET/CT (mCT, Siemens) followed by a PET/MR scan (mMR, Siemens) following clinical WB-protocols. PET/MR images were reconstructed using standard MR-AC and four modified attenuation maps. These were created by co-registering (b-spline) the CT images to (ACin_op) and adding CT bone mask values representing cortical bone: 1200HU (ACcortCT), spongiosa bone: 350HU (ACspongCT), average CT value (ACmeanCT) and original CT values (ACorgCT). PET images were reconstructed after MR-AC using AW-OSEM (3 iterations, 21 subsets, 4mm Gaussian) on 344-matrices. Relative difference images of PET following modified MR-AC and MR-AC using ACin_op were compared. Mean/max standardized uptake values (SUVbw) were calculated in anatomical reference regions and PET-positive lesions.

RESULTS
Visual assessment of the AC-PET and relative difference images indicated most prominent changes over standard MR-AC (ACin_op) limited to the skeletal system. The average relative difference of PET following PET/MR-AC was 10% higher than MR-ACin_op.

CONCLUSION
Ignoring bone tissue during MR-AC causes an average underestimation of (10-14)% in reference tissues, bone and soft tissue lesions, which is visually insignificant but considerable during follow-up.

CLINICAL RELEVANCE/APPLICATION
Standard MR-AC appears acceptable in clinical routine for now but mandates improvements in accuracy and reliability for quantitative follow-up examinations.

SSK17-06 • 18-FDG PET/MRI Compared with 18-FDG PET/CT and Whole Body MRI for Lesion Detection, Confidence and Radiation Dose in the Evaluation of Metastatic Breast Cancer

Amy N Melsaether MD; Akshat C Pujara MD (Presenter); Rajan Rakheja; Mohammed B Shaik MD; Eric Sigmund PhD; Sungheon Kim; Christian Geppert *; Linda Moy MD

PURPOSE
PET/CT is often used to evaluate for systemic breast cancer (BC), but provides low contrast at a relatively high radiation dose. Whole body (WB) MRI is also being investigated in this role. Simultaneous PET/MRI scanners are currently available. We therefore evaluated PET/MRI performance for lesion detection, reader confidence and radiation dose as compared with PET/CT and contrast enhanced WB MRI.

METHOD AND MATERIALS
For this HIPPA compliant, IRB approved prospective study, 26 women (age 37-76 mean 56) with n=1 newly diagnosed T2 BC or n=25 history of metastatic disease underwent WB simultaneous 18-FDG PET/MRI on an integrated 3T PET/MR scanner (Siemens Biograph mMR), after PET/CT.

RESULTS
Compared with PET/CT, PET/MRI detected treatment changing brain and bone metastases and a primary endometrial cancer in one patient each. PET/MRI also detected breast cancers in two patients which were not seen on PET/CT. WB MRI detected the brain metastases and endometrial cancer, but did not see the treatment changing bone metastasis. In addition, PET/MRI detected liver, bone, lung, pleural and nodal metastases in 2, 7, 1, 1 and 6 patients with high confidence. PET/CT saw the same lesions with lower overall confidence. WB MRI saw bone metastases in only 6 of these patients and detected the same liver, lung, pleural, nodal and brain metastases with lower confidence. WB MRI detected additional low confidence nodal and liver lesions in 9 and 2 patients. Mean PET/MRI radiation dose was 50% less than PET/CT (10.4 mSv vs 20.7 mSv).

CONCLUSION
18-FDG PET/MRI may outperform PET/CT and WB MRI at half the radiation dose of PET/CT. Further investigation is warranted.

CLINICAL RELEVANCE/APPLICATION
18-FDG PET/MRI may provide greater lesion detection and confidence at half the radiation dose as compared with PET/CT and contrast enhanced WB MRI.

SSK17-07 • PET/MRI as an Alternative Reduced Radiation Staging Algorithm in Patients with Lymphoma

Alexander R Guimaeraes MD, PhD (Presenter) *; Onofrio A Catalano MD; Wendy Atkinson MS; Michael A Blake MBBCh *; Ciprian Catana MD, PhD; Bruce R Rosen MD, PhD *

PURPOSE
In patients with lymphoma, FDG-PET/CT is critical in the initial staging with early interim PET CT being a strong independent predictor of progression free survival. Diffusion weighted MRI is also a biomarker of malignancy with an uncertain role in lymphoma. The goal of this work was to evaluate the diagnostic performance of simultaneous PET/MR compared to PET/CT in patients with lymphoma.

METHOD AND MATERIALS
15 subjects with lymphoma underwent an IRB approved, single-injection/dual-imaging protocol, consisting of a PET/CT and subsequent PET/MR scan. PET-images of both modalities were reconstructed iteratively. Attenuation, decay and scatter correction and regional allocation was performed using low dose CT data for PET/CT and Dixon-MR sequences for PET/MR. Whole body DWI was performed using a respiratory gated SSEPI (TI/TE/TR 220/68/7800ms) with 3 b-values (0,50,800). ADC was calculated using a mono-exponential fit. SUVmax for FDG-avid lesions were measured and compared using ROI analysis by a single radiologist and Osirix (Osirix®, Lausanne, Switzerland) for each imaging modality. ROI analysis was performed as well comparing ADC fused to FDG-PET/MR SUVmax. Strength of correlation between variables was measured using the Spearman rank correlation coefficient (rs).

RESULTS
Of the 15 subjects, 4 had Hodgkin’s and 11 had non-Hodgkin’s (NHL) lymphoma. The mean age was 53 +/- 16 years. Thirty-seven FDG-avid lesions were identified. The mean difference in time between PET/CT and PET/MR acquisitions was (209.9 +/- 43.9 min). SUVmax from PET/FDG-PET/MR (mean 8.5 +/- 4.6) versus FDG-PET/CT (mean 4.6 +/- 2.7) was on average higher and demonstrated a strongly positive correlation (rs=0.84 (0.71, 0.92); p

CONCLUSION
FDG-PET/MR offers an equivalent whole body staging examination as compared with PET/CT with an improved radiation safety profile (by negating the CT component) in lymphoma patients. Correlation of ADC to SUVmax was weak understating the potential importance of both biomarkers in this disease process.
S102AB

Children between 0 and 2 Years

SSK18-01 • SSK18

Wednesday, 10:30 AM - 12:00 PM

SSK17-09 • SSK18-01 • [18F]-FDG-PET/CT

**Purpose**

Therapeutic decisions in non–small cell lung cancer (NSCLC) patients depend on the tumor stage. Positron emission tomography/computed tomography (PET/CT) with [18F]-FDG is widely accepted as the diagnostic standard of care. The feasibility of pulmonary tumor staging with simultaneous [18F]-FDG-PET/MRI has recently been proven, but no state-of-the-art lung MRI protocol was used in this early study. The purpose of this study was to compare a dedicated pulmonary [18F]-FDG-PET/MRI protocol to [18F]-FDG-PET/CT for thoracic staging in NSCLC patients.

**Method and Materials**

38 patients (23 male, 15 female, mean age 63.9±10.5 years) with histopathologically confirmed NSCLC underwent [18F]-FDG-PET/CT followed by a [18F]-FDG-PET/MRI (including a dedicated pulmonary MRI protocol). The TNM stage was determined in separate sessions for PET/CT and PET/MRI by two readers in consensus. The mean and maximum standardized uptake values (SUVmean; SUVmax) and the maximum diameter of the primary tumor were measured. TNM stages, SUVmean/max and tumor size obtained from PET/CT and PET/MRI were compared and Pearson correlation analysis and Bland-Altman plots were performed for quantitative parameters.

**Results**

PET/MRI and PET/CT agreed on T-, N- and thoracic M-stages in 33/38 (87%), 32/38 (84%) and 35/38 (92%) of patients. Compared to PET/CT, T-stages, N-stages and thoracic M-stages were staged down by PET/MRI in 3 (8%), 3 (8%) and 3 (8%) and were staged up in 2 (5%), 3 (8%) and 0 (0%) patients, respectively. Pearson correlation coefficients for the primary tumors’ SUVmean, SUVmax and maximum diameter in PET/CT and PET/MRI were 0.89, 0.90 and 0.98, respectively. Using Bland-Altman analysis, the lower and upper limits of agreement between PET/CT and PET/MRI were -3.45 to 3.15 for SUVmean, -7.43 to 6.55 for SUVmax and -0.86 to 0.96 for the tumor size, respectively.

**Conclusion**

PET/MRI using a dedicated pulmonary MRI protocol and PET/CT generally show a good agreement on thoracic TNM-stages in NSCLC patients. Comparability of primary tumor sizes measured in PET/CT and PET/MRI is substantial and is very well for quantitative measures of [18F]-FDG uptake.

**Clinical Relevance/Application**

In NSCLC the choice of therapeutic options is based on the individual tumor stage. Hence, comparability of thoracic TNM-stages and primary tumor sizes assessed by PET/CT and PET/MRI is essential.

S18-01 • SSK18-01 • [18F]-FDG-PET/CT

**Purpose**

The equivalence of PET/MRI both qualitatively and quantitatively offer a provocative, future clinical staging and surveillance option in patients with lymphoma with dramatic savings in radiation dose.

**Method and Materials**

The image material of all children between 0 and 2 years, who were suspected to have a cranioencephral injury and had an initial cranial computer tomography at the University Hospital Essen, were analyzed retrospectively from the years 1999 to 2012. In cases where additional MR examinations existed, these MR images were also analyzed. First, the demographic and anamnestic data were recorded. Second, the radiological co-findings were analyzed. Third, we searched for criteria indicating AHT as origin of SDHy.

**Results**

The inclusion criteria detailed above were met by 136 cases. In 33 cases an AHT was assumed from the total of clinical, forensic, and_
criminalistic findings. 17 cases showed evidence of SDHy. In only one SDHy case, there was adequate accidental trauma anamnesis. The demographic data and the radiologic findings in cCT and cMRI will be presented. The classification scheme by Zanini et al. (2008) is not suitable. Instead, for indicating AHT as cause of SDHy, the presence of bridging vein thromboses appears to indicate a high degree of violence and thus, in the absence of adequate accidental trauma, the presence of AHT.

CONCLUSION

There are different SDHy appearances which allow for conclusions to the mechanism of causation. Therefore, neuroradiologists should be aware of the possible presentations of AHT. The presence of bridging vein thromboses indicates AHT.

CLINICAL RELEVANCE/APPLICATION

Although difficult to investigate, understanding of SDHy's may allow for new insights into the pathogenesis of phenomena such as the shaken baby syndrome.

SSK18-02  •  Semi-quantitative Evaluation of Neuroblastoma Tumor Burden Using 123I-MIBG and 18F-FDG PET/CT

Khun Visith Keu MD, FRCPC (Presenter); Claire Twist MD; Andrew Quon MD; Erik S Mittra MD, PhD; Andrei Iagaru MD *

PURPOSE

Metaiodobenzylguanidine radiolabeled with I-123 (mIBG) is routinely used for assessing neuroblastoma (NB), but 18F-FDG PET/CT (FDG) are used in indeterminate situation where undifferentiated histology or aggressive tumor behavior is suspected. The purpose of this study was to evaluate the correlation of semi-quantitative analysis of FDG to mIBG scoring system in high-risk NB patients.

METHOD AND MATERIALS

We retrospectively reviewed pediatric patients who were referred at our institution from 2003 to 2011, and who underwent mIBG and FDG studies, within 3 weeks, for staging, monitoring response to therapy or surveillance. Patients who had treatment or surgical procedure between the two studies were excluded. On mIBG, the severity of disease extent was evaluated at 10 different anatomic locations, using a scoring scale of 0 to 3, known as the Curie Score (CS). On FDG, estimated threshold delimitation was used to calculate the five largest and distinct lesions: SUVmax, SUVmean, MTV (metabolic tumor volume) and TLG (total lesion glycolysis = MTV x SUVmean) were extracted from each scan. The CS on mIBG was correlated with the sum of TLGs on FDG, using a Spearman rank test.

RESULTS

Twenty-one patients were assessed with mIBG and FDG scans: in 7 patients, the pair studies were not performed within 3 weeks and/or treatment was administered before the second scan. Only fourteen pediatric patients (6 men, 8 women) with an average age (+SD) of 104 (±80) months were eligible for further analysis. The median (and interquartile range = IQR) of CS and sum of TLGs were respectively 2 (IQR = 1 – 12) and 38 (IQR = 6 – 156). Both semi-quantitative scoring systems were correlated but not significantly, with a rho = 0.514 and P = 0.06. One third of patients were lost after one year follow-up. In the other two thirds, all patients with CS > 1 died shortly after the imaging (< 18 months survival) and most patients with a sum of TLGs > 10, died without reaching a 2 years survival post-scan.

CONCLUSION

CS on mIBG and sum of TLGs on FDG scans provide similar information on tumor burden in high-risk NB patients. These data suggests also that mIBG might be better in identifying patients with poor outcome. This is the first study we know of that compares the tumor burden semi-quantitatively on mIBG and FDG scans.

CLINICAL RELEVANCE/APPLICATION

Prognostic value of each scan is better defined with standardize and reproducible semi-quantitative scoring systems.

SSK18-03  •  Correlation of 18F FDG Activity and Gd-contrast Enhancement of Pediatric Tumors on PET/MR: The Next Step towards a One Stop Shop? Tumor Staging

Christopher Klenk MD (Presenter); Rakhee S Gawande MD; Vythao Tran MD; Sandy Napel PhD *; Andrew Quon MD; Heike E Daldrup-Link MD

PURPOSE

MRI is the modality of choice for local staging of many solid malignancies in pediatric patients. 18F FDG-PET/CT is often complemented for whole body staging. Integrated PET/MR can combine local and whole body staging in one imaging exam while eliminating the CT portion of a PET/CT. The purpose of this study was to determine the need for administering contrast for local tumor staging with PET/MR by comparing tumor areas of increased 18F-FDG metabolic activity with areas of Gd-enhancement.

METHOD AND MATERIALS

We retrospectively evaluated imaging studies of 35 children (age 1-18 years, mean 9.9 years) with small round blue cell tumors, who had undergone an 18F-FDG PET/CT and gadopentetate-enhanced MRI with an interval of less than three weeks. Patients in remission or with brain tumors were excluded. 18F-FDG PET and Gd-enhanced MR scans were color encoded and fused using Osirix software. A pediatric radiologist and nuclear medicine physician evaluated the concordance or discordance of 18F-FDG and Gd-tumor enhancement in consensus. Results were compared using the McNemar’s Test.

RESULTS

29/35 patients had regions of tumor that demonstrated avid contrast enhancement that correlated with regions of significant FDG avidity (83%). 6/35 patients had areas of contrast enhancement that was disconcordant with regions of FDG avidity (17%). The McNemar’s Test demonstrated a significant correlation between 18F-FDG and Gd-tumor enhancement.

CONCLUSION

PET/MR as a combined imaging modality is highly effective for staging and restaging of pediatric malignancies when used as a combined imaging modality and would allow for “one stop shop” tumor staging. There is a high concordance between areas of increased 18-FDG avidity on PET with areas of GD-enhancement on MRI in small cell tumors. Thus, MR contrast agent administration may not be needed and should be assessed on a patient-by-patient basis.

CLINICAL RELEVANCE/APPLICATION

PET-MR as a combined imaging modality is highly effective for staging and restaging of pediatric malignancies which allows “one stop shop” tumor staging and significantly reduces radiation exposure.

SSK18-04  •  Comparison of Multivoxel MR Spectroscopy and I-123 MIBG Findings in Neuroblastoma

Zakir Sakci MD (Presenter); Yonca Anik MD; Ahmet Akca; Mehmet Gencturk MD; Ali Demirci MD; Hakan Demir; Gozde Da?l?oz Gorur; Funda Corapcioglu MD

PURPOSE

In neuroblastoma patients who have tumor residue after treatment the use of conventional MRI provides limited information regarding the maturity of the tumor. For this reason, we use I-123 Metaiodobenzylguanidin (MIBG) to evaluate the tumor for maturity before prescribing further treatment. We can learn about the current membrane turnover by looking at the MR Spectroscopy maturity levels along with the peak of cholin. We can analyze the cholin peaks at finer detail with the use of multivoxel MR spectroscopy. The aim of our study was to evaluate tumor activation with MRS and compare the findings with that of I-123 MIBG.

METHOD AND MATERIALS

We included twenty patients diagnosed pathologically proven with neuroblastoma. MR imaging was done via 3T MR device before treatment and during treatment intervals> Multivoxel spectroscopy was performed with TE: 140. Cholin peak and choline/creatine ratio were measured. I-123 MIBG was also performed. Uptake was graded as 4 grade on1-123 MIBG. Time interval between both modalities was at most 10 days. In all patients primary tumor was imaged and in three patients metastatic lesions were also imaged. Cholin peak
RESULTS
We demonstrated choline peak in all I-123 MIBG active tumors. Correlation among cholin peak and choline/creatinine ratio and MIBI grade revealed significant correlations both in primary tumors and metastatic lesions.

CONCLUSION
I-123 MIBG has radiation exposure and is repeated several times during treatments, takes a long time to perform. On the contrary MRS lacks radiation, can be performed in about twenty minutes. MRS can provide tumor activation information. MRS may be an alternative technique for I-123 MIBG in near future. Further analysis with larger number of patients is required.

CLINICAL RELEVANCE/APPLICATION
MRS may be an alternative technique for MIBI in near future. MRS lack radiation, to be able to performed in about twenty minutes are advantages to MIBI.

SSK18-05 • Evaluation of Whole Body MRI including Diffusion-weighted and Conventional Unenhanced and Contrast Enhanced Imaging as the Sole Staging and Follow-up Imaging Procedure in Pediatric Tumors Compared to Other Imaging Modalities
Guenther K Schneider MD, PhD (Presenter) ; Alexander Massmann MD ; Stefan R Rick ; Arno Buecker MD * ; Jonas Stroeder MD ; Peter Fries MD

PURPOSE
In 36 pediatric pts with suspected malignant tumors prediagnosed by other imaging modalities whole body MRI was evaluated as the sole staging procedure including established staging procedures such as PET, MIBG or bone scintigraphy. CT at risk for recurrences in follow-up whole body MRI were used for evaluation of tumor response and tumor recurrence, again compared against conventional imaging.

METHOD AND MATERIALS
167 whole body exams in 36 pts were performed for staging / follow-up of different benign and malignant tumors confirmed by histology and/or surgical exploration. In 9 pts benign tumors incl. mature teratoma, liver abscess, hemorrhage, mesothelial cysts, hemangiomas, angiomylipoma and myofibromatosis were diagnosed, in the remaining 27 pts 8 lymphoma and 19 solid tumors (neuro-, nephro- and hepatoblastoma, different sarcomas) were found. MR protocol incl. T1w dynamic GRE sequences of the abdomen post CM (0.05 mmol/kg BW Gd-BOPTA (MultiHance) and during the liver specific phase. DWI was acquired during free breathing and transversal T2w TSE sequences with navigator triggering and a composed whole-body STIR-sequence in coronal orientation were acquired.

RESULTS
MRI correctly differentiated between malignant and benign tumors in 35/36 pts. In one patient infantile myofibromatosis was misdiagnosed as rhabdomyosarcoma without metastases. In malignant tumors one rhabdoid tumor was misinterpreted as nephroblastoma but correctly staged and one case of Hodgkin lymphoma was misinterpreted as PNET, again with correct staging. Differences between MRI and CT at risk for recurrences in follow-up whole body MRI were used for evaluation of tumor response and tumor recurrence, again compared against conventional imaging.

CONCLUSION
Whole body MRI performed with the described technique can correctly stage and diagnose a variety of malignant tumors and further large scale studies have to prove if MRI can finally replace at least some of the actually established staging procedures.

CLINICAL RELEVANCE/APPLICATION
This study demonstrates the potential of whole body MRI using DWI and conventional techniques for complete evaluation of pediatric malignancies.

SSK18-06 • Intussusception Revisited: Is On-site Surgeon Presence at the Time of Radiologic Reduction Necessary?
Haithuy N Nguyen MD (Presenter) ; J. H Kan MD ; R. Paul Guillian MD ; Christopher I Cassady MD

PURPOSE
The ACR-SPR clinical practice guidelines recommend that fluoroscopic-guided intussusception reduction be performed with a surgeon readily available. At many institutions, this may not be feasible. The purpose of this study is to assess the utilization of immediate surgical services at the time of radiologic intussusception reduction.

METHOD AND MATERIALS
All radiologic intussusception reductions at a tertiary care children's hospital from 11/07-8/12 were reviewed to determine method, complications, clinical status of the child, and time interval between unsuccessful reduction and operative intervention.

RESULTS
433 intussusceptions were referred for fluoroscopic reduction. 86.1%(N=373) were successful and 13.9%(N=60) were unsuccessful, with 5 perforations representing 8.3%(5/60) of unsuccessful and 1.2%(5/433) of total reduction attempts. Six patients became hemodynamically unstable during attempted reduction (4 perforations, 2 unsuccessful reductions without perforation), representing 10%(6/60) of unsuccessful and 1.4%(6/433) of total reduction attempts. Percutaneous needle decompression and cardiopulmonary resuscitation restored hemodynamic stability in all cases. The mean time to surgery after perforation, unsuccessful reduction complicated by hemodynamic instability, and unsuccessful radiologic reduction without complication was 1.3, 2.2 and 4.3 hours, respectively.

CONCLUSION
In site surgeon presence at the time of radiologic reduction attempts, provided that the radiologist is facile with percutaneous needle decompression and management of hemodynamic instability, and ultimate surgical care can be arranged expeditiously.

CLINICAL RELEVANCE/APPLICATION
The ACR-SPR guidelines should continue to reflect the need for emergent on-call surgical back-up for intussusception reduction attempts, but surgical attendance is not required during the procedure.

SSK18-07 • Prevalence of Developmental Dysplasia of the Hip in Breech Infants after Normal Screening Ultrasound: Is Follow-up Radiography Really Necessary?
Booth Aldred MD (Presenter) ; Henry J Baskin MD ; Brett Weitzel MD

PURPOSE
DDH is a prevalent source of morbidity seen within pediatric orthopedics. A significant amount of discrepancy exists in the literature regarding selective screening and follow-up imaging for the patient at risk for DDH. Current protocol at our institution dictates that all normal breech infants in breech infants be followed-up with radiography at four to six months. Yet, the data is conflicted on the value-added by these follow-up radiographs. We evaluate the utility of follow-up radiography in breech infants with initial normal ultrasound findings and determine if radiographs add significant value, justifying their use.

METHOD AND MATERIALS
We performed a systematic review of all breech infants born since 2009 collected from our institution's database. All infants ultrasounds were performed by accredited sonographers utilizing standard techniques. Breech infants with a negative ultrasound at around 6 weeks were included if a follow-up radiograph was performed at approximately 6 months. Then, using standard departmental criteria, we evaluated whether the infant had radiographic findings of DDH or remained normal.

RESULTS
Preliminary screening of approximately 200 breech infants demonstrated 125 infants that met out inclusion criteria. Of these 125 infants, there were 5 infants with radiographic findings of DDH. We expect another 200 to 250 infants to meet inclusion criteria for this study.

CONCLUSION
Preliminary data suggests that breech infants with negative US at 6 weeks have a small but significant risk of DDH diagnosed with radiograph by 6 months of age. Given the severe morbidity of delayed diagnosis of DDH, we suggest radiographic followup of breech children who had normal screening hip ultrasound in the newborn period.

CLINICAL RELEVANCE/APPLICATION
Morbidity associated with DDH in the infant is significant. Our center recently began follow-up imaging in breech infants who had a negative initial ultrasound. Is this imaging necessary?

SSK18-08 • Iterative CT Image Reconstruction Allows Sub-0.1 mSv Effective Dose for the Diagnosis of Craniosynostosis

Caroline Ernst MD ; Tine Hulstaert (Presenter) ; Dries Belsack MD ; Nico Buls DSc, PhD * ; Gert Van Gompel PhD ; Koenraad H Nieboer MD * ; Johan De Mey *

PURPOSE
To evaluate diagnostic quality of markedly lowered dose cranial computed tomography (CT), reconstructed by full model based iterative reconstruction (MBIR), in the diagnosis of craniosynostosis.

METHOD AND MATERIALS
During 2009-2012 48 patients, aged 0-35 months, underwent cranial 3D CT on a 64 Multidetector CT to assess cranial sutures. In 2009-2010 24 patients were scanned on a Philips system (Brillance CT 64) with a standard acquisition protocol (120 kVp; 276 mA, fixed) and reconstructed by FBP. In 2011-2012 the other 24 patients underwent a lowered dose CT (80 kVp; 10 mA, fixed) on a Discovery 750HD (GE Healthcare) system using MBIR reconstruction (Veo®). CTDIvol and DLP were obtained from the dose report and effective doses were estimated conform current ICRP guidelines. Objective image quality (IQ) was assessed in terms of image noise, signal-to-noise ratio's (SNR) and sharpness. Subjective IQ assessment by two blinded expert readers was performed by scoring several parameters and structures such as noise, bony structures and overall diagnostic acceptability. Statistical evaluation was performed with independent T-test, non-parametric Mann-Whitney U test and kappa analysis.

RESULTS
The use of MBIR in cranial 3D CT allows sub-0.1 mSv effective dose for the diagnosis of craniosynostosis without impairing diagnostic quality.

CLINICAL RELEVANCE/APPLICATION
Implementation of novel CT technologies allows for increased radiation safety in paediatrics.

SSK18-09 • Limited Abdominal Ultrasound for Evaluation of Children with Acute Abdominal Pain

Martha M Munden MD (Presenter) ; Shannon Wai MD ; Michael Distefano MD ; Wei Zhang PhD

PURPOSE
The aim of this study is to determine whether a complete abdominal ultrasound (US) is necessary in the evaluation of children with right lower quadrant (RLQ) pain suspicious for appendicitis in the Emergency Department (ED), and whether performing a “limited” RLQ US would miss a clinically significant diagnosis.

METHOD AND MATERIALS
This is a retrospective review of 1204 consecutive initial abdominal US studies done from March through December of 2008 for children presenting to a tertiary pediatric ED with abdominal pain concerning for appendicitis. Primarily performed “limited” ultrasound examinations, and examinations done for those with chronic disease such as cystic fibrosis, and sickle cell disease were excluded. Our “limited” US examination excludes evaluation of the pancreas, spleen and left kidney. Data were extracted from the complete abdominal US to see if any abnormalities were noted of the pancreas, the spleen and the left kidney, and patients' charts were reviewed to see if any positive findings in these organs were clinically significant.

RESULTS
Of the 704 US examinations included in this study, there were 65 potential missed diagnoses, ie abnormal US findings noted in the pancreas, spleen or left kidney. Only 6 of these findings were clinically significant and 5 were managed medically while 1 (a left ureteropelvic junction obstruction) underwent surgical intervention. The chance of missing a diagnosis is calculated as 65/704 = 9.2% (95% confidence interval: 7.2% - 11.7%) and the chance of missing a diagnosis that is clinically significant is 6/704 = 0.85% (95% confidence interval: 0.35% - 1.94%).

CONCLUSION
In children with acute abdominal pain concerning for appendicitis, evaluation with a “limited” RLQ US provides a timely diagnosis, while missing only 1 case of surgically treatable abdominal pain. The “limited” US resulted in overall savings in time to perform examination and charges.

CLINICAL RELEVANCE/APPLICATION
By limiting the ultrasound examination, significant time and expense can be saved with the chance of missing a clinically significant diagnosis of only 0.85%.

Physics (CT-Imaging Phantoms)

Wednesday, 10:30 AM - 12:00 PM • S403A
Hotelling Observer and Its Correlation with Human Observers

**Lifeng Yu** PhD (Presenter); **Shuai Leng** PhD; **Yi Zhang**; **Zhoubo Li**; **James M Kofler** PhD; **Cynthia H McColllough** PhD *

**PURPOSE**
Despite its current use as a metric in the low-contrast resolution test for the American College of Radiology (ACR) CT Accreditation Program, contrast to noise ratio is not appropriate for iterative reconstruction (IR). The purpose of this study was to develop and validate a quantitative metric using a channelized Hotelling observer (CHO) that can be used to assess low-contrast resolution in the ACR phantom for IR methods.

**METHOD AND MATERIALS**
The proposed metric is based on a CHO model, which predicts an index of detectability from a number of 2-alternative forced choice (2AFC) trials, in this case generated from repeated CT scans of the ACR phantom. To test this metric, the low-contrast module of the ACR phantom was scanned on a 128-slice scanner (Definition Flash, Siemens) and a 64-slice scanner (Lightspeed VCT, GE). Routine abdomen protocols were used at three dose levels (CTDVol=16, 12, and 8 mGy), each scanned 100 times. On each scanner, images were reconstructed with one filtered-backprojection kernel and 2 IR settings: B40 and 140 with strengths of 3 and 5 for Siemens; Standard and ASIR with a mix ratio of 50% and 100% for GE. Three board-certified medical physicists blindly evaluated images in a random order (totally 1800 images = 2 vendors x 3 doses x 3 reconstructions x 100 images), and recorded a quality score for detecting all four 6-mm rods using a 6 point scale. Percent correct of the 2AFC was calculated using CHO. The correlation between the index of detectability predicted by CHO and the scores by human observers was tested.

**RESULTS**
A strong correlation between CHO and human observer scores was observed. Pearson correlation coefficients were 0.932 (95% CI: [0.70, 0.99]) for Siemens and 0.926 (95% CI: [0.68, 0.98]) for GE. Both IR methods improved low-contrast performance, with one more significantly than the other (p < 0.05).

**CONCLUSION**
The proposed task-based low-contrast detectability metric may provide an objective measure of low-contrast performance in ACR CT evaluations.

**CLINICAL RELEVANCE/APPLICATION**
Use of IR methods challenges existing low-contrast performance tests, such as with the ACR phantom. The proposed metric provides an objective and reliable measure of low-contrast performance.

**SSK19-02 • Moving Forward with the AAPM-ICRU CT Dose Phantom**

**Donovan M Bakalyar** PhD (Presenter); **John M Boone** PhD *; **Michael F McNitt-Gray** PhD *; **Robert L Dixon** PhD *; **Erik Angel** PhD *; **Kirsten L Boedeker** MS *; **Kish Chakrabarti** PhD *; **Heather Chen-Mayer** PhD *; **Dianna D Cody** PhD *; **Wenzheng Feng**; **Shuai Leng** PhD; **Sarah E McKenney** BS, BA *; **Richard L Morin** PhD; **J. Thomas Payne** PhD; **Jeffrey Siewersden** PhD *; **Keith J Strauss** MS; **Paul B Sunde** *; **Thomas L Toth** *; **Zhitong Yang** PhD

**CONCLUSION**
The AAPM-ICRU phantom and proposed measurement techniques are robust, simple and readily applied to the ever growing variety of CT design geometries.

**Background**
CTDVol and DLP are universally used members of the CTDI family of radiation dose indices. However, the phantoms and measurement techniques used for determining these values suffer from limitations that are especially evident for the growing number of cone beam and very wide fan beam CT machines. In accordance with the recommendations of AAPM Task Group 111, Task Group 200 (TG200) has designed a phantom and testing procedures which are suitable over a broader range of machines and conditions than the current methodology.

**Evaluation**
The phantom is 30 cm in diameter and is constructed of polyethylene; it is of sufficient length (60 cm) so that virtually no scatter from scanning near the ends of the phantom will reach the central plane. A small detector is placed in the central plane at the center, near the edge, or at an intermediate radius and a helical scan through the entire phantom is performed. For this scan the dose recorded by the chamber approaches Deq, the value that would be reached for an infinite scan. By recording the dose rate as a function of position during the scan, the dose D(L) at the central plane can be determined for any scan length L. From this record, the approach to equilibrium function H(L), defined as the ratio D(L)/Deq, is determined. These concepts can be extended to axial scans on stationary tables and are not limited by the width of the beam. Testing has been performed on a Philips Brilliance 64 scanner and a Toshiba Aquilion One.

**Discussion**
H(L) is a robust function and displays only a weak dependence on tube potential and z-axis collimation. Our measurements show that the central plane dose is substantially more uniform than that for the CTDI body phantom. The phantom design is easily and transparently scalable, making it readily adaptable to the size specific dose estimates described by the report of AAPM Task Group 204 resulting in an index that remains simple but accounts for both girth and scan length. Correlations to air and small phantom measurements can be used for verification in the field.

**SSK19-03 • A Comprehensive Study of Single- and Dual-source Coronary CT Angiography with Stents Using an Anthropomorphic Phantom with a Beating Heart Model**

**George S Fung** PhD (Presenter) *; **Karl Stierstorfer** PhD *; **Satomi Kawamoto** MD *; **Katsuyuki Taguchi** PhD *; **Matthew K Fuld** PhD *; **Thomas G Flohr** PhD *; **Eliot K Fishman** MD *; **Benjamin Tsui** PhD *

**PURPOSE**
The object is to study the effect of coronary stents and heart motion on the quantification accuracy of lumen diameter and lumen attenuation of coronary stents using an anthropomorphic phantom with a beating heart model and a CT projection simulator in single- and dual-source CT (SSCT and DSCT) angiography.

**METHOD AND MATERIALS**
The digital 4D phantom with a beating heart model, coronary arteries and stents, was developed and used in simulating coronary CT angiography (CTA) image data with different heart rates (HRs), i.e., 50-110bpm. Clinical stainless steel coronary stent models of different diameters, i.e., 2.5-4mm, were deployed at 3 coronary locations, i.e., LAD, LCX and RCA. Single and dual-source CTA images of the phantom were generated using an instrumental-accurate CT projection simulator at mid-diastolic phase and reconstructed using standard clinical protocols. Artificial in-stent lumen narrowing (ALN) and lumen attenuation (ALA) were calculated from the reconstructed CTA images using both SSCT and DSCT systems at the different HRs.

**RESULTS**
In the static heart study, CTA images from all 3 stents suffered similar degradation, as ALN increased from 28% to 48% and ALA increased from 2% to 68% as the stent diameter decreased from 4mm to 2.5mm, due to partial volume (PV) and metal beam-hardening (BH) artifacts. In the beating heart study using SSCT, there were minor degradations for LAD stent at all HRs and for LCX stent at 50-70bpm. For LCX stent at 90-110bpm and for RCA stent at all HRs, lumen diameter and attenuation could not be robustly measured due to the high variation of in-stent attenuation and deformed structure of the stents in the CTA images. In the beating heart study using DSCT, CTA images of LAD stent at low HRs and RCA stent at 50bpm had minor motion artifacts. The RCA stent in CTA images suffered from significant motion artifacts at 70bpm and above. When compared to SSCT, DSCT achieved comparable ALA for LAD stent at all HRs and over 30% of improvement in ALA for LCX and RCA stents at low HRs.

**CONCLUSION**
High temporal resolution provided by DSCT overcomes most of the motion artifacts for the stents at the LAD and LCX over large range of HRs in CTA images. Additional research is needed to reduce artifacts due to the large motion of RCA, and PV and BH effects.

**CLINICAL RELEVANCE/APPLICATION**

DSCT overcomes most of the motion artifacts for the stents at the LAD and LCX over large range of HRs in CTA.

**SSK19-04 • Size-specific Organ Dose Calculation Using Age and Gender Specific Computational Human Phantoms in Patients Undergoing Computed Tomography Examinations**

**Choonsik Lee PhD (Presenter) ; Jennifer W Siegelman MD, MPH ; Mark P Supanich PhD * ; Les R Folio DO, MPH**

**PURPOSE**

To develop a method to estimate organ doses for patients with different torso diameters that can be readily used in clinical settings without the need for Monte Carlo simulation. CT Dose Index (CTDIvol) and Dose Length Product (DLP) are available from the dose report for patients undergoing computed tomography (CT) examinations but are based on CTDI phantom measurements that do not represent patient organ dose. As direct measurement is not feasible, intensive Monte Carlo simulation coupled with computational human phantoms is used to calculate patient organ doses; more important measure.

**METHOD AND MATERIALS**

We employed a set of computational human phantoms in six age groups (newborn to adult) based on ICRP reference data to pre-calculate organ dose library using the known x-ray spectra of a reference CT scanner (Siemens Sensation 16). CTDIvol-normalized doses to major organs included in (or close to) the scan coverage was calculated for head, chest, abdomen–pelvis (AP), and chest-abdomen-pelvis (CAP) scans using head and body filters and 120 kVp. Effective diameters at the middle level of the scan range were measured and exponential regression curves were derived between organ doses and the effective diameters. Illustrative organ doses were calculated for a given CT scanner and patients with different effective diameters by multiplying the organ dose library by the CTDIvol of the given CT scanner.

**RESULTS**

Exponential regression coefficients were established for male and female patients scanned for head, chest, AP, and CAP examinations for a range of effective diameters. Illustrative organ doses were calculated for hypothetical male patients with the effective diameters of 10, 20, 30, and 40 cm scanned for a CAP examination (CTDIvol of 11.1 mGy). Exponential fitting coefficients for CAP scan normalized by body phantom were used for the calculation.

**CONCLUSION**

A convenient method to calculate doses for patient organs included in or close to scan coverage was developed for major examinations. Once the effective diameter of a patient and the CTDIvol measurement (or from dose report) are available, organ dose may be calculated using the proposed method with the exponential fitting coefficients.

**CLINICAL RELEVANCE/APPLICATION**

The proposed method will be useful for calculating patient organ dose using the effective diameter of the patient and CTDIvol measurement without performing intensive Monte Carlo simulation.

**SSK19-05 • Validation of Monte Carlo Simulation Dosimetry Method Using In-Vivo Measurements in Patients Undergoing CT Examinations**

**Maryam Khatabadi (Presenter) * ; Jonathon Mueller ; Kyle McMillan * ; Maria Zanki PhD ; Dianna D Cody PhD * ; Christopher H Cagnon PhD ; John J Demarco PhD ; Michael F McNitt-Gray PhD**

**PURPOSE**

The purpose of this study was to validate Monte Carlo (MC) simulation based dose estimates by generating voxelized models of patients for the purpose of simulations and comparing simulated values with in-vivo dose measurements from clinical CT scans.

**METHOD AND MATERIALS**

In-vivo rectal TLD dose measurements were performed for 9 patients undergoing CT Colonography on an MDCT (LightSpeed VCT, GE Healthcare), with IRB (Institutional Review Board) approval. For each patient, two scans, prone and supine, were acquired; both using a fixed mAs technique. In-vivo dose measurements were obtained from TLDs that were affixed to the inner lumen of rectal catheters. Dose from the TLDs were determined taking into account their energy response. For each patient, voxelized models from CT images were generated based on a tissue-Hounsfield Unit (HU) look-up table. In a small validation study using the Visible Human (VH) GSF voxelized model, dose calculations using the tissue-HU look up table from CT image data were within 10% of those obtained using the voxelized model in which each voxel is identified with a tissue type. A previously developed and validated MC based dosimetry package was used with the voxelized colonoscopy patient models to simulate dose to the TLDs. Measured and simulated in-vivo TLD doses were compared for all 9 patients, calculating a Root Mean Square of absolute percent error between measured and simulated values.

**RESULTS**

The RMS of absolute percent error between TLD measurements and MC simulations was 12.2% with a maximum of 20.3% and minimum of -19.7%.

**CONCLUSION**

The results of this study demonstrated that MC simulations using voxelized patients and equivalent source model result in reasonably accurate doses compared to actual measurements. Simulations mostly overestimated measurements due to small FOV of the images used to create voxelized models, which resulted in cutoﬀ of anatomy, i.e. less tissue for simulated photons to penetrate through, and therefore higher dose to segmented TLDs than actual TLD dose measurements.

**CLINICAL RELEVANCE/APPLICATION**

In-vivo validation of MC methods used to estimate dose is crucial for implementation of MC simulations in the clinic. This study showed that these estimations reasonably agree with measurements.

**SSK19-06 • Lower Bound on Detectable Lung Nodule Growth Using Phantom CT Data**

**Marios A Gavrielides PhD (Presenter) ; Qin Li ; Rongping Zeng PhD ; Kyle J Myers PhD ; Berkman Sahiner PhD ; Nicholas Petrick PhD**

**PURPOSE**

To determine the minimum detectable growth in lung nodules of various sizes.

**METHOD AND MATERIALS**

Four different combinations (layouts) of synthetic nodules were placed in the vasculature insert of an anthropomorphic phantom and scanned at different slice thicknesses. Each layout included four nodules of different shapes (spherical, elliptical, lobulated, and spiculated) but with the same size (5, 8, 9, or 10mm) each placed in a fixed location. For each layout, ten repeat scans were acquired at 20, 100, and 200 mAs; 1.2 pitch; thin or thick slice collimations (16x0.75mm and 16x1.5mm, respectively); and reconstructed to 0.8, 1.5, and 3mm for the thin slice collimation, and 2, 3, and 5mm for the thick slice collimation. Nodule volume estimates were determined using a previously developed 3D matched filter estimator. For each nodule size, the pooled distribution of volume estimates was shifted by a percentage c to simulate a growing nodule. The standard deviation of the shifted distribution was also accounted for. Analysis of nodule growth was then conducted as a detection problem, where the shifted distribution was considered the signal present distribution and the baseline (non-shifted) distribution was considered signal absent. The area under the receiver operating characteristic curve (AUC) was used as a detectability metric, where c was varied until a target AUC was reached. The resulting value of c was the minimum detectable change for that AUC value. Bootstrap re-sampling was used to derive 95% confidence intervals on the value.
RESULTS
Both nodule size at baseline and choice of slice collimation protocol had an effect in the value of minimum detectable growth. For AUC=0.95, the minimum detectable nodule growth (volume increase) across all protocols and shapes was 45% [42-48], 21% [20-21] and 16% [16-17] for nodule sizes of 5, 8, and 9 mm respectively. Minimum detectable growth fell to 17% [16-17], 19% [19-21] and 15% [15-16]) when the thin slice collimation protocol (16x0.75mm) was used.

CONCLUSION
Our phantom study indicates that the lower bound for detectable nodule growth in subcentimeter nodules is relatively small, on the order of 20% or less in volume for a thin slice CT acquisition protocol.

CLINICAL RELEVANCE/APPLICATION
These results could complement findings from theoretical and clinical studies to determine a potentially useful role for volume as a surrogate metric of nodule size change.

SSK19-07 • Iterative Reconstructions and Low Contrast Resolution Measurements: Are ACR Accreditation Threshold Values Still Valid?

James M Kofler PhD (Presenter) ; Lifeng Yu PhD ; Shuai Leng PhD ; Yi Zhang ; Zhoubi Li ; Cynthia H McCollough PhD *

PURPOSE
The ACR recently switched from visual analysis of low contrast resolution (LCR) to quantitative measurement of contrast-to-noise ratio (CNR). This study compares the use of CNR threshold values as pass/fail criteria with use of visual impressions of LCR by human observers for the task of evaluating iteratively reconstructed (IR) phantom images.

METHOD AND MATERIALS
Two scanner models from 2 manufacturers (Lightspeed VCT, GE; Definition Flash, Siemens) were used to acquire data of the low contrast resolution section of the ACR CT accreditation phantom at CTIDvol levels of 8, 12, and 16 mGy. Images were reconstructed at 5 mm image thickness using 3 different algorithms—1 FBP and 2 IR (at different strength settings). Image acquisition and reconstruction were repeated 100 times for each, yielding at total of 1800 images. All images were blindly reviewed by 3 board-certified physicists using a 6-point scale to rate the detectability of the four 6-mm rods. CNR measurements were recorded, with a CNR = 1.0 indicating “pass”, which is the CNR threshold value used by the ACR accreditation program for adult abdominal protocols.

RESULTS
CNR measurements for nearly all of the IR images, at all dose levels, passed the ACR accreditation criteria. Visual analysis, using previous ACR criteria, showed a marked decrease in the pass rate with decreasing dose levels for all reconstruction methods. At an arbitrary pass rate of 20% (i.e., 20% of the 100 images passed), visual analysis showed 1 IR strength (vendor 1) and 2 IR strengths (vendor 2) as passing at 12 mGy (all IRs pass at 16 mGy; all fail at 8 mGy). Using a CNR threshold of 1.0, all IR images pass at all dose levels.

CONCLUSION
CNR threshold values currently used by the ACR CT accreditation program are misleading with respect to the visual assessment of LCR for IR images.

CLINICAL RELEVANCE/APPLICATION
The established quality assured by ACR CT accreditation will not be maintained with IR images. Very poor quality images, as rated by observers, pass the ACR CNR criteria by a wide margin.

SSK19-08 • Patient-specific Whole-body Voxel Models for Accurate Organ and Effective Dose Estimation

Natalia Saltybaeva (Presenter) ; Daniel Kolditz PhD * ; Willi A Kalender PhD *

PURPOSE
Monte Carlo (MC) simulations can be performed on patient CT image data. However, this data is limited to the scanned volume and does not allow estimating dose for organs outside the directly exposed range. Standard mathematical phantoms do not have this limitation, but they do not reflect individual patient anatomy. The aim of this work was to generate whole-body patient-specific voxel models for accurate organ and effective dose estimations.

METHOD AND MATERIALS
Three anthropomorphic phantoms representing an adult (Alderson Research Laboratories, New York, USA) and 5 and 1 y.o children (CIRS, Norfolk, VA, USA) were considered as patients and scanned with thorax routine protocols (SOMATOM Definition Flash, Siemens, Forchheim, Germany) with tube voltages of 80, 100 and 120 kV. The absorbed dose was measured using 90 calibrated TLD chips. Whole-body voxel models were generated by amending the patient CT volume by size-adapted versions of the ICRP Reference Male phantom in case of the adult and ORNL voxel phantoms in the case of the pediatric patients. Organ definitions provided with these phantoms were transferred to the combined models and adapted interactively. MC simulations were performed using the validated tool ImpactMC (CT Imaging GmbH, Erlangen, Germany) for a) the unamended patient volumes, b) the combined whole-body models. Simulated 3D dose distributions were compared with TLD measurements chip by chip.

RESULTS
The mean difference between measurements and simulations based on the unamended CT volumes was 19%; using the whole-body model reduced the difference to 6%. In contrast to unamended CT volumes, whole-body models intrinsically also provided the dose values for organs outside the scanned volume. These organs contributed 17%, 34% and 36% to effective dose for the adult, 5 y.o. and 1 y.o. phantom, respectively.

CONCLUSION
Patient-specific whole-body models allow to increase accuracy of dose estimation and to calculate dose for all relevant organs.

CLINICAL RELEVANCE/APPLICATION
The approach is useful for individual patient dose estimation, especially for clinical studies.

SSK19-09 • A Single Phantom for Objective Quality Control of Both CT and Dental CBCT

Hugo De Las Heras PhD, MSc (Presenter) * ; Felix Schofer PhD * ; Wilhelm J Van Der Putten PhD *

CONCLUSION
The QUART phantom (with software) is an objective, reliable, time and cost-efficient alternative to perform the tests required for the quality control of both dental CBCT devices and CT scanners.

Background
The latest developments in quality control for dental cone beam CT (CBCT) devices have a much more objective and efficient approach than traditional QC phantoms for CT scanners. We present a phantom and software that recently became the German and Italian standard for dental CBCT (QUART DVT AP). The phantom is designed to evaluate all test parameters required in national and international protocols for CT quality control (IAEA publication 19, EU criteria publication 162 and ACR QC manual), as well as to test noise reduction algorithms and tube current modulation. In order to evaluate its application to whole body CT scanners, evaluations were performed using it and a standard Catphan® phantom.
Both phantoms were scanned in a CT scanner using the same settings. Consecutive scans were obtained at 130 kVp with exposures varying from 50 to 300 mAs. Both phantoms could evaluate uniformity, imaged slice width, position accuracy, noise and CT number accuracy. However, in addition, the QUART phantom and software presented here enabled the direct, automatic evaluation of contrast (between 120 and 150), limiting resolution (0.6 lp/mm at 10% of the modulation transfer function) and contrast-to-noise ratio (CNR, increasing from 128 to 290) in less than 20 seconds per image.

**Evaluation**

**Discussion**

The CNR is an objective, straight-forward and time-efficient measure that releases equivalent results to traditional low contrast-detail tests and increases the reliability of quality control tests. As an example, the attached figure shows a comparison of contrast and CNR for both phantoms. The observed sensitivity (score range divided by uncertainty) of the CNR evaluation (0.013 ± 0.002 mAs⁻¹) was twice the one obtained with the Catphan contrast-detail evaluation method (0.007 ± 0.002 mAs⁻¹).

**RESULTS**

Mono-energy image HU values for the iodine tubes were independent of tube location, tube diameter, or phantom size. There was no significant difference (p=0.39) in the standard deviation (SD) of HU values at different tube locations in the small-size phantom (SD=0.76%) vs. the large-size phantom (SD=0.88%). Variation of the HU values between tubes with different diameters was even smaller, 0.46% in the small-size and 0.64% and large-size phantom. Compared to mono-energy images, in the conventional images the variation of HU values at different tube locations was significantly higher (p<0.05). The quality of virtual mono-energy images at 65 keV was superior to that of conventional images, with no beam-hardening effect. Mono-energy images demonstrated stable iodine density measurements, independent of phantom size, tube location, and tube diameter.

**CLINICAL RELEVANCE/APPLICATION**

Stable density measurements of contrast material, independent of patient size and ROI location, are important for integration of Spectral Detector CT into clinical practice.

**SSK20-02 • The Size-based Emphysema Quantification Using Length Scale Analysis in 3D Volumetric Chest CT**

**PURPOSE**

To propose a quantification method to classify emphysema clusters by size using length scale analysis in volumetric chest CT.

**METHODOLOGY AND MATERIALS**

Volumetric CT scans of twenty 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. Using thresholding by -950 HU, emphysema index (EI) of low attenuation area (LAA) mask was evaluated. Based on these LAA masks, a length scale analysis to estimate each emphysema cluster's size was performed as follows. At first, Hole filling algorithm was performed on the emphysema mask and Gaussian low pass filter (LPF) with various size of kernel (3mm, 5mm, 15mm) was performed from large to small size, iteratively. Maximum density voxel in the each filtered volume was selected and dilated by the size of the kernel, which was regarded as the specific size emphysema mask. In this way, emphysema cluster with specific size range was classified and evaluated from the LAA mask. The accuracy of this classification result was evaluated and compared by an expert thoracic radiologist with 10 scale visual evaluation to determine size classifying accuracy and to determine probabilities for incorrect estimation. In addition, an artificial phantom study for mimicking emphysema and a COPD patients study were performed to evaluate the accuracy of this algorithm.

**RESULTS**

In phantom study, in case of sphere-like the shape of emphysema with various sizes from 1mm to 15mm, the method shows exact estimation on every case. In the COPD patients, size based EI were 3.48±1.97%, 12.85±7.07%, 7.07±7.88%, and 4.11±8.22%, (size : 15mm), respectively. In addition, association study between blind visual evaluations of size based EI by an expert thoracic radiologist and our method showed all significant correlations r values : 0.499,0.725,0.768,0.939, respectively) and probabilities for incorrect estimation were 0.0±0.0%, 0.67±0.2%, 0.5±0.41%, and 1.17±0.26% (size : 15mm), respectively. Overall underestimation and overestimation probabilities are 1.17% and 1.17%, respectively.

**CONCLUSION**

The methods proposed a robust emphysema clustering method, which could lead to new implication and progress of COPD clinical practice.

**CLINICAL RELEVANCE/APPLICATION**

This method is especially useful in measuring size based emphysema analysis and could be possible to evaluate etiology and progress of COPD using 3D volumetric chest CT.
Improving CT Perfusion Image Quality Using Principal Component Analysis

Myung Jin Chung MD *; Wan-Youk Kim (Presenter); Dong Ik Cha MD; Sung Mok Kim MD; Moon C Kim RT; Kyung S Lee MD, PhD

PURPOSE
To create virtual non-contrast CT, two-material decomposition is allowed from Spectral CT based on sinogram space, instead of three-material decomposition method allowed in image space. However, various virtual non-contrast images can be made from various material decomposition (MD) methods in spectral CT. We evaluated the feasibility of three different virtual non-contrast (VNC) images derived from single source dual energy spectral CT compared to true non-contrast (TNC) image.

METHOD AND MATERIALS
This HIPAA-compliant study was approved by institutional review board and informed consent was provided from all patients. Twenty-four patients prospectively underwent non-contrast CT followed by contrast enhanced chest CT using single source fast kVp switching dual energy scan. Iodine eliminated images so called as VNC were reconstructed using two kinds of 2-material decomposition algorithms (MDW, material density-iodine/water; MDC, material density-iodine/calcium) and material suppression algorithm (MSL, iodine suppression image). Using third party workstation, semiautomatic calcium measurements were performed.

RESULTS
Quantified calcium scores (A2 score) from all three VNCs correlated well with that of TNC (R2 = 0.95, 0.88, and 0.88 for MDW, MDC, and MSL, respectively). However correlation coefficients were less than 0.9 (C = 0.83, 0.62, and 0.63 for MDW, MDC, and MSL, respectively). Measured calcium volumes on VNCs also correlated well with that of TNC (R2 = 0.94, 0.87, and 0.90 for MDW, MDC, and MSL, respectively), with correlation coefficients of 0.78, 0.59, and 0.63 for MDW, MDC, and MSL, respectively. Among the three VNCs, MDW correlated best with TNC.

CONCLUSION
VNC image from contrast enhanced CT using dual energy material decomposition/suppression is feasible for coronary calcium scoring. However, among various methods to make virtual noncontrast image from spectral CT, material quantifications are different depending on the decomposition methods. Furthermore, the absolute value on VNC tends to be smaller than that on TNC and should be considered with calibration.

CLINICAL RELEVANCE/APPLICATION
Absolute values of calcium scoring on VNC tend to be smaller than that on TNC and should be considered with VNC.

SSK20-04 • Reproducibility of Imaging Features Computed from Same-day Repeat CT Scan Images Reconstructed at Different Acquisition Parameters

Binsheng Zhao Dsc (Presenter); Yongqiang Tan PhD; Mingshi Wang; Hyun-Ju Lee MD, PhD; Chuanmiao Xie; Jing Qi; Ross C Ehmk BA; Lawrence H Schwartz MD

PURPOSE
Radiogenomics promises the genetic assessment of cancer patients with non-invasive radiographic imaging studies. To date, little attention has been paid to the sensitivity of imaging features to repeat scans and acquisition parameters. This study explored the reproducibility of imaging features computed on repeat CT scans reconstructed at different parameters.

METHOD AND MATERIALS
This study included a retrospective dataset containing 32 lung cancer patients, each having two same-day repeat CT scans and reconstructed into 6 image series, i.e., a combination of 3 slice intervals (5, 2.5 and 1.25mm) and 2 reconstruction algorithms [Lung (L) and Standard (S)]. Three radiologists independently used an in-house algorithm to segment 32 tumors (= 1 cm; one per patient) in all image series. 261 imaging features describing tumor size, histogram, shape, edge and texture were computed from the final tumor volumes, based on the common volumes obtained by 2 out of the 3 radiologists. The concordance correlation coefficient (CCC) was used to measure the agreement between each feature computed from two repeat scans reconstructed at the 6 series, i.e., 1.25L (first scan) and 1.25L (second scan), 1.25Snd1.25S, 2.5Lsnd2.5S, 2.5Sand2.5S, 5Lsnd5S, and 5Sand5S.

RESULTS
Out of the 261 features, CCC of 32 features were = 0.95 and of 169 features were = 0.75 for all 6 series. Size and histogram features were highly reproducible for all parameter settings; shape index and boundary gradient strength were the least reproducible. For 2.5Sand2.5S re-scans, all run-length, GTDM and spatial correlation features had CCC=0.95; surprisingly, many features showed inferior reproducibility with 1.25Lnd1.25L re-scans, possibly due to noise.

CONCLUSION
Imaging parameters and repeat scans affect the reproducibility of imaging features to various degrees. Generally, the reproducibility of size, histogram, GTDM, run-length, spatial correlation, Laws’, Gabor, wavelet, LoG and GLCM features (except 1.25Lnd1.25L for several features) at all parameter combinations ranged from acceptable (CCC=0.75) to excellent (CCC=0.95). The correlation of these features to gene expression warrants further investigation.

CLINICAL RELEVANCE/APPLICATION
Precautions should be taken with regard to CT imaging acquisition parameters when conducting radiogenomics studies.

SSK20-05 • Improving CT Perfusion Image Quality Using Principal Component Analysis

Timothy Pok Chi Yeung BSc (Presenter); Nathan De Haan; Mark Dekaban; Laura Morrison; Lisa Hoffman; Slav Yartsev; Glenn S Bauman MD *; Ting-Yim Lee MSC, PhD *

PURPOSE
Many CT perfusion (CTP) studies of small animal tumor models are performed using clinical CT scanner due to its availability, but the tradeoff between spatial resolution and image noise affects the quality of CT perfusion images. This study aimed to evaluate the ability of the principal component analysis (PCA) in improving the contrast-to-noise ratio (CNR) of CTP images in a preclinical model of malignant glioma.

METHOD AND MATERIALS
Wistar rats (n = 8) implanted with C6 glioma cells were scanned using CTP. Each CTP image set was filtered using 2, 4, 6, 8, and 10 principal components from PCA to result in 40 additional image sets. The noise level and CNR were used to quantify image quality in all 48 unfiltered and filtered image sets. The fractional residual information (FRI) was used to evaluate the amount of information loss after PCA filtering. Blood flow (BF), blood volume (BV), and permeability-surface area product (PS) before and after filtering were calculated. Noise level, CNR, BF, BV, and PS in the normal brain and tumor were expressed as mean ± standard error of the mean. These metrics before and after filtering with different numbers of principal components were compared to evaluate the differences between the filtered and the unfiltered image sets.

RESULTS
PCA filtering significantly decreased noise level and increased CNR (p = 0.01). An average of 26% (range, 11 – 49%) of pixels in the tumor had information loss of = 5% when filtering with only two principal components; this percentage decreased to an average of 1% (range, 0 - 3%) with four or more components. Normal brain BV and PS were significantly different than the values in the tumor (p < 0.01) without or with PCA filtering (using 4 or more principal components). Normal brain and tumor BF values were not significantly different without PCA filtering, but they became significantly different after filtering with 4 principal components (p = 0.03).

CONCLUSION
PCA filtering improved the CNR in CTP studies. Four or more principal components are required to filter the CTP source images without substantial loss of information leading to higher contrast between tumor and normal brain tissue in BF maps.
Classification of Osteoarthritic and Healthy Chondrocyte Patterns in Human Patellar Cartilage on Phase Contrast Computed Tomography through Topological and Geometric Features

Mahesh Nagarajan (Presenter); Paola Coan; Markus B Huber PhD; Paul C Diemoz PhD; Christian Glaser MD; Axel Wismueller MD, PhD

PURPOSE

Phase-contrast X-ray computed tomography (PCI-CT) has been demonstrated at achieving soft-tissue contrast with micrometer scale resolution while imaging cartilage. This study proposes to quantitatively evaluate the performance of topological and geometrical approaches in characterizing chondrocyte patterns as observed in PCI-CT of human patellar cartilage as healthy or osteoarthritic.

METHODOLOGY AND MATERIALS

Five osteochondral cylinders (7 mm diameter, 3 osteoarthritic, 2 healthy) extracted from post-mortem human patellae were subject to PCI-CT at 26 keV (European Synchrotron Radiation Facility, Grenoble, France). From reconstructed CT images of the cartilage, 842 regions of interest (ROI) of size 51x51 pixels capturing chondrocyte patterns were then annotated in the radial zone of the cartilage matrix from high resolution images (voxel size: 8 x 8 x 8 μm³). Two texture analysis techniques - (1) Scaling Index Method (SIM), that estimates local scaling properties and (2) Minkowski Functionals (MF), that evaluates topological properties, were used to extract features. Prostate deformations due to needle insertion were simulated using the surface displacements as boundary condition. A 3D thin-plate spline deformation field was calculated by registering the mesh vertices. The TRE was defined as the Euclidean distance between registered and reference landmark position and was calculated for 45 reference landmarks manually annotated in both T2-weighted images. The results of this automated method were also compared to previous results obtained with manual optimization.

RESULTS

The median TRE of the automated surface-based registration method with biomechanical regularization was 2.21 mm (range 0.55-7.32 mm), which was significantly lower than a median TRE of 3.02 mm (range 0.85-7.95 mm) obtained without biomechanical regularization (P = 0.10).

CONCLUSION

Non-rigid surface-based image registration extended with biomechanical modeling can be automated and improves the registration accuracy for prostate MR guided biopsies.

CLINICAL RELEVANCE/APPLICATION

The automated surface-based registration method extended with biomechanical modeling is applicable to MR-TRUS registration and can help to improve effectiveness of MR guided TRUS biopsy procedures.

SSK20-07 • Validity of Myocardial Perfusion Asynchrony Measurements

Andrew Van Tosh MD *; Nathaniel Reichek MD; Christopher J Palestro MD; Kenneth Nichols PhD (Presenter) *

PURPOSE

Left ventricular (LV) asynchrony can be quantified by both gated blood pool (BP) and myocardial perfusion (MP) tomography. A concern regarding MP phase measurements is their reliance on tracking myocardial walls in cases of severely reduced MP, for which counts are low. PET data are acquired in gated list mode and both BP and MP data are available for the same pts. To test validity of MP phase measurements for severely decreased MP we compared MP to BP phase measurements, which are not affected by decreased MP.

METHODOLOGY AND MATERIALS

Data were analyzed retrospectively for 67 pts (42 males; 23 females; 71±12 yrs) with suspected heart disease evaluated by 82Rb PET/CT. Data were collected in gated list mode and rebinned into BP tomograms of tracer imaged during the first pass transit through the heart chambers, and separately into MP tomograms of tracer imaged during equilibrium. For BP PET data LV contraction phases were computed for each of 17 LV segments. Excluding the 3 most basal-septal segments to ensure LV cavity sampling the bandwidth (BW) of contraction phases were computed, defined as % of the R-R interval accounting for 95% of LV regional contractions. MP tomograms were analyzed by commercial algorithms, which computed summed rest scores (SRS) indicating severity of MP defects, and MP phase BW derived from phases of maximum count brightness corresponding to regional end-systole at each voxel at locations identified by algorithms as corresponding to the myocardial wall.

RESULTS

37 pts had negligible defects (SRS = 4) with BP phase BW = 16±8%, lower than the 30 pts with significant MP defects (SRS > 4) (33±22%, p = 0.0001). BP and MP phase BW were similar for all pts (24±% versus 26±16%, p = 0.49), pts with SRS = 4 (16±8% versus 19±9%, p = 0.15), and pts with SRS > 4 (33±23% versus 36±19%, p = 0.50). BP and MP phase BW correlated significantly and similarly with SRS (r = 0.59, p < 0.0001) and r = 0.61, p < 0.0001), consistent with greater amounts of asynchrony being related to more severe myocardial damage. Differences between BP and MP phase BW had no correlation to SRS (r = 0.04, p = 0.75). Thus, severe MP defects had no deleterious effect on MP phase quantitation.

CONCLUSION

Detection of LV asynchrony by phase measurements derived from gated 82Rb PET/CT tomograms are robust and reliable, regardless of severity of MP defects.

CLINICAL RELEVANCE/APPLICATION

It is justifiable to include scintigraphic asynchrony measurements in forming clinical impressions for pts exhibiting severe MP defects.

SSK20-08 • Image Registration for Prostate MR Guided Biopsy Using Automated Biomechanical Modeling

Wendy Van De Ven MSc (Presenter); Nico Karssemeijer PhD *; Jelle O Barentsz MD, PhD; Henkjan Huisman PhD *

PURPOSE

To investigate the effect of extending a non-rigid surface-based registration method with biomechanical modeling for prostate MR guided biopsies on the target registration error (TRE) using internal reference landmarks. The method is fully automated and we compare accuracy to previous results obtained with manual optimization of parameters in every patient.

METHODOLOGY AND MATERIALS

The accuracy of a novel non-rigid registration method involving biomechanical modeling to account for deformations inside the prostate was determined. While MR-TRUS registration is the ultimate goal, we used MR guided MR biopsy imaging data from six consecutive patients for this evaluation. The data included T2-weighted images (0.8x0.8x3.0 mm) before and after insertion of a needle guide causing deformation of the prostate. The needle guide had an orientation and dimension comparable to a transrectal ultrasound (TRUS) probe. The prostate in the two images was segmented and corresponding surface meshes were generated in both images by assuming identical prostate orientations. Next, a tetrahedral volume mesh was generated from the image before needle insertion. Prostate deformatons due to needle insertion were simulated using the surface displacements as boundary condition. A 3D thin-plate spline deformation field was calculated by registering the mesh vertices. The TRE was defined as the Euclidean distance between registered and reference landmark position and was calculated for 45 reference landmarks manually annotated in both T2-weighted images. The results of this automated method were also compared to previous results obtained with manual optimization.

RESULTS

The median TRE of the automated surface-based registration method with biomechanical regularization was 2.21 mm (range 0.55-7.32 mm), which was significantly lower than a median TRE of 3.02 mm (range 0.85-7.95 mm) obtained without biomechanical regularization (P = 0.10).

CONCLUSION

Non-rigid surface-based image registration extended with biomechanical modeling can be automated and improves the registration accuracy for prostate MR guided biopsies.

CLINICAL RELEVANCE/APPLICATION

The automated surface-based registration method extended with biomechanical modeling is applicable to MR-TRUS registration and can help to improve effectiveness of MR guided TRUS biopsy procedures.

SSK20-06 • Classification of Osteoarthritic and Healthy Chondrocyte Patterns in Human Patellar Cartilage on Phase Contrast Computed Tomography through Topological and Geometric Features

Nathaniel Reichek MD; Christopher J Palestro MD; Kenneth Nichols PhD (Presenter) *

PURPOSE

Lowering radiation exposure can lead to deterioration of CNR in CTP studies. PCA improves CNR to allow repeated ultralow dose CTP studies for assessing treatment response in the clinical setting.

METHOD AND MATERIALS

Five osteochondral cylinders (7 mm diameter, 3 osteoarthritic, 2 healthy) extracted from post-mortem human patellae were subject to PCI-CT at 26 keV (European Synchrotron Radiation Facility, Grenoble, France). From reconstructed CT images of the cartilage, 842 regions of interest (ROI) of size 51x51 pixels capturing chondrocyte patterns were then annotated in the radial zone of the cartilage matrix from high resolution images (voxel size: 8 x 8 x 8 μm³). Two texture analysis techniques - (1) Scaling Index Method (SIM), that estimates local scaling properties and (2) Minkowski Functionals (MF), that evaluates topological properties, were used to extract features from the ROIs. Random sub-sampling cross-validation was utilized in optimizing a support vector regression model with a radial basis function kernel for the classification task. Performance was measured using area under the Receiver-Operator Characteristic (ROC) curve (AUC) for each feature.

RESULTS

With the experimental conditions used in this study, the best classification performance was observed with the SIM histogram (0.95 ±
Intravoxel Incoherent Motion Perfusion MRI: A Sensitive Imaging Biomarker of Tumor Oxygenation

Zhongwei Zhang MD, PhD (Presenter); Rami R Hallac MS; Qing Yuan PhD; Peter Peschke PhD; Ralph P Mason PhD *

PURPOSE
The overall poor perfusion rate caused by abnormal vascular architecture and increased flow resistance is an important contributor to hypoxia and resistance to therapies. The intravoxel incoherent motion (IVIM) effect observed by diffusion-weighted MRI offers a non-invasive, quantitative, non-invasive method to measure perfusion. In this study, we investigate the feasibility of using the perfusion parameters derived from IVIM MRI as a sensitive imaging biomarker of tumor oxygenation.

METHODOLOGY AND MATERIALS
Small pieces of tumor tissue (Dunning R3327-AT1 and MAT-Lu rat prostate sublines) were implanted subcutaneously in the thigh of six male Copenhagen rats. MRI was performed at 4.7 T with a 35 mm volume coil, tunable to 1H or 19F. Each animal breathed air followed by 100% oxygen and then carbogen (95% O2, 5% CO2), all delivered at 2 L/min. A multi-shot FSE DWI sequence was performed with TR/TEeff = 2000/56 ms, 40 mm × 40 mm FOV, 128 × 64 matrix, ETL = 8, and 2 NSA. Diffusion gradients were applied in 3 orthogonal directions with b-values (0-1500/mm2). ADC was computed by fitting all b-values to a monoexponential model and IVIM parameters were calculated using a biexponential model: S/S0 = fp*exp(-bDp) +(1-fp)exp(-bDt). ADCiv = ADC-Dt was also defined to quantify intravascular space. pO2 (mmHg) was estimated using 19F FREDOM method through injection pO2 reporter. Pearson correlation coefficients (r) between IVIM parameters and pO2 were calculated.

RESULTS
The pO2 measured in air correlated strongly and significantly with the mean of fp*DP(r=0.88), as well as Dp in air(r=0.84), which indicates fp and fp*DP are sensitive to pO2 in air. When gas challenge was given, Strong correlation with fp was found for ?pO2o2 (pO2 in oxygen-pO2 in air)(r=0.89). A similar strong and significant correlation was found between ADCiv and ?pO2cb and ?pO2o2 (r=0.86 and r=0.92). It suggests that the baseline fp as well as ADCiv determines the size of tumor response to gas challenge.

CONCLUSION
This study indicates that the perfusion parameters derived from IVIM MRI serve as a sensitive imaging biomarker of tumor oxygenation. IVIM Perfusion MRI may also be of value in the assessment of tumor microenvironment, monitoring tumor radiation therapy response.

CLINICAL RELEVANCE/APPLICATION
The IVIM Perfusion MRI provides a unique tool for assessment of tumor oxygenation and tumor microenvironment without the use of exogenous contrast.
SSK21-02 • Establishing Cell Structure-based Biomarkers of Disease Using Label-free Optical Quantification of Cell Mass, Volume, and Density in Early and Late Stage Colorectal Cancer Cell Lines

Sophia Bornstein MD, PhD; Eric Anderson MD, PhD; Melissa Wong PhD; Owen McCarty PhD; Kevin Phillips (Presenter)

ABSTRACT
Purpose/Objectives
Metastasis, the leading cause of all cancer-related deaths, is facilitated by the hematogenous transport of circulating tumor cells (CTCs) from the primary tumor site to distant organs. We have developed label-free optical tools to quantify the basic physical features of CTCs including their total dry mass content and subcellular density distribution. To interpret these biophysical signatures of cancer at the single cell level, we investigated these quantitative features as a function of tumorigenic potential in the patient-matched SW480/SW620 colorectal cancer cell lines as a model of early and late stage disease.

Materials/Methods
Using non-interferometric quantitative phase microscopy (NIQPM), a technique that can be carried out on commercial microscopes, we quantified the dry mass content and subcellular density distribution of cultured cell lines plated on microscope slides. The density distribution was fit with a bi-modal Gaussian distribution whose size parameters quantified the contributions of small and large density structures to the overall composition of the cells. The Jarque-Bera test was used to evaluate normality of all parameters. One-way analysis of variance with Bonferroni post hoc analysis was used to assess statistical significance among parameters across multiple normally distributed cell parameters.

Results
SW620 cells demonstrated a morphology-dependent total dry mass content. The relative amount of small and large micron-scale density contributions to cellular density was found to be morphology-dependent among SW480 cells. SW620 cells possess significantly denser small-scale structures in comparison to SW480 cells. The density contributions from large-scale structures are conserved across all the SW cell types.

Conclusions
Micron scale characterization of the SW cell types with NIQPM demonstrated a systematic bimodal distribution of the subcellular density distribution whose small-scale peak was sensitive to tumorigenic potential of the SW620 cells. Total mass was also specific to SW620 cells. This work quantitatively elucidates distinct cellular architectural phenotypes of early and late stage colorectal cancer in an in vitro setting. These results provide a rational for the use of label-free optically derived metrics to be tested clinically as biomarkers capable of monitoring responses among CTCs to radiological interventions.

SSK21-03 • Comparison of Quantitative Approaches to Identify Patients with Parkinsonism Using Dopamine Transporter Scans

Kenneth Nichols PhD (Presenter) *; Maria B Tomas MD; Christopher J Paleasto MD

PURPOSE
Presynaptic dopamine transporter 123I-ioflupane (DaT) SPECT imaging facilitates the differentiation of Parkinsonism from essential tremor (ET). Some groups advocate quantitative analyses of caudate (C) or putamen (P) counts for improved differentiation of these two entities, while others recommend applying normal limits to background-corrected counts. This investigation was undertaken to determine which data analysis approach agrees most strongly with a final diagnosis of Parkinsonism.

METHOD AND MATERIALS
We performed a retrospective analysis of 123I-FP-CIT SPECT data for 50 pts (age 64±12 years; 28 F; 22 M) who were evaluated for movement disorders. Data were reconstructed by OSEM (12 iterations, 8 subsets) and corrected for attenuation by the Chang method. BASGAN software (Eur J Nucl Med Mol Imaging 2007;34:1240–53) generated ratios of automated caudate (AC) and automated putamen (AP) counts per pixel versus background counts per pixel, and dichotomous abnormal values for caudate (DC) and putamen (DP) by applying recently updated age- and sex-adjusted normal limits (Eur J Nucl Med Mol Imaging 2013;40:365–73). In separate processing sessions, a medical physicist manually drew regions of interest to determine maximum caudate (MC) and maximum putamen (MP) counts, without knowledge of other clinical or quantitative results. The diagnosis of the patient’s official report served as the reference standard. ROC analysis determined optimal discrimination thresholds and kappa statistics evaluated strength of agreement.

RESULTS
Twenty-seven pts had Parkinsonism and 23 had ET. Highest agreement with final diagnoses was found for MP (κ = 0.72), followed by DC, MC, AC, AP and DP (κ = 0.67, 0.64, 0.64, 0.63 and 0.41, respectively). MP also had highest accuracy (86%), with sensitivity of 78% and specificity of 96%. Pixel averaging and statistical noise of background counts were likely reasons that automated output from BASGAN software underperformed manual determinations of maximal counts.

CONCLUSION
We conclude that, in the analysis of presynaptic dopamine transporter SPECT scans, a straightforward detection of abnormally suppressed putamen counts is the single quantitative measure that agrees most strongly with a diagnosis of Parkinsonism.

CLINICAL RELEVANCE/APPLICATION
While quantitation of DaT scans can bolster visual determinations of disease states, use of quantitative measures should be applied judiciously in influencing final diagnoses.

SSK21-04 • Spectral CT with K-edge Detection of Targeting Gold-nano-Particles: An Experimental Study

Thorsten R Fleiter MD (Presenter) ; Marie-Christine Daniel PhD ; Omer Aras MD

PURPOSE
To determine the specific detectability of targeting Gold-nano-particles using K-edge CT imaging for the selective and quantitative imaging of the Gold cores.

METHOD AND MATERIALS
Mice with over-expression of the Angiotensin - converting Enzyme (ACE) were prepared with Lisinopril-Gold-Nano-particles. The Gold core diameter of the conjugates was measured with 10-15 nm. The animals were euthanized and frozen at 2, 4, 6 and 10 min after the injection of the conjugates. A control group of mice was prepared with conventional Lisinopril ahead of the injection of Lisinopril-Gold-Nano-particles to block the binding sites for the conjugate and therefore to analyze the targeting capabilities of the Conjugates. The mice were scanned with a photon counting full spectral CT with data sampling 5KeV above and below the K-edge of Gold at 80.7 KeV. The difference of these two measurements was used to reconstruct images that contained the Gold signal only. Additional data sampling was performed over the residual x-ray spectrum and used for the reconstruction of the anatomical background for the Gold specific images.

RESULTS
The highest signal to noise and Gold to anatomical background ratios were achieved at 10 min after the injection of the Lisinopril-Gold-Nano-particles. The highest signal was measured in the heart muscles and the lung parenchyma. The anatomical background was completely eliminated in the k-edge images of the Gold. The signal to noise ratio in these images was >5:1. An overlay of the anatomical and the Gold images better demonstrated the distribution of the Gold particles. There were no gold signals detectable in mice that were pre-treated with Lisinopril prior to the conjugate injection.

CONCLUSION
K-edge imaging to detect targeting Gold-Nano-Particles with Computed Tomography is feasible. The specific Gold-images can be used for a fast assessment of the distribution of the particles and therefore the density of the bindings sites for the molecule.

CLINICAL RELEVANCE/APPLICATION
K-edge imaging with Spectral CT can be used to track Nano-particles with high Z cores like Gold that could be designed to specifically
SSK21-05 • Direct Visualization of miRNA-22 Biogenesis in Isoproterenol-induced Cardiac Hypertrophy by Bioluminescence Imaging In Vitro and In Vivo

Yingfeng Tu (Presenter) ; Bao-Zhong Shen

CONCLUSION
These findings elucidate the feasibility of using our constructed miRNA reporter imaging system to monitor the location and magnitude of expression level of miRNA-22 in CH to appraise the function of antagonim-22 in silencing the cardiac endogenous miR-22 expression in vitro and in vivo.

Background
Evidence from recent studies has shown that miRNAs play key roles in cardiac hypertrophy (CH). To measure the expression level of endogenous miRNAs, it very conducive to understanding the importance of miRNAs in CH. However, current methods to monitor endogenous miRNA level, such as northern blotting, quantitative real-time polymerase chain reaction (qRT-PCR), and miRNA microarrays can not provide real-time information of miRNA biogenesis in CH. Here, we constructed a novel miRNA reporter imaging system to monitor the miR-22 expression in CH in which three copies of the antisense of miR-22 (3×PT-miR-22) was cloned immediately into the downstream region (3'UTR region) of the gassia luciferase (Gluc) reporter genes, driven by a cytomegalovirus (CMV) promoter.

Evaluation
In this current study we found that with prolongation of isoproterenol (ISO) stimulation in vitro and in vivo, the expression level of miR-22 in cardiomycocytes was gradually increased. Accordingly, the bioluminescence imaging analysis revealed that the fluorescence signals of the miRNA reporter imaging system (CMV/Gluc/3×PT-miR-22) gradually decreased under conditions where miRNA-22 was up-regulated by ISO stimulation. However, the firefly luciferase (Fluc) activity of CMV/Fluc, as a positive control, was not affected with ISO treatment. Furthermore, knockdown of miR-22 by antagonim-22 could reverse the repressed fluc activies in vitro and in vivo.

Discussion
The development of imaging strategies related to miRNAs will be critical to advance our understanding of the interactions of miRNAs with their target genes and signaling pathways, and eventually to evaluate the use of miRNAs as a novel class of diagnostics and therapeutic targets in cardiovascular disease.

SSK21-06 • Volume of Drug Distribution as a Function of Time for Adaptive Gamma Variate Fits to Plasma Concentrations Curves

Michal J Wesołowski PhD, MSc (Presenter) ; Surajith N Wanasundara PhD, MSc ; Richard C Puetter PhD ; Maria T Burniston PhD ; Paul S Babyn MD ; Carl A Wesołowski MD, FRCP

CONCLUSION
While it is often assumed that the distribution of a drug in the body is complete after 1-2 hours, this does not appear to be the case for patients having a GFR marker study and a high incidence of ascites for whom it may take several days to reach 95% of the final volume of distribution.

Background
In studies of renal function and glomerular filtration rate (GFR) it is commonly assumed that the distribution of drug in the body is complete within the first 1-2 hours after a single injection or institution of a continuous infusion of a GFR marker. If incorrect, this may lead to inaccuracy in the calculation of plasma clearance and affect patient care. To test the validity of this assumption, a time dependent volume of drug distribution term was derived from the mass conservation equation in the Tikonov adaptively fit gamma variate (Tk-GV) model of plasma clearance.

Evaluation
Following a single intravenous injection, the plasma concentration of a radioactively labeled glomerular filtration marker, 51Cr-EDTA, was monitored over 24 hours (up to 16 samples) in thirteen patients being evaluated for liver transplantation. For each patient, the volume of drug distribution as a function of time, from adaptive gamma variate fits to plasma concentration versus time curves, was obtained. Plasma clearance and the time required to reach 95% of the final GFR marker volume of distribution were calculated.

Discussion
In these patients, the time required to reach 95% of the final volume of distribution ranged from 0.79 to 11.08 days, which is significantly longer than is commonly assumed. In fact, the GFR marker appears to be eliminated faster than the completion of the volume distribution process.

SSK21-07 • Prognostic Value of Metabolic Tumor Volume Measured by Differing Methods on Staging 18F-fluorodeoxyglucose Positron Emission Tomography in Esophageal Cancer

Vinod Malik MBChB, MA (Presenter) ; Ciaran J Johnston MD ; Julie A Lucey PhD ; John V Reynolds MD

PURPOSE
Metabolic tumor volume (MTV) a volumetric parameter obtained on 18F-fluorodeoxyglucose positron emission tomography/computed tomography (18F-FDG PET/CT) has been shown to be an independent prognostic factor for survival in patients with esophageal cancer. This study ascertained if different methods of calculating MTV would have an effect on its utility as a prognostic factor.

METHOD AND MATERIALS
From December 2008 to May 2011, 150 patients with biopsy-proven cancer of the esophagus or esophagogastric junction underwent staging 18F-FDG PET/CT. Maximum standardized uptake value (SUVmax) and MTV of the primary tumor was recorded at different thresholds (absolute cut-offs of SUV 2.5 and 3.5, threshold values of 42% and 50% SUV max and a variable method depending on the SUV max of the primary tumor). Survival analysis was performed using Kaplan-Meier and independent prognostic factors determined using Cox regression multivariate analysis.

RESULTS
18F-FDG PET/CT SUVmax < 4.1 (p=0.0014), 18F-FDG PET/CT MTV (absolute cut-off SUV 2.5 method)< 14.5cm3 (p=0.001), 18F-FDG PET/CT MTV (absolute cut-off SUV 3.5 method) < 7.5cm3 (p=0.0013), 18F-FDG PET/CT MTV [threshold value of 42% method]< 5.9cm3 (p=0.0005), 18F-FDG PET/CT MTV (threshold value of 50% method) < 4.4cm3 (p=0.0004), 18F-FDG PET/CT MTV (variable method)< 4.7cm3 (p=0.0008) were all significantly associated with outcome on analysis.

CONCLUSION
Regardless of the method used to measure MTV, it consistently was able to predict survival even when simple quantitative analysis only is performed.

CLINICAL RELEVANCE/APPLICATION
MTV is a valuable prognostic factor in patients with esophageal cancer even when performed with simple quantitative analysis which is available on all clinical scanners.

SSK21-08 • Determining the Minimal Required Radioactivity of F-18 FDG for Reliable Semi-quantification in PET-CT Imaging: A Phantom Study
METHOD AND MATERIALS
We performed F-18 FDG PET-CT study using an ECT phantom containing various spheres (diameter: 3.4, 2.1, 1.5, 1.2, 1.0 cm) filled with a fixed concentration of 165 KBq/ml and background 23.3 KBq/ml (total 156.8 MBq) at multiple time points up to 20 hrs of radioactive decay. The images were acquired for 10 min/bed at each time point using 3-D mode in a hybrid GE Discovery 690 scanner equipped with LYSO detectors and a 64-slice CT. The images were reconstructed in 1, 2, 3, 4, 5, and 10 min per bed using ordered-subset expectation maximum (OSEM) algorithm with 24 subsets and 2 iterations. The standardized uptake values (SUV) of the spheres with both maximal and average were measured by applying volume of interests (VOI) in serial PET images. The minimal required activity concentrations at various acquisition time were determined as well as the minimal product of activity concentration and acquisition time.

RESULTS
The minimal required activity concentration for precise SUVmax quantification in spheres (CONCLUSION
Our phantom study provided guidance for minimal required activity and acquisition time for precise semi-quantification in F-18 FDG PET imaging. We can further reduce dose and radiation exposure to patients at reasonable acquisition time in clinical studies.

CLINICAL RELEVANCE/APPLICATION
(dealing with PET-CT) Based on the data, we can further reduce the administratice dose of F-18 FDG in clinical studies.

SSK21-09 • Detecting Osteoporosis Using Photoacoustic Spectroscopy
Behnoosh Tavakoli (Presenter) ; Xiaoyu Guo ; Shadpour Demehri MD ; Abdullah Muhit PhD ; John A Carrino MD, MPH *
Emad Doctor PhD, MSc *

CONCLUSION
Photoacoustic spectroscopy is technically for detecting the osteoporosis at no radiation cost. This method may be sensitive to the micro structural changes in the bone. In addition with multi spectral imaging, it is possible to analyze different components of the bone tissue such as calcium by decomposing the photoacoustic spectrum to the standard tissue absorbers optical spectrums.

Background
Osteoporosis, is the most common metabolic bone disorder. Monitoring the micro architectural deterioration of the bone tissue and the decrease of the bone mineral density are necessary for early detection the osteoporosis. Broadband attenuation of ultrasound signal is correlated with bone mineral density and its microstructure. In addition, the optical absorption spectrum of the bone tissue analyzes its mineral, water, lipid and oxy-deoxy hemoglobin content. Therefore photoacoustic spectroscopy as a hybrid functional method that combines both optical and ultrasound information is a promising technique for determination of osteoporosis in early stages.

Evaluation
In this study, the quantitative ultrasound calcaneal phantoms of normal and osteoporotic bone were imaged in the transmission mode and the corresponding photoacoustic spectra were obtained. Our photoacoustic imaging system includes a tunable Q-switch Nd:YAG laser followed by an OPO system generating pulses at the wavelength range of 690 nm-950 nm. The photoacoustic signal is detected with the FDA approved Sonix RP ultrasound system including a data acquisition device for recording the raw data. Multiple points of each phantom were evaluated using a linear US probe with 128 elements. Finally the maximum raw data was extracted from the elements and the value was normalized to the illuminating laser energy.

Discussion
The result revealed a general decrease in the spectrum of the osteoporotic phantom compared to the normal one. The trend matches the optical spectrum of the calcaneal bone tissue. In this test, there was about two times contrast between the normal and osteoporotic case. These phantoms were modeling the bone microstructure and more contrast is expected in the real bone tissue including other tissue absorbers.

CONCLUSION
Our phantom study provided guidance for minimal required activity and acquisition time for precise semi-quantification in F-18 FDG PET imaging. We can further reduce dose and radiation exposure to patients at reasonable acquisition time in clinical studies.

CLINICAL RELEVANCE/APPLICATION
(dealing with PET-CT) Based on the data, we can further reduce the administrative dose of F-18 FDG in clinical studies.

SSK22-01 • Definitive Chemoradiation for Cervical Esophageal Carcinoma Using Altered Fractionation
Melissa H Lemieux MD (Presenter) ; Romy Pandey ; Daniel W Golden MD ; Daniel J Haraf ; Victoria M Villaflor

ABSTRACT
Purpose/Objective(s):
The purpose of this study is to assess the utility of PET in predicting pathologic complete response (pathCR) in patients treated with neoadjuvant chemoradiotherapy (chemoRT) for locally advanced esophageal cancer, and to evaluate the influence of PET response and pathCR on outcomes including disease-free (DFS) and overall survival (OS).

Materials/Methods:
We conducted a retrospective review of patients treated at our institution with neoadjuvant therapy and esophagectomy for T3 or N+ esophageal cancer. We collected data including the type of neoadjuvant therapy, Maximum SUV (SUVm) on PET imaging prior to and 6 weeks after neoadjuvant therapy, clinical and pathologic staging, surgical pathological findings, and overall and disease-free survival.

Results:
The data were collected for 25 patients, all treated with neoadjuvant chemoRT and esophagectomy. The 3-year DFS and OS were 27% and 57% respectively. The initial clinical staging was T3N0 for 9 patients (36%), cN1 in 12 (48%), cN2 in 4 patients (16%). Pre-treatment PET had a median SUVm of 8.9 (range 4-20.5), Post-treatment PET-CT was done a median 6.1 weeks (range 3.9-6.7 weeks) after completion of RT. Post-treatment PET had median SUVm of 4.6 (range 0-9). 8 patients (40%) had a pathCR. The pathCR rates was 0% in patients with post-therapy SUVm at background levels (n=4), 50% in patients with a post-therapy SUVm 5 (n=9). When comparing post- to pre-treatment PET, 4 patients had complete response, 6 patients had >50% reduction of SUVm, and 5 had 95% pathologic response in these groups were 50%, 50%, and 40% respectively. Nodal downstaging from N+ to N0 occurred in 7 (44%) of the 16 clinically N+ patients. Patients who had a pathCR had a trend to longer median survival compared to those who did not (2.4 vs. 0.6 years, p=0.07). Patients who had >95% pathologic response had a prolonged median survival compared to those who did not (3.6 vs. 0.6 years, p=0.001). There were no differences in 1-year DFS between patients whose post-treatment SUVm was background,
less than 5, or greater than 5.

Conclusions:
PET-CT did not predict pathCR or DFS in our population. PathCR after chemoradiotherapy may improve DFS in patients with locally advanced esophageal cancer.

SSK22-04 • Early Outcomes with the Use of Intensity Modulated Radiation Therapy with Simultaneous Integrated Boost as a Part of Neoadjuvant Therapy with Concurrent Chemotherapy for Advanced Stage Rectal Cancers

Shilpa Vyas MD (Presenter) ; Nitika Thawani MD ; Dharanipathy Rangaraj ; Niloyjyoti Deb MD ; Subhakar Mutyala MD

ABSTRACT
Title: Intensity Modulated Radiation Therapy decreases acute toxicity of neoadjuvant pelvic radiation with concurrent 5-Fluorouracil based chemotherapy for rectal cancer compared to Three Dimensional Conformal Radiation Therapies. Objective: To compare the acute toxicity of neoadjuvant pelvic radiation with 5-FU based chemotherapy for rectal cancer using Intensity Modulated Radiation Therapy (IMRT) with simultaneous integrated boost (SIB) technique compared to 3D Conformal Radiation Therapy (3D CRT).
Methods: Forty two (42) consecutive rectal cancer patients treated with pelvic radiation and concurrent 5-FU based chemotherapy were analyzed. We compared twenty-two (21) patients treated on an institutional IMRT protocol versus twenty-eight (21) patients treated with 3D CRT. All patients received 45-50.4 Gy to the pelvis in 3DCRT group. All patients with IMRT received 45 Gy in 25 fractions to the pelvic nodes and primary rectal tumor along with a simultaneous integrated boost to a dose of 50 Gy in 25 fractions to areas of gross disease. IMRT planning was done with dose constraints for bladder, rectum, and small bowel and bone marrow. All patients in both groups received 5-FU based chemotherapy during radiation. Evaluation of toxicity was based on RTOG criteria. Two patients in the 3DCRT group and two in IMRT group received either growth factors or blood-products transfusion and needed hospitalization during treatment secondary to acute toxicities.
Results: All patients completed their prescribed course of radiation. Complete response rates were 5/21(23%) in 3DCRT and 4/21(19%) in the IMRT-SIB (p-value 0.74). 9/21(42%) and 15/22(71%) in the IMRT group underwent Low anterior resection according to the location of the tumor. There was no grade 4 toxicity in the IMRT-SIB group. Overall grade 2 toxicity in 3D Vs IMRT-SIB group was - GI -52% Vs 19%, GU -8% Vs 8%, skin 42 Vs 4%, hematologic 33 Vs 47%. Overall Grade 1 toxicity in 3dCRT Vs IMRT group was- GI 33% Vs 52%, GU 23% vs 28%, skin 52% Vs 38%, hematologic 4% Vs 33%.
Table: Total Incidence of toxicity

<table>
<thead>
<tr>
<th>Grade</th>
<th>3D CRT</th>
<th>IMRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>1(4%)</td>
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</tr>
<tr>
<td>Grade 2</td>
<td>14(66%)</td>
<td>10(47%)</td>
</tr>
<tr>
<td>Grade 3</td>
<td>3(14%)</td>
<td>3(14%)</td>
</tr>
<tr>
<td>Grade 4</td>
<td>2(9.5%)</td>
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</tbody>
</table>

Conclusions: Neoadjuvant pelvic radiation with concurrent 5 FU for rectal cancer has less GI, skin and hematologic toxicity when delivered via IMRT-SIB versus 3D CRT with comparable complete response rates. Long-term follow up is needed to assess for chronic toxicity and disease outcomes.

SSK22-05 • Feasibility and Efficacy of Radiotherapy for Patients 80 Years Old or Older with Esophageal Cancer

Kazuya Inoue ; Tetsuro Tamamoto (Presenter) ; Emiko Katayama MD ; Isao Asakawa ; Masatoshi Hasegawa

SSK22-06 • Advantages of Using Double Contrast Enema as a Low Cost Technique for Accurate Target Delineation during CT Simulation for Rectal Cancer Treated with Neoadjuvant Chemoradiation with Intensity Modulated Radiation Technique (IMRT)

Mammen Sam MD (Presenter) ; Nitika Thawani MD ; Sameer Jhavar MD, PhD ; Karen Stumph ; Shilpa Vyas MD ; Subhakar Mutyala MD

ABSTRACT
Purpose:
Neoadjuvant chemoradiation followed by surgery with adjuvant chemotherapy is the current standard of care for advanced rectal cancers. Target delineation in radiation treatment planning is central to tumor control probability and to limiting normal tissue radiation toxicity especially when using conformal techniques like IMRT. Metabolically active imaging such as PET/CT is increasingly used for identification and localization of biologically viable target. Using an air contrast enema during CT simulation for radiation treatment planning is inexpensive, readily available and potentially allows for similar targeting results without additional radiation exposure.
Materials and Methods:
Twelve consecutive patients with biopsy-proven rectal cancers who were treated with neo-adjuvant chemoradiation were identified who underwent PET/CT imaging in treatment planning position. CT simulation was performed with double contrast barium enema. GTV was delineated on simulation CT by 1) double contrast enema, 2) FDG activity on pretreatment PET/CT, and 3) CT portion of the PET/CT. CTVs were generated to account for microscopic disease. GTVs generated using double contrast enema and CT /PET were compared with GTV generated by PET using correlation coefficients. We also compared the percent non-overlap between the CTV generated by PET and double contrast enema.

Results:
The mean and median GTV volumes based on PET were 21.9 and 20.1 cc respectively (range 4.27 - 53.7 cc). The mean and median GTV volumes based on double contrast enema were 47.5 and 49.1 cc respectively (range 5.7 - 95.2 cc). The mean and median GTV volumes based on CT/PET were 39.1 and 38.8 cc respectively (range 5 - 96 cc). The correlation coefficient between PET GTV and double contrast enema GTV was 0.74 and between PET GTV and CT/PET GTV was 0.85 suggesting strong correlation for both. The mean and median non-overlap volume between CTVs generated from PET and double contrast enema was 36% and 34% respectively (range 27% - 64.8%).
Conclusion:
In our pilot study we found that there was a good correlation between the GTVs generated both from PET and double contrast enema and also between PET and CT/PET. We also noticed that the CTV generated with double contrast enema accounts for internal target motion with a potential of missing the target if not used. Limitations include inability to assess nodal volume. Double contrast enema is a low cost technique with several advantages.

SSK22-07 • The Use of a Neoadjuvant Hypofractionated Chemoradiation Approach for Unresectable Pancreatic Adenocarcinoma

Roberto Sabater (Presenter) ; Chance Matthiesen ; Salahuddin Ahmad PhD ; Terence Herman

ABSTRACT
Objective: Initial surgical resection is the most curative therapy approach for pancreatic cancer. Many patients are not resectable due to locally advanced tumor. For such patients, the optimal approach is unclear. Chemotherapy with and without standard fractionation radiation has been studied in multiple trials with conflicting results, and continues to be the subject of ongoing trials. We reviewed our institutional experience utilizing a neoadjuvant hypofractionated chemoradiation approach for inoperable pancreatic adenocarcinoma.
Methods: A retrospective review was performed identifying eleven patients diagnosed with adenocarcinoma of the pancreas and treated with RT from 2009-2012. Median age for the group was 65 years (range 50-80 years). Patients were deemed unresectable via radiographic (10, 90.9%) or endoscopic (1, 9.1%) criteria. Eleven were diagnosed with adenocarcinoma of the pancreatic head (8, 72.7%), body (2, 18.2%), or multicentric (1, 9.1%). Disease TNM staging included T4N0M0 (5, 45.5%), T2N0M0 (2, 18.2%), T3N1M0 (2, 18.2%), T4N2M0 (1, 9.1%), and T4N0M0 (1, 9.1%).

Results:

<table>
<thead>
<tr>
<th>Stage</th>
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<th>2</th>
<th>3</th>
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</tr>
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<tbody>
<tr>
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<td>5</td>
<td>45.5%</td>
<td>2, 18.2%</td>
<td>1, 9.1%</td>
</tr>
<tr>
<td>Grade 2</td>
<td>2</td>
<td>18.2%</td>
<td>2</td>
<td>18.2%</td>
</tr>
<tr>
<td>Grade 3</td>
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<td>18.2%</td>
<td>1, 9.1%</td>
<td></td>
</tr>
<tr>
<td>Grade 4</td>
<td>1, 9.1%</td>
<td></td>
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</tbody>
</table>

Conclusions: The use of a neoadjuvant hypofractionated chemoradiation approach for unresectable pancreatic adenocarcinoma delivered via IMRT-SIB versus 3DCRT with comparable complete response rates. Long-term follow up is needed to assess for chronic toxicity and disease outcomes.
SSK22-08 • Adjuvant Chemoradiotherapy for Resected Hepatocellular Carcinoma

Ato O Wright MD (Presenter)

ABSTRACT
PURPOSE: Curative surgical approaches for hepatocellular carcinoma (HCC) include partial hepatectomy (PH) and liver transplantation. In other malignancy subsites, data demonstrate a benefit of adjuvant therapy for close or positive margins and/or nodal positivity; it may be reasonable to extrapolate these oncologic principles to the management HCC. The purpose of this study is to evaluate the outcomes and toxicity in patients with HCC treated with PH followed by adjuvant radiation therapy (RT). To our knowledge, this is the first study to evaluate the role of adjuvant RT for HCC.

METHOD: This study includes patients who underwent PH and adjuvant RT at our institution between 2001 and 2012 for HCC. Patients with distant metastatic disease were excluded.

RESULTS: Six patients were identified who met inclusion criteria. All patients were locally advanced, with stage III-IVA disease, based on AJCC 7th edition. Preoperative Childs-Pugh grade was class A for five patients and class B for one patient. Preoperative alpha fetoprotein (AFP) level was less than 200ng/mL for 5 patients and unknown for one patient. The median AFP level for the 5 patients was 3.5ng/mL. The resection margins ranged from 0 mm to 8 mm, with a median margin of 4 mm. Tumors from 4 patients demonstrated vascular invasion. Positive lymph nodes were negative for vascular invasion and unknown for one. Five of 6 patients had lymph node sampling with 3 having involved nodes. The median radiation dose was 45 Gy in 1.8 Gy fractions. Five patients received concurrent Capcitabine and one patient received concurrent infusional 5-fluorouracil. After a median follow up of 62 months (range 12-75 months), the overall survival rate is 83% (5 of 6 patients alive). The overall local and distant recurrence rates are 17% (1 of 6 patients) and 17%(1 of 6 patients), respectively. One patient had progression of disease within the liver and one patient developed distant lung disease. Two patients experienced acute grade 1 upper GI toxicity and 2 patients experienced grade 1 lower GI toxicity. One patient experienced grade 3 fatigue. There were no late grade 3/4 toxicities. One patient developed worsening liver dysfunction from Childs-Pugh A to B, 1 patient from B to A and the rest were unchanged.

DISCUSSION: The safety and efficacy of PH have greatly improved over the past two decades, largely due to advances in radiologic assessment, improved patient selection and perioperative care. In our retrospective study, we have demonstrated that adjuvant radiation therapy for patients undergoing PH for locally advanced HCC is safe and may potentially improve outcomes. Randomized studies are required to validate these findings.

Vascular/Interventional (Venous Access/Women's Intervention)

Wednesday, 10:30 AM - 12:00 PM • E353A

SSK23 • ARA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5

Moderator
Bart L Dolmatch, MD *

Moderator
Anne C Roberts, MD *

SSK23-01 • Central Venous Access: Evolving Roles of Radiology and Other Specialties Nationally over Two Decades

Richard Duszak MD (Presenter); Nadia Husain; Daniel D Picus MD; Danny Hughes PhD; Baogang Xu PhD

PURPOSE
To evaluate national trends in central venous access (CVA) procedures over two decades with regard to changing specialty group roles and places of service.

METHOD AND MATERIALS
Aggregated claims data for temporary central venous catheter (CVC) and long-term central venous access device (CVAD) procedures were extracted from Medicare Physician Supplier Procedure Summary master files from 1992 through 2011. CVC and CVAD procedure volumes by specialty group and place of service were studied.

RESULTS
Between 1992 and 2011, temporary and long-term CVA placement procedures increased from 638,703 to 808,071 (+27%) and 76,444 to 316,042 (+313%), respectively. For temporary CVCs, radiology (0.4% in 1992 to 32.6% in 2011) now exceeds anesthesiology (37.0% to 22.0%) and surgery (30.4% to 11.7%) as the dominant provider group. Surgery continues to dominate in placement and explantation of long-term CVADs (80.7% to 50.4% and 81.6% to 47.7%, respectively), but radiology’s share has grown enormously (0.7% to 37.6% and 0.2% to 28.6%). Although volumes remain small (45.5% to 60 Gy in 18-30 fractions).

CONCLUSION
Adjuvant chemoradiation is a well-tolerated treatment approach for unresectable pancreatic cancer. This approach can achieve resectability in some patients. Further investigation is warranted.

SSK23-02 • Mechanical Failure with a Radiologically Placed Totally Implantable Central Venous Arm Port System

Jasmin D Busch MD (Presenter); Catherine T Mahler; Christian R Habermann MD; Andreas Koops MD; Gerhard B Adam MD; Harald Ittrich MD

PURPOSE
To evaluate the frequency of mechanical failures, in particular catheter line rupture and fragment embolization, related to a radiographically controlled and brachially placed totally implantable central venous arm port system (TCVAP) used for mid- to long-term vascular access.

METHOD AND MATERIALS
An analysis of extracted surgical procedures was performed. The charts of all patients with implantable port systems were reviewed.

Results: All patients completed RT without complications or treatment interruption. Median follow up after RT was 6 months (range 0-21). Eight (72.7%) patients had post-RT PET/CT. Results showed four lesions with a complete resolution of hypermetabolic activity, and four lesions decreased to a median SUV of 4.4 (range 2.7-5.4). Median post-RT CA 19-9 nadir was 51 (range 0-2393.1). Five patients (45.5%) proceeded to surgical resection. All achieved a R0 resection. Pathologic staging was ypT3N1 (1, 20%), ypT1N0 (2, 40%), ypT1N0 (minimal residual disease) (1, 20%), and no residual disease (1, 20%). One (20%) patient died of surgical complications; the other four (80%) remain disease free. Six patients (54.5%) remained inoperable at completion radiotherapy. At the time of review, seven (63.6%) patients remain alive, two (27.3%) are deceased, and one (9.1%) was lost to follow up.

Conclusion: Hypofractionated chemoradiation is a well-tolerated treatment approach for unresectable pancreatic cancer. This approach can achieve resectability in some patients. Further investigation is warranted.
A retrospective audit of our Centricity Radiology Information System (GE Healthcare, Braunschweig, Germany) was performed from 2006 until April 2013 to determine the number of Cook Vital-Port Mini Titanium (Cook Medical Inc., Limerick/Ireland) implanted between January 1, 2006, and June 30, 2011 and the frequency of device-related complications (mechanical failure, rupture and fragment embolization) until demise or explantation.

RESULTS

CONCLUSION
With the Cook Vital-Port Mini Titanium implanted at the upper arm we observed in 2.3% a partially or complete catheter line fracture associated with a high incidence of fragment embolization. The high rate of clinically unapparent catheter line fractures demands special attention of TCVAP users to recognize malfunctions. Despite from the risk of extravasation in patients under chemotherapy, in particular, fragment embolization puts the patients at risk for further severe complications.

CLINICAL RELEVANCE/APPLICATION
TCVAP are a proper tool for vascular access. However, due to the accumulation of material failure further investigation are warranted to determine the cause of material failure.

SSK23-03 Characteristics of an Infectious Complication on Implantable Venous-access Port

Jisue Shim; Tae Seok Seo MD, PhD; In-Ho Cha MD, PhD; Myung Gyu Song MD (Presenter); Eun-Young Kang MD; Hwan Seok Yong MD; Chang Hee Lee MD

PURPOSE
The purpose of this study is to assess the demographic and bacteriologic characteristics and risk factors of implantable venous-access port (IVAP)-associated infection.

METHOD AND MATERIALS
Between August 2003 and November 2011, we placed 1,747 ports in interventional radiology suites. A total of 144 and 1,603 ports were placed in patients with hematologic malignancy and with solid tumor, respectively. We removed 45 ports to treat port-related infection, from 37 patients with systemic febrile symptom and 8 patients with signs of local infection. We evaluated the incidence of port-related infection, demographic factors, bacteriologic data, and patients' progress by review of medical record. Univariate analyses (chi-square test and Fisher’s exact test) and multivariate logistic regression analyses were used to determine the risk factors for complications.

RESULTS
Overall, 45 (2.58%) out of 1,747 ports were removed for infectious symptom, with an incidence rate of 0.075 events/1,000 catheter-days. The incidence rate of port-related infection was higher in hematologic disease patient than in solid organ tumor patient (p=0.03). The infection rate was higher in inpatients intervention than outpatients (p=0.02). Hematologic malignancy was the only significant risk factor of IVAP-related infection (OR 0.304, 95% confidence interval 0.144-0.643, p=0.002). Microorganisms were isolated from 30 (66.7%) blood samples. Causative organisms were Staphylococcus species (n=13), Candida species (n=9), Non-tuberculosis Mycobacterium (n=2), Escherichia coli (n=1), Acinetobacter baumannii (n=2), Klebsiella pneumonia (n=2), Rhodotorula mucilaginosa (n=1) and Enterococcus faecium (n=1). Additionally, catheter tip culture studies were positive in nine cases and isolated microorganisms were same as blood culture studies. Wound culture in localized infection revealed no organisms in all cases.

CONCLUSION
The incidence of IVAP-related infection was significantly high in hematologic malignancy patient and when intervention was done after admission. The common causative organisms were Staphylococcus and Candida species. The explantation of devices seems to be helpful for treatment of local and systemic infection suspiciously related with IVAPs.

CLINICAL RELEVANCE/APPLICATION
The knowledge of the characteristics of IVAP-related infection may be helpful to manage infected port.

SSK23-04 Patients’ Perceptions of Peripherally Inserted Central Catheter for Cancer Treatment: A Comparative Single-institution Prospective Analysis

Francois-Xavier Arnaud MD (Presenter); Christophe Teritehau; Gabrielle Weber-Donat; Denis Metivier; Caroline Bouzad; Julien Potet MD *

PURPOSE
To prospectively assess the perceptions of cancer patients of having a PICC and to compare these perceptions with those of non-cancer patients.

METHOD AND MATERIALS
Patients’ perceptions were registered on three occasions (T1, right after PICC placement; T2: 1 week after placement and T3: three weeks after placement), with the use of two specific questionnaires. Questionnaire I contained 17 items covering five domains (anxiety, information, restrictions in daily activities, pain, procedure duration and discomfort), whereas questionnaire II was made up of 17 items covering 6 domains (pain, information, restrictions in daily activities, anxiety, discomfort and overall satisfaction) Results were analyzed considering the cancer group and then compared to the non-cancer group using Pearson chi-squared or Fisher’s exact tests and Student T-tests. Regression tests were performed to study the association between different factors and the procedure-related pain at T1 or the global satisfaction at T2 and T3.

RESULTS
150 PICCs were implanted in 125 consecutive patients (78 patients in the cancer group and 47 in the non-cancer group). Pain level was low (2.5, 95% CI 2.0-2.9) in cancer patients at T1 and decreased at the end of the procedure (0.5, 95% CI 0.2-0.7). 96.2% of cancer patients found that the pain was equal or lower than expected before the procedure. Disturbing factors were venous puncture (24.4% of patients), local anesthesia (23.1%) and lying position on the angiography table (20.5%) in cancer patients. Pain levels at exit-site at T2 and T3 were low but significantly higher in the cancer group than in the non-cancer group (T2: 0.9 vs 0.4, p=0.05 and T3: 0.8 vs 0.2, p=0.01). At T2, global satisfaction was 5.4 times worse in painful patients (p=0.02). Cancer patients stated that the PICC interfered when taking a shower (48.1% of patients at T2), but not for basic activities. They mostly feared that PICC might be a source of infection (46.3% vs 18.2% in non-cancer patients, p=0.008). No factor of disturbance, discomfort or fear was associated with a worse global satisfaction.

CONCLUSION
PICC placement and port during hospitalization were well accepted by cancer patients. Physicians should focus on exit-site pain treatment in cancer patients for a better satisfaction.

CLINICAL RELEVANCE/APPLICATION
PICC placement was well tolerated and PICC device were a well-accepted method of delivering chemotherapy and supportive agents in the daily life of cancer patients.


H. Y. J Leung (Presenter); Simon C Yu MD; Ka Lok Lee MBChB; Mabel M Tong MBBCh; Helen Hoi Lun Chau; Eva Chun Wai Cheung; Alyssa Sze Wai Wong; Anil T Ahuja MD

PURPOSE
To assess the safety and efficacy of ultrasound guided high-intensity focused ultrasound (USHIFU) treatment of symptomatic uterine fibroids using high sonication energy protocol.
SSK23-08 • The Apparent Diffusion Coefficient (ADC) Value of the Uterine Adenomyosis for the Prediction of the Potential Response to Uterine Artery Embolization (UAE)

Yaewon Park (Presenter) ; Dae Chul Jung ; Man Deuk Kim MD

PURPOSE
To determine the utility of the apparent diffusion coefficient (ADC) value for the prediction of the potential response to uterine artery embolization (UAE) for symptomatic adenomyosis.

METHOD AND MATERIALS
This was a prospective on going phase one study. Protocol was approved by institutional review board and informed consent were obtained. A total of 20 patients with 22 symptomatic fibroids were included in the study and were treated with US-guided HIFU ablation. The fibroids were ablated using dot mode under power output of 800 -1500W for 1500 - 2000 sonication pulses at each spot. The primary endpoints were peri-procedural complications. The secondary endpoints were clinical symptomatic improvement and radiological evidence of treatment response including degree of fibroid infarction and volume shrinkage at 3 months after treatment. The symptoms included pain, menorrhagia, and fibroid related urinary symptoms and these were assessed by pain score, pictorial chart score, Urogenital Distress Inventory (UDI -6) and Incontinence Impact Questionnaire (IIQ-7). The degree of fibroid infarction was assessed by dynamic contrast 3T MRI and was reflected by non-perfused ratio (NPR) calculated as non-perfused volume as a percentage of the total fibroid volume.

RESULTS
Nineteen patients tolerated the treatment well and were treated on an outpatient basis. One patient who received treatment for a fibroid located

CONCLUSION
This prospective study suggests that USgHIFU may be safe and effective in treating symptomatic uterine fibroids in carefully selected patient group. Uterine fibroids which are located

CLINICAL RELEVANCE/APPLICATION
Non-invasive In Vivo Estimation of Uterine Fibroid Thermal Conductivity in Magnetic Resonance Imaging Guided High Intensity Focused Ultrasound (MR-HIFU) Therapy

Jiming Zhang * ; John H Fischer MD ; Pei-Herng Hor PhD ; Raja Muthupillai PhD (Presenter) *

RESULTS
A total of 13 cells with diameters of 4mm (n=3), 8mm (n=7), and 12mm (n=3) were used to treat uterine fibroids. The mean temperature elevated from 37°C to 64.8 ± 1.4°C, resulting in an average 240 EM dose volume of 1.8 ±1.3 cm³ across cells. From the recorded spatial-temporal temperature profiles, the thermal conductivity(k) was estimated to be 0.5 ± 0.06 W/(m.K).

CONCLUSION
The results from our study show that it is possible to estimate thermal conductivity of human uterine fibroid tissue in-vivo from spatio-temporal evolution of temperature during volumetric MR-HIFU. In-vivo uterine fibroid thermal conductivities across different cell sizes were within 13% of the mean, indicating close agreement, and is roughly similar to reported thermal conductivities of skeletal muscle. 1. Kohler, et al. Med. Phys., 36(8), 3521-35, 2009 2. Zhang, et al. JMRI, 37(4), 950-7, 2012

CLINICAL RELEVANCE/APPLICATION
1. Effectiveness of tissue ablation during MR-HIFU in vivo is influenced by tissue thermal properties such as thermal conductivity which can be estimated from spatio-temporal evolution of temperature.

SSK23-07 • MRgFUS Treatment of Uterine Fibroids: Evaluation of Fibroid Volume, Perfused Volume (PV) and Clinical Scores Modifications at 6-month and 12-month Follow Up

Marta Valani MD (Presenter) ; Irene Invernizzi MD ; Paola Enrica Colombo ; Fabio Zucchoni MPH ; Angelo Vanzulli MD ; Cristiana Ticca MD

RESULTS
Fibroid volume significantly decreased from 140±126cm³ to 102±107cm³ (6-m) and 100±103cm³ (12-m) (p The average post-treatment PV ratio (p-tPV ratio, considered as post-treatment PV divided by initial volume) was 29±17% and PV significantly increased between baseline and 12-m from 44±56cm³ to 74±88cm³ (p

CONCLUSION
MRgFUS treatment of uterine fibroids determines significant fibroid shrinkage and clinical improvement already after 6-m, and results are still important even after 12-m. The significant PV increase between post-treatment and 12-m is not correlated with p-tPV ratio and does not affect the clinical improvement of patients

CLINICAL RELEVANCE/APPLICATION
MRgFUS is a non-invasive, safe and effective treatment for uterine fibroids; the PV significant increase between post-treatment and 12-m does not affect the important clinical improvement of patients

SSK23-06 • Non-invasive In Vivo Estimation of Uterine Fibroid Thermal Conductivity in Magnetic Resonance Imaging Guided High Intensity Focused Ultrasound (MR-HIFU) Therapy

Jiming Zhang * ; John H Fischer MD ; Pei-Herng Hor PhD ; Raja Muthupillai PhD (Presenter) *

RESULTS
Nineteen patients tolerated the treatment well and were treated on an outpatient basis. One patient who received treatment for a fibroid located

CONCLUSION
This prospective study suggests that USgHIFU may be safe and effective in treating symptomatic uterine fibroids in carefully selected patient group. Uterine fibroids which are located

CLINICAL RELEVANCE/APPLICATION
Non-invasive In Vivo Estimation of Uterine Fibroid Thermal Conductivity in Magnetic Resonance Imaging Guided High Intensity Focused Ultrasound (MR-HIFU) Therapy

Jiming Zhang * ; John H Fischer MD ; Pei-Herng Hor PhD ; Raja Muthupillai PhD (Presenter) *

PURPOSE
To estimate in vivo thermal conductivity of uterine fibroid tissue from the spatio-temporal evolution of temperature during MR guided focused ultrasound surgery (MR-HIFU) in women.

METHOD AND MATERIALS
All MR-HIFU was performed at 1.5 T using a commercial MR-HIFU platform (Sonalleve™, Philips Healthcare) with a 256Ch spherical shell HIFU transducer (1.2-1.4 MHz), and an integrated receiver coil. The temperature evolution after 13 volumetric sonications in three women was recorded in real-time using a multi-shot echo planar imaging technique described previously. All subjects provided written informed consent as per IRB guidelines.

Estimation of thermal conductivity: Thermal conductivity is calculated based on Penne’s bi-heat transfer equation. The spatio-temporal temperature evolution following heating is modeled by a Gaussian distribution. If $S_x$, $S_y$, and $S_z$ represent the standard deviation of the spatio-temporal deviation spread in the in-plane/through-plane monitoring slices, then the rate of change of standard deviation over time yields thermal diffusivity $D$ and thermal conductivity $k$.

RESULTS
A total of 13 cells with diameters of 4mm (n=3), 8mm (n=7), and 12mm (n=3) were used to treat uterine fibroids. The mean temperature elevated from 37°C to 64.8 ± 1.4°C, resulting in an average 240 EM dose volume of 1.8 ±1.3 cm³ across cells. From the recorded spatial-temporal temperature profiles, the thermal conductivity(k) was estimated to be 0.5 ± 0.06 W/(m.K).

CONCLUSION
The results from our study show that it is possible to estimate thermal conductivity of human uterine fibroid tissue in-vivo from spatio-temporal evolution of temperature during volumetric MR-HIFU. In-vivo uterine fibroid thermal conductivities across different cell sizes were within 13% of the mean, indicating close agreement, and is roughly similar to reported thermal conductivities of skeletal muscle. 1. Kohler, et al. Med. Phys., 36(8), 3521-35, 2009 2. Zhang, et al. JMRI, 37(4), 950-7, 2012

CLINICAL RELEVANCE/APPLICATION
1. Effectiveness of tissue ablation during MR-HIFU in vivo is influenced by tissue thermal properties such as thermal conductivity which can be estimated from spatio-temporal evolution of temperature.
METHOD AND MATERIALS
Our study included twenty-three patients who underwent diffusion weighted (DW) MRI before UAE between June 2011 and November 2012. All patients underwent 3 months follow-up MRI after UAE. The embolic agent used was polyvinyl alcohol (PVA) particle. A quantitative measurement of the ADC was performed for each adenomyosis. Complete response was defined as more than 90% of non-perfusion area of adenomyosis following UAE at 3 months follow-up MRI. Incomplete response was defined as less than 90% of non-perfusion area at follow-up MRI. ADC value was compared between patients that achieved complete response and incomplete response after UAE via analysis. Statistical analysis was performed to evaluate the diagnostic performance of the predictor for differentiated the complete from the incomplete response.

RESULTS
Of the twenty-three patients, seventeen showed complete response and six showed incomplete response. The ADC ranged from 0.8413 ± 1.2440 x 10⁻³ mm²/s (mean 1.0745 ± 0.1122). The mean ADC of the complete response group was 1.0449 ± 0.1063 and 1.1585 ± 0.0881 in the incomplete response group (p value = 0.029). Using a threshold of less than 1.1475 x 10⁻³ mm², the sensitivity and specificity of the ADC for the prediction of success after UAE were 83.3% and 82.4%, respectively.

CONCLUSION
The ADC of uterine adenomyosis can be utilized as a predictor for successful response of UAE in adenomyosis.

CLINICAL RELEVANCE/APPLICATION
The ADC of uterine adenomyosis is a potential predictor for complete response of UAE in symptomatic adenomyosis.

SSK23-09 • Embolization of Symptomatic Post-abortion Uterine Arteriovenous Malformations
Helene Vernhet-Kovacsik MD, PhD ; Valerie Monnin-Bares ; Hamid Zarqane (Presenter) ; Sebastien Bommart MD
PURPOSE
To assess immediate and mid-term clinical outcome of hyperselective embolization of symptomatic post-abortion uterine arterio-venous malformations (AVM).

METHOD AND MATERIALS
Since January 2009, 13 consecutive women with acquired symptomatic (bleeding) intra-uterine post-abortion arteriovenous malformation were referred in our institution. Women with AV malformation persisting 10 weeks after abortion, as demonstrated by MR angiography and/or US doppler were referred for embolization. MRI was performed before and after embolization (1 month). Technical success, immediate and mid-term (6-36 months) clinical outcome (recurrent bleeding, myometral necrosis or infection) and imaging follow-up (myometral thickness and enhancement after injection of gadolinium, presence of residual AVM) were recorded.

RESULTS
At 10 weeks after abortion, 11/13 women had persistent AV malformation. Hyper-selective embolization using Onyx (n=9), particles (n=2) was performed during 1 (n=6), 2 (n=2) up to 3 (n=3) sessions. Complete technical success was reached in 9/11 cases. The MAV could not be completely occluded in 2 case (arterial ovarian supply, uterine supply). Bleeding was stopped in all cases and recurrent spotting at 3 months was noted in 2 cases (cases with technical failure). No uterine necrosis nor infection was present at -mid-term follow-up. At MRI, a persistent active AVM was present in 2 cases, myometral thickness was decreased at the site of the embolized AVM in 2 cases and normal enhancement of the entire uterine wall was present in 10/11 cases.

CONCLUSION
Hyperselective embolization of post-abortion uterine AVM is safe and immediately efficient but clinical mid-term outcome closely depends on technical success of embolization.

CLINICAL RELEVANCE/APPLICATION
Hyperselective embolization of post-abortion uterine AVM is safe and efficient when complete.

Vascular/Interventional (GI Interventions/Topics of Interest)
Wednesday, 10:30 AM - 12:00 PM • N226

SSK24 • AMA PRA Category 1 Credit™:1.5 • ART Category A+ Credit:1
Moderator
Ranjith Vellody , MD
Moderator
Raul N Uppot , MD

SSK24-01 • Incidence and Prognostic Factor for Stent Migration after Retrievable Expandable Metallic Stent Placement: Experience in 444 Patients with Esophageal Stricture
Jung-Hoon Park RT (Presenter) ; Ho-Young Song MD ; Jin Hyoung Kim MD ; Young Chul Cho BS ; Eun Jung Jun PhD ; Soo Hwan Kim ; Ki Back Lee
PURPOSE
To evaluate the incidence, prognostic factor, and interventional management of stent migration after placement of retrievable expandable metallic stents in patients with esophageal strictures.

METHOD AND MATERIALS
Retrievable expandable metallic stents were placed under fluoroscopic guidance in 444 patients with symptomatic esophageal stricture. We retrospectively reviewed collected patient records to evaluate the incidence and interventional management of stent migration. Multivariate analysis was performed to evaluate prognostic factors of stent migration. Stent migrations were classified into four patterns on the basis of the location of migrated stent.

RESULTS
Stent migration occurred in 50 (11.3%) of 444 patients 1 – 228 days (mean, 42 days) after stent placement. Multivariate analysis revealed that young patients (odds ratio [OR], 1.026; P = 0.036), grade 2; able to tolerate soft food without vomiting before the procedure (OR, 5.989; P < 0.001), and benign stricture (OR, 3.044; P = 0.017) were independent prognostic factors of stent migration. 39 (78%) of 50 patients with stent migration were required second interventional management. The remaining 11 patients showed improvement of the strictures until the end of the follow-up.

CONCLUSION
The overall incidence of stent migration was 11.3%. Stent migration occurs most commonly in young age, capability to tolerate soft food without vomiting before the procedure, and in patients with benign stricture. Stent migration can be successfully managed by additional intervention.

CLINICAL RELEVANCE/APPLICATION
Patients with capability to tolerate soft food without vomiting before the procedure were considered contra-indication for esophageal stent placement.
**SSK24-02 • Metallic Stent Placement in Patients with Recurrent Malignant Obstruction in Surgically Altered Stomach**

Soo Hwan Kim (Presenter) ; Ho-Young Song MD ; Jin Hyoung Kim MD ; Jung-Hoon Park RT ; Young Chul Cho BS ; Ki Back Lee

**PURPOSE**
To assess the technical feasibility and clinical effectiveness of expandable metallic stent placement in 196 patients for recurrent malignant obstruction in surgically altered stomach.

**METHOD AND MATERIALS**
The 196 patients were treated with five different types of gastric surgery for gastric cancer: total gastrectomy (type 1) in 72 patients, distal gastrectomy with gastroduodenostomy (type 2) in 39 patients, distal gastrectomy with a Roux-en-Y gastrojejunostomy (type 3) in 21 patients, distal gastrectomy with a gastrojejunostomy (ie, Billroth type II operation) (type 4) in 49 patients, palliative gastrojejunostomy for unresectable gastric cancer (type 5) in 14 patients. Technical and clinical success, complications, and dysphagia score were evaluated and complications compared between fully covered stent and partially covered stent. Overall survival and stent patency rates were calculated according to the Kaplan-Meier method.

**RESULTS**
Stent placement was technically successful in 192 of 196 patients (97.9%) with 184 of 192 patients (95.8%) showing symptomatic improvement. In four patients, the guide wire could not pass through the stricture. The mean dysphagia score improved from 3.24 ± 0.64 to 1.48 ± 0.82 (P < 0.001). The complication rate was 25%. Incidence of stent migration was significantly greater in fully covered stents than partially covered stents (P < 0.001). The median survival and stent patency were 127 and 41 days, respectively.

**CONCLUSION**
Placement of expandable metallic stents in patients with recurrent cancer after surgically altered stomach technically feasible and clinically effective.

**CLINICAL RELEVANCE/APPLICATION**
Accurate knowledge of the type of surgical procedure performed and determination of the pattern of tumor recurrence are important for successful stent placement.

**SSK24-03 • The Use of Colorectal Stents to Avoid the Need for a Stoma When Treating Colorectal Cancer**

Victoria H Wilkinson MBChB, FRCR ; James N Hampton MBBS ; Rina George MRCS ; Junaid Saeed MBBS, MRCS (Presenter)

**PURPOSE**
To ascertain the rate of stoma avoidance in patients having a colorectal stent inserted as a bridge to surgical resection of their colorectal cancer.

**METHOD AND MATERIALS**
The records of patients who had a colorectal stent for large bowel obstruction between December 2007 and February 2012 in Sheffield Teaching Hospitals were retrospectively analysed.

**RESULTS**
121 colorectal stents were placed over a 4.5 year period. 19 patients had the procedure as a bridge to surgical resection of their colorectal cancer. 2 patients had a clinically unsuccessful stent and required subsequent Hartmann’s procedures. 11 patients had a primary anastomosis, of whom 2 had a stoma formed subsequently due to complications. Thus 9 of the 19 patients (47%) avoided a stoma at any point.

**CONCLUSION**
Only a minority of the colorectal stents placed in Sheffield are as a bridge to surgical resection of colorectal cancers with the majority being a palliative procedure. The use of stenting prevents some patients with surgically treatable disease needing a stoma. A significant number however still require stoma formation due to a failed stent or patient or surgical factors which prevent a primary anastomosis.

**CLINICAL RELEVANCE/APPLICATION**
Colorectal stenting as a bridge to surgical resection of a tumour can be used to avoid the morbidity associated with a stoma.

**SSK24-04 • Primary Mushroom-cage Radiologically Inserted Gastrostomy (RIG) without need for Conscious Sedation: 10-year Single Centre, Single Operator Experience in 206 Patients**

Stephen Gregory MBBS (Presenter) ; Ounali Jaffer MBBS, FRCR ; Dylan Lewis MBChB, FRCP ; Thoraya Ammar ; Paul S Sidhu MRCP, FRCR *

**PURPOSE**
To retrospectively review experience in primary insertion of the skin-level mushroom cage gastrostomy tube (Entristar TM, Covidien, MA, USA); under radiological guidance.

**METHOD AND MATERIALS**
Over a 10-year period (2002 to 2012), patients who underwent a primary RIG procedure by a single operator utilizing 4 gastropexy sutures, under local anaesthetic without conscious sedation were reviewed for procedural complications (minor or major), 30-day mortality and tube longevity. Indications for RIG were noted. Radiological reports, PACS images, biochemical and hematological parameters, clinical notes and discharge summaries were reviewed.

**RESULTS**
Our large number, single centre, single operator experience suggests that primary placement of this durable gastrostomy tube is safe with acceptable complication rates and no procedure related deaths in this cohort of 206 patients.

**CONCLUSION**
Primary insertion of gastrostomy tubes of the mushroom-cage type is safe and should be considered in all patients requiring RIG as a means for long term nutrition. Tube longevity is un matched.

**SSK24-05 • Parietal Contrast Enhancement as a Sign of Giant Cell Arteritis and as an Inflammatory Marker**

Jose Gutierrez MD ; Pedro Arguis MD (Presenter) ; Marcelo Sanchez MD ; Daniel Barnes ; Sergio Prieto ; Maria C Cid ; Ana I Garcia MD

**PURPOSE**
1. To evaluate the parietal contrast enhancement of the aorta as a sign of Giant Cell Arteritis (GCA), in recently diagnosed patients
2. To determine the relevance of parietal contrast enhancement as an inflammatory marker

**METHOD AND MATERIALS**
1. CT-angiography (CTA) was performed in 16 newly diagnosed biopsy-proven GCA patients
2. All patients had an evaluable CTA with arterial and venous phases
3. We defined significant enhancement as an increase of 20 UH or more, between the arterial and venous phases
4. 16 patients without evidence of arteritis were used as the control group. They were chosen for having similar clinical characteristics, and an equivalent burden of aortic calcifications, for each patient with GCA.

5. A CTA was performed one year later.

6. Levels of erythrocyte sedimentation rate (ESR) before the first CTA and a year later were tested.

RESULTS
1. All patients (100%) presented high levels of ESR at the moment of diagnosis and normal levels in follow up testing one year later.
2. 15 of 16 patients (93.75%) presented enhancement. None of the normal controls showed enhancement.
3. 11 of 15 patients (73.3%) presented absence of enhancement in the CTA acquired a year later. 3 of 15 (20%) were classified as non-evaluable (because the arterial wall had less than 2 millimeters), and only 1 (6.66%) of them were enhanced.

CONCLUSION
1. Parietal enhancement of the aorta is an excellent sign in non-treated GCA, and could be considered a diagnostic criterion, especially in patients with doubtful parietal thickening.
2. Parietal enhancement is useful as an inflammatory marker, as absence of enhancement in most of treated patients on CTA performed one year later (with normal ESR values) was observed, despite the fact that 11 of them still presented parietal thickening.

CLINICAL RELEVANCE/APPLICATION
Parietal enhancement could detect inflammation before the systemic markers, distinguish inflammatory thickening from parietal fibrosis, and determine important therapeutic decisions.

SSK24-06 • Technical Working Group Postmortem Angiography Methods (TWGPAM): Preliminary Results of a Multicenter Study for Validating Post-mortem Computed Tomography Angiography

Silke Grabherr (Presenter) ; Jochen M Grimm MD ; Axel Heinemann ; Giuseppe Guglielmi MD ; Krzysztof Wozniak ; Franziska Eplinius ; Fabrice Dedouit ; Florian Fischer MD ; Guy N Rutty ; Bruno Morgan MD ; Holger Wittig ; Patrice Mangin MD, PhD ; Richard Dinhofeer

PURPOSE
Post-mortem CT-angiography is an exam that aims to increase the sensitivity of post-mortem radiology. However, until today all applied methods have remained research. There is a need to define a standardized method and technical equipment in order to transform postmortem CT-angiography into a routine examination. With this aim, an international working group called TWGPAM (Technical Working Group Postmortem Angiography Methods) has been created in spring 2012. It consists of nine participating centers in six European countries. The goal of this prospective international multi-center study is to validate the technique, define its conditions and evaluate its advantages and limitations.

METHOD AND MATERIALS
In 2013, a study comparing findings of the recently developed Multi-phase Postmortem CT-Angiography (MPMCTA) with conventional autopsy has been published by our research group. Based on results of this study, the multicenter study was initiated. Each center performed MPMCTA on their cases using the standardized study protocol. 500 cases of medico-legal and clinical autopsies will be included.

RESULTS
Nearly all findings were visualized with both techniques. However, some findings can better or exclusively be visualized with one of them. MPMCTA has a higher sensitivity for identifying skeletal and vascular lesions. However, conventional autopsy gives more information about organ morphology and remains the only way to diagnose a vital vascular occlusion with certitude. Preliminary results of the ongoing study confirm these results.

CONCLUSION
MPMCTA can reveal important findings, not visible at conventional autopsy. However, some diagnoses remain autopsy-diagnoses. The multi-center study confirms these results and will enable the new technique to be accepted in the medico-legal community.

CLINICAL RELEVANCE/APPLICATION
Post-mortem CT angiography is a new technique allowing the diagnosis and visualization of vascular findings. This study enables the new method to become a routine investigation.

SSK24-07 • Utilization and Results of Adrenal Mass Biopsy in the PET/CT Era: 10-year Retrospective Analysis

Ari C Sacks MD (Presenter) ; Nisha Saianani MD ; Cheryl A Sadow MD ; Robert W Gordon MD ; Edmund Cibas MD * ; Stuart G Silverman MD *

PURPOSE
To evaluate indications for and results of percutaneous image-guided adrenal mass biopsy in the era of FDG-PET/CT.

METHOD AND MATERIALS
RESULTS
Ninety-four percutaneous adrenal mass biopsies were included in 92 patients (53 males, 39 females), average age 66.2 years (range 37-85). When comparing before (n=22) and after (n=72) January 2004, there was statistically significant difference in the number of pre-biopsy PET/CT scans 22.7% (n=5) vs. 65.3% (n=47) (p<.001).

CONCLUSION
Increasing use of PET/CT in the workup for malignancies has resulted in increase in number of adrenal mass biopsy being performed based on PET/CT referral, with change in indication from evaluation of an indeterminate adrenal mass to confirmation of malignancy.

CLINICAL RELEVANCE/APPLICATION
FDG-PET/CT imaging has changed the indications and results of image-guided percutaneous adrenal mass biopsy with increasing adrenal mass biopsies performed for diagnosis and confirmation of metastases.

SSK24-08 • Adequate Biopsy Sampling in the Molecular Treatment Era: Factors Predicting Successful Cancer Sampling for Genetic Tests

Mikhail Silk BS (Presenter) ; Jeremy C Durack MD ; Natasha Rekhtman ; Cyrus Hedvat MD ; Joseph E Ernjeri MD, PhD ; Stephen B Solomon MD *

PURPOSE
To determine the procedural factors that influence the success rate for biopsies taken for cancer genetic testing.

METHOD AND MATERIALS
We retrospectively reviewed all percutaneous image-guided needle biopsies taken for genetic testing by the interventional radiology department from January 2002 to March 2013 at a single institution. The number of biopsy reports deemed diagnostic by rapid touch preparation cytology and reported as insufficient for genetic testing were reviewed for reason for failure and biopsy type (FNA vs. Core).

RESULTS
The Interventional Radiology Department conducted 2417 biopsies [1536 (64%) core + FNA, 572 (24%) FNA only, 254 (11%) core only, and 15 (2%) unidentified in reports] for genetic testing during the observation period. In this cohort 248 (10%) deemed diagnostic by rapid touch preparation cytologic review at the time of biopsy did not contain sufficient tissue for genetic testing. Of the 248, 166 (67%)
by slide review contained too few tumor cells to advance to testing and 82 (33%) were test failures due to inadequate DNA. Of the 166
determined by the pathologist as insufficient to advance for genetic testing, 89 (54%) had a core + FNA sample taken, 56 (34%) were
FNA only, 18 (11%) were core only and 3 (2%) were unidentified in reports. Of the 82 failures that advanced to genetic testing 47 (57%)
had a core + FNA sample taken, 16 (20%) were FNA only, 11 (13%) were core only, and 8 (10%) were unidentified in reports.

CONCLUSION
Genetic testing is an increasingly important aspect of cancer biopsies. Insufficient DNA quantity or poor DNA quality are relatively
common reasons for genetic testing failure. We found that when genetic testing is planned, biopsies without a core component were more
likely to be insufficient than those that did. Improved systems for rapid assessment of DNA quantity at the time of biopsies may improve
the rate of adequate sampling for genetic testing.

CLINICAL RELEVANCE/APPLICATION
When genetic testing is planned adding a core biopsy has a higher chance of being adequate and reduces the need for repeat sampling
due to inadequate tumor tissue.

SSK24-09  •  3D-Evaluation of Tumor Necrosis in HCC Patients after TACE - A Radiologic-Pathologic Correlation

Julius Chapiro  MD (Presenter) ; Laura Wood  MD ; Mingde Lin  PhD * ; Toby Charles Cornish  MD, PhD ; Vania Tacher  MD ; Jean-Francois H Geschwind  MD *

PURPOSE
To evaluate the precision of a three-dimensional (3D) HCC tumor necrosis assessment using quantitative EASL (qEASL) and volumetric
RECIST (vRECIST), we correlate radiologic and pathologic findings in patients with HCC, who underwent tumor resection (TR) or liver
transplantation (LT) after TACE.

METHOD AND MATERIALS
This retrospective study included 17 patients with HCC, who underwent TACE and received contrast-enhanced MR (CE-MRI) imaging
within 90 days prior to TR or LT. A semiautomatic 3D volumetric segmentation and tumor volume measurement was performed on the
last CE-MRI scans before TR/LT. The total tumor volume was expressed as vRECIST. The volume of enhancing tumor was measured using
qEASL as a percentage of the total tumor volume. The tumor necrosis was thus defined as 1 – qEASL%. The treated lesions were
evaluated by gross and histopathology. The percentage of tumor necrosis was assessed following serial sectioning and microscopically
analyzed using hematoxylin and eosin stains. Correlation coefficients were calculated to compare the percentage of necrosis shown on
pathology with the percentage of necrosis calculated with qEASL.

RESULTS
The mean interval between latest MRI and LT/TR was 42.5 +/- 40.5 days. The mean interval between latest TACE and LT/TR was 128 +/-
94 days. A total of 9 patients (52.94%) received DEB-TACE, 8 patients (47.06%) received conventional TACE treatment. 6 patients
(35.3%) underwent TR and 11 patients (64.7%) received a LT. The mean tumor necrosis on qEASL was 76.94 % (Range 37.61–99.91%) and
correlated with statistical significance with the tumor necrosis on pathology, with an R-value of 0.93 (95% confidence interval (CI),
0.7678-1.034; p < 0.001). The treated lesions were correlated with gross and histopathology (the gold standard in tumor response assessment). Thus,
qEASL can be a valuable imaging-based tool to measure tumor response.

CLINICAL RELEVANCE/APPLICATION
The close radiologic-pathologic correlation of qEASL necrosis assessment validates this 3D tool for a standardized clinical use. Thus,
qEASL has the potential to complement existing response criteria.

PET Imaging of Neuroendocrine Tumors-Clinical State of the Art

Wednesday, 12:15 PM - 12:45 PM  •  SS03AB

CL-MIE-WESA
Shadi A Esfahani , MD, MPH
Pedram Heidari , MD
Umar Mahmood , MD, PhD

PURPOSE/AIM
18F-FDG, despite its widespread use in oncologic assessment, has limited application in imaging of neuroendocrine tumors (NET) a broad
range of PET tracers has been developed that range from small molecules to labeled peptides. This overview encompasses
1. Importance of PET imaging in NET 2. Limitations of 18F-FDG in imaging of NET 3. Various classes of receptor PET tracers including small
molecules, and peptides 4. A detailed description (including advantages and limitations) of tracers in each class with potentially higher
clinical impact in NET 5. Future directions in development of novel PET tracers for NET.

CONTENT ORGANIZATION
This study shows a high precision of the 3D semiautomatic tumor segmentation software and qEASL assessment in measuring HCC tumor
necrosis after TACE, which strongly correlates with gross and histopathology (the gold standard in tumor response assessment). Thus,
qEASL can be a valuable imaging-based tool to measure tumor response.

CONCLUSION
The close radiologic-pathologic correlation of qEASL necrosis assessment validates this 3D tool for a standardized clinical use. Thus,
qEASL has the potential to complement existing response criteria.

Molecular Imaging - Wednesday Posters and Exhibits (12:15pm - 12:45pm)

Wednesday, 12:15 PM - 12:45 PM  •  SS03AB

CL-MIS-WEA  •  AMA PRA Category 1 Credit ™: 0.5
HOST
Donna J Cross , PhD *

CL-MIS-WEA1  •  Preliminary Study of Oxygen-enhanced Longitudinal Relaxation in MRI: A Potential Novel Biomarker of
Oxyg enation Changes in Multiple Myeloma

Ettore Squillaci  MD (Presenter) ; Francesca Bolacchi ; Marco Nezzo  MD ; Marco Antonicoli ; Giovanni Simonetti  MD

PURPOSE
To investigate the significance of the oxygen-enhanced longitudinal relaxation in MRI (R1) of diffuse spinal bone marrow infiltration in
patients with Multiple Myeloma

METHOD AND MATERIALS
Twenty-one patients with diffuse multiple myeloma underwent measurement of lumbar bone marrow R(1) while breathing medical air
...
RESULTS
Baseline Delta(1) showed a statistically significantly higher with respect to control subjects (0.058 vs 0.021 s(-1)). Peak enhancement percentage (Emax) showed a positive correlation with Delta(1) (r = 0.62, p < 0.01). No correlation was found between Emax and Delta(1) (p > 0.05). A negative correlation was found between the TTP values and Delta(1) (r = -0.58, p < 0.01). A decrease in the Emax and Delta(1) values was observed with increased TTP values after treatment in all of the 16 patients who responded to treatment with respect to non responders (p < 0.01). Baseline Delta(1) values also showed a negative correlation with recovery time as assessed by laboratory data (r = -0.756, 95% CI= -0.938- -0.241, P=0.11)

CONCLUSION
These results provide evidence that oxygen-enhanced longitudinal relaxation can monitor changes in tumor oxygen concentration. The technique shows promise in identifying hypoxic regions within tumors and may enable spatial mapping of change in tumor oxygen concentration.

CLINICAL RELEVANCE/APPLICATION
Oxygen-enhanced longitudinal relaxation in MRI of the bone marrow can monitor changes in tumor oxygen concentration and can be used as a prognostic biomarker for response evaluation in MM.

CL-MIS-WE3A • A Peptide Based Molecular Probe for CXCR4 Targeted Oncological MR Imaging
Liang Zhu MD (Presenter); Jing Lei; Yonglan He MD; Huadan Xue MD; Zhengyu Jin MD

PURPOSE
To construct a CXCR4 targeted iron oxide nanoparticle for cancer MR imaging, and to evaluate its binding specificity to various cancer cells and its ability to quantify CXCR4 expression level by altering MR T2/T2* signal in vitro.

METHOD AND MATERIALS
A novel CXCR4 binding peptide (Pep12) was introduced for targeted MRI. Immuno-fluorescence studies and flow cytometry were introduced to test its binding affinity to tumor cells expressing CXCR4, with CXCR4 monoclonal antibody as a positive control, and a random peptide as a negative control. The iron oxide nanoparticle was synthesized and conjugated to Pep12. Its cellular toxicity was tested by MTS. Pullulan stain were done to confirm its binding specificity to various cancer cells(A549, PANC-1 and MCF-7). Pep12-USPIO incubated with cancer cell suspensions were scanned at 1.5T MR.

RESULTS
Pep12 had great binding affinity to tumor cells expressing CXCR4, which is comparable to CXCR4 monoclonal antibodies. Pep12-USPIO forms stable aqueous colloid in water/PBS solution. The hydro diameter was 80.5 nm. MTS tests proved its low cellular toxicity. Pullulan stain showed pep12-USPIO could bind to tumor cells in a concentration dependent way, while USPIO alone could not. A significant T2/T2* signal dropout was observed in Pep12-USPIO incubated cell suspension, and the value of T2/T2* change has positive correlation to the expression level of CXCR4 in different cancer cells.

CONCLUSION
A peptide based MR contrast agent was developed for CXCR4 targeted imaging, it could specifically bind to CXCR4 expressing cells and produce MR signal change. The value of T2/T2* change might be used for the prediction of CXCR4 expression and somehow, tumor metastasis potential. Further studies will be carried out in mice xenograft models, to see its pharmacokinetics, biological toxicity and ability to detect tumor metastasis potential in vivo.

CL-MIS-WE3A • A Preliminary Study Evaluating the Functional Diffusion Map for Early Evaluation of TACE Treatment Response in Patients with Liver Carcinoma
Yu-Fang Chen (Presenter); Yong-Bo Yang; He Wang PhD; Dong Chen; Xing-An Long; Hong-Yan Cheng

PURPOSE
To investigate the value of Functional Diffusion Map (FDM) 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 they are all treated with TACE. T1-weight and Diffusion Weighted Imaging (DWI, b=600) were performed before and 4 weeks after treatment. The three-color FDM was obtained from the registration of DWI (DWI, b=600) were performed before and 4 weeks after treatment. The three-color FDM was obtained from the registration of DWI images to their own pre-treatment T1-weighted images by a 12-degree of freedom transformation using FSL (FMRIB, Oxford, UK). In FDM images, the Red voxels (VR) have the ADC increased significantly, blue voxels (VB) have the ADC decreased significantly, and green voxels (VG) have the ADC did not change significantly, where total voxels (VT= VR+VB) for which the ADC changed significantly. Each patient was examined by dynamic contrast-enhanced CT or MRI every 3 months during the follow-up.

RESULTS
CONCLUSION
FDM could evaluate the early therapeutic response in patients with liver carcinoma after TACE, and showed a fairly close association with those by the long-term conventional means of imaging. It could be a powerful and promising biomarker and may provide an early and important reference for the clinical protocols.

CLINICAL RELEVANCE/APPLICATION
FDM could be a powerful and promising biomarker for the early evaluation of TACE treatment response and may provide early and important reference for the clinical protocols.
**PURPOSE**
Semiquantitative analysis of striatal dopamine transporter (DAT) specific uptake is a more subjective way than visual interpretation of DAT images. Due to CT-based data can improve attenuation correction accuracy for SPECT applications as well as delineate ROI. The aim of this study was to evaluate the decreased degree of the striatium by semiquantitative method.

**METHOD AND MATERIALS**
Fifteen patients with Parkinson's disease and four healthy volunteers served as control were enrolled in this study. Parkinson's disease was diagnosed according to generally accepted criteria. All the enrolled subjects were injected with $30mCl 99mTc-TRODAT-1 and brain SPECT studies were commenced 3 hours later. With dual-head camera equipped with LEHR collimators, data were acquired. Images were reconstructed using the iterative method and CT-based attenuation correction. Fixed regions of interest were marked for the caudate nucleus and putamen of each hemisphere, on composite images of the 16 slices (40.3mm) containing the basal ganglia activity. The putamen, and caudate uptake ratios (ratioPO and ratioCO) were estimated as mean counts of the putamen, and caudate ROIs divided by means of the occipital cortices (OC), that is, ratioPO: (putamen)/OC, and ratioCO: (caudate)/OC, respectively. We even half divided the caudate nucleus and putamen into two groups as the upper and lower groups. The lower putamen, caudate uptake ratios (ratioPO1, and ratioCO1) and the upper putamen, caudate uptake ratios (ratioPO2, and ratioCO2) were estimated. We define the uptake ratio in right brain (RatioPO, RatiaCO, RatiaPO1, RatiaCO1, RatiaPO2, and RatiaCO2) and vice versa in left brain.

**RESULTS**
As compared to healthy subjects, the uptake ratio in the Parkinson's disease showed marked decreased radioactivity in some areas, especially in the lower putamen. With t test, we got significant p value ($p<0.05$) in this study.

**CONCLUSION**
The study demonstrate that the lower putamen may be the early target in Parkinson's disease, whereas those to the caudate nucleus are relatively spared.

**CLINICAL RELEVANCE/APPLICATION**
Under the SPECT/CT system with the reconstructed images by CT attenuation correction, the 'fixed volume ROI' over the basal ganglion can serve as a semiquantitative method in clinical practice.

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**CL-NMS-WE2A ● The Clinical Impact of DaTscan Imaging in the Management of Clinically Uncertain Parkinsonâ€™s Disease in a Secondary Hospital Setting**

**Thomas J Gordon BSc (Presenter); Vineet Prakash MBCh; Renuka Govinda-Rajoo MBCh; Ranbir Sandhu MBBS, MRCS; Joann Simpson; Jan Coebergh MD; Susanna Davidson MBCh, FRCP**

**PURPOSE**
DaTscan imaging has an established diagnostic role in neurology for differentiating parkinsonian syndromes from other aetiologies. This imaging is now being used in secondary referral centres. DaTscans are relatively expensive. We evaluate its clinical impact in patients management for this secondary care setting.

**METHOD AND MATERIALS**
- Retrospective standards audit
- 1 year 2011-12, with 6 month clinical follow-up.
- Mean age of patients: 77 years old
- 20 patients were selected at random out of all patients who had a DAT scan over 12 months
- Overall positive imaging findings were recorded with final clinical disease diagnosis
- Image findings were correlated with any change in the management focusing on stopping or starting medication, triggering of supplementary investigations

**RESULTS**
Overall Findings:
- The DAT scan was positive for Parkinson’s disease in 65%.
- When positive, the DAT scan led to a change in management in 55%
- This change involved:
  - Starting treatment in 35%
  - Change in dose or medication regimen in 20%
- The DAT scan was negative for Parkinson’s disease in 35%.
- 30% of patients were on pre-existing treatment for Parkinson’s disease prior to the DAT scan.

**CONCLUSION**
For the investigation of clinically uncertain Parkinson’s disease in a secondary hospital setting, preliminary results reveal DaTscans were positive in 65% of patients and in these patients led to a change of management in 55% of subjects. 30% of patients were on pre-existing treatment for Parkinson’s disease prior to the DAT scan. Further data will be presented at the meeting summarizing this preliminary finding.

**CLINICAL RELEVANCE/APPLICATION**
DaTscan imaging is a useful investigation in the tertiary care management of a challenging neurological condition. It may also be of clinical utility in the secondary care domain.

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**CL-NMS-WE3A ● Assessment of Myocardial Damage and Prediction of Future Cardiac Function in Patients with Acute Myocardial Infarction Using Sestamibi Early Washout Imaging**

**Ryo Tanaka (Presenter); Tokuo Kasai; Tomoharu Nakamura; Keiko Yamamoto**

**PURPOSE**
The aim of this study is to elucidate the usefulness of early phase of washout rate of MIBI in predicting future cardiac functional recovery.

**METHOD AND MATERIALS**
Forty-two AMI patients were hospitalized within 24 hours of the onset and underwent successful PCI then enrolled in this study. MIBI SPECT was obtained in sub-acute phase and repeated 6 months later. Images were acquired at five minutes (0h), one hour (1h), and six hours (6h) after MIBI injection. Washout rate was calculated as washout index (WI) between 0h and 1h, 1h and 6h, respectively.

**RESULTS**
There were 18 patients whose WI showed 0 from 0h to 1h (group A) and 24 patients whose WI was accelerated (group B) (0 vs. 13.7 ± 3.1). p No differences were found in the number of perfusion defect segments (NPSD) on SPECT among 0h, 1h and 6M in group A. On the other hand, significant differences were found between 0h and 1h, 1h and 6M, in group B (3.8 ± 3.0 vs. 5.0 ± 3.1). p Group B demonstrated much higher peak CKP value than that in group A (4074 ± 1627 IU/l vs. 1457 ± 976 IU/l). p LVEF improved from 55.7 ± 12.1% to 63.2 ± 8.8% over six months in group A. On the other hand, no improvement was found in group B (from 46.7 ± 11.6% to 49.3 ± 11.6%).

**CONCLUSION**
FDG PET/MRI: Workflow Solutions for Oncologic Staging

Alexander R Guimarães MD, PhD (Presenter) *; Michael A Blake MBCh *; Onofrio A Catalano MD; Dushyant V Sahani MD; Bruce R Rosen MD, PhD *; Ciprian Catana MD, PhD

PURPOSE/AIM
PET/MRI is a cutting edge imaging modality that combines simultaneous acquisition of PET with MRI. In patients with pelvic (e.g., rectal, and cervical cancer), whole body (e.g. lymphoma), breast, and thoracic (e.g. pleural) malignancies, PET/MRI provides high spatial resolution and soft tissue contrast required for T staging, fused with whole body FDG PET for N (nodal) and M (metastatic) staging. This education exhibit will demonstrate the decision algorithms and protocol design considerations needed for a complete FDG PET/MRI in order to properly stage these malignancies in imaging times less than one hour, thereby producing a potentially time-saving and cost-saving alternative.

CONTENT ORGANIZATION
We discuss the unique attributes of protocol development in order to maximize the benefits of PET/MR for complete staging of patients with whole body, thoracic, breast, and pelvic malignancies. We will demonstrate the ability of combined PET/MR to stage accurately the primary malignancy, in addition to liver and in bone marrow. We will illustrate these in example case studies.

SUMMARY
Combined PET/MR offers a single modality, low radiation, well-tolerated solution to staging patients with various malignancies because of its higher sensitivity and specificity over existing imaging modalities.
Haiyan Wang MD (Presenter) ; Bin Zhao MD

PURPOSE
Objectives: To evaluate the clinical value of low-dose dual-source computed tomography (DSCT) in infants and children with congenital airway abnormalities.

METHODOLOGY AND MATERIALS
Thirty-six patients (median age: 20 months, mean age: 30.5 months, range: 2 months to 12 years; male 20; mean weight: 14.8kg) with congenital airway abnormalities underwent low-dose DSCT non-enhanced scan or angiography. Bronchoscopy was performed in 29 patients, and surgeries were performed in 9 patients (include 2 patients underwent bronchoscopy and surgery). The accuracy was calculated based on the bronchoscopy and surgical findings. The overall imaging quality was evaluated on a five-point scale.

RESULTS
A total of 40 separate congenital airway abnormalities were confirmed. Three tracheobronchomalacia were missed and one tracheobronchomalacia was misdiagnosed as congenital tracheal stenosis (CTS) by DSCT. The accuracy, sensitivity, specificity, positive predictive value and negative predictive value were 98.0%, 90.0%, 99.5%, 97.3% and 98.1%, respectively. The average subjective image quality score was 4.4±0.8. The mean dose-length product (DLP) was 17.50±9.26 mGy.cm. The mean effective dose was 0.33 ± 0.16 mSv.

CONCLUSION
Low-dose DSCT with a very low effective radiation dose allows the accurate diagnosis of congenital airway abnormalities in infants and children. It has great promise to become a commonly used technique for congenital airway abnormalities.

CLINICAL RELEVANCE/APPLICATION
Low-dose dual-source CT utilizing low radiation dose while ensuring proper image quality in infants and children with congenital airway abnormalities.

Yanhua Duan MD (Presenter) ; Ximing Wang PhD

PURPOSE
To investigate the performance of high-pitch spiral mode for dual-source CT in pediatric patients with congenital bronchopulmonary dysplasia and tracheoesophageal fistula without breath holding.

METHODOLOGY AND MATERIALS
A total of 20 consecutive pediatric patients (age, 30±7.5 days) with suspected tracheal diseases or esophageal diseases underwent 128-slice dual-source CT of the chest in a high-pitch spiral mode, 6 of them performed with enhanced CT, and the other 14 pediatric patients performed with non-enhanced CT scanning. Scan parameters were as follows: pitch=3.0, 2*128*0.6 mm slice acquisition, 0.28 seconds gantry rotation time, care Dose 4D and care kV on. Images were reconstructed with a slice thickness of 0.75 mm and SAFIRE-algoration. No breathing instructions were given to all pediatric patients, and sedation was administered into the 6 pediatric patients, who underwent enhanced CT, and sedation was not given to the other 14 children who underwent non-enhanced CT. Image quality was assessed focusing on motion artifacts and delineation of the vascular structures and the lung. Radiation dose values were calculated from the dose length product provided in the patient protocol. The diagnostic efficacy was confirmed by bronchoscopy, esophagoscopy or surgical findings.

RESULTS
Diagnostic images were obtained in all patients. 5 patients with Tracheal Bronchus; 4 patients with bridging bronchus (pulmonary artery slings were detected in 2 of them), 7 patients with tracheal stenosis (pulmonary artery slings were detected in 3 of them), 2 patients were diagnosed with right bronchus obstruction and pulmonary stenosis, and 2 patients with tracheoesophageal fistula. Compared with bronchoscopy, esophagoscopy or surgical findings, the diagnostic efficacy was 100%. The effective dose was 0.39±0.12 mSv.

CONCLUSION
High-pitch chest CT is a promising method to provide good image quality making sedation or breath holding for the chest CT examination in pediatric patients unnecessary, whereas maintaining low radiation dose value.

CLINICAL RELEVANCE/APPLICATION
High-pitch chest CT is a precise method for pediatric patients with congenital bronchopulmonary dysplasia and tracheoesophageal fistula.

Hannele M Niiniviita MSc (Presenter) ; Erkki J Svedstrom MD, PhD ; Jarmo Kulmala DPhil

PURPOSE
Image quality and radiation dose are optimized in imaging chest X-ray of premature infants with variation traditional parameters and extra filters.

METHODOLOGY AND MATERIALS
The X-ray unit was Mobiett XP mobile unit (constant filter inside the unit 2.5 mm Al). Fuji sensitive one size image plate HR-V and Fuji FCR Capsula XLII reader was used. The additional filtration was either 1mmAl +0.1mmCu or 1mmAl + 0.2 mmCu. In mobile unit was the own DAP meter. Clinical X-ray imaging was done in department of premature infant. The weight of infants varied from 1000 g to 4000 g. Absolute doses were measured with thermoluminescent dosimeters (TLD) placed in ATOM pediatric phantom (newborn size). The five TLDs were placed on thyroid, lungs (2 pieces), rib, sternum and ovary. The image quality was estimated by five radiologists by comparing two blinded images, where another was taken with and the other without additional filtration. The image quality was compared on 15 image pairs. The radiologist evaluated from images overall impression, parenchyma, pleura and catheter by grading if the quality was as equally good on both images or if one of them was better.

RESULTS
On four image pairs radiologist estimated the images taken with normal parameters and without additional filtration to be better on all disciplines but on the last 11 image pairs at least one radiologist ranked one area to be better at the images taken with additional filtration. But all images were diagnostics. The TLD measured radiation doses varied between 2 to 196 mGy depending on the organ, weight and image parameters. Optimized imaging parameters are found comparing the evaluated image quality and measured organ doses. The DAP values correlated with the absolute dose values.

CONCLUSION
Image quality and radiation dose can be optimized with here presented model and in clinical practise it is possible to find imaging parameters (imaging quality adequate and radiation dose low) according to infant size.

CLINICAL RELEVANCE/APPLICATION
Radiation dose of chest x-ray studies of newborns and premature can be lowered using additional filtration without loss of diagnostic information.
of the Graf Method with Acetabular Epiphyseal Depth Measurement

Sara R Teixeira MD ; Vitor F Dalto MD (Presenter) ; Orlando S Zogbi Neto MD ; Daniel Maranho ; Jose B Volpon ; Marcello Hogueira-Barbosa MD, PhD

PURPOSE
To evaluate if the acetabular epiphyseal distance (AED) has feasibility and reproducibility comparable to the Graf method

METHOD AND MATERIALS
A retrospective study from January 2010 to March 2012 included 115 patients (230 hips) at risk for developmental dysplasia of the hip (DDH) and underwent ultrasound (US) evaluation between third and fourth week of life. The Graf modified classification was assessed and the hips were distributed in two groups: non-dysplastic (I, IIA) and dysplastic hips (IIC, III, D, IV). AED in coronal neutral and flexion views was assessed by measuring the distance between the acetabular fossa and the medial surface of the femoral head. For both methods there were two readers, one junior and one experienced radiologist (one and seven years of practice, respectively).

Interobserver reliability was calculated by intraclass correlation coefficient (ICC).

RESULTS
213 hips were non-dysplastic (ND) and 17 dysplastic (DH). In neutral position, AED in ND was 3.09 (95% CI 3.09-3.35) and in DH was 6.29 mm (95% CI 5.09-7.50). AED measured in flexion view was 3.64 (95% CI 3.60-3.79) and 7.59 (95%CI 6.09-9.09), respectively. AED measurements between both groups were significantly different (95% CI -3.623 to -2.531). ICC between measurements of the AED of the senior and the junior reviewers, both on flexion (ICC, .864, 95% CI .826-.893) and on neutral views (ICC, .852 95% CI .811-.885) was almost perfect. For Graf angles ICC was .842 (95%CI .800-.876) for alfa angle, and .760 (95%CI .700-.810) for beta angle.

CONCLUSION
Ultrasound is worldwide-accepted for screening developmental dysplasia of the hip (DDH). It tends to reduce the rate of late diagnosis and the need for surgical interventions. AED can be used for differentiating dysplastic from non-dysplastic hips with satisfactory interobserver agreement. Graf classification is used in many countries, but it depends on a long learning curve to correctly diagnose a dysplastic hip.

CLINICAL RELEVANCE/APPLICATION
AED may be an optimal screening parameter as it is easier to perform, reproducible, and does not depend on the standard sectional view proposed by Graf, nor on sonographer`s experience.

CL-PDS-WESA • Role of Contrast Enhanced Ultrasound (CEUS) in the Identification and Evaluation of Localized Low-energy Abdominal Trauma in a Pediatric Population: Our Initial Experience

Guendalina Menichini MD ; Margherita Trinci MD ; Vincenza Di Giacomo ; Stefania Ianniello ; Ilenia Di Gianpietro ; Vittorio Miele MD (Presenter) ; Barbara Sessa MD

PURPOSE
To assess the feasibility and reproducibility of CEUS in the study of low-energy abdominal trauma compared to baseline-US and MDCT in pediatric patients. Illustrate the different CEUS patterns and focus on the typical direct and indirect signs. Discuss advantages, limits and most common pitfalls of CEUS.

METHOD AND MATERIALS
RESULTS
35/127 patients were considered eligible to be included in the study. 3/35 patients were negative at MDCT examination. In the remaining 32 patients, MDCT depicted 35 lesions (left kidney n=11;right kidney n=3;spine n=9;pancreas n=2;liver n=5). Active bleeding was present in 4 cases, urinoma in 1. CEUS identified 30/35 lesions and no lesions in the patients with negative CE-MDCT findings. CEUS missed 3 active bleedings and the urinoma. Unenhanced US depicted 9/35 parenchimal lesions. Thus, the diagnostic performance of CEUS was much better than that of US, as sensitivity, specificity, PPV, NPV and accuracy in the evaluation of parenchimal lesions were 96.6%,100%,100%,99.3% and 99.4% for CEUS and 30%,100%,100%,87.3% and 88% for US.

CONCLUSION
CEUS is more sensitive and accurate than baseline-US and almost as sensitive as CT in the identification and characterization of blunt abdominal trauma. Moreover this examination can be performed at the patient's bedside, without moving the traumatized child to the CT section, representing a useful alternative to CT in the follow-up of hospitalized children with a known abdominal injury. The limits were active bleeding, urinomas and pancreatic lesions.

CLINICAL RELEVANCE/APPLICATION
According to ALARA's criteria, our data suggest that CEUS should be considered as a useful tool in the assessment and monitoring of blunt abdominal trauma in children.

CL-PDE-WESA • Spectrum of Vascular Findings at Initial Ultrasound Post Pediatric Liver Transplant: Normal Variation and Vascular Complications

Lucy H Jamieson MD ; Bo Arys MD (Presenter) ; Gavin Low MBChB, FRCR ; Ravi Bhargava MD * ; Surekha Kumbla FRANZC ; Jacob L Jaremko MD

PURPOSE
Liver transplant Doppler ultrasound is routinely performed on post-operative day 1 to detect complications including rejection, vascular thrombosis, or biliary disruption. However, there is a lack of published data defining the normal range of ultrasound appearances in this setting. To enable evidence-based distinction between normal post-operative variation and complications, we compared Doppler ultrasound findings to clinical outcomes post liver transplant at two quaternary pediatric transplant centres.

METHODS
This ethics-approved two-centre retrospective review included children aged 0-10 years with (1) liver transplant 2002-2012 for any indication, (2) post-operative Doppler ultrasound, (3) operative reports, (4) clinical outcome data 1 year post transplant. From ultrasound performed Day 1 post transplant, we evaluated waveforms and Doppler flow parameters of common hepatic artery (CHA), intrahepatic arteries, hepatic veins (HV), main portal vein, and IVC at HV anastomosis. We recorded outcomes from clinical charts.

RESULTS
Of 111 patients, 66 (60%) had at least 1 post-operative complication, 41 (37%) requiring additional surgery. There were 30 (27%) vascular and 46 (41%) non-vascular complications. The most common vascular complications were thrombosis of common hepatic artery (CHA, 7/111) or portal vein (PV, 6/111), and hepatic venous (HV) complications (3/111). The most common non-vascular complications were biliary strictures. CHA velocity and resistive index were decreased in patients with arterial complications. Portal venous complications manifested mainly as absent portal venous flow. The normal HV flow was multiphasic and rapid, with peak velocity higher on average than in the CHA. Decreased HV velocity, although nonspecific, was associated with development of arterial and portal venous complications.

CONCLUSION
In this study we correlated Doppler ultrasound and clinical results following pediatric liver transplant in a relatively large two-centre cohort. This allowed us to construct a reference frame of ultrasound findings associated with successful outcomes or post-operative complications. An understanding of the age-specific range of expected post-transplant findings is essential to accurately detect early signs of complications, which can be crucial for graft and patient survival.
SOREDEX: SCANORA 3Dx - New CBCT Unit for in-office ENT Imaging

Wednesday, 12:15 PM - 01:00 PM • South Building Hall A Booth 3314

EPT10
Matti Linnosaari
Bob Diffin
Chris Bope

LEARNING OBJECTIVES
SCANORA 3Dx is a new Cone Beam CT system for the Head and Neck area. It is targeted especially for maxillofacial and ENT (Ear, Nose, Throat) diagnostic imaging. In the presentation, general features of the product are described, the benefits of 3D imaging in a point-of-care environment for ascertaining the continuity of care are discussed and software features are demonstrated.

Breast - Wednesday Posters and Exhibits (12:15pm - 12:45pm)

Wednesday, 12:15 PM - 12:45 PM • Lakeside Learning Center

LL-BRS-WEA • AMA PRA Category 1 Credit ™:0.5
Host
Emily F Conant, MD *

LL-BRS-WE1A • Is there a Correlation of Breast Parenchymal Enhancement in MRI and SUVmax in 18FDG Breast PET-CT?

Doris Leithner (Presenter) ; Pascal A Baltzer MD ; Heinrich Magometschnigg ; Georg J Wengert MD ; Thomas H Helbich MD * ; Katja Pinker-Domenig MD

PURPOSE
Breast parenchymal enhancement (BPE) is considered to reflect tissue proliferative activity due to hormonal stimulation. It is regarded as a detrimental factor on diagnostic accuracy and, on the other hand, as a risk factor for breast cancer. Our purpose was to evaluate if breast parenchymal enhancement (BPE) with contrast-enhanced MRI of the breast at 3T correlates with quantitative maximum Standardized Up-take Values (SUVmax) in 18FDG breast PET-CT.

METHOD AND MATERIALS
130 patients undergoing 18FDG PET-CT and 3T CE-MRI of the breast due to BIRADS 4 or 5 imaging findings were included in this IRB approved prospective study. Examinations were scheduled no longer than 3 days apart. The MRI protocol included a contrast-enhanced 3D-T1-w sequence before and after application of a standard dose of 0.1 mmol/kg Gd-DOTA (Dotarem®). In all patients, a prone PET-CT dataset over the breasts was acquired allowing the same patient geometry as with MRI. Patients were injected with approximately 300 MBq 18FDG. Scanning was started 45 min after injection. CT data was used for attenuation correction. In all patients BPE and breast parenchyma SUVmax of the normal contralateral breast was recorded. BPE was qualitatively assessed by two independent readers and graded as none, mild, moderate and marked. Reader 1 re-assessed all cases. Appropriate statistical tests were used to assess correlation of BPE and SUVmax, inter- and intra-reader agreement.

RESULTS
There was no BPE in 58, mild in 54, moderate in 14 and marked in 4 patients. Due to the small number of marked BPE, moderate and marked BPE were considered together (n=28). SUVmax for patients with no BPE was 1.56 (SD 0.6), for mild BPE 1.9 (SD 0.6), for moderate/marked 2.3 (SD 0.6). SUVmax increased with BPE and there was a significant difference in SUVmax for patients with none and mild BPE (p=0.003) and none and moderate/marked BPE (p=0.5).

CONCLUSION
SUVmax of normal breast parenchyma is positively correlated with BPE in CE-MRI of the breast.

CLINICAL RELEVANCE/APPLICATION
As higher SUVmax is expected in patients with moderate/marked BPE, a possible masking effect of lesions in such cases has to be considered.

LL-BRS-WE2A • Utility of Breast MRI in Preoperative Planning for Free Flap Breast Reconstruction

Nidhi Sharma MD (Presenter) ; Melanie Chellman-Jeffers MD ; Graham S Schwarz

PURPOSE
Noninvasive angiographic imaging modalities have been increasingly used to aid in flap design and perforator vessel mapping in free flap breast reconstruction. Few studies, however, have addressed recipient vessel mapping.

Standard breast MRI is an integral tool for oncologic treatment planning at Cleveland Clinic. It is performed as part of our institutional protocol to evaluate extent of disease, and is an increasingly prominent component of national treatment guidelines. A majority of our patients obtain breast MRI prior to mastectomy and breast reconstruction. The aim of this study is to evaluate how intraoperative internal mammary (IMA/IMV) vessel measurements correlate with breast MRI measured vessel caliber.

METHOD AND MATERIALS
Following IRB approval, IMA and IMV diameters were prospectively measured intraoperatively at anticipated microanastomotic sites with micro-calipers just prior to division of the vessels. An anatomic reference point was established. T1-weighted, contrast enhanced, and coronal STIR sequences were obtained on a 1.5T Siemens MRI unit with a dedicated breast coil and images reviewed on an AGFA.
workstation. Using standard workstation measurement tool software a resident and a senior breast radiologist independently noted vessel diameters at corresponding anatomic reference points. Correlation models evaluating intraoperative and MRI measurements were developed and analyzed for significance using methods of repeated measures mixed models.

RESULTS
Thirty one vessels were evaluated (13 arteries, 18 veins) in 8 consecutive women undergoing free flap breast reconstruction (5 bilateral, 3 unilateral). Intraoperative mean IMA diameter was 2.8 mm (range 2 - 4 mm), mean IMV1 diameter was 3 mm (range 2 - 4.5 mm) and mean IMV2 diameter was 2.1 mm (range 1.5 - 3 mm). Respective MRI mean diameters were: IMA 3 mm (range 2.1 - 4 mm), IMV1 2.8 mm (range 2 - 4.8 mm) and IMV2 2.3 mm (range 1.6 - 2.9 mm). Significant correlation existed between intraoperative and MRI measurements for both arteries and veins (arteries r = 0.77, p=0.0056 and veins r=0.7, p=0.0045).

CONCLUSION
Breast MRI measurements correlate well with actual IMA and IMV diameters, thereby, allowing vessel size prediction as well as anatomic localization.

CLINICAL RELEVANCE/APPLICATION
In centers using this modality, standard Breast MRI may be a useful adjunct in free flap planning without adding to cost of care or subjecting patients to ionizing radiation.

LL-BRS-WE3A ● Invasive Breast Cancer in Women 35 Years of Age or Younger: MR Imaging and Clinicopathologic Features

Jin You Kim MD ; Ji Won Lee MD ; Suk Kim MD ; Suck Hong Lee ; Ji Eun Jo (Presenter)

PURPOSE
Breast cancer rarely occurs in women under age 35. The purpose of this study was to retrospectively evaluate magnetic resonance imaging (MRI) findings and clinicopathologic characteristics of invasive breast cancer in young women (age <35) and to compare them with those of breast cancers in less young premenopausal women (35 = age = 45).

METHOD AND MATERIALS
A total of 270 invasive breast cancers in 266 premenopausal women 45 years and younger who underwent preoperative breast MRI were identified between February 2009 and February 2013. Subjects were divided into two age groups: young group (< 35 years, n = 56) and less young group (35-45 years, n = 214).

MRI features (morphology, kinetics, T2-weighted signal intensity, and visual grading of background parenchymal enhancement), clinicopathologic data (presentation, tumor size, lymph node status, histologic grade, estrogen receptor (ER), progesterone receptor (PR), human epidermal growth factor receptor 2, p53, and Ki-67 expression), and the visibility of cancer on mammogram were compared between the two groups.

RESULTS
On MRI, young group was more likely to have smooth mass margin (65.0% vs 15.5%, P < .001), hyperintense signal on T2-weighted image (39.3% vs 25.2%, P = .037), and less likely to have irregular shape (10.0% vs 40.5%, P < .001) than less young group. No differences were found for kinetics and background parenchymal enhancement. Axillary nodal involvement (60.7% vs 36.4%, P = .001), higher histologic grade (grade1; 7.1% vs 17.8%, grade 2; 39.3% vs 45.8%, grade 3; 30.6% vs 36.4%; P = .032), ER negative (46.6% vs 25.2%, P = .002), PR negative (57.4% vs 26.2%, P < .001), higher expression of p53 and Ki-67 (< 20% positive tumor cells; 50.0% vs 24.4% and 64.3% vs 40.2%, P < .001 and P = .001, respectively) were more frequently observed in young group compared to less young group. The visibility of cancers on mammogram for young group (64.3% vs 82.2%, P = .004) was lower than less young group, despite comparable tumor size (mean; 2.7 vs 2.6cm, P = .89).

CONCLUSION
Invasive breast cancers occurring in women under age 35 years of age frequently have morphologic features commonly seen in benign lesion on MRI, and are associated with aggressive histology and unresponsiveness to endocrine therapy.

CLINICAL RELEVANCE/APPLICATION
Breast cancers in young women (age < 35) are, however, no longer available after minimally invasive interventions such as MR-HIFU. Concordance in indication for systemic therapy pre- and post-operatively is, however, unknown. The aim of this study is to establish the diagnostic accuracy of pretreatment imaging and core biopsy to indicate systemic therapy according to the Dutch guidelines (oncoline.nl). McNemar tests were used to assess concordance between the two arms. Sensitivity, specificity, NPV and PPV of the biopsy-arm were calculated relative to the resection-arm (gold standard). Results were stratified in subgroups.

RESULTS
Overall, the biopsy-arm showed high specificity (98%) and PPV (97%) to indicate systemic therapy. However, the sensitivity (68%) and NPV (72%) were lower, suggesting risk of underestimating the indication for systemic therapy (p70 years (n=15; NPV 91%; p=0.0005)

CONCLUSION
Prior to MR-HIFU, positive indication for systemic therapy based on imaging and core biopsy is accurate. Risk of underestimation exists, however, with a negative test result, unless patients are >70 years, tumor size >2.0cm, or ER-status is negative.

CLINICAL RELEVANCE/APPLICATION
Using pretreatment biopsy and imaging, subgroups of patients may be at risk of undertreatment by adjuvant therapy after minimally invasive breast cancer therapy.

LL-BRS-WE4A ● Pretreatment Imaging and Core Biopsy to Indicate Systemic Therapy after Minimally Invasive Breast Cancer Therapy: When Is It Safe?

Alexander M Schmitz MD (Presenter) ; Joost Oudejans ; Thijs Van Dalen ; Paul Diest Van ; Kenneth G Gilhuijs PhD

PURPOSE
In breast conserving therapy, selection of systemic therapy is based on prognostic markers from the resection specimen. This specimen is, however, no longer available after minimally invasive interventions such as MR-HIFU. Concordance in indication for systemic therapy pre- and post-operatively is, however, unknown. The aim of this study is to establish the diagnostic accuracy of pretreatment imaging and core biopsy to assess eligibility for systemic therapy. Secondly, to identify patient and tumor characteristics that affect the accuracy.

METHOD AND MATERIALS
A retrospective study was performed on 97 consecutively included women (age 36-83 year) with primary invasive breast carcinoma on core biopsy (May 2009 - Dec 2010). Prognostic markers were obtained in two separate arms. Biopsy-arm: ER-status, tumor grade, largest tumor diameter (LD) (mammography, ultrasound, or MRI), age, and number of positive lymph nodes (ultrasound +/- fine needle aspiration). Resection-arm: ER-status, tumor grade, LD, age, and number of positive lymph nodes (sentinel node biopsy +/- axillary node dissection). The 10-year risk of mortality and relapse using Adjuvant! Online were combined to indicate systemic therapy according to the Dutch guidelines (oncoline.nl). McNemar tests were used to assess concordance between the two arms. Sensitivity, specificity, NPV and PPV of the biopsy-arm were calculated relative to the resection-arm (gold standard). Results were stratified in subgroups.

RESULTS
Overall, the biopsy-arm showed high specificity (98%) and PPV (97%) to indicate systemic therapy. However, the sensitivity (68%) and NPV (72%) were lower, suggesting risk of underestimating the indication for systemic therapy (p70 years (n=15; NPV 91%; p=0.0005)

CONCLUSION
Prior to MR-HIFU, positive indication for systemic therapy based on imaging and core biopsy is accurate. Risk of underestimation exists, however, with a negative test result, unless patients are >70 years, tumor size >2.0cm, or ER-status is negative.

CLINICAL RELEVANCE/APPLICATION
Using pretreatment biopsy and imaging, subgroups of patients may be at risk of undertreatment by adjuvant therapy after minimally invasive breast cancer therapy.

LL-BRS-WE5A ● The Value of Molecular Breast Imaging as a Diagnostic Adjunct to Mammography and Ultrasound in Patients Undergoing Biopsy

Thomas S Chang MD (Presenter) ; Marcela Bohm-Velez MD ; Douglas A Kieper BS * ; Susy L Suarez Lemcke BS * ; Antoinette Cockcroft RTRM

PURPOSE
To evaluate the impact of molecular breast imaging (MBI), also called breast-specific gamma imaging, in the management of diagnostic breast patients undergoing breast biopsy.

METHOD AND MATERIALS
Patients who have MBI are entered into a patient registry. Patients were included in this study if they had: 1) mammography, MBI, and biopsy; and 2) BI-RADS 3 or higher on mammography, ultrasound, or MBI. Biopsy was performed at the discretion of the radiologist or at the request of the patient.

RESULTS
Over a 5-year, 8-month period, the registry accrued 1176 patients, of whom 214 patients with 228 lesions were included in this study. Biopsy yielded 54 malignancies (24 DCIS, 24 IDC, 6 ILC) and 174 benign results, including 22 high-risk diagnoses. Mammography and/or ultrasound were BI-RADS 4 or 5 for 158 of the 228 lesions, yielding 34 malignancies (17 DCIS, 16 IDC, 1 ILC); sensitivity = 63%, PPV = 22%. The addition of MBI resulted in 49 more biopsies, of which 18 were malignant (7 DCIS, 6 IDC, 5 ILC); combined sensitivity = 96%, PPV = 25%. The two false-negative lesions were 0.5 cm and 0.7 cm focal asymmetries without sonographic correlate and normal MBI (both IDC).

CONCLUSION
The addition of MBI to mammography and ultrasound provided a 53% improvement in sensitivity for the detection of breast malignancies and a significant increase in the detection of ILC (1 with conventional imaging, 6 with the addition of MBI).

CLINICAL RELEVANCE/APPLICATION
When added to mammography and ultrasound in the work-up of challenging cases or symptomatic patients with normal conventional imaging, MBI significantly improves breast cancer detection.

LL-BRS-WE6A • Can 2D Central Projection Acquired during Digital Breast Tomosynthesis Replace Digital Mammography?
Paola Clauser MD (Presenter); Cristina Molinari MD; Viviana Londero MD; Rossano Girometti MD; Angelo Taibi PhD; Chiara Zuiani MD; Massimo Bazzocchi MD

PURPOSE
Based on a novel approach, Digital Breast Tomosynthesis (DBT) may simultaneously acquire 2D and 3D images of the breast. Variable dose geometry is used to give a sufficient dose in the central projection for that image to be a 2D mammogram (2D-CP). We aimed to assess the detection rate for suspicious lesions (ACR-BIRADS 3-5) of Digital Mammography (DM) vs 2D-CP and the diagnostic yield (DY) of both modalities.

METHOD AND MATERIALS
152 women recalled from regional screening program underwent DM and DBT with 2D-CP to characterize a suspicious finding. Examinations were retrospectively reviewed by two experienced radiologists, blinded to final diagnosis, in separate sessions. They assessed breast lesions as benign or suspicious in case of ACR BIRADS scoring of 1-2 and 3-5, respectively. Discordant cases were reviewed in consensus. Agreement was assessed with weighted-kappa statistic. We estimated the diagnostic yield (DY) of both modalities for the patients who had 6 months follow up, a negative contrast enhanced Magnetic Resonance (CE-MR) or histology of the finding.

RESULTS
DM detected 95 lesions, and 52 were assessed as suspicious (55.3%; 95%CI=45.3%-65.3%); 2D-CP detected 93 lesions, and 51 were assessed as suspicious (54.8%; 95%CI=44.6%-64.91%). The agreement was good (k=0.78; Weighted-Kappa). Twenty-six patients underwent short-term follow up, CE-MR or histology and 13 malignant lesions were found. True positive for both modalities were 13 on 13. No false negatives were found. DM had 10 false positive and 3 true negative; 2D-CP, instead, had 8 false positive and 5 true negative. DY for DM was 61.5%, and for 2D-CP was 69.2%.

CONCLUSION
All-in-one, dose sparing, 2D-CP provides a good agreement with DM in detection of breast lesions, and is comparable to DM both in lesion detection and in DY for malignancy.

CLINICAL RELEVANCE/APPLICATION
DBT examination with 2D-CP is an all-in-one, low dose, approach that has the potential to replace DM in association with DBT.

LL-BRS-WE7A • Biologic Significance of Benign Breast Biopsies Obtained under MRI vs. under Mammographic Guidance
Simone Schrading MD (Presenter); Kevin Strobel PhD; Nienke L Hansen MD; Christiane K Kuhl MD *

PURPOSE
It is well established that some proliferative breast lesions (so called borderline or “high-risk”) lesions are associated with an increased risk of future breast cancer. We investigated the prevalence of such high-risk lesions in MR-guided versus mammography-guided biopsies.

METHOD AND MATERIALS
Between 01-2011 and 12-2012, 439 MR guided vacuum biopsies for contrast enhancing lesions seen in breast MRI alone and 216 mammography-guided biopsies for suspicious mammographic findings, mainly suspicious microcalcifications, were performed. We investigated the fraction of proliferative high-risk lesions, such as atypical ductal (ADH) or lobular hyperplasia, LIN, flat epithelial hyperplasia (FEA), complex sclerosing lesion in MRI- versus mammography-guided biopsies.

RESULTS
A total 53% (232/439) of MR-guided biopsies and 62% (135/216) of mammography guided biopsies proved benign. Among the benign MR lesions, 29.7% (69/232) were high-risk lesions, with ADH in 43.5% (30/69), FEA in 39.1% (27/69), LIN in 11.6% (8/69) and complex sclerosing lesions in 5.8% (4/69). Among the benign mammographic lesions, 8.9% (12/135) were high-risk lesions, with 66.7% (8/12) ADH and 33.3% (4/12) FEA.

CONCLUSION
The prevalence of high risk changes among non malignant breast lesions is significantly higher in MRI than in mammography. This needs to be considered when discussing the rate of “false positive” findings in breast MRI vs. mammography.

CLINICAL RELEVANCE/APPLICATION
The biologic importance of benign lesions detected on the basis of contrast enhancement in MRI appears to be different from that of benign lesions detected on the basis of mammographically changes.

LL-BRE-WE8A • Pictorial Review of Second-look Ultrasound Findings with MRI and Pathologic Correlation
Paola V Nasute Fauerbach MD (Presenter); Silvia Perez; Alejandro R Sebastian MD

PURPOSE/AIM
The purpose of this exhibit is:
1. To review the possible MRI findings in the screening and diagnostic studies with US correlation.
2. To illustrate the second look US findings in both of these populations, emphasizing how subtle US malignant lesions can be.
3. To present the Imaging- Pathologic correlation.

CONTENT ORGANIZATION
1- Background of screening and diagnostic MRI indications recommended by ACR currently. 2. Description and illustration of the MRI findings in both of these populations. US findings will be shown and described following the latest BIRADS Lexicon with emphasis in the importance of a correct location correlation (patient prone versus supine) 3- Differential diagnosis based on clinical and imaging findings will be discussed. 4- Pathologic correlation will be presented. This will include benign and malignant lesions.
**SUMMARY**
The main teaching points of this presentation will be: 1. The importance of an accurate MRI and US correlation of the findings. 2. Mass-like and Non mass-like lesions can generally be seen on second-look US. 3. US findings can be very subtle specially in the high risk population. 4. MRI masses do not always correlate with a sono graphic discrete mass well seen in orthogonal planes. The US correlate may show some benign appearing characteristics and still represent a carcinoma.

**LL-BRE-WE9A • 'It was the Worst Day of My Life': How to Decrease Patient Anxiety during Diagnostic Workups and Breast Procedures**

Angela Robinson MD (Presenter); Claudia Cotes MD; Maria R Torrone MD; Ashley Moehring BS

**PURPOSE/AIM**
Review medical and psychological literature dealing with anxiety provoking situations. Present practical procedural guidelines to decrease patient anxiety during diagnostic procedures and breast biopsies. Present useful bedside manner and patient discussion tips to improve the patient experience during diagnostic studies and breast procedures.

**CONTENT ORGANIZATION**
Present psychological literature explaining the basis for and detrimental effects of significant patient anxiety. Present medical literature discussing patient anxiety in relation to mammography. Procedural guidelines for diagnostic procedures and breast biopsies; i.e. how to perform procedures while provoking the least amount of patient anxiety. Patient discussion tips including review of appropriate ways to deliver unexpected news.

**SUMMARY**
'Increased patient anxiety' is at the center of many national discussions and debates in reference to mammography. Although the current dialogue focuses on increased patient anxiety from unnecessary breast procedures, very little attention has been directed toward the radiologist's role in decreasing patient anxiety through changes in practice delivery and patient discussion. This exhibit will offer simple and realistic tools to decrease patient anxiety in a typical practice setting.

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**Cardiac - Wednesday Posters and Exhibits (12:15pm - 12:45pm)**

**Wednesday, 12:15 PM - 12:45 PM • Lakeside Learning Center**

**LL-CAS-WEA • AMA PRA Category 1 Credit ™: 0.5**

Host
Suhny Abbara, MD *
Host
Lisa Diethelm, MD

**LL-CAS-WEA • Area at Risk and Infarct Core Visualized by 3.0T cMRI and Multifunctional Stainings in a Rabbit Model of Myocardial Infarction**

Yuanbo Feng (Presenter); Zhanlong Ma MD; Feng Chen, MD, PhD; Marlein Miranda Cona MSc; Raymond H Oyen MD, PhD; Yicheng Ni MD, PhD

**PURPOSE**
To identify the myocardial infarction (MI) core and salvageable zone (SZ) within the area at risk (AAR) after myocardial infarction (MI) is crucial for reperfusion therapies. In this article we have strived to set up a multifunction staining postmortem methodology to directly visualize and quantification MI core, AAR and SZ simultaneously and correlated it with 3.0T Cardiac magnetic resonance (cMRI) on a rabbit model of acute reperfused MI.

**METHOD AND MATERIALS**
Rabbits (n=15) were surgically subjected to 90-min left anterior descending (LAD) coronary artery occlusion to induce reperfused MI that was then stained by intravenously injected Evans blue (EB). One-day later, 3.0T cMRI was performed for T2-weighted imaging (T2WI), first-pass perfusion weighted imaging (PWI) and delayed enhancement (DE) T1WI to determine AAR and MI-core before euthanasia. Afterwards, the excised heart with LAD re-ligated was infused via aorta with a red-iodized-oil (RIO) dye to delineate AAR. The heart was sliced into 3-mm sections for digital radiography (DR) and histology. DE-T1WI-discerned and EB-stained areas, RIO-unstained and DR-negative regions, and T2WI-hyperintense and first-pass-PWI-defect regions were planimetrically compared to define the SZ and calculate myocardial salvage indexes (MSI). The perfusion density rate (PDR) on DR was compared between AAR and normal myocardium and correlated with PWI-derived parameters.

**RESULTS**
There was no significant difference between MI-cores defined by DE-T1WI and EB-staining (31.20±14.87% vs 29.83±15.57%, p=0.74; r2=0.91). AAR was virtually equivalent (r2=0.99) by RIO (38.12±14.41%) and DR (38.67±15.98%). T2WI significantly (p<0.01) reduced artifacts and improved image quality. The introduced methodology with a rabbit model and new staining technique may contribute to translational cardiac imaging research and help in management of ischemic heart disease.

**CLINICAL RELEVANCE/APPLICATION**
The new multiple staining technique accurately identified the salvageable zone within the area at risk is crucial to plan upcoming reperfusion therapies.

**LL-CAS-WE2A • Does Adaptive Statistical Iterative Reconstruction Technique Affect Coronary Artery Calcium Scoring Based on Filtered Back Projection Technique?**

Fumiko Kimura MD, PhD (Presenter) *; Tatsuya Umezawa; Masahiro Takahashi MD; Yusuke Watanabe MD

**PURPOSE**
Adaptive statistical iterative reconstruction (ASiR, GE Healthcare) has been used for coronary CT angiography to improve image quality and reduce radiation dose, but its influence on coronary artery calcium scores (CACS) is unknown. We compared CACS, coronary artery calcium volume (CACV), and image noise from FBP and ASiR to clarify if CACS differs significantly between the two.

**METHOD AND MATERIALS**
We retrospectively evaluated CACS, CACV, and image noise in 340 consecutive patients (average age 65.1 years; 213 men, 127 women) who underwent non-contrast cardiac CT between January 2012 and January 2013. We reconstructed images using FBP, ASiR 30, 50, 70, and 100%. Workstation software automatically calculated CACS (Agatston method) and CACV; we manually measured image noise of the left ventricle. We compared these values among reconstruction techniques (RTs) and evaluated changes by ASiR among the CACS groups (CACS scores 1-100, 101-400, and >401) using Wilcoxon signed-rank test (Holm’s method). P < 0.05 was considered significant.

**RESULTS**
Of the 340 patients, 105 had CACS score of 0; 107, CACS 1-100; 85, CACS 101-400; and 43, CACS > 401 (mean CACS 197.5 ± 465.2; range 0 to 4468) on FBP. Of the 235 patients with CACS > 0, significant differences among RTs were observed in image noise (P < 0.01),...
total CACS (P < 0.01), and total CACV (P < 0.01), decreasing as ASiR percentage increased. Compared to FBP, CACS decreased 5.3% in ASiR 30%; 9.1% (ASiR 50%); 12.6% (ASiR 70%); and 17.7% (ASiR 100%). Reduction was larger by ASiR in patients with low CACS scores: CACS decreases by ASiR in CACS 1-100, 101-400, and > 400 groups were 10.1%, 7.8% and 4.3% (ASiR 30%); 15.9%, 13.1% and 7.0% (ASiR 50%); 21.2%, 17.3% and 10.1% (ASiR 70%); and 29.2%, 23.9% and 14.4% (ASiR 100%), respectively. Using ASiR, CACS became 0 in 7 patients (mean CACS 2.3 on FBP), though CACS 0 with FBP remained 0 in all patients.)

CONCLUSION

Image noise, CACS, and CACV decreased as ASiR percentage increased. Compared to FBP, a blend of no more than 50% ASiR limited CACS reduction to about 15% in all CACS groups; the same RT should be used to assess temporal changes in CACS.

CLINICAL RELEVANCE/APPLICATION

The use of high-percentage ASiR may lead to underestimation of risk in patients with low CACS. Therefore, we consider limiting ASiR to 50% for appropriate evaluation.

LL-CAS-WE3A • MRI Demonstrates a Decrease in Myocardial Infarct Resorption and Increase in Compensatory Hypertrophy Following Coronary Embolization

Maythem Saeed DVM, PhD (Presenter) ; Hisham Bajwa MD ; Loi Do ; Mohammed Suhail MD ; Steven W Hetts MD * ; Mark W Wilson MD

PURPOSE

To use cine and delayed contrast enhanced MRI (DE-MRI) in serially quantifying the effects of coronary microemboli on infarct resorption, LV mass and function in swine model with pre-existing myocardial infarct and poor collateral flow.

METHOD AND MATERIALS

Materials and Methods: Group I animals (n=8) were subjected to myocardial infarction by 90min LAD coronary artery occlusion followed by reperfusion, while group II (n=8) were subjected to 90min LAD occlusion followed by microemboli (32mm3 volume, 80µm diameter) delivery for mechanical obstruction of microvessels then reperfusion. Four animals served as control. All infarcts were imaged at 3 days and 5 weeks post coronary interventions. The studied animals all have matching infarct size on DE-MRI at 3 days. The ±3SD threshold method was used to measure myocardial infarct and persistent MVO on images acquired at 10min post Gd-DTPA injection (1.5 mmol/kg). At 3 days, we selected animals in group I with matched infarct size in group II to eliminate the influence of infarct size difference on LV mass.

RESULTS

Results: DE-MRI illustrated myocardial infarct as hyperenhanced region and MVO as hypoenhanced region. Four animals in group I and all animals in group II had persistent MVO, with significantly larger MVO zone size in group II. Five weeks later, group I animals showed significantly greater infarct resorption (31±2%) and less increase in compensatory LV mass (31±4%) compared with group II animals (23±2%, P<0.05).

CONCLUSION

Mechanical obstruction of coronary microvessels impairs infarct resorption (healing), LV function and causes increased compensatory hypertrophy. This noninvasive MRI study indirectly confirms what was recently hypothesized that MVO limits delivery and transit of cellular components required for optimal infarct healing.

CLINICAL RELEVANCE/APPLICATION

MRI can show the deleterious effects of microemboli on LV function/remodeling. There is urgent need to develop new distal filtration devices that can capture microemboli during coronary interventions.

LL-CAS-WE6A • Advanced Glycation Endproducts, as Measured by Skin Autofluorescence, Are Increased in Patients with Incremental Degrees of Atherosclerosis

Martijn A Den Dekker MD, MS ; Gert Jan Pelgrim MSC ; Rozemarijn Vliegenthart MD, PhD (Presenter) ; Matthys Oudkerk MD, PhD ; Marjan Zwiets MD ; Andries J Smit MD, PhD * ; Clark J Zeebregts MD, PhD ; Joop D Lefrandt MD, PhD ; Douwe J Mulder MD, PhD

PURPOSE

Studies in diabetes and renal disease patients show that advanced glycation endproducts (AGEs) may be linked to the development of atherosclerosis. AGE levels can be measured non-invasively by skin autofluorescence (AF). It is not yet known if skin AF is already increased in subclinical atherosclerosis. The purpose of this study was to evaluate whether skin AF is associated with increasing degrees of atherosclerosis, independent of diabetes and renal function.

METHOD AND MATERIALS

In this study, we included 223 patients who were referred for primary (n=163) or secondary (n=60) prevention between 2006 and 2012. The study was approved by the local medical ethical board. The AGE-Reader was used for skin AF measurements. Degree of atherosclerosis was assessed based on ultrasonographically detected plaques in carotid and femoral arteries (in primary prevention only), and on computed tomography derived coronary calcium score. Primary prevention patients were classified into a group with subclinical atherosclerosis defined as >1 carotid or femoral plaque, or calcium score >100 (n=67; age 53 years [interquartile range 48-56]; 49% male) and without (controls; n=96; 43 [38-51]; 55%). For secondary prevention, patients with proven peripheral arterial disease were chosen (n=60 [58-70]; 73%).

RESULTS

Skin AF was higher in patients with subclinical and clinical atherosclerosis compared to controls (skin AF 2.11 [1.83-2.46] and 2.71 [2.15-3.27] vs. 1.87 [1.68-2.12] respectively; P<0.01). The correlation coefficient between skin AF and the Carotid Atherosclerosis score (CACS) for primary prevention was -0.45 (P=0.0001) and for secondary prevention was -0.30 (P=0.0006).

CONCLUSION

Skin AF is increased in subclinical and clinical atherosclerosis, independent of known risk factors such as diabetes and renal disease. These data suggest that AGE levels are associated with the burden of atherosclerosis.

CLINICAL RELEVANCE/APPLICATION

AGEs levels, as measured by skin AF, are related to atherosclerosis, also in persons without diabetes or renal disease. Skin AF may be useful to detect persons at higher risk of atherosclerosis.

LL-CAS-WE6A • Feasibility Study of the 100kVp and 400mA Coronary CTA

Kai Zhao (Presenter) ; Yuan Jiang ; Jian-Xing Qiu MD ; Xiaoying Wang MD

PURPOSE

To study the image quality and radiation dose of 100 kVp and 400 mA CT imaging in patients undergoing coronary CT angiography (CCTA).

METHOD AND MATERIALS

From september to december 2012, 101 patients suspected of coronary artery disease were scanned by GE CT 750HD with retrospectively ECG-gated reconstruct mode whose weight was less than 80 kg. They were divided into 100 kVp group (n=65) and 120kVp group (n=36). The patients in 100 kVp group were scanned with 100 kVp and ECG modulation tube current (peak current 400 mA), while 120 kVp group were scanned with 120 kVp and ECG modulation tube current (peak current 500 mA). Contrast medium injection rate and volume were personalized by patients' weight (370 mgI/ml, mean 40ml). CT image raw data sets were reconstructed with ASiR-FBP composite at 30%. The effective radiation dose (ED) and size specific dose estimation (SSDE) of each patient were calculated. CT attenuation of the main vessels were measured and the image quality (noise, CNR, SNR) were estimated. Subjective evaluation was
Non-contrast MRI T1ρ Images Can Identify Chronic Myocardial Infarction

Jiayu Sun (Presenter); Rui Xia; Yucheng Chen MD, PhD; Jie Zheng PhD; Fabao Gao MD, PhD

PURPOSE
Recent study using a porcine model of chronic myocardial infarction (MI) reveals capability of non-contrast spin-lock T1ρ-weighted imaging to correctly identify location and extension of MI. However, this approach has yet been revaluated in clinical patients with MI.

METHOD AND MATERIALS
Twelve patients (male 7, female 5) with suspected myocardial ischemia and/or MI were scanned in a Siemens 3T Trio system. The protocol included 4-slice pre-contrast T1ρ imaging and multi-slice post-contrast late gadolinium enhancement (LGE). The T1ρ sequence was newly developed for the 3T system to reduce inhomogeneity effects and to obtain single-slice absolute T1ρ map within one breath-hold. The later was created by acquiring three different spin-lock times (10, 30, and 50 ms) with a spin-lock frequency of 255–340 Hz. By comparing with corresponding LGE images, the T1ρ values in normal and infarcted tissue areas can be obtained. The size of enhanced infarction area in LGE images were compared to the size of increased T1ρ areas (infarction increases T1ρ value).

RESULTS
Seven patients had evidence of MI as detected by LGE. The normal (in the myocardial tissue of patients without MI) and infarcted tissues had T1ρ of 46.3 ± 4.1 and 87.3 ± 8.9 ms, respectively, which agreed with the values in the animal study. The size of infarcted area measured by T1ρ map strongly correlate with the size in the LGE image (r2 = 0.998). Figure 1 shows one example of LGE and T1ρ map with arrows pointed to the infarcted tissue areas.

CONCLUSION
This is the first time that non-contrast T1ρ method was used to assess MI in a clinical setting. Although it is warranted further vigorous validation, non-contrast T1ρ method appears to provide a simple alternative mean to diagnose chronic MI, particularly for patients with renal insufficiency.

Cardiac MR of Partial Anomalous Pulmonary Venous Return and Its Association with Sinus Venosus Atrial Septal Defect in Adults

Lancia L Guo MD (Presenter); Conrad Crofts; Naeem Merchant MD

PURPOSE
1) To determine the lobar distribution of PAPVR in the adult population using cardiac MR (CMR). 2) To determine specific CMR findings of PAPVR that are predictive of a co-existing sinus venosus type ASD (SV-ASD).

METHOD AND MATERIALS
With institutional ethics review board approval, we retrospectively reviewed 36 patients (21 females, 15 males), mean age 46 year old (18 to 76), who underwent CMR for congenital heart disease. Using a 1.5 Tesla magnet, the following sequences were obtained: 1) Multiple long and short axis SSFP images. 2) Cine phase contrast images through the aorta and main pulmonary artery. 3) 3-dimensional MRA images with gadolinium.

RESULTS
1) PAPVR most often occurs in the right upper lobe (64%). A significant portion of PAPVR occurs in more than one pulmonary lobes, and the most common combination is the right upper lobe (RUL) and right middle lobe (RML) (42%). 2) 14 out of the 36 patients (39%) with PAPVR have a co-existing SV-ASD. Among these patients, 12 patients (86%) have PAPVR draining both RUL and RML. 3) The height of drainage of right-sided PAPVR into SVC is associated with co-existing SV-ASD: In PAPVR patients with co-existing SV-ASD, the height of drainage of right-sided PAPVR into SVC was significantly lower in patients with SV-ASD than those without. A drainage height < 30 mm is predictive of the presence of co-existing SV-ASD.

CONCLUSION
1) RUL is the most common location for PAPVR. 2) PAPVR involving both RUL and RML are most commonly associated with the presence of SV-ASD. 3) The height of PAPVR draining into the SVC in relation to the atricoaval junction is significantly lower in patients with SV-ASD than those without. A drainage height < 30 mm is predictive of the presence of co-existing SV-ASD.

Mental MR perfusion imaging is a powerful diagnostic tool aiding clinical diagnosis, understanding and management of various clinical conditions at high in space resolution and in absence of ionizing radiation.
**LL-CHS-WEA • Characterization of Pulmonary Changes in Smoke Inhalation Injury in a Sheep Model Using Contrast Enhanced CT-scans**

Regina Moritz (Presenter); Frank L Goerner PhD *; Val M Runge MD *; Osamu Fujiwara MD; Gabriele A Krombach MD; Matthew K Fuld PhD *; Ernesto Lopez MD; Donald Prough MD; Perenlei Enkhbaatar MD, PhD

**PURPOSE**

Annually more than 1 million burn injuries occur in the US (1). The concomitant smoke inhalation frequently causes severe pulmonary injury (ARDS) and significantly increases mortality (2, 3). The aim of this study was to characterize pulmonary changes following smoke inhalation injury (SII) in a sheep model using contrast enhanced CT.

**METHOD AND MATERIALS**

Six anesthetized female sheep (3 months old; 30 - 45 kg) received an SII by insufflation of cold cotton smoke. Contrast enhanced (Isovue 370®, Bracco Diagnostics Inc., Princeton, NJ) CT scan (Siemens Definition Flash, Erlangen, Germany) were performed in each sheep immediately prior to injury and 24 hours post injury. Following the final CT scan the animals were euthanized and the lungs removed. The lungs were cut into slices and correlated to the CT images. Tissue histology was evaluated and correlated to CT. Two experienced chest radiologists reviewed the CT scans. Each axial slice was divided into 4 quadrants, and the presence of ground glass opacities, septal thickening, consolidation, atelectasis and bronchial wall thickness was graded (0: no changes, 1: mild changes, 2: moderate changes, 3: severe changes) and the presence of casts in the bronchial system as well as occlusion of pulmonary vessels was noted in the individual quadrants. Also the wall thickness of the trachea, the main and lobar bronchi was measured in healthy and injured animals.

**RESULTS**

The study revealed that the most dramatic changes occurred in the bronchial system (especially the trachea and the main and lobar bronchi). There was massive thickening of the bronchial wall caused by edema and inflammation. Cast formation within the bronchial lumen led to airway obstruction, and atelectasis of the lung was seen in all the injured animals. In 5 of the 6 sheep segmental and peripheral pulmonary arteries were occluded. There were additional changes in the lung parenchyma including peribronchial edema, atelectasis and focal inflammation. The patchy distribution of these changes appears to be very characteristic for this particular disease.

**CONCLUSION**

This study showed that smoke inhalation injury has a distinctive appearance on CT, allowing an early diagnosis and improved treatment.

**CLINICAL RELEVANCE/APPLICATION**

SII has a unique appearance on CT aiding early diagnosis and giving new insights into its pathophysiology. Pulmonary artery occlusion is shown, helping to optimize treatment and reduce mortality.

**LL-CHS-WE1A • Lifetime Attributable and Excess Lifetime Risk Estimates for Radiation Induced Solid Cancers Risks Based on Organ Doses and Age Variations in Chest CT-Excess Lifetime Risk Estimates for Radiation Induced Solid Cancers Risks with Routine Chest**

Sarabjeet Singh MD (Dose Presenter); Monica Ghitab PhD; Ranish D Khawajaa MBBS, MD; Sarvenaz Pourjabbar MD; Atul Padole MD; Mannudeep K Kalra MD *; James A Brink MD

**PURPOSE**

Recent data from life span study from Japanese Atomic Explosion estimate increased Excess Lifetime Risks (ELR) of certain radiation-induced solid cancers, when exposure occurs at middle age rather than in childhood. The purpose of our study was to assess population based estimated ELR for solid cancers following chest CT in different age groups using size adjusted CT protocols in a large tertiary health care center.

**METHOD AND MATERIALS**

Our IRB approved study included 2930 consecutive “routine” chest CT. Dose monitoring software (Exposure, Radimetrics) was used to obtain patient demographics, scanning parameters as well as radiation dose information (Size Specific Dose Estimate (SSDE), estimated effective doses (EED) and organ doses). Patients were stratified by age groups of 0-10, 11-20, so on, >70 years. Estimated ELR from the time of exposure from chest CT was estimated based on recently reported literature on risk estimation from radiation induced solid cancer risks published from 2007-2012.

**RESULTS**

SSDE for chest CT were significantly lower for patients younger than 20 years of age as compared to those 21 and above (4.5 – 6.2 mGy vs 9.7 – 10.3 mGy, p< 0.001). EED (ICRP 103) were 3 - 4 mSv and 7-8 mSv for these age groups (p<0.001).

**CONCLUSION**

SSDE and estimated effective doses are suboptimal for cancer risk estimation and organ doses should be used for solid cancer radiation induced risk estimation, regardless of patient's age.

**CLINICAL RELEVANCE/APPLICATION**

Contrary to the previously belief, dose concerns are not only important for the younger age groups (0-20) but also for older patients (30-60 years), especially for risk estimations of lung, breast, li

**LL-CHS-WE3A • 99 Patients Status-Post Lung Transplantation (LTx) for Usual Interstitial Pneumonia (UIP): CT-Pathologic Correlation**

Diane C Strollo MD (Presenter); Iclal Ocak MD; Sonja Dacic MD; Joseph M Pilewski MD; Christian Bermudez; Maria M Crespo MD

**PURPOSE**

1. Review patient demographics and surgical procedures. 2. Assess CT-pathologic features of fibrosis, ground glass opacity (GGO), lung nodules, consolidation, lymphadenopathy, +/− thoracic malignancy.

**METHOD AND MATERIALS**

Patient age, gender, history of smoking and malignancy, etiology of UIP, surgical procedures, pathologic and MDCT techniques, and intervals between MDCT and LTx were recorded. MDCTs and explanted lung specimens were reviewed by 2 chest radiologists and a pulmonary pathologist, respectively. We correlated the MDCT pattern and distribution of UIP, emphysema, GGO, lung nodules, consolidation, nodular fibrosis, lymph nodes >12mm, +/− thoracic malignancy, with pathology reports of the explanted lungs. Discordant cases were re-evaluated by our pathologist.

**RESULTS**

99 patients (63 M; 36 F) with UIP underwent LTx over a 2 year period. Mean age was 49.3 years (36.0-77.6 years). 58 (58%) had been smokers, and 6 (6%) had a history of treated malignancy (lung or breast cancer or lymphoma). DLTx (n=61) or SLTx (n=38) was performed. Mean interval between CT and LTx was 5.0 months (0.25-15.5 mo). Etiology of UIP was
The Value of MDCT Direct-lymphangiography in Diagnostic of Diffuse Pulmonary Lymphangiomatosis

**Xiaoli Sun** MD, PhD (Presenter) ; **Rengui Wang** MD ; **Tingguo Wen** ; **Xiaobai Chen** ; **Lei Yang**

**PURPOSE**
Diffuse pulmonary lymphangiomatosis (DPL) is an uncommon entity characterized by an abnormal growth of pulmonary lymphoid tissue.

**METHOD AND MATERIALS**
This study was approved by local ethics committee, and informed consent was not required. Between August 1997 and December 2012, 23 patients with DPL (13 men and 10 women) were retrospectively reviewed for this study. Ages ranged from 2 to 48 years (mean age of 24 years). All patients had undergone MDCT direct-lymphangiography examination.

**RESULTS**
The findings of MDCT direct-lymphangiography were intrathoracic and extrathoracic abnormalities. Among the intrathoracic abnormalities, 100% (n=23) of patients had abnormal lymph reflux (abnormal deposition of the contrast medium), lymphangiectasia, infiltration of mediastinal soft tissue, and thickening of peribronchovascular. 82.6% (n=19) patients had interlobular septal thickening, 78.3% (n=18) patients had diffuse ground-glass opacities, 95.7% (n=22) patients had pleural effusion, 52.2% (n=12) patients had pleural thickening, 60.9% (n=14) patients had extra-pleural soft tissue thickening, 87.0% (n=20) patients had pericardial effusion, 43.5% (n=10) patients had multiple lymphadenopathy in mediastinum. The features of extrathoracic abnormalities included retroperitoneal lymphangiectasia and abnormal lymph reflux(21.7%, n=5), abdominal effusion (4.3%, n=1), retroperitoneal and splenic cystic lymphangioma (4.3%, n=1), cervical lymphangiectasia (43.5%, n=10), multiple lymphadenopathy in axilla (87.0%, n=20), and skeletal or vertebral lesions (17.4%, n=4).

**CONCLUSION**
MDCT direct-lymphangiography is well suited to the evaluation of DPL because it is capable to show the extent of the abnormal lymphatic reflux, to clarify the dilatation and proliferation of lymphatic channels, to clearly depict the intrathoracic and extrathoracic abnormalities, and the typical images are quite helpful in diagnosis of DPL. This method provides an excellent tool for diagnosis of DPL and has high value in the determination of a treatment plan.

**CLINICAL RELEVANCE/APPLICATION**
MDCT direct lymphangiography provides an excellent tool for diagnosis of DPL and has high value in the determination of a treatment plan.

Mediastinal Lymph Nodes Characterization with Diffusion Weighted Imaging with Background Suppression (DWIBS) at 3T

**Caroline Mesmann** MD (Presenter) ; **Francois Tronc** MD, PhD ; **Yves Berthezene** MD, PhD ; **Philippe Douek** MD, PhD ; **Loic Boussel** MD

**PURPOSE**
To determine whether DWIBS can differentiate between malignant and benign mediastinal lymph nodes.

**METHOD AND MATERIALS**
45 patients (27 to 69 years-old) scheduled for surgical lymph node exploration prospectively underwent a T1weighted and free breathing whole thoracic DWIBS sequences (TR/TE 6674/44; FatSat STIR with IR=260ms; Slice Thickness=5mm; b-factors=0-400-800s/mm2) on a 3T Philips Achieva MRI system. ADC maps were also calculated. For each lymph node that have been surgically removed during the mediastinal surgical exploration, mean ADC and lymph nodes to thoracic muscles signal ratio (LNTMR) were respectively calculated on ADC maps and b800 images.

**RESULTS**
11 lymph nodes from 9 patients (8 lung cancers, 1 Hodgkin lymphoma) were malignant and 40 lymph nodes from 36 patients were benign (14 sarcoidosis, 4 silicosis, 4 asbestosis, 4 histiocytosis, 2 tuberculosis, 8 with non-specific benign lymph nodes). The mean LNTMR was significantly higher in malignant than in benign lymph nodes (6.18 +/- 2.23 vs 2.67 +/- 1.23; p The ROC analysis showed a highest accuracy for a threshold of 4.5 and 1171 mm²/sec for respectively the LNTMR and the ADC measurements resulting in a sensitivity of 81.8% and 72.7% and a specificity of 90% and 97.5% respectively.

**CONCLUSION**
Thoracic MRI with DWIBS sequence can help in differentiating benign from malignant mediastinal lymph nodes by using ADC and lymph nodes to thoracic muscles signal ratio at b800.

**CLINICAL RELEVANCE/APPLICATION**
Thoracic MRI with DWIBS sequence is promising to predict malignancy of mediastinal lymph nodes.

Emergency Radiology - Wednesday Posters and Exhibits (12:15pm - 12:45pm)

**Wednesday, 12:15 PM - 12:45 PM • Lakeside Learning Center**
Identification

Jonas C Apitzsch

RESULTS

Each case was followed up with detailed autopsy reports for every organ. These pathology and CT findings were finally tabulated for recognition and evaluation normal postmortem findings seen on postmortem imaging.

PURPOSE

Body identification is the cornerstone of forensic investigation. It can be performed using radiographic techniques, if antemortem images are available. This study was designed to assess the value of visual comparison of the CT anatomical aspects of the sphenoid sinuses, in forensic individual identification.

METHOD AND MATERIALS

This retrospective work took place in a university hospital. The supervisor of this study randomly selected from the PACS, 58 patients who underwent one (16 patients) or two (42 patients) head computed tomography in various neurological contexts. To avoid bias, those studies were prepared (anonymized, and all the head structures but the sphenoid sinuses were excluded), and used to constitute two work lists of 50 [42 cases CT pure obtained at 120kV,400 mA at 1.25 slice thickness of the sphenoid sinuses). An anatomical classification system of the sphenoid sinuses anatomical variations was created based on the anatomical and surgical literature. In those two work lists, three blinded readers had to identify, using the anatomical system and subjective visual comparison, 42 pairs of matched studies, and 16 unmatched studies. Readers were blinded from the exact numbers of matching studies.

RESULTS

Each reader correctly identified the 42 pairs of CT with a concordance of 100% [97.5% confidence interval: 91-100%], and the 16 unmatched CT with a concordance of 100% [97.5% confidence interval: 79-100%]. Overall accuracy was 100%.

CONCLUSION

Our study shows that establishing the anatomical concordance of the sphenoid sinuses by visual comparison, could be used in personal identification, especially if antemortem dental records, fingerprints or DNA samples are not available. This simple and fast method, based on a frequently and increasingly prescribed exam, still needs to be assessed on a postmortem cohort. Integration of head CT examinations in missing person databases should be considered, for purposes of personal identification.

CLINICAL RELEVANCE/APPLICATION

The anatomical concordance of the sphenoid sinuses by visual comparison, could be used in personal identification, if antemortem dental records, fingerprints or DNA samples are not available.

LL-ERS-W2A • Cardiothoracic Ratio in Post-mortem Computed Tomography: Reliability and Threshold for the Diagnosis of Cardiomegaly

Sebastian Winkhofer MD (Presenter); Nicole Berger MD; Thomas D Ruder MD; Paul Stolzmann MD; Michael J Thali MD; Hatem Alkadhi MD; Garyfalia Ampanozi MD

PURPOSE

Aim of this study was to evaluate the reliability of the cardiothoracic ratio (CTR) in postmortem computed tomography (PMCT) and to assess a CTR threshold for the diagnosis of cardiomegaly based on the heart weight derived from autopsy.

METHOD AND MATERIALS

PMCT data of 170 deceased were retrospectively evaluated by two blinded radiologists. The CTR was measured in axial slices and the actual cardiac weight was derived from conventional autopsy. Inter-rater reliability, sensitivity and specificity were calculated. Receiver operating characteristics curves were calculated to assess enlarged heart weight by CTR. The autopsy definition of cardiomegaly was based on normal values of the Zeek (within a range of both, one or two SD) and the Smith method (within the given range).

RESULTS

Intra-class correlation coefficients (ICC) demonstrated excellent agreements (0.983) regarding CTR measurements. In 105/170 (62%) cases the CTR in PMCT was >0.5, indicating enlarged heart weight, according to clinical references. The mean heart weight measured in autopsy was 405 ± 105 g, resulting in an interpretation of 114/170 (67%) cases of enlarged heart weight regarding the normal values of Zeek within one SD, of 97/170 (57%) within two SD and in 100/170 (59%) according to Smiths normal values. The sensitivity/specificity of the 0.5 cut-off of the CTR for the diagnosis of enlarged heart weight was 78% / 71% (Zeek one SD), 74% / 55% (Zeek two SD), and 76% / 59% (Smith), respectively. The discriminative power was 79%, 73%, and 74% for the normal values of Zeek (1SD/2SD) and Smith to differentiate between normal heart weight and cardiomegaly. Changing the CTR threshold to 0.57 resulted in a minimum specificity of 95% for all three definitions of cardiomegaly.

CONCLUSION

With a CTR threshold of 0.57, cardiomegaly can be ruled in with a very high specificity, which may be useful if PMCT is used by forensic pathologists as a screening tool for medicolegal autopsies.

CLINICAL RELEVANCE/APPLICATION

The cardio-thoracic ratio seems to be a helpful tool in post-mortem computed tomography for a simple assessment of heart weight.

LL-ERS-W3A • AnœuvreNormaliz²? Changes Detected on Post Mortem CT Examinations

Sarvenaz Pourjabbar MD (Presenter); Sarabjeet Singh MD; Atul Padole MD; Beth Vettiyil MBBS; Akshay Saini; Mannudeep K Kalra MD; Ranish D Khawaja MBBS, MD; Diego A Lira MD

PURPOSE

To recognize and evaluate normal postmortem findings seen on postmortem imaging.

METHOD AND MATERIALS

In an IRB approved study, 100 adult cadavers (61.66 ± 15.2 years, M: F 62:38) underwent postmortem CT examinations. Head to toe whole body CT were acquired at 120kV, 400 mA on 12 slice dual source MDCT (Definition FLASH, Siemens) (n= 85, mean age 61.4 ± 15.2 years, M: F 52:35) and 64 slice MDCT (Discovery750HD, GE Healthcare) (n= 13, 63.2 ± 15.9 years, M: F 10:3). Postmortem CT examination was performed as close to death as possible. CT images were read and interpreted by experienced thoracic, neuro and abdominal radiologists. “Normal” postmortem findings were considered in interpretation of the “abnormal” CT findings by radiologists. Each case was followed up with detailed autopsy reports for every organ. These pathology and CT findings were finally tabulated for assessing correlation between pathology and radiology findings.

RESULTS

Most post mortem CT examinations were performed within 24 hours (20.0 ± 28.0 hours, n=89). Two cases were scanned 192 hours and 114 hours after death and exact time of death for 26 patients was not recorded on hospital database. Loss of gray white matter was seen...
Acute Aortic Syndromes: Review of Pathophysiology, Imaging Characteristics, Complications and Treatment

**PURPOSE/AIM**

1. Provide an intuitive understanding of the morphologic types, injury mechanisms, and classification systems of adult proximal femur fractures, including soft tissue and vascular supply, essential for complete characterization of these fractures. 2. Review the multimodality imaging approach to diagnosis. 3. Review the morphologic types of proximal femur fractures, anatomic features, injury mechanisms, and classification systems using multiple imaging modalities, 3D models, and animations. 4. Outline the reporting process with emphasis on critical features for orthopedists. 5. Describe the treatment principles and potential complications. 6. Provide a case-based conclusion with emphasis on "what not to miss.”

**SUMMARY**

Learners will be able to: 1. Understand proximal femur fracture types, mechanisms, imaging features, and classification systems that orthopedic surgeons consider clinically significant. 2. Provide confident imaging interpretation that emphasizes potential complications and best guides early and effective intervention.

Wrist Trauma—What the Surgeon Wants to Know

**PURPOSE/AIM**

1. Simplify and clarify the complex measurements, terminology and classification systems used in evaluating wrist trauma. Enable the radiologist to communicate the relevant critical findings to the hand surgeon. 2. The wrist is a complex region with unusually shaped and oriented bones requiring careful review and dedicated views to ensure adequate evaluation. A number of measurements, lines and relationships have been described to evaluate for the presence and type of injury. In addition, injury patterns and classifications are sometimes confusing or overlapping. These challenges can cause distress and discomfort for trainees and other radiologists without extensive MSK expertise. This exhibit aims to identify the critical findings that the hand surgeon wants and needs to know about, to ensure optimal treatment for the injured wrist. Findings that are not relevant or important to the surgeon can be ignored. This simplified but targeted approach will provide guidance for radiologists to more confidently review images of the wrist, and provide valuable and relevant information to the hand surgeon.

**SUMMARY**

This educational exhibit provides a simplified practical approach to imaging of wrist trauma that ensures communication of relevant findings to the hand surgeon.

Acute Aortic Syndromes: Review of Pathophysiology, Imaging Characteristics, Complications and Treatment

**PURPOSE/AIM**

1. Provide an intuitive understanding of the morphologic types, injury mechanisms, and classification systems of adult proximal femur fractures. 2. Describe the normal anatomy, including soft tissue and vascular supply, essential for complete characterization of these fractures. 3. Review the multimodality imaging approach to diagnosis. 4. Review the morphologic types of proximal femur fractures, anatomic features, injury mechanisms, and classification systems using multiple imaging modalities, 3D models, and animations. 5. Outline the reporting process with emphasis on critical features for orthopedists. 6. Describe the treatment principles and potential complications. 7. Provide a case-based conclusion with emphasis on "what not to miss.”

**SUMMARY**

This exhibit reviews the pathophysiology, imaging characteristics, complications and treatment of aortic dissection, including its atypical forms (intramural hematomas and penetrating aortic ulcer) on both unenhanced and contrast-enhanced Computed Tomography (CT). CT has a sensitivity and specificity of nearly 100% in diagnosing acute aortic syndromes. Due to its key role in tailoring appropriate treatment and follow up imaging. A number of measurements, lines and relationships have been described to evaluate for the presence and type of injury. In addition, injury patterns and classifications are sometimes confusing or overlapping. These challenges can cause distress and discomfort for trainees and other radiologists without extensive MSK expertise. This exhibit aims to identify the critical findings that the hand surgeon wants and needs to know about, to ensure optimal treatment for the injured wrist. Findings that are not relevant or important to the surgeon can be ignored. This simplified but targeted approach will provide guidance for radiologists to more confidently review images of the wrist, and provide valuable and relevant information to the hand surgeon.

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Acute appendicitis is a common troublesome problem in pregnancy. In today's tertiary care centers the diagnosis of appendicitis is limited to the clinical judgment of those performing the physical exam. There is controversy in the literature over the superior migration of the appendix during pregnancy. Thus, we propose a retrospective cohort study that looks solely at the displacement of the appendix, as it relates to gestational age in trauma patients who received a CT scan without evidence of appendicitis.

Our hypothesis was that there is no change in appendix location with gestational age.

METHOD AND MATERIALS

Acute appendicitis is a common troublesome problem in pregnancy. In today's tertiary care centers the diagnosis of appendicitis is limited to the clinical judgment of those performing the physical exam. There is controversy in the literature over the superior migration of the appendix during pregnancy. Thus, we propose a retrospective cohort study that looks solely at the displacement of the appendix, as it relates to gestational age in trauma patients who received a CT scan without evidence of appendicitis.

Our hypothesis was that there is no change in appendix location with gestational age.
A retrospective analysis of pregnant females presenting to Maricopa Medical Center for trauma was performed. 191 of these patients received CT scans of the abdomen and pelvis as part of their workup. Of these, 80 were analyzed. Study participants were of all ages, gestational ages from 14 to greater than 40 weeks. Exclusion criteria included those with major non-obstetrical abdominal surgery. The left iliac crest and umbilicus were used as anatomic landmarks to describe the location of the appendix. We used statistical analysis to find a correlation between the appendiceal location with the gestational age, trimester and body mass index.

RESULTS
Using both a Pearson's Correlation and a Levene T-test, we found a statistically significant difference in appendiceal location relative to the left iliac with both gestational age and trimester in the crania-caudal dimension but not the transverse dimension. Statistically significant difference was also found when comparing the appendiceal location with trimester in the AP dimension.

CONCLUSION
Our study demonstrates a significant difference in the mobility of the appendix in the transverse and AP dimensions. This may be of value when using the physical exam to assess the pregnant patient for signs of acute appendicitis.

CLINICAL RELEVANCE/APPLICATION
Our study aims to aid in the evaluation of the diagnosis of acute appendicitis in the pregnant patient.

LL-GIS-WE2A • CT Findings of Transient Decreased Attenuation Areas in the Distal Pancreatic Parenchyma with Obstructive Pancreatitis; Evaluation by Dynamic Helical CT

Koji Takeshita MD (Presenter) ; Shigeru Furui MD

PURPOSE
Obstructive pancreatitis is caused by obstructions or stenosis of the main pancreatic duct (MPD), and in some cases, obstructive pancreatitis may indicate pancreatic cancer. The purpose of this study is to evaluate the characteristic enhancement pattern in obstructive pancreatitis.

METHOD AND MATERIALS
We selected 335 patients with dilatation of the MPD by more than 2 mm on ultrasonography and performed non-enhanced and three-phase contrast enhanced CT scans of the pancreas. The attenuation of pancreatic parenchyma, proximal and distal to the site of the MPD stenosis or obstruction, was measured and the differences were calculated from proximal attenuation (PA) minus distal attenuation (DA) (PA-DA (HU)). Decreased attenuation in the distal pancreatic parenchyma (DADP) was defined positive when the PA-DA was more than 30HU. The cases positive for DADP (n=12) were investigated further. The tumor size, the maximum diameter of the MPD, stenosis or obstruction of the MPD were determined, and atrophic changes in the pancreatic parenchyma were also evaluated in the cases with DADP.

RESULTS
The cases positive for DADP were seen in 12 patients (3.6 %) during the arterial-phase. DADP was not seen on non-enhanced, or enhanced pancreatic and delayed-phase imaging. Mean values of PA-DA in 12 patients were 50.5±6.7 HU, and these patients were diagnosed as pancreatic cancer. In cases with DADP, the tumor diameters ranged from 15 mm to 28 mm (mean 19.9±5.0 mm), and were statistically smaller than in cases with pancreatic cancer without DADP (mean tumor diameter 38.2±8.0 mm). Two cases were stage 1, and the others were stage 3. Focal stenosis or obstruction of the MPD with dilatation of the distal MPD was demonstrated in all patients (mean MPD diameter 5.8±1.3mm). Evidence of atrophic change in the distal pancreatic parenchyma was demonstrated in 4 patients.

CONCLUSION
Transient DADP may reflect decreased pancreatic microvascular blood flow associated with high pancreatic interstitial pressure derived from obstructive pancreatitis. The findings may be a clue to diagnosis in the early stages of pancreatic cancer with obstructive pancreatitis.

CLINICAL RELEVANCE/APPLICATION
The findings of transient DADP on arterial phase in obstructive pancreatitis may be a clue in the diagnosis of pancreatic cancer at the early stages.

LL-GIS-WE3A • Quantitative Analysis the Features of Benign and Malignant Gastric Mucosal Lesions: The Initial Experience of Spectral CT

Cheng Ni MD (Presenter) ; Biyong Tan MD ; Daoyu Hu MD, PhD ; Zhen Li MD, PhD ; Baseng Li ; Xiaoyan Meng MD ; Yao Hu MD

PURPOSE
To investigate the quantitative analysis value of spectral computed tomography (CT) in differentiating benign and malignant mucosal lesions.

METHOD AND MATERIALS
64 patients with gastric cancer (GC), 48 patients with gastric inflammation (GI) and 50 patients with normal gastric mucosa (NG) were retrospectively studied in cohort. All the patients underwent double phase (arterial phase, AP and portal venous phase, PVP) enhancement spectral CT performed. The mean iodine concentrations (ICs, mg/ml) of GC, GI, NG, benign gastric mucosa (BG, including GI and NG) and gastric mucosal disorders (GD, including GC and GI) were calculated. An independent sample t test was performed to compare mean ICs between these groups. Diagnostic performance was evaluated by receiver operating characteristic (ROC) curve analysis.

RESULTS
CONCLUSION
Spectral CT quantitative analysis appears to be useful in characterizing malignant gastric mucosal lesions, and might help increase the sensitivity and specificity of gastric mucosal lesions detection.

CLINICAL RELEVANCE/APPLICATION
Spectral CT quantitative analysis appears to be useful in characterizing and detecting gastric mucosal lesions.

LL-GIS-WE4A • Evaluation of Fibrotic Liver Disease by Whole-liver T1-rho MR Imaging: A Feasibility Study in Humans at 1.5T

Thomas Allikemper MD (Presenter) ; Florian Sagmeister MD ; Vito Cicinnati MD ; Susanne Beckebaum MD ; Hendrik Kooijman * ; Christian Kanthak * ; Christoph Stehling MD ; Walter L Heindel MD

PURPOSE
To investigate the feasibility of whole-liver T1-rho magnetic resonance imaging (MRI) in patients with fibrotic liver disease at 1.5T.

METHOD AND MATERIALS
The study was approved by the institutional ethics committee (#2012-428-f-S). All subjects provided written informed consent. Healthy volunteers (n=20) and patients (n=18) with cirrhosis (Child-Pugh A to C) underwent whole-liver T1-rho MRI at 1.5 T using spin-lock times (SLT) of 10, 20, 40, and 80 ms. Mean T1-rho value and standard deviation were calculated from ROIs depicting liver parenchyma (n=40–60 ROIs per liver) and regarded as the characteristic T1-rho value of each subject. T1-rho values of volunteers and patients were analyzed by one-way analysis of variance and appropriate post-hoc tests. Pearson’s correlation coefficient was used to test for correlation between T1-rho, age and gender in all subjects.

RESULTS
T1-rho values of volunteers and patients were significantly different (F(3,34)=26.45, p In all subjects, T1-rho did not correlate with age or
CONCLUSION

Whole-liver T1-ρo MRI at 1.5 T to detect and assess human liver cirrhosis is feasible. Further investigation and optimization of this technique is warranted to cover the entire spectrum of fibrotic liver disease.

CLINICAL RELEVANCE/APPLICATION

Non-invasive liver MRI with T1-ρo imaging may serve as a biomarker that can be used to monitor progression of fibrotic liver disease.

LL-GIS-WE5A • Diagnostic Value of MRI to Evaluate of Pancreatic Cystic Neoplasms

**Temel Tirkes MD (Presenter); Aashish A Patel MD; Bilal Tahir MD; Lili Yang; Alex M Aisen MD *; Fatih Akisik MD ***

**PURPOSE**

To determine the sensitivity and specificity of MRI in characterization of cystic pancreatic neoplasms.

**METHOD AND MATERIALS**

An IRB approved retrospective image analysis of 72 patients with pancreatic cysts was performed. Forty-four of these were pathologically proven cystic neoplasms and 28 patients were pseudocysts. Pseudocysts were designated as non-neoplastic group and found in patients with recent history of pancreatitis, without acute imaging findings and were confirmed either surgically or by spontaneous regression on follow-up studies. The cystic neoplasms included; 17 side branch type intra-duetal papillary mucinous neoplasms (IPMN), 13 mucinous cystic neoplasms (MCN) and 14 serous cystic neoplasms (SCN). Two experienced abdominal radiologists blindly reviewed the images.

**RESULTS**

There was substantial inter-observer agreement between the readers (kappa coefficient: 0.65). Sensitivity, specificity, false positive and false negative rates of MRI for diagnosis of all cystic neoplasms was 95%, 56%, 44% and 4.5%, respectively. When each neoplasm was individually analyzed, sensitivity and specificity for IPMN was 94% and 87%, for MCN 75% and 91%, for SCN 89% and 95%. Readers felt they could detect the communication of the side-branch IPMNs with the main pancreatic duct in 97% of the cases on both thick slab MRCP and 3D MRCP. IPMNs had average size of 2.5 cm, lobulated contours, mostly located in the head but were multifocal in half of the cases. MCNs were the largest cystic lesions with average size of 5.5 cm, 40% showed internal debris and 85% had a visible capsule. Because of these features, MCNs were misdiagnosed as pseudocysts in 30% of the cases. Pseudocysts demonstrated debris in 64% and a capsule in 74% of the cases. SCNs were mostly solitary cyst, located in the tail, and lobulated. Enhancing septations were seen (71%) of SCNs, as a distinguishing feature.

**CONCLUSION**

MRI with MRCP has 89% sensitivity and 67% specificity for diagnosis of cystic neoplasms. Due to overlapping imaging features, inter-observer agreement is not very high. However, MRCP has a very high sensitivity for differentiating side-branch IPMN from other pancreatic cystic cysts such as MCNs which carries a higher malignant potential. Making this distinction can be very helpful in the management of the cystic neoplasms.

**CLINICAL RELEVANCE/APPLICATION**

MRI with MRCP is a very useful diagnostic tool for evaluation of pancreatic cystic neoplasms.

LL-GIS-WE6A • Ultra-high-Field (7.0-T) MR Imaging of Esophageal Carcinoma Ex Vivo: Correlation of High-spatial-Resolution MR Images and Histopathologic Findings

**Ichiro Yamada MD (Presenter); Naoyuki Miyasaka MD; Keigo Hikishima PhD, MS; Yutaka Tokairin MD; Tatsuyuki Kawano MD; Eisaku Ito MD; Daisuke Kobayashi MD; Yoshinobu Eishi MD; Hideyuki Okano MD, PhD; Hitoshi Shibuya MD**

**PURPOSE**

To determine the usefulness of high-spatial-resolution MR imaging at ultra-high field strength (7.0 T) for evaluating the depth of mural invasion by esophageal carcinomas.

**METHOD AND MATERIALS**

Twenty esophageal specimens each containing a carcinoma were studied using a 7.0-T MR system with a four-channel phased-array surface coil. High-spatial-resolution T2-weighted MR images were acquired by using a fast spin-echo sequence with the following parameters: repetition time, 3000 msec; effective echo time, 80 msec; rapid acquisition with relaxation enhancement factor, 4; and number of excitations, 32. High-spatial-resolution T1-weighted MR images were also acquired. All the images were obtained with a field of view of 50-60 x 25-30 mm, matrix of 512 x 256, and section thickness of 1.0 mm, which resulted in a voxel size of 0.098-0.12 x 0.098-0.12 x 1.0 mm = 0.0095-0.014 mm3. MR images were compared with the histopathologic findings as the gold standard.

**RESULTS**

High-spatial-resolution T2-weighted MR images at 7.0 T clearly depicted the normal esophageal wall in all 20 specimens (100%) as consisting of the following eight layers: epithelium (low signal intensity (SI)), lamina propria mucosae (high SI), muscularis mucosae (low SI), submucosa (high SI), inner circular muscle (low SI), intermuscular connective tissue (high SI), outer longitudinal muscle (low SI), and adventitia (high SI). These eight layers were found to clearly correspond to the individual tissue layers of the normal esophageal wall. In all 20 esophageal carcinomas (100%), high-spatial-resolution MR images were capable of determining the depth of tumor invasion of the esophageal wall that was confirmed by histopathologic examination. High-spatial-resolution MR images were also capable of differentiating tumor from fibrosis and visualizing tumor growth patterns and adjacent lymph node involvement.

**CONCLUSION**

High-spatial-resolution 7.0-T MR imaging is capable of clearly depicting the individual tissue layers of the normal esophageal wall, and it has excellent diagnostic accuracy for evaluating the mural invasion of esophageal carcinomas. Thus, high-spatial-resolution 7.0-T MR imaging may make it possible to noninvasively diagnose the depth of mural invasion by esophageal carcinomas.

**CLINICAL RELEVANCE/APPLICATION**

By using high-spatial-resolution MR imaging at 7.0 T, we may have a new tool to noninvasively diagnose the depth of mural invasion by esophageal carcinomas.

LL-GIS-WE7A • Optimization of Contrast Medium Administration in CT Perfusion in the Abdomen

**Tonomori Kanda; Takeshi Yoshikawa MD *; Keitaro Sofue (Presenter); Yoshiharu Ohno MD, PhD *; Yasuko Fujisawa MS *; Tohru Murakami; Mizuho Nishio MD *; Hisanobu Koyama MD; Naoki Kanata MD; Noriyuki Negi RT; Kazuhiro Sugimura MD, PhD**

**PURPOSE**

To optimize administration techniques of contrast medium (CM) in abdominal perfusion CT

**METHOD AND MATERIALS**

One hundred twenty eight patients (male:82, female: 46, mean: 68.0 years) underwent upper abdominal CT perfusion. Scans (0.5mm x 320, 80kV, 210-250mA) were conducted 7 to 120 secs after administration of CM and 25-ml saline chaser. The patients were randomly divided into 4 groups; group A (370 mlg/ml, 30 ml, 5 ml/s), B (370, 30, 5 min after routine contrast-enhanced scan), C (370, 21, 3.5), and D (320, 30, 5). Demographic features and scan parameters (FOV, MA, CTMI, DLP) were recorded. Hepatic arterial and portal perfusion (HAP and HPP, ml/min/100ml), arterial perfusion fraction (APF, %), mean transit time (MTT, sec), and distribution volume (DV, ml/100ml) were calculated using dual-input maximum slope (dMS), deconvolution (dDC), and compartment model (dCM) methods using the same ROIIs and on a prototype software. Arterial perfusions (AP), MTT, and DV of pancreas, spleen, gastric wall were calculated using single-input MS, DC, and CM (sMS, sDC, sCM) methods.
The values were compared among the groups.

RESULTS
There was no significant difference in demographic features, scan parameters, HPP, and APF. Significant differences (CONCLUSION)
When using different CM administration techniques, perfusion measurement is most robust in the liver. MS was the most robust method and HPP, APF, and MTT are robust parameters in the upper abdomen. Perfusion CT immediately after routine contrast-enhanced examination should be avoided. Reductions of CM concentration, volume, or injection rate are considerable when required.

CLINICAL RELEVANCE/APPLICATION
Perfusion values measured by CT can be affected by CM injection technique, and are more robust when measured in the liver, using MS, or assessed by HPP, APF, or MTT.

LL-GIS-WEA9 • Intraoperative Contrast Enhanced Ultrasound (IO-CEUS) and Color Coded Elastography (CCE) for Characterization of Liver Lesion before Surgical Resection

Janine Rennert MD (Presenter) ; Christian R Stroszczyński MD ; Ernst Michael Jung MD

PURPOSE
To evaluate if IO-CEUS and CCE allow a differentiation between malignant and benign liver lesions in comparison to histopathology.

METHOD AND MATERIALS
Retrospective evaluation of digitally stored intraoperative CEUS examinations. IO-CEUS and CCE of 59 liver lesions were compared to histopathology following surgical resection. Examinations were performed by one experienced examiner using a multifrequency linear probe (6-9 MHz, LOGIQ E9/GE). Loops of CEUS were evaluated during the arterial (15-45s), the portal venous (60-90s) and the late-venous phase (2-5 min). Characterization of the CCE quality using digital cine-loops >10 s, based upon a color coding system. Semi-quantitative evaluation of the lesions’ stiffness based upon a specified scaling of 0-6 (0 low up to 6 high) using 6 ROIs (1 in the center, 5 in the marginal zone).

RESULTS
Lesion diameter from 7 – 56 mm, mean 26 mm. All 54 malignant lesions (20 HCCs, 8 CCCs, 24 metastases) displayed a portal venous washout. 3 lesions that could not be characterized definitely using IO-CEUS and CCE, were found to be a partially thrombosed hemangioma, a granuloma and a dystrophic fibrosis by histopathology. 4 lesions were correctly diagnosed as complicated cysts using IO-CEUS. Overall sensitivity of IO-CEUS was 90%, PPV was 100%, NPV 40% and accuracy was 94%. Using CCE, malignant lesions were found to be inhomogenous, only partially indurated in 12 lesions, with a scaling of 5. In 13/59 lesions, only central inductions were visible (scaling 4-6). Sensitivity of the CCE was 65%, PPV was 94%, NPV 20% and accuracy was 71%. 2 CONCLUSION
IO-CEUS offers clear benefits for localization and characterization of liver lesions. CCE only sometimes allows a correct characterization of lesions.

CLINICAL RELEVANCE/APPLICATION
CEUS in comparison to US elastography (CCE) enables a more exactly intraoperatively localization and characterization of liver tumors before resection.

LL-GIS-WEA9 • Colorectal Liver Metastasis Treated With 90Y Radioembolization and Classified as Stable by RECIST: What Do Growth Kinetics Tell Us?

Fernanda D Gonzalez Guindalini MD * ; Adeel R Seyal MD (Presenter) * ; Keyur Parekh MD * ; Hamid Chalian MD ; Riad Salem MD, MBA * ; Vahid Yaghmai MD

PURPOSE
To demonstrate the growth kinetics pattern of colorectal cancer liver metastases classified as stable disease by RECIST after treatment with yttrium 90 (90Y) radioembolization.

METHOD AND MATERIALS
This HIPAA compliant retrospective study was IRB approved. Sixty-three chemorefractory colorectal cancer liver metastases in 41 patients with one MDCT scan before and one after 90Y-radioembolization treatment were evaluated. Growth kinetics parameters analyzed were percentage growth rate (%GR) and reciprocal doubling time (RDT). For growth kinetics, negative values of %GR and RDT defined responders and positive values defined non-responders. Percentage change in the largest lesion diameter was used to classify lesion response to therapy according to RECIST.

RESULTS
The mean interval time between the treatment and the post therapy scan was 30 days. Forty-eight lesions (76.2%) classified as stable by RECIST had responded based on GK (%GR and RDT) while 15/63 (23.8%) lesions did not respond. CONCLUSION
In patients with colorectal cancer liver metastases treated with 90Y radioembolization, there is discrepancy between RECIST classification and growth kinetics. RECIST stable disease may not be an accurate reflection of tumor growth kinetics.

CLINICAL RELEVANCE/APPLICATION
Stable disease category by RECIST may include lesions that have negative growth rate. Further studies of growth kinetics as a biomarker for response to radioembolization may be warranted.

LL-GIE1237-WEA • High Resolution MRI of Rectal Carcinoma with Pathologic Correlation after Total Mesorectal Excision

Miguel E Nazar MD (Presenter) ; Nicolas Rotholtz ; Gabriel Casas MD ; Carmen Castro ; Maria F Grana MD ; Eduardo P Eyheremendy MD ; Javier Castillo ; Eduardo J Mondello MD ; Ariel O Vazquez MD

PURPOSE/AIM
The complete removal of the tumour-containing rectum and its draining lymph nodes as a distinct anatomic package is the essence of total mesorectal excision. Clear preoperative depiction of the fascial planes and nerve plexus and their relationship to the surgical planes of excision is critical. The aim of this exhibit is to describe the High Resolution MRI (HR MRI) appearance of these anatomic structures and to compare the findings of rectal cancer with histological correlation after total mesorectal excision of the rectum.

CONTENT ORGANIZATION
HR MRI plays a vital role in the pre and posttreatment assessment of primary rectal cancer. High-resolution T2-W imaging is the key sequence in the MRI evaluation of primary rectal cancer. 25 patients underwent HR MRI in a 1.5 T unit between October 2012 and March 2013. Phased-array multichannel coils were used for signal reception. The MR sequences followed the standard rectal MRI protocol as described in the literature.

SUMMARY
HR MRI can accurately delineate the extent of primary tumours providing physicians, surgeons and radiotherapist with information regarding depth of tumour invasion, status of circumferential resection margin, relationship of the tumour to mesorectal fascia, extramural vascular invasion, and lymph node status.

LL-GIE1246-WEA • Review of Anatomy and Imaging Based Approach to Primary and Secondary Diseases of the Peritoneum and...
Mesentery

Sergi

Mesentery

Signè?

Apparent Diffusion Coefficient (ADC) Value and TRUS-guided Target Biopsy

LL-GUS-WE2A

Wednesday, 12:15 PM - 12:45 PM

Genitourinary/Uroradiology - Wednesday Posters and Exhibits (12:15pm - 12:45pm)

Wednesday, 12:15 PM - 12:45 PM • Lakeside Learning Center

GU

LL-GUS-WEA • AMA PRA Category 1 Credit ™:0.5

Host

Amy M Neville, MD

LL-GUS-WEA1 • Triage of Low-risk Prostate Cancer Patients with PSA Levels Equal to or Less than 10ng/ml: Comparison of the Apparent Diffusion Coefficient (ADC) Value and TRUS-guided Target Biopsy

Ryo Itatani (Presenter); Tomohiro Namimoto MD; Hiroy Kajihara; Kazuhiko Katahira; Shoji Morishita MD; Kousuke Kitan; Yasuyuki Hamada; Mitsuhi Koaka; Takeshi Nakaura MD; Yasuyuki Yamashita MD *

PURPOSE

To identify low-risk prostate cancer we retrospectively determined the optimal cutoff apparent diffusion coefficient (ADC) and compared the diagnostic value of the combination of routine MRI studies (T2- and diffusion-weighted images) plus the cutoff ADC with that of MRI followed by transrectal ultrasound (TRUS)-guided target biopsy in patients with PSA levels = 10 ng/ml.

METHOD AND MATERIALS

In the preliminary study we used receiver operating characteristic (ROC) analysis and determined the cutoff ADC optimal for the identification of prostate cancer with a Gleason score (GS) = 6 in 120 consecutive patients with PSA levels = 10 ng/ml who had undergone radical prostatectomy. Our primary study included another 89 consecutive patients with PSA levels = 10 ng/ml who were also treated by radical prostatectomy for pathologically-proved prostate cancer. Two radiologists independently assessed the combination of routine MRI studies plus the results of the cutoff ADC value (method A) for its diagnostic effectiveness in identifying prostate cancer classified as low-risk by the D’Amico clinical risk score (T stage = T2a, GS = 6, PSA = 10 ng/ml). Their findings were then compared with the diagnostic value of routine MRI combined with the GS obtained from TRUS-guided target biopsies (method B) to identify the superior diagnostic method.

RESULTS

Our preliminary study showed that a mean ADC of 1.04 x 10^{-3} mm²/sec was the optimal cutoff for identifying prostate cancer with a GS = 6 with an area under the ROC curve of 0.707. Under method A, sensitivity, specificity, PPV, NPV, and accuracy were 71.4%, 97.3%, 83.3%, 94.8%, and 93.3% for reader 1, and 71.4%, 94.7%, 71.4%, 94.7%, and 91.0% for reader 2, respectively. Under method B they were 57.1%, 89.3%, 50.0%, 91.8%, and 84.3% (reader 1) and 57.1%, 85.3%, 42.1%, 91.4%, and 80.9% (reader 2). For each reader accuracy was statistically higher with method A (p = 0.041).

CONCLUSION

In patients with PSA levels = 10 ng/ml, the combination of MRI findings plus the cutoff ADC is significantly more accurate for the identification of low-risk prostate cancer than is the combination of MRI followed by TRUS-guided target biopsy.

CLINICAL RELEVANCE/APPLICATION

MRI study combined with ADC evaluation is highly useful for the detection of low-risk prostate cancer in patients with PSA levels ;10 ng/ml and avoids unnecessary invasive procedures including biopsy.

LL-GUS-WEA2 • Role of Fetal MRI in the Differential Diagnosis of Vermian Pathologies in Fetuses under 24 Weeks: The àCæTail Signï¿?

Silvia Bernardo MD (Presenter); Lucia Manganaro MD; Valeria Vinci MD; Paolo Sollazzo; Matteo Saldari; Maria Eleonora Sergi MD; Carlo Catalano MD

PURPOSE

Our aim is to define by fetal MRI the “tail sign” and its meaning in the differential diagnosis of vermician pathologies.

METHOD AND MATERIALS

From February 2010 to January 2013 we performed 287 fetal MRI of the encephalic district and we included in the study 61 cases under 24 weeks of gestation coming with the US suspect of posterior cranial fossa pathology. Fetal MRI was performed with a 1.5-T Magnet without mother sedation. We evaluated the biometrical parameters of the cerebellum, vermis morphology and biometry, IV ventricle, cerebellopontine angle, cisterna magna and tentorium insertion. We highlighted the presence of a linear hypointensity on T2 images in correspondence of the inferior part of the vermis and we called it the “tail sign”. This feature corresponds histologically to a thickness of the 4th ventricle roof that appears raised and dysplastic.

RESULTS

Fetal MRI detected alterations of the posterior cranial fossa in 55/61 cases and excluded the US suspicion of pathologies in the remaining 6 cases. We diagnosed in 19/55 cases Dandy-Walker malformation, in 11/55 cases partial vermis agenesis, in 7/55 cases vermis hypoplasia, in 6/55 cases vermis malrotation, in 4/55 cases cisterna-magna dilatation, in 3/55 cases ponto-cerebellar hypoplasia, 1/55 cases rhombencephalosinapsis, in 2/55cases ischaemic-haemorrhagic lesions and in 2/55 cases a reduction in cranial-cerebellar biometry. MRI results were compared with post-mortem results in 41/55 cases or after birth follow up (Ultrasound,MR or clinical follow up ) in the remaining 14 cases. Our results were confirmed in 51/55 cases and misconfirmed in 4 cases. We identified the “tail sign” in the 100% of Dandy-Walker malformation and in 9/11 cases of partial vermis agenesis. We had no evidence of “tail sign” in all cases of vermis hypoplasia.
Subjective scores accurately characterize prostate MRI focal abnormalities. Further research is needed to find discriminant semiotic features.
features that could help build a score usable by non-experts.

**LL-URE-WE6A • Sonography of the Acute Scrotum: Traumatic and Non Traumatic Causes**

Pamela J Lombardi MD (Presenter) ; Gregory M Grimaldi MD

**PURPOSE/AIM**

Provide the viewer with a concise review of sonographic findings in acute pathology of the scrotum. The exhibit will also include a short overview of testicular anatomy. Relevant radiologic signs and management will be discussed.

**CONTENT ORGANIZATION**

**Normal Testicular Anatomy:** Original drawings demonstrating testicular and epididymal anatomy will be presented with corresponding ultrasound images.

**Traumatic Pathology:** Hematoma, Fracture, Rupture, Hematocele.

Ultrasound images with accompanying text will focus on testicular contour, echogenicity, vascularity and the tunica albuginea.

**Non Traumatic:** Testicular Torsion, Torsion of the appendix testes, Orchitis, Epididymo-orchitis and Abscess.

Ultrasound images with accompanying text will focus on scrotal anatomy, testicular echogenicity and vascular waveform analysis. Images featured in conjunction with clinical history will assist the viewer in their ability to differentiate various non traumatic pathology of the scrotum.

**SUMMARY**

The ability to accurately identify pathological appearances of the scrotum and testes on Ultrasound can greatly assist the clinician in proper patient treatment and surgical intervention if necessary. Doppler waveform analysis can add valuable information, particularly in the setting of acute torsion/detorsion and in the evaluation of capsular blood supply in suspected rupture.

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**Health Services - Wednesday Posters and Exhibits (12:15pm - 12:45pm)**

**Wednesday, 12:15 PM - 12:45 PM • Lakeside Learning Center**

**LL-HPS-WEA • AMA PRA Category 1 Credit ™:0.5**

**Host**

Edward Y Lee , MD, MPH

**Host**

Janie M Lee , MD *

**LL-HPS-WE1A • Consensus Oriented Group Review: Analysis of the First Year of Peer Review Data**

H. B Harvey MD, JD (Presenter) ; Tarik K Alkasab MD, PhD ; Sergio A Segrera ; Daniel I Rosenthal MD ; G. Scott Gazelle MD, PhD *

**PURPOSE**

Our department developed consensus-oriented group review (COGR), a software-enabled, peer review process in which groups of radiologists meet regularly to review randomly selected cases and record consensus on the acceptability of the issued reports. Designed around departmental teaching conferences, COGR is intended to foster the educational, peer coaching, and systems improvement aims of peer review. We study the peer review data collected after one year of performing COGR in our large academic radiology department.

**METHOD AND MATERIALS**

Data of all cases undergoing COGR from October 2011 through October 2012 were exported into Microsoft Excel using the COGR software tool. The data was analyzed to determine the percentage of cases undergoing COGR review in accredited modalities (e.g. CT, MRI, U/S, mammography) and the rates of discrepancy and non-consensus. Additionally, all cases resulting in a consensus that the report should change (i.e. discrepant cases) were analyzed in greater detail to identify and categorize the source of the error/discrepancy.

**RESULTS**

From October 2011 through October 2012, 7,609 cases were reviewed with COGR in 1,541 conferences. Across all divisions, 2.0% of exams in accredited modalities were reviewed by COGR. The average radiologist participated in 55 COGR conferences. A total of 156 of reviewed cases (2.1%) resulted in a consensus that the report should change and 92 cases (1.2%) resulted in no consensus. For the discrepant cases, sources of error/discrepancy could be attributed to a dictation error in 20% of cases, omitted finding in 52% of cases, interpretative error in 19% of cases, failure to use non-routine communication of results in 1% of cases, and error related to a recommendation in 8% of cases.

**CONCLUSION**

Ongoing application of the COGR process generates highly contextualized peer review data that elucidates sources of error in diagnostic imaging. Sustained use in our department permits review of sufficient cases to comply with external standards for ongoing performance review while generating opportunities to identify issues and monitor progress towards quality goals.

**CLINICAL RELEVANCE/APPLICATION**

Consensus oriented group review is a feasible and sustainable option for radiology peer review in a large academic medical center where it produces highly contextualized quality and safety data.

**LL-HPS-WE2A • The Big Picture: Radiology Quality Improvement in the Hospital QA Setting: Communication Is (almost) Everything**

Bettina Siewert MD (Presenter) ; Olga R Brook MD * ; Jonathan B Kruskal MD, PhD *

**PURPOSE**

The purpose of this study is to analyze radiology quality improvement issues that were brought to our attention through hospital personnel working outside of radiology to identify opportunities for improvement and provide better customer service.

**METHOD AND MATERIALS**

We collected quality improvement entries and inquiries that were brought to our attention over an eight months period from August 2012 to March 2013. The origin of the complaint reported to us by personnel working outside of radiology was noted as: electronic hospital patient safety and adverse event reporting system, office for Health Care Quality, office for Patient Relations and hospital e-mail. The radiology component of the cases was categorized into interpretative error, technical error, procedure complication and communication issues. All cases were reviewed and opportunities for improvement were identified.

**RESULTS**

32 cases were referred to us through: electronic patient safety and adverse event reporting system (n=18), office for Health Care Quality (n=5), hospital e-mail (n=5), office for Patient Relations (n=4). Errors were classified as communication (n=16) (50%), misread (n=7) (22%), technical (n=5) (16%), procedure complication (n=4) (12%). Upon review of the cases no opportunities for improvement could be identified in 9 cases (28%) as they represented known procedural complications that could not have been avoided (n=4), perceived 'technical errors' where the study had been performed correctly (n=4) (shoulder injury not attributable to mammogram, MRI of the pituitary gland did not identify septic emboli as area of brain was not imaged due to limited field of view, premedication for iv contrast due to shellsh allergy was not initiated by radiologist, US demonstrated no flow in transplant kidney), communication error (n=1) .
CONCLUSION
50% of radiology quality improvement issues reported by personnel working outside of radiology are due to communication issues alone, only 22% are due to an error in image interpretation. In 28% of cases, no opportunity of improvement could be identified.

CLINICAL RELEVANCE/APPLICATION
50% of radiology QA entries though hospital systems are due to perceived lack of communication.

LL-HPS-WE3A • A Critical Review of the Level of Readability of Online Patient Education Materials from RadiologyInfo.org

David R Hansberry PhD (Presenter) ; Ann John ; Elizabeth John ; Nitin Agarwal ; Sharon F Gonzales MD ; Stephen R Baker MD *

PURPOSE
The widespread availability and ease of access has made the Internet a major source of healthcare information for patients. To account for patient diversity, the American Medical Association (AMA) and National Institutes of Health (NIH) guidelines recommend that consumer healthcare websites be written between a 3rd and 7th grade level. The purpose of this study is to evaluate the jointly sponsored American College of Radiology and the Radiology Society of North America website, RadiologyInfo.org, for its level of readability.

METHOD AND MATERIALS
In December 2012, patient education resources from RadiologyInfo.org were downloaded. Each of the 137 patient education articles available on this website were assessed for their respective level of readability using 10 different scales: the Flesch Reading Ease, Flesch-Kincaid Grade Level, SMOG Grading, Coleman-Lieu Index, Gunning-Fog Index, New Dale-Chall, FORCAST, Fry graph, Raygor Estimate, and New Fog Count.

RESULTS
All 137 articles were written at a level well above the AMA and NIH recommended guidelines of material to be written no higher than a 7th grade level. In fact, only 5% (7/137) were written below the 10th grade level and only 1.5% were below the 9th grade level. When averaged across all 137 articles, the readability of material on RadiologyInfo.org ranged between the 11.5 and 13.7 grade levels.

CONCLUSION
The readability of the text of patient education resources on RadiologyInfo.org is beyond both the AMA and NIH recommended guidelines. This disconnect may negatively impact patient understanding of such Internet resources. Therefore, patient education resources available on RadiologyInfo.org may benefit from revision in an attempt to improve patient comprehension.

CLINICAL RELEVANCE/APPLICATION
NA

LL-HPS-WE4A • Peer Review (Retrospective Sampling) vs. Quality Assurance Database (Voluntary Data Entry) in Ob/Gyn Imaging

Olga R Brook MD (Presenter) * ; Janneth Y Romero MD ; Alexander Brook PhD * ; Jonathan B Kruskal MD, PhD * ; Deborah Levine MD *

PURPOSE
Our quality assurance (QA) database is a voluntary learning system for radiologists to submit technical and clinical QA errors, complications and related events. Submissions into peer review (PR) are mandatory entries by radiologists through a process of retrospective review of cases. Our purpose of this study was to evaluate patterns of submissions into PR and QA databases involving Ob/Gyn imaging.

METHOD AND MATERIALS
Submissions to departmental QA (9/2004-11/2012) and PR (3/2007-11/2012) databases were searched for Ob/Gyn-related keywords. After exclusion of duplicates, there were 202 cases in QA and 73 in PR databases. Review and grading of cases was performed independently by two ultrasonologists. Cases were categorized into perceptual, interpretive, communication and procedural errors. Impact of the errors was assessed based on clinical and radiological follow up. Probability of the error occurrence was estimated. 17 cases from QA and 9 cases from PR database were not true QA issues by consensus agreement, thus excluded from further analysis. The final study group included 185 cases in QA and 64 in PR databases.

RESULTS
There was no significant difference in patient age (44 ± 18 vs. 42 ± 16 yrs, p=0.41), or time period between study and error reporting, (298 ± 584 vs. 152 ± 368 days, p=.10) in PR and QA databases, respectively. The majority of the submissions were for outpatient studies37/64, 58% and 139/185, 75%, respectively. More emergency room studies were submitted to PR 25/64, 39%, compared to QA 26/185, 14% (p

CONCLUSION
More clinically relevant, but less frequent cases are submitted through a voluntary quality assurance reporting mechanism than through the peer review process.

CLINICAL RELEVANCE/APPLICATION
Our results suggest that efforts to improve quality (by increasing the reporting of adverse events and diagnostic errors) should continue to encourage voluntary entry of all QA cases.

LL-HPS-WE5A • The ABRâ€™s Practice Analysis Survey: Comparison of 2010 and 2013

June C Yang PhD,RN (Presenter) ; Anthony Gerdesman PhD ; Kay H Vydareny MD ; Gary J Becker MD ; Jennifer Bosma PhD

PURPOSE
To present the findings of the 2013 ABR Practice Analysis survey, performed to determine the critically important and frequently performed activities in clinical practice, and to note changes in practice patterns since the prior survey in 2010.

METHOD AND MATERIALS
The survey instrument was distributed electronically to 17,721 members of American College of Radiology with a unique identification code for each individual in 2010 and to 16,369 individuals in 2013. A five-point scale was established for both frequency and importance variables. Rating scales were identical both in 2010 and 2013. Currently, the data are being collected and data collection will be closed on April 12, 2013.

RESULTS
In 2010, 2909 (19.32%) diagnostic radiologists answered the survey, while in 2013, there were 1964 (13.00%) respondents as of April 2, 2013. 2,233 (76.8%) of the respondents indicated that they spent at least 50% of their time in clinical practice in 2010 whereas 1368 (69.65%) diagnostic radiologists who participated reported practicing 50% or more in clinical practice thus far in 2013. The test of statistical significance will be tested in the clinical practice settings and in other demographic data between the two surveys, 2010 and 2013. Changes in top three activities/indications in importance and frequency between the two surveys will be compared.

CONCLUSION
The 2013 practice analysis survey may show changes in practice patterns between 2010 and 2013. These changes will be incorporated
A major barrier to quality assurance (QA) activities in interventional radiology (IR) is the lack of a user-friendly method of data entry and evaluation. The described mandatory complication entry system and the QA database allow collection of overall and procedure-specific complication data. The system also provides an easy way of monitoring the effect of specific quality improvement projects.

CONCLUSION
Performing a well-planned test-migration identifies the most critical problems of the data migration and allows early solutions of these problems before starting the actual migration process. This will both ensure a higher rate of successful migration and less problems during the actual migration process.

CLINICAL RELEVANCE/APPLICATION
PACS transition and especially image data migration is challenging. This research shows that a test-migration can effectively identify problems which will allow a more smooth actual migration process.

LL-INS-WE3A • Use of a Mandatory Complication Entry System Integrated into the Radiology Dictation System for Monitoring Effects of Quality Improvement Initiatives

Sharjeel Sabir MD (Presenter) ; Jay Patel ; Thai T Nguyen ; Michael J Wallace MD * ; Charles T Suito MS ; Kevin W McEnery MD * ; Marshall E Hicks MD * ; Sanjay Gupta MD

CONCLUSION
The described mandatory complication entry system and the QA database allow collection of overall and procedure-specific complication data. The system also provides an easy way of monitoring the effect of specific quality improvement projects.

Background
A major barrier to quality assurance (QA) activities in interventional radiology (IR) is the lack of a user-friendly method of data entry and collection. We present our experience with the use of a mandatory program for entry of interventional radiology (IR) procedure-related complications that is completely integrated with the radiology dictation system. We also evaluated its usefulness in monitoring a quality improvement project aimed at reducing lung biopsy related complications.

Evaluation
During the study period, 63,871 IR procedures were entered in the database, 3,273 complications were reported, 318 (0.5%) of which...
were classified as major. Common major complications included vascular (n=89; 28%), infection (n=70; 22%), and lung biopsy related air-leak events (N=70; 22%). We used the database to evaluate the effect of a quality improvement project, initiated in 2007, aimed at reducing the lung biopsy related pneumothorax and chest tube rates. Based on the entries made in the database, the lung biopsy related pneumothorax rates decreased from 38.3% in 2006 to 24.9% in 2008, and the chest tube insertion rates decreased from 17.8% in 2006 to 11.4% in 2008. Collection of chest tube rates from the Radiology Information System using the CPT codes during this same time period revealed similar data (16.8% in 2006 and 10.7% in 2008).

Discussion
The mandatory IR complication entry process is integrated with the Radiologist Dictation system application and prevents the radiologists from finishing the dictation without performing the data entry step. The system also forces the radiologist to enter appropriate complication data to previous IR dictations. All entries are sent to IR database, which can be queried to run reports and to identify trends. All major complications are peer-reviewed and subsequently discussed in the IR peer review committee meetings.

**LL-INS-WE6A • A Growing Need for an Official Introduction to Cloud Computing in the Radiology Residency Curriculum**

**Chika I Logie MD (Presenter); G. R Haines; Donald E Hatley; Matt Jordan; Mark D Murphey MD**

**CONCLUSION**
Rapid evolutionary changes in technology, specifically cloud technology cast a new set of challenges to present-day radiologists. A result of these new challenges is a growing and definite need to formally introduce cloud technology to the Radiology education curriculum, with 90% of survey respondents in favor of adding cloud technology lectures to the curriculum. We believe that educating radiologists about cloud technology will ultimately enhance the ability of radiologists to meet new, complex demands that are attributable to rapidly evolving technology and advanced applications.

**Background**
Present-day radiologists face a novel set of challenges that accompany rapidly advancing technology. Given the absence of cloud technology as a core portion of the Radiology education curriculum, we believe that signs of lack of this specific education are already evident. In acknowledgement of the increased exposure of residents to social applications compared to practicing radiologists (based on lifestyle and age differences), we hypothesized that residents would be more familiar with cloud computing terminology, would use a greater number of relevant applications and devices, and would demonstrate measurably greater knowledge base on the subject of cloud computing.

**Evaluation**
A 10-question electronic survey was created using Adobe Acrobat FormsCentral. The content and manner of data collection was ascertained to comply with institutional regulations, which categorizes this activity as meeting criteria for exempt status. The survey was emailed to 3000 radiology residents and practicing radiologists. Four independent sample t-tests were used to determine familiarity, cloud use, knowledge base and computing hardware preferences. A Bonferroni corrected alpha level of .013 was used.

**Discussion**
There were 210 respondents with distribution as follows: Radiology Residents (44%), Radiology Fellows (11%), Academic Radiologists (24%), Community Radiologists (15%), and other (6%). Overall, 63% reported they neither understood the concept of cloud computing nor knew how it applies to radiology. 90% agreed that the Radiology Residency Curriculum would benefit from the incorporation of lectures on cloud technology.

**LL-INS-WE5A • Errors in Interpretation: Lessons Learned from Abdominal Quality Assurance**

**Aaron W Maxwell BS (Presenter); Jonathan B Krukskal MD, PhD *; Ronald L Eisenberg MD, JD; Vassilios D Raptopoulos MD; Bettina Siewert MD**

**PURPOSE**
Radiologic errors are common and primarily represent missed findings. Errors in interpretation occur with less frequency, but are potentially more straightforward to remediate because they result from the faulty analysis of appropriately identified findings. The purpose of this study was to analyze such errors and characterize potentially contributing factors, with an emphasis on subsequent opportunities for remediation.

**METHOD AND MATERIALS**
All submissions to the online quality assurance database at our institution between October, 2004 and April, 2013 were retrospectively reviewed. Only interpretive errors made during CT evaluation of the abdomen and pelvis were included for analysis. Errors were organized by organ system and categorized as undercalls or overcalls. The following contributing factors were analyzed: historical bias, anatomic misconception, technical factors, lack of Hounsfield unit (HU) measurement, inappropriate pattern recognition, and lack of comparison with prior studies. Where documentation was available, note was made of the examination setting and the associated report’s author (attending if error in full report, resident if error in preliminary report).

**RESULTS**
2845 cases were identified in our initial search, of which 111 (3.9%) met full inclusion criteria. The majority of errors represented undercalls (59 cases, 53.2%). Contributing factors were identified in all 111 (100.0%) cases, with more than one factor identified in 52 (46.8%) cases. Anatomic misconceptions were noted in 47 (42.3%) cases, historical bias in 43 (38.7%) cases, technical factors in 30 (37.0%) cases, lack of HU measurement in 25 (22.5%) cases, inappropriate pattern recognition in 19 (17.1%), and lack of comparison with prior studies in 16 (14.4%) cases. Errors were most frequent in the outpatient setting (57.7% vs. 27.9% emergency vs. 14.4% inpatient). Errors involved attendings in 104 (93.7%) cases and residents in 7 (6.3%).

**CONCLUSION**
The factors that most frequently contribute to errors in interpretation are anatomic misconceptions, historical biases, and technical limitations of the study. Undercalls are somewhat more common than overcalls. Frequently, more than one contributing factor is present.

**CLINICAL RELEVANCE/APPLICATION**
Efforts at remediation of interpretive errors should focus on common potential contributing factors, such as anatomic misconceptions, historical bias and technical limitations of the study.

**LL-INE-WE56A • Load Balancing Breast Imaging Screens In Oceanetta: A Large Scale Radiology Scheduling Application**

**Shafiquil Abedin (Presenter); Margarita L Zuley MD**

**Background**
Prospectively planning how many physicians are needed to cover patient demand and also balancing workload at each location in complex medical systems is challenging. UPMC offers breast imaging at 9 locations throughout the region and a large number of these screening exams have been assigned to one physician daily due to the inability to easily manage screening mammography resulting in issues with interpretation quality for those with very low and very high volume as well as requiring one FTE per annum to cover the patient demand. As part of both a quality initiative in breast imaging and staffing management plan, a novel software application, Oceanetta, has allowed prospective planning of how many studies will be read by every physician each day at each location and is based on the number of studies generated through use of technologists’ schedules.

**Evaluation**
We integrating load balancing and technologist schedule into our existing physician scheduling application. This enabled us to project the number studies generated against numbers interpreted by physicians on a given day, thus allowing prospective analysis of load balancing and overflow. By implementing the process of withholding fixed number of exams and sending the rest to our central location to be read by a physician assigned only to screening, we predicted a reduction in days requiring a dedicated screening reader and reduction...
CONCLUSION
With our experimental model applied to real data we decreased needed staffing by .78 FTE and reduced variance in number interpreted to improve quality.

LL-INE3226-WEA ● Development of a Dose Index Registry in Japan (J-DIR) - Dedicated for Low-dose Lung Cancer CT Screening

Yoshihisa Muramatsu PhD (Presenter); Rikuta Ishigaki; Kouzou Hanai PhD; Masafumi Shinozaki RT; Michael F McNitt-Gray PhD *; Akihiro Machitori; Yoshito Tabata; Masato Mori; Tomohiro Arai RT

Background
A Dose Index Registry for Japan (J-DIR) has been developed for Japan. An extension of the J-DIR is to adapt this specifically for Low-dose lung cancer CT screening. The purpose of this study is to describe the developments in the database software (Combined Application Dose Index: "CADI") required for this new application.

Discussion
Because a lung cancer screening program involves healthy subjects, strict adherence to a low dose CT protocol is required. In this demonstration phase, a chest phantom was scanned and CADI was used to record and analyze dose information from routine chest examinations. By maintenance of nationwide infrastructure, central collective management is realized.

CONCLUSION
We developed database software (CADI) for Low-dose Lung cancer CT screening with the function of DIR. A pilot study for low dose lung cancer screening will be started in June, 2013 among 10 institutions.

LL-INE3222-WEA ● Abdominal Lymph Node Diagnosis Assistance Based on Automated Lymph Node Detection and Quantification

Kensaku Mori PhD (Presenter); Yoshihiko Nakamura MEng; Kazuhiro Furukawa; Kazunari Misawa MD, PhD; Masahiro Oda PhD; Shigeru Nawano MD; Yukitaka Nimura

PURPOSE/AIM
The aim of this exhibit:
1. To understand how the system detects abdominal lymph nodes from CT volumes
2. To understand how the system detects candidate regions from CT volumes
3. To understand how the system eliminates false positives from candidate regions by support vector machine
4. To understand how the system quantifies detected lymph nodes
5. To understand how the system visualize detection and quantification results

CONTENT ORGANIZATION
This exhibit consists of two parts:
1. Demonstration of the assistance system for abdominal lymph node assistance
   Automated detection and quantification of lymph node
   CT volume reading with highlighting detected lymph nodes
2. Explanation of lymph node detection and quantification
   How the system initially detects lymph nodes
   How the system eliminates false positive regions by support vector machine
   How the system quantifies features of detected lymph nodes
   How the system visualizes detection and quantification results

SUMMARY
The major teaching points of this exhibit are:
- How the radiologist diagnoses lymph nodes with automated detection and quantification functions
- How the system can detect lymph nodes that can be often overlooked by radiologist
- How the assistance system can be integrated into the workflow of a radiologist

LL-INE3179-WEA ● One Size in No Way Fits All - Quantifying Hip Variations by Automatic Morphometric Measurements from CT

Ju Zhang (Presenter); Jacqui Hislop-Jambrich PhD *; Duane Malcolm; C David L Thomas; Poul Nielsen

Background
The femur and hip joint in particular are complicated structures that have both clinical and anthropological significance. The variability of surface structures among individuals especially in terms of gender makes the extraction of consistently reproducible measurements non-trivial and time consuming. Automatic image segmentation and meshing methods allow precisely-defined measurements to be taken from CT-volumes as part of an automated pipeline. We present initial findings from such a pipeline for obtaining morphometric measurements of the hip. We believe that the importance of this work lies in the eventual creation of a comprehensive databank that will be of use in the development of prosthetic devices and the tracking of disease and evolutionary morphometry.

Evaluation
A 16-row MDCT was used to acquire images on 55 human cadavers (24 male, 31 female). The outer femoral surface was automatically segmented and meshed with sub-voxel accuracy. Femoral head area, femoral axis length, neck angle, neck width, and subtrochanteric width were automatically measured on the mesh according to mathematical definitions based on mesh geometry. All automatic measurements except for neck angle showed significant differences between genders (p-value)

Discussion
We present this initial evaluation of five measurements with a view toward the creation of a macro-structural atlas of bones in the hip. The automated system shows good promise in terms of accuracy and sensitivity compared to manual measurements. We describe the variability of these measurements in our homogenous population with specific reference to gender to provide an overview of what is possible using current technology.

CONCLUSION
Automatic assessment of proximal femur morphometry has shown that variations are sufficient to warrant the creation of a bank of detailed morphometric assessments of the hip. We believe that detailed knowledge of this complicated structure may be used to support the development of prosthetic devices and assist in diagnosing complex hip-based disorders.

LL-INE3181-WEA ● Organ Segmentation of Fetal MR Images Using Active Contours and Morphology

Shivaprasad A Chikop (Presenter); Sneha Shiradon; Pavan Poogar BEng; Arush Honnedevasthanna Arun; Smitha Saraswatthi; Sonal A Pungavkar MD; Barjor Gimi PhD; Ramesh Babu; Sairam Geethanath

The major teaching points of this exhibit are:
1. How the assistance system can be integrated into the workflow of a radiologist
2. How the system can detect lymph nodes that can be often overlooked by radiologist
3. How the system quantify features of detected lymph nodes
4. How the system initially detects lymph nodes
5. Explanation of lymph node detection and quantification
6. CT volume reading with highlighting detected lymph nodes
7. Automated detection and quantification of lymph node
8. How the radiologist diagnoses lymph nodes with automated detection and quantification functions
9. How the system quantifies features of detected lymph nodes
10. How the assistance system can be integrated into the workflow of a radiologist
A database containing 6 MRI volumes of fetuses was used for this study. All images were acquired with the single shot Fast Spin Echo sequence on a 1.5T GE MR scanner. Acquisition parameters were: TR/TE=1750/91.616 ms, flip angle = 90, slice thickness/gap = 4/5 mm. Region of interest (ROI) was selected for the input image and segmentation was performed using active contour method. The number of iterations and smoothing parameter for the active contour were optimized for our algorithm based on 1 volume. Post-processing was performed using morphological operations of opening and closing. Manual and semi-automatic segmentation of the brain and the lungs were performed on the 6 datasets and were compared. The output of our algorithm can also be seen in the figure attached 1(d). The figure also contains the results of segmentation for a representative data set showing the fetus (a), segmented brain (b) and segmented lungs (c).

CONCLUSION
We have proposed a supervised method for the contrast independent segmentation of fetal brain and lungs. The proposed method does not depend on prior information such as eye-localization, which is highly contrast dependent. The results of comparison of the manual and semi-automated segmentation show the utility of the approach. Current and future work involves automation of ROI, 3D reconstruction and volumetric analysis.
LL-MKS-WE1A • Percutaneous Vertebroplasty for Pain Management in Patients with Multiple Myeloma: Is Radiofrequency Ablation Necessary?

Marco Matteoli MD (Presenter); Gianluigi Orgera MD; Miltiadis E Krokidis MD, PhD; Gianluca M Varano; Florindo Laurino; Michele Rossi MD

PURPOSE
To investigate the added role of radiofrequency ablation to vertebroplasty on the pain management of patients with multiple myeloma.

METHOD AND MATERIALS
Thirty-six consecutive patients (51-82 years) with vertebral localization of multiple myeloma were included in the study and randomly divided into two groups: 18 patients (Group A) that underwent radiofrequency ablation and then vertebroplasty and 18 patients (Group B) that underwent only vertebroplasty. Primary endpoints were technical success and pain relief score rate measured by the visual analogue pain scores (VAS) and Roland-Morris Questionnaire (RMQ); secondary endpoint was the amount of administered analgesia. Survival and complications were compared between the two groups.

RESULTS
Technical success was 100% in both groups. The VAS score (at 24h and 6-weeks post procedure) decreased in equal manner for both groups by a mean of 9.1 to 3.4 and 2.0 for Group A and from a mean of 9.3 to 3.0 and 2.3 for Group B without statistically significant difference. RMQ mean score prior to the procedure was 19.8 for Group A and 19.9 for Group B and decreased to a mean of 9.6 and 8.2 for Group A and 9.5 and 8.7 for Group B at 24h and 6-weeks post procedure respectively. The amount of medication was equally decreased in the two groups. No major complication occurred and two patients died from other causes.

CONCLUSION
The use of percutaneous vertebroplasty alone appears to be effective on the pain management of the patients with vertebral involvement of multiple myeloma. The use of radiofrequency ablation does not offer any clear added benefit on the mid-term pain management of such patients.

CLINICAL RELEVANCE/APPLICATION
Vertebroplasty alone is a suitable choice as pain treatment for vertebral localization of myeloma.

LL-MKS-WE2A • A Preliminary T2 Mapping MRI Study of How Anterior Lumbar Fusion Accelerates Adjacent Segment Degeneration in the Intervertebral Disc Anterior Annulus Fibrosus of Adjacent Segments

Hajimu Goto MD, PhD (Presenter); Yuki Iwama MD; Kenichiro Kakutani MD, PhD; Kotaro Nishida MD, PhD; Nobukazu Aoyama RT; Masahiko Fujii MD; Kazuro Sugimura MD, PhD *

PURPOSE
The purpose of this study was to study early stages of alteration of adjacent discs both above and below the affected segment after posterior vertebral fusion, and to demonstrate the potential benefits of biochemical magnetic resonance imaging (MRI) T2 mapping of intervertebral discs with regards to detection of the early stages of degenerative disc disease.

METHOD AND MATERIALS
From March 2010 to April 2013, 25 patients (22 female and 3 male) with a mean age of 68.2 years (range, 54-83 years) who underwent posterior lumbar fusion were included in this study. The patients underwent follow-up MRI for over two years. In total, MRIs of over 300 discs were evaluated: one disc in an adjacent segment above an affected lumbar disc, and one disc in an adjacent segment below an affected lumbar disc at each follow-up point. For two upper vertebrae, one disc was selected as a control disc. Selected discs were divided into three parts: anterior annulus fibrosus (AF), posterior AF, and nucleus pulposus (NP). One-Way Repeated-Measures ANOVA and post-hoc tests according to the Tukey test were performed to evaluate the significance of the variation in T2 mapping between 3-months, 1-year, and 2-years of follow-up. A p value of less than 0.05 was considered statistically significant.

RESULTS
After posterior lumbar fusion, adjacent segment disc T2 values decreased mainly in the anterior AF. The adjacent segment above the affected fused disc had a significantly larger degree of decrease in T2 values compared to below the affected fused disc. There was no significant relationship between T2 values and degree of fusion and the number of fused discs.

CONCLUSION
Adjacent segment disc degeneration may be caused by altered lumbar biomechanics, which occurs in the anterior AF after lumbar fusion. T2 mapping can be used to detect early stages of alteration in adjacent discs after posterior vertebral fusion.

CLINICAL RELEVANCE/APPLICATION
Clarification of the factors that effect ASD could be used to select patients who would benefit from operative therapy and to show the benefits of T2 mapping for understanding early disc degeneration.

LL-MKS-WE3A • Treatment of Metastatic Osseous Lesions with a Bipolar Navigational Radiofrequency Ablation Device: Retrospective Study

Praveen Anchala MD (Presenter); Winston D Irving MD; Michael V Friedman MD; Travis J Hillen MD *; Jack W Jennings MD

PURPOSE
To report the safety and efficacy of radiofrequency ablation (RFA) of malignant spinal lesions using the STAR System which includes a navigational electrode with two active thermocouples.

METHOD AND MATERIALS
A retrospective review of patients receiving RFA as a treatment for metastatic osseous lesions using the STAR System between March 2012 and March 2013 was performed. A total of eighty-two metastatic lesions were identified in forty patients who underwent a total of thirty-seven procedures. Cement augmentation was performed using the same ablation cannula when required. Follow-up consisted of Visual Analogue Scales (VAS) obtained preoperatively as well as postoperatively at the one week, one month, and six month time points. Additionally, interval change in the patients’ pain medications was also recorded. Postoperative imaging was used to assess stability at the treated level in cases in which it was available.

RESULTS
RFA was technically successful in all of the lesions. Our study demonstrated significant (p < 0.05) difference in VAS pain scores and RMQ between baseline and post-procedure. The STAR System is an RF device that was safely and effectively used in the treatment of metastatic osseous lesions. The navigational osteotome allows the operator to steer the ablation tip to reach previously untreated lesions. Additionally, the two thermocouples on the device allow real-time monitoring of the peripheral ablation edge, avoiding damage to neural tissue and providing an accurate ablation cavity size. Cement can be delivered after ablation via the same working cannula. This new device allows RFA treatment of lesions that were previously considered untreatable, and also allows for the reduction of pain in lesions not controlled by systemic or radiation therapy. Prospective clinical trial is under preparation.

CLINICAL RELEVANCE/APPLICATION
Modifications within this new RFA device allows for safe and effective ablation of previously untreated osseous metastatic lesions.
Purpose
To assess feasibility of T2*-corrected fat fraction map using three-point Dixon-VIBE sequence as a tool for differentiation between malignant marrow replacing lesion and benign red marrow deposition of vertebra.

Method and materials
From Mar. 2012 to Feb. 2013, magnetic resonance imaging was performed for consecutive 33 patients who were referred for vertebral marrow abnormality assessment. Twenty two pathologically confirmed malignant marrow replacing lesions and 11 benign red marrow lesions from the patients were subjects of this study. Three sequences were applied using a 1.5-T MR imaging scanner like follows: three-point Dixon-volume interpolated breath-hold GRE sequence (VIBE) for fat fraction (FF) measurement; conventional T1 weighted imaging (T1WI); pre- and post-contrast enhanced fat-suppressed T1WI (CE). To measure fat fraction or signal intensity (SI), region of interest (ROI) was placed at the target lesions. Average measurements from consecutive three slices of the target lesions were used for data analysis. Three parameters from the measurements were obtained like follows for each lesion: FF from VIBE; LDR (lesion-disc ratio; $SI_{\text{of marrow}}/SI_{\text{of disc}}\times 100$) for T1WI; CER (contrast enhancement ratio; $LDR_{\text{of post-contrast T1WI-LDR of pre-contrast T1WI}}\times 100$ / LDR of pre-contrast T1WI) for CE. To evaluate diagnostic performance of the three parameters, receiver operating characteristic (ROC) curves were obtained and areas under curves (AUCs) of the parameters were compared to each other. The sensitivity and specificity at the most ideal cut off values for the parameters were obtained.

Results
AUCs of FF, LDR, CER were 0.96, 0.83, 0.74. FF showed superior AUC than CER with statistical significance. The optimal cut-off value and the corresponding sensitivity/specificity in percentage were like follows: 16, 0.81/1 in FF; 116.2, 1/63.6 in LDR; 93.4, 0.68/0.81 in CER.

Conclusion
T2*-corrected fat fraction measurement using a three-point Dixon-VIBE sequence showed superior diagnostic performance than contrast enhanced T1WI, and it showed excellent specificity in differentiation between malignant marrow replacing lesion and benign red marrow deposition of vertebra.

Clinical relevance/application
T2*-corrected fat fraction measurement using a three-point Dixon-VIBE sequence is expected to play an important role to differentiate benign red marrow from malignant marrow lesion.

LL-MKS-WE6A • Do the OS Trigonum Play a Fundamental Role as a Determining Factor of Ankle Instability?
Sarah Marques Llano (Presenter); Hector Vidal Trueba; Javier Arnaiz Garcia MD; Andres Garcia Gamez; Tatiana Piedra Velasco MD; Alex A Thompson; Ana Canga MD

Purpose
The purpose of this work is to analyze the role of the os trigonum as a determining factor in ankle instability: - Os trigonum as conditioning ankle instability factor, that favors an acute ankle torsion, that breaks the anterior talar peroneal fascicle.

- Os trigonum as conditioning chronic ankle instability in patients without breakage of the anterior talar peroneal fascicle.

Method and materials
Retrospective analysis of 34 ankle MRIs of patients presenting chronic ankle instability from January 2011 until December 2012. Of the patients studied, 91.2% had MRI signs of chronic ankle instability such as: sinus tarsi syndrome, flexor tendosynovitis and focal synovitis. We analyzed the prevalence of os trigonum in patients presenting chronic ankle instability with and without anterior talofibular fascicle.

Results
Of the 34 patients, 11 have an os trigonum (32%) (compared to 7-8% of prevalence in the normal population). If we classify by gender, the prevalence of os trigonum reaches a 40.9% of men with chronic instability in terms of age, the average age in men with chronic instability is 35.6 years vs. 41 years in the overall and 59.5 years in women. The patients studied with chronic instability and os trigonum, without injury to the anterior talofibular fascicle, in males, reaches a 83%.

Conclusion
With the results of this study, we conclude that the os trigonum plays a fundamental role in chronic ankle instability and acute ankle instability that injuries the anterior talofibular ligament.

Clinical relevance/application
Understanding the role of os trigonum in acute and chronic ankle instability can allow a better diagnostic characterization of the ankle injury and open new therapeutic options and techniques.

LL-MKE-WE7A • Ultrasound in Ulnar Collateral Injuries of the Thumb-Are We Getting It Right?
Rakesh Gadvi MBBS, FRCR (Presenter); Surabh Choudhary MD, FRCR; Rajive Jose

Purpose
Ulnar collateral ligament (UCL) injuries of the thumb are frequently encountered by sports physicians and orthopaedic/hand surgeons.

- It is caused by an abduction/hyperextension injury to the metacarpophalangeal joint of thumb, often associated with skiing injuries.

- While partial ligament injuries may heal with conservative treatment, a complete UCL rupture will need operative repair due to abnormality of adductor aponeurosis (Stener lesion).

- Ultrasound (US) is increasingly used in conjunction with clinical examination in assessment of the ligament and has been reported in literature as having high sensitivity and specificity in the diagnosis of complete UCL tears.

- We report findings of an audit on diagnostic performance of US in characterising UCL injuries and also revisit the role of high resolution US in this subgroup of hand injuries.

- Whilst previous studies have assessed US in complete ulnar collateral ligament tears, authors in the present study attempt to elucidate the role of US in surgical decision making in the entire spectrum of thumb UCL injuries, with emphasis on technique and common pitfalls.

Methods
- Retrospective data was collected on all US examinations of the thumb for suspected UCL injuries from Jan 2010 to Sept 2012 using radiology information system (RIS).

- Clinical findings on clinical examination and US were recorded. Clinical notes and operative findings in these patients from hand clinic were accessed from the online clinical portal system.

- In surgically explored patients, operative findings were used as a gold standard. In patients who were conservatively managed, follow up clinic letters documenting stability of metacarpophalangeal joint on stress testing was used as gold standard for follow up.
Lakeside Learning Center

Multisystem/Special Interest - Wednesday Posters and Exhibits (12:15 - 12:45pm)

Wednesday, 12:15 PM - 12:45 PM • Lakeside Learning Center

**LL-MSE-WE6B • Radiological Manifestations of the SMAD3-related Aneurysms-osteoarthritis Syndrome**

**Sm Van Raak** MD, MSc (Presenter) ; **Ingrid M Van De Laar** MD, PhD ; **Adriaan Moelker** MD ; **Annick S Devos** MD ; **Aida M Bertoli-Avella** MD, PhD ; **Edwin H Oei** MD, PhD

**PURPOSE/AIM**
1. Acknowledge SMAD3-related aneurysms-osteoarthritis syndrome (AOS) as a newly identified autosomal dominant disease. 2. To describe the current state of knowledge regarding AOS. 3. To describe the specific imaging findings of cardiovascular and musculoskeletal anomalies associated with AOS. 4. Discuss the role of imaging in patient management and follow-up.

**CONTENT ORGANIZATION**
1. Introduction of the SMAD3-related aneurysms-osteoarthritis syndrome and its phenotypic spectrum. 2. Radiological findings related to...
SUMMARY
An underrecognized entity is a newly identified autosomal dominant disease caused by a mutation in SMAD3 gene and characterized by cardiovascular and joint anomalies. The cardiovascular abnormalities include thoracic aortic aneurysms and/or dissection, tortuosity and aneurysms of other arteries, and valvular disease. Joints show osteoarthritis-like abnormalities, presenting at a young age. Other common musculoskeletal anomalies include deformities of vertebral endplates, intervertebral disc degeneration, osteochondritis dissecans and scoliosis.

**LL-MSE1211-WEB • Ultra Fast Doppler: Understanding the Terms, Current and Potential Clinical Applications**

**Manish Dhyani MBBS (Presenter); Arash Anvari MD; Anthony E Samir MD**

**PURPOSE/AIM**
UltraFast Doppler is a new Doppler technique that utilizes massive parallel computing to enable frame rate increases by a factor of 5 to 10 compared with conventional color Doppler, without sacrificing field of view or spatial resolution. This provides a more accurate visualization of complex flow dynamics and transient flow events. It also has potential to increase measurement accuracy particularly in stenosis grading and resistance index calculation. This will likely have important implications for the accuracy of stenosis grading.

**CONTENT ORGANIZATION**
1. Doppler Ultrasound: General Principles – color, power and pulsed wave.
2. Terms: Resistive indices, Peak systolic flow velocity.
3. UltraFast Doppler:
   a. Review of technology
   b. Current applications
   c. Potential Applications
4. Advantages over Doppler Ultrasound

**SUMMARY**
UltraFast Doppler holds significant potential to enhance measurement accuracy and visualization of flow dynamics. The purpose of this exhibit is to educate the audience on this new state-of-the-art Doppler imaging technology.

**Neuroradiology/Head and Neck - Wednesday Posters and Exhibits (12:15pm -12:45pm)**

**Wednesday, 12:15 PM - 12:45 PM • Lakeside Learning Center**

**LL-NRS-WEA • AMA PRA Category 1 Credit ™: 0.5**

**Host**
Pratik Mukherjee, MD, PhD *

**LL-NRE-WE10A • The Concept and MR Imaging Features of Neuromyelitis Optica Spectrum Disorder (NMOSD)**

**Da Mi Kim (Presenter); In Ho Lee MD**

**PURPOSE/AIM**
The purpose of this exhibit is:
To review the concept of neuromyelitis optica spectrum disorder (NMOSD)
To explain the magnetic resonance imaging features in the diagnosis of NMOSD

**CONTENT ORGANIZATION**
Diagnostic criteria and pathophysiology of NMOSD
Review of representative MR imaging findings – spine, brain, and orbit lesions in neuromyelitis optica (NMO)
Discuss the relationship of autoantibodies (NMO-IgG/antiaquaporin 4, anti-Ro antibody) and NMOSD

**SUMMARY**
The major teaching points are: 1. NMOSD, which includes a proportion of patients with recurrent longitudinally extensive myelitis (T2 high signal intensity in spinal cord and various enhancement in postcontrast T1-weighted image) or optic neuritis (T2 high signal intensity in optic nerve and nerve or nerve sheath enhancement in fat-suppressed, postcontrast T1-weighted image) and as well as associated with systemic autoimmune disease patient or with brain lesions typical of NMO corresponded to site of high antiaquaporin 4 expression; these were hypothalamic, corpus callosum, periventricular, or brainstem (including medulla oblongata). 2. Patients with Sjogren’s syndrome or systemic lupus erythematosus who were NMO-IgG positive were likely to have a recurrent myelitis or optic neuritis, or brain lesions which suggests the coexistence of a NMOSD with their systemic autoimmune disorder.

**LL-NRE-WE11A • Love the Fat in the Neck**

**Tina S Sanghvi MD (Presenter); Ilona M Schmalfuss MD * **

**PURPOSE/AIM**
Fat planes play a critical role in the interpretation of head and neck studies and facilitate detection, localization and determination of the extent of lesions.

**CONTENT ORGANIZATION**
Enhanced detection and extent of pathology is possible with careful evaluation of often overlooked fat planes located in the orbital apex, pterygopalatine fossa, cranial nerve foramina, buccinator muscle, buccal space, peri-epiglottic and post-cricoid regions. Their normal imaging appearance will be contrasted with examples of subtle, yet clinically significant, abnormalities which may be overlooked if not exclusively looked for. The presented pathology will include infections (e.g. dental phlegmon, invasive fungal disease), inflammatory disease processes (e.g. Tolosa-Hunt syndrome), primary neoplastic lesions (e.g. retromolar trigone, buccal mucosal, hypopharyngeal cancers) and secondary neoplastic involvement along various cranial nerves (e.g. trigeminal, facial and superior laryngeal nerves).

**SUMMARY**
Inclusion of often overlooked fat planes in the head and neck in the interpretation process will facilitate detection and identification of the extent of underlying pathology. This can immensely increase not only reporting accuracy and confidence, but also play a significant role in patient care and management.

**LL-NRS-WE1A • Usefulness of Amide Proton Transfer Imaging in Grading Diffuse Gliomas: Comparison with Contrast-enhanced and Diffusion-weighted MR Imaging**

**Osamu Togao MD, PhD (Presenter); Takashi Yoshiura MD, PhD; Jochen Keupp PhD *; Akio Hiwatashi MD; Koji Yamashita MD; Kazufumi Kikuchi MD; Hiroshi Honda MD**

**PURPOSE**
Amide proton transfer (APT) imaging is a specific type of endogenous chemical exchange saturation transfer (CEST) imaging for detection
METHOD AND MATERIALS

RESULTS
High-grade gliomas (HGG, grade III or IV) showed significantly stronger contrast enhancement (P<0.05) compared to low-grade gliomas (LGG, grade I or II) at baseline. APT imaging can provide better diagnostic performance in differentiating HGG from LGG compared with contrast-enhanced MR imaging and DWI.

CLINICAL RELEVANCE/APPLICATION
APT imaging can provide better diagnostic performance in differentiating HGG from LGG compared with conventional MR imaging sequences.

LL-NRS-WE3A • Three-dimensional Amide Proton Transfer Imaging of Glial Tumors: Correlational Analysis with Ki-67 Labeling Index, SUV and ADC

Akihiko Sakata MD (Presenter); Tomohisa Okada MD, PhD; Akira Yamamoto MD, PhD; Mitsunori Kanagaki MD, PhD; Yasutaka Fushimi MD, PhD; Emiko Morimoto MD; Ryo Sakamoto; Taha M Mehedi MBBCh; Satoshi Nakajima MD; Hirofumi Yamada; Sachi Okuchi MD; Benjamin Schmitt; Katsutoshi Murata; Kaori Togashi MD, PhD.

PURPOSE
Amide proton transfer (APT) MR imaging is a specific type of chemical exchange saturation transfer imaging to detect amide protons. Diagnostic performance of three-dimensional (3D) APT imaging in grading the glial tumor and its correlations with other tumor proliferation markers, i.e. Ki-67 labeling index, minimum apparent diffusion coefficient (ADCmin) and maximum standardized uptake value (SUVmax), was investigated.

METHOD AND MATERIALS
This study is approved by institutional review board. Consecutive 19 patients with newly diagnosed glial tumors scanned with both MRI (3 Tesla) and 18F-FDG-PET were included in this study. In this study, APT imaging was conducted using a 3D gradient-echo pulse sequence (TR/TE=8.3/ 3.3ms, Flip angle: 12°, 24 slices, resolution: 1.72x1.72x4mm) with a presaturation module consisting of five RF pulses with 99ms duration plus 100ms delay and 1.67T amplitude. APT signal was calculated as the asymmetry of the magnetization transfer rate at 3.5 ppm: APT signal = [1-(S-(3.5ppm) - S+(3.5ppm))]/S0 x 100 %. Images of APT signal, ADC and SUV were coregistered to the FLAIR image and resliced using SPM8. For each subject, the same regions-of-interest were drawn and applied. The mean APT ratios were compared between high and low grades, and linear correlations were investigated between APT ratios and Ki-67, ADC min, or SUVmax. A p value was calculated.

RESULTS
The mean APT signal was significantly higher in high grade gliomas (2.46±0.57) than in low grade gliomas (1.14±0.39). The APT signals had significant linear correlations with Ki-67 (R=0.72), SUVmax (R=0.73) and ADCmin (R=-0.72), and 1% increase of APT ratio corresponded to changes of 16.0%, 2.61 and -0.25×10-3mm2/s, respectively.

CONCLUSION
The APT ratio was confirmed to differentiate between low and high grade gliomas. It had significantly high correlations with other indexes of malignancy and would contribute as another marker of malignancy with different contrast mechanism.

CLINICAL RELEVANCE/APPLICATION
APT ratio had high correlations with other indexes of malignancy (Ki-67 index, minimum ADC and maximum SUV) and would contribute as another marker of malignancy with different contrast mechanism.

LL-NRS-WE3A • Diffusion-weighted Magnetic Resonance Imaging for Monitoring Early Treatment Response to Chemoradiotherapy of Nasopharyngeal Carcinoma

Chen Yunbin MD; Xiangyi Liu BS (Presenter); Dechun Zheng MS; Luying Xu BS; Xisheng Cao BS; Linfeng Cai BS; Weibo Chen MSc; Jianji Pan.

PURPOSE
To prospectively evaluate the feasibility of Diffusion-weighted magnetic resonance imaging (DWI) for monitoring early treatment response to Chemoradiotherapy (CRT) of Nasopharyngeal Carcinoma (NPC).

METHOD AND MATERIALS
A significant increase in ADC was observed at each stage of therapy (P<0.001) in lesions of primary and metastatic (Graph 1). The ADC values, ADC changes (%ADC) and percentage ADC changes (%ADC) of day 20 in responders were significantly higher than in non-responders for both primary lesions (p=0.01, p=0.005, p=0.007) and metastatic lymph nodes (p=0.002, p=0.005, p=0.005) (Graph 2). There was a positive correlation between %ADC of day 20 and percentage size reduction after NAC in primary lesions (p=0.16) and metastatic lymph nodes (p=0.008). Non-responders achieve a higher rate of residual for primary lesions (P=0.088) and metastatic lymph nodes (P=0.005) than responders.

CONCLUSION
DWI with ADC change allows for detecting early treatment response of NPC. 20 days after NAC initiation might be the optimal time for monitoring and predicting early treatment response.

CLINICAL RELEVANCE/APPLICATION
Measurement of ADC dynamic change early after chemotherapy is feasible for evaluating treatment effect. Thus, it provides the opportunity to adjust following treatment regimen.

LL-NRS-WE4A • Radiation Necrosis, Pseudo-progression, and Tumor Recurrence: A Diagnostic Dilemma

Ashima Lyall MBBS (Presenter); Vesselin Miloushev MD, PhD; Daniel S Chow MD; Andrew B Lassman MD; Angela Lignelli MD.

PURPOSE
Surveillance of primary brain malignancies relies on imaging. Conventional MRI can demonstrate increased contrast enhancement following radiotherapy for newly diagnosed malignant gliomas, which may represent tumor recurrence requiring a change in management, or pseudoprogression (PsPD) that resolves spontaneously. This study aims to describe the utility of positron emission tomography (FDG PET-CT), conventional MR, MR perfusion and MR spectroscopy, alone and together, in distinguishing between these two entities (true progression vs. PsPD).

METHOD AND MATERIALS
A query of brain PETs was performed between 2010 and 2013. Patients with primary intracranial neoplasms who underwent surgical resection followed by radiotherapy with or without concurrent temozolomide chemotherapy were included. Results from surveillance imaging with conventional MR, PET-CT, MR spectroscopy, and perfusion weighted imaging were recorded. Data was analyzed for utility of FDG PET-CT over conventional MR imaging and for concordance and discordance between FDG PET-CT, MR perfusion and spectroscopy techniques.
RESULTS
A total of 27 patients with primary brain tumors comprising of 44% (12/27) glioblastomas, 26% (7/27) grade 3 astrocytomas and 30% (8/27) low grade tumors (Grade 1-2) were included. A subset of patients, 41% (11/27), had MR perfusion imaging and 41% (11/27) had MR spectroscopy imaging. 87% (13/15) had equivocal findings on conventional MR, an FDG PET-CT was useful in delineating radiation changes from true recurrence, as evidenced by clinical/imaging follow up and surgical pathology in a subset. 3.7% (1/27) FDG PET-CT had false negative results, with pathology proven recurrence subsequently. 7.4% (2/27) FDG PET-CT were false positive at another site, different from the site of concern on conventional MR. FDG PET-CT and MR perfusion had concordance rates of 45% (5/11); FDG PET-CT and MR spectroscopy had concordance rates of 73% (8/11). Combining all three modalities, the diagnostic utility of imaging was increased to 83% (10/12), in patients who either had FDG PET-CT with either MR perfusion or MR spectroscopy.

CONCLUSION
Multimodal advanced MR imaging with perfusion, MR spectroscopy and FDG PET CT brain is advantageous in diagnostic considerations of high grade recurrence versus radiation necrosis/ pseudo-progression.

CLINICAL RELEVANCE/APPLICATION
Combined multimodality approach can be helpful in describing recurrence versus pseudo-progression.

LL-NRS-WE5A • Resting State fMRI in the Presurgical Patient with Brain Malignancy Is Feasible and Reproducible and Shows Good Correlation with the Active Task fMRI
Tom De Beule MD (Presenter) ; Sofie Van Cauter MD ; Felice D’Arco MD ; Ronald Peeters ; Stefan Sunaert MD

PURPOSE
To determine the feasibility of resting state functional MRI (rfMRI) in patients with brain tumors in the presurgical workup in order to map eloquent functional areas and to correlate with active task fMRI.

METHOD AND MATERIALS
Resting state fMRI was performed in 22 patients, (GE-EPI; TR 1.7 s; TE 40 ms) (two third male with a mean age of 42) with known brain tumors, as an addition to the routine presurgical workup, consisting of task-based fMRI (language and motor), diffusion tensor imaging and anatomical imaging.

Analysis of rfMRI data was done in FSL with an independent component analysis. The results were visually scored for the presence of the following resting state networks: default mode network, dorsal attention network, ventral attention network, extrastriate visual network, right and left parietofrontal network. We furthermore scored the classical primary motor network, primary visual network, auditory and the language network. A visual comparison was then made between the language and motor areas as delineated in the active task fMRI and the networks in rfMRI as calculated with FSL.

RESULTS
The rfMRI sequence showed data of good quality and a full analysis could be achieved in all scanned patients. The default mode network and the primary visual cortex were demonstrated in all patients, dorsal attention and ventral attention networks in 20 patients, motor functions in 19, language and auditory function in 19 patients. In almost all patients the supplementary motor area (SMA) was visible. We did a visual correlation with the standard task based fMRI. The full language network correlated visually in 19 out of 22 patients. The SMA had a positive correlation in 16 patients. The derived motor network showed large similarity to the active task fMRI in 15 of 18 patients.

CONCLUSION
Resting state fMRI is feasible to perform in the presurgical workup of patients with brain tumors. We could demonstrate the typical resting state networks, the motor and language network with rfMRI in a high percentage of the patients in our study group and a fairly good correlation could be made with the active task fMRI for language and motor areas.

CLINICAL RELEVANCE/APPLICATION
rfMRI in determination of eloquent functional areas can be of assistance in brain tumor patients with poor compliance, for which it might be difficult to perform a cognitive demanding active fMRI.

LL-NRS-WE6A • Slice Accelerated Dynamic-Susceptibility Contrast Enhanced (DSC) MRI
Dingxin Wang PhD (Presenter) * ; Charles Cantrell MS ; Bruce Spottiswoode PhD * ; Vibhas Deshpande PhD * ; Timothy J Carroll PhD ; Keith Heberlein PhD *

PURPOSE
Slice acceleration techniques simultaneously excite multiple slices with multiband RF pulses and use parallel imaging to separate aliased slices. In this study, we investigated the feasibility of using slice accelerated EPI for DSC-MRI measurement with reduced volume acquisition time (TR) and experimentally demonstrated the effect of reduced sampling rate on the DSC-MRI perfusion analysis.

METHOD AND MATERIALS
All experiments were performed using a 3.0T Siemens Magnetom Skyra MRI with 20-channel head and neck coil. The slice accelerated DSC-MRI was performed using a GRE-EPI sequence with 3 fold slice acceleration (12 slices, TR/TE = 509/35 ms). Dynamic images were acquired following IV injection of Gd-DTPA contrast agent. SVD-based deconvolution method was used to compute tissue residue function.

RESULTS
Slice accelerated DSC-MRI was successfully performed on 4 subjects. The CBV maps from TR = 509 ms and 1527 ms look qualitatively similar, but the spatial distributions of CBF maps seem quite different. While the MTT maps from TR = 1527 ms show relative small variation in the brain parenchyma, the MTT maps from TR = 509 ms show tissue dependent contrast. Additionally, the Tmax maps from TR = 509 ms show more subtle spatial variation than the Tmax maps from TR = 1527 ms which appear to bin at the TR (1.527 s) across the brain. This may indicate delay and dispersion effect and the Tmax’s sensitivity to sampling rate (TR).

CONCLUSION
Our study demonstrates for the feasibility of using slice accelerated EPI for DSC-MRI measurement and shows the evidence of association between sampling TR and perfusion parameters. The MTT and Tmax maps with faster TR sampling (509 ms) of perfusion data provide more image contrast than slower sampling rate (1527 ms). The difference in MTT also contributes to the variation of CBF spatial pattern. Faster data acquisition should reduce discretization errors in the perfusion measurement, especially for Tmax, as the measured Tmax is rounded-off to integer multiples of TR.

CLINICAL RELEVANCE/APPLICATION
Slice accelerated EPI for DSC-MRI allows faster volume sampling time (TR) which may potentially provide more accurate DSC perfusion maps for patient care of ischemic stroke.

LL-NRS-WE7A • Cerebral Vascular Leaks in a Mouse Model of Alzheimers Disease Measured by Nanoparticle CT Contrast
Ananth Annapragada PhD (Presenter) * ; Zbigniew Starosolski PhD ; Stephanie Fowler PhD ; Eric Tanifum PhD * ; Ketan B Ghaghada PhD * ; Joanna Jankowsky PhD

PURPOSE
BBB leaks are of critical importance in the delivery of therapeutic molecules and molecular imaging agents to CNS lesions. We investigated the leakiness of the BBB in a mouse model of Alzheimers disease, using a novel liposomal CT contrast agent. We hypothesized that BBB leaks would correlate with amyloid deposits.
RESULTS
All animals showed avid leaks in the choroid plexus and circumventricular organs. AD+ mice, showed cortical and olfactory spheroidal leaks (A, B, C in Figure), and perivascular leaks in the medial orbitofrontal artery (MOFA), rostral rhinal vein (RRV) and great cerebral vein of Galen (GCVG) (D, E, F in Figure). In AD- mice, the spheroidal leaks were absent, but the perivascular leak was detectable. Intensities varied widely, differences were insignificant at the 90% confidence level, with one exception: cortical spheroidal leaks were higher in the AD+ mice. However, no correlation with the amyloid plaques was observed. The radiation dose had no visible effect.

CONCLUSION
The BBB is permeable to 120nm liposomal particles in the region of the choroid plexus and circumventricular organs. AD+ mice show unique cortical and perivascular leaks that do not correlate with amyloid deposits, but could be confounded by simultaneous clearance of extravasated particles.

CLINICAL RELEVANCE/APPLICATION
Leakage of 120nm particles in the choroid plexus, circumventricular organs and cerebral cortex suggests the deliverability of payload to these sections of the brain.

LL-NRE-WEB8A • Application of Diffusion Techniques to Common Clinical Problems in Spine Imaging
Zombor Zoltani MD (Presenter) ; Vahe M Zohrabian MD ; M. Alex Dresner PhD * ; Richard J Gorniak MD ; David S Chiang MD ; Adam E Flanders MD
PURPOSE/AIM
The purpose of this exhibit is:
- To review the principles behind diffusion tensor imaging.
- To review the acquisition methods available on modern clinical scanners.
- To illustrate through examples and review of the literature the clinical utility of DWI and DTI in assessment of spinal cord injury, myelopathy, multiple sclerosis, infection, spinal cord infarction and oncology.

CONTENT ORGANIZATION
- Introduction to DWI and DTI
- Principles of DWI and DTI acquisition methods on modern clinical scanners
- Clinical Utility
  - Spinal cord injury (SCI).
  - Spondylotic and oncologic myelopathy.
  - Multiple sclerosis, assessment of normal appearing spinal cord.
  - Spinal cord infarction, differentiation from other entities.
  - Spinal infection
  - Oncologic applications in differentiating etiologies
  - Advanced applications of DWI and DTI
- Tractography for pre-operative planning for tumor resection.
- Tractography for pre-embolization planning and follow up for spinal AVM.
- Shortcomings of diffusion as a problem solving tool.

SUMMARY
The major teaching points of this exhibit are:
- DWI and DTI of the spine and spinal cord are technically feasible on modern clinical scanners.
- Diffusion techniques have some practical added value in specific clinical scenarios in spine imaging.

LL-NRE-WE9A • ÀœCoAll Eyes on the Exits½?: Imaging of Routes of Spread of Intraorbital Pathologies
Ananya Panda MBBS, MD (Presenter) ; Sanjay Sharma MD ; Chandan J Das MD
PURPOSE/AIM
1) To review the radiological anatomy of various orbital foramina. 2) To depict the foraminal and extra-foraminal routes by which the intra-orbital pathologies spread outside.

CONTENT ORGANIZATION
- Description of radiological anatomy of various orbital foramina such as superior orbital fissure, optic canal, inferior orbital fissure, nasolacrimal duct. • To discuss the pathologies extending across these foraminal and extra-foraminal routes into adjacent regions. These will include:
  1) Neoplastic: Optic nerve sheath glioma, meningioma, retinoblastoma, lymphoma, leukemia, metastases.
  2) Perineural spread of tumors and infections.
  3) Vascular: Carotico-cavernous fistula, vascular malformations.
  4) Cystic lesions: Dacrocystocele, dermoid.
  5) Infective/Inflammatory: Orbital cellulitis, pseudotumour, Tolosa-Hunt syndrome, granulomatous abnormalities.

SUMMARY
• A heterogenous spectrum of pathologies can manifest and spread via the natural defects in the orbit.
• Familiarity with bony anatomy and various orbital foramina is essential to accurately delineate extent and spread of disease in and around the orbit.
• Multimodality imaging with CT and MRI can facilitate optimum clinical management.
CONTENT ORGANIZATION

1. Epidemiology and Histopathology
2. General Imaging Features
3. Variations in Appearance: Location and Degeneration
4. Differential Diagnosis
5. Features To Distinguish Leiomyomas
6. Leiomyoma Mimicking Intrauterine Lesions (Adenomyosis, Adenomyotic Cyst, Retained Placenta etc.)
7. Leiomyoma Mimicking Ovarian Lesions (Ovarian Fibroma, Ovarian Carcinoma, etc.)
8. Features to Distinguish Leiomyomas from Aggressive Lesions
9. Leiomyoma Mimicking Aggressive Lesions (Leiomyosarcoma, Fallopian Tube Carcinoma, Cervical Carcinoma, etc.)
10. Rare Leiomyomas (Parasitic Leiomyoma, Retroperitoneal Leiomyomatosis, etc.)

SUMMARY
Leiomyomas are most likely to be misdiagnosed if they demonstrated extensive degeneration or were situated in an unusual locations. It is important to be familiar with imaging features of leiomyomas and understand these unusual appearances to allow distinction of complicated leiomyomas from other pelvic masses.

Physics - Wednesday Posters and Exhibits (12:15pm - 12:45pm)

Wednesday, 12:15 PM - 12:45 PM ● Lakeside Learning Center

LL-PHS-WEA ● AMA PRA Category 1 Credit ™:0.5
Host
Samuel G Armato , PhD
Host
Bruce R Whiting , PhD

LL-PHE-WE10A ● Current and Novel Imaging Technologies in Coronary Computed Tomography: What the Radiologist Needs to Know

Haruhiko Machida MD (Presenter) ; Isao Tanaka ; Rika Fukui ; Yun Shen PhD * ; Yue Dong ; Eiko Ueno MD ; Takuya Nishino ; Etsuko Tate

PURPOSE/AIM
1. To review standard coronary computed tomography (CCT) and its limitations
2. To illustrate current and novel imaging technologies in CCT
3. To demonstrate optimal strategies using these technologies by presenting experimental data and clinical images

CONTENT ORGANIZATION
1. Standard CCT and its limitations
   • retrospective ECG-gated helical scan/ECG mA modulation
   • radiation/contrast medium (CM) dose
   • limited spatial/temporal resolution
   • calcification/stent/beam-hardening (BH) artifact
2. Current and novel imaging technologies
   • step-and-shoot (SAS) scan
   • iterative reconstruction (IR)
   • high definition CT (HDCT)
   • motion correction algorithm
   • dual-energy CT (DECT): BH correction/monochromatic imaging/material density imaging
3. Optimal strategies using these technologies

SUMMARY
To overcome the limitations of standard CCT, SAS scan and IR can reduce radiation dose, and HDCT and motion correction algorithm can improve spatial and temporal resolution. DECT can reduce CM dose and BH effect, remove vessel calcification, improve vessel contrast and delineation, and provide unique information about plaque composition. Optimal strategies using these technologies in CCT are essential for appropriate patient management.

LL-PHS-WE1A ● Validation of Commercial Software’s Reported SSDE Values

Dustin A Gress MS (Presenter) ; Jenifer W Siegeman MD, MPH ; Mark P Supanich PhD * ; Alphonso Magri PhD

CONCLUSION
Calculation of the derivative metric of effective diameter is accurate within the stated error of the SSDE calculation method (10-20%, TG-204). It is acceptable to use the effective diameter and SSDE outputs of this commercial software program.

Background
Some accrediting and regulatory bodies are requiring CT facilities to manage patient radiation dose. This work helps to validate a significant time-saving tool for such a QA initiative. A commercially available CT dose calculation and data aggregation software program (Radimetrics) used by a medium-sized community hospital in Connecticut has the capability of reporting SSDE, calculated using a patient’s effective diameter obtained at a single level at the mid slice of the z-axis of the scan range. This work compares the effective diameter results of the software program with those calculated via manually measured AP and lateral dimensions, and determines whether or not the software’s reported patient effective diameter, and in turn its reported SSDE, are valid for use in a patient dose management QA initiative.

Evaluation
The mid z-axis slice from 52 consecutive patients undergoing CT abdomen pelvis was identified. AP and lateral measurements were performed manually within PACS. Effective diameter from manual measurement was compared with that of the software using a Bland Altman analysis.

Discussion
Software reported a mean effective diameter 3.2% higher than the manual method, with 95%CI of +/-5.3%. Resulting SSDE from software is 3.4% lower than the manual method, with a 95% CI of +/-5.5%.

LL-PHS-WE2A ● Improving Best-Phase Image Quality in Cardiac CT by Motion Correction with MAM Optimization

Thomas G Flohr PhD (Presenter) * ; Herbert Bruder * ; Christopher Rohkohl * ; Thomas Allmendinger * ; Karl Stierstorfer
PURPOSE
We propose a novel technique for motion estimation and compensation, which for the first time allows for a significant improvement of the clinical relevant best-phase image quality and does not need on a multiple – phase (4D) data acquisition.

METHOD AND MATERIALS
The novel motion estimation algorithm is composed of three major components which will be detailed in the following. First, different motion artifact metrics (MAM) are defined which allow the relative quantification of local motion artifacts. Meaningful MAMs are the image entropy and/or image positivity. Locality of the motion artifacts requires the identification of corrupted volume areas (volume of interest) which we denote motion maps. As last component, an optimization algorithm for the MAMs is required which actually estimates the unknown parameters of the motion model. Motion estimation corresponds to finding a set of motion parameters that minimizes one or more of the selected MAMs. For minimization a simple gradient descent algorithm with adaptive step size is utilized.

RESULTS
It can be observed that the image quality drastically improves single source acquisition datasets, i.e. the motion artifacts are clearly reduced by the novel algorithm. Also, in case of Dual Source in high pitch mode, where the maximum heart rate is currently limited to medium values, the heart rate limit can be released. We evaluated 10 patient data sets with heart rate above 70bpm and show that the image quality of coronary segments improved in any case. In Fig. 1 it can be seen how the proposed algorithm can significantly improve the best phase image quality at higher heart rates even in datasets with a very good temporal resolution of 75ms. Further the algorithm is capable to improve image quality reconstructed in non-ideal phases and in datasets with a low temporal resolution.

CONCLUSION
This demonstrates the generality of the proposed approach and that it can fully automatically optimize image quality. However, we are convinced that the software-based approaches cannot make hardware developments like dual source CT mandatory, but rather extend their applicability to a wider range of patients.

CLINICAL RELEVANCE/APPLICATION
Due to the encouraging results we think that image quality of the coronary arteries can be drastically increased without exposing the patient to more dose and without requiring the latest hardware.

LL-PHS-WE3A • Iterative Image Reconstruction for Low-dose Dedicated Breast CT

Junguo Bian PhD (Presenter) ; Kai Yang PhD ; Xiao Han MSc ; Emil Y Sidky PhD ; John M Boone PhD * ; Xiaochuan Pan PhD *

PURPOSE
A large number of projections are needed for FBP-based image reconstruction in breast CT while the total imaging dose is limited to that of a typical two-view mammography. This can result in low signal-to-noise ratio (SNR) in projection data and high noise in reconstruction images. Breasts are of small contrast and have fine tissue structures. Low SNR, small contrast, and fine structures thus make reconstruction improvement from low-dose dedicated breast-CT data very challenging. In the work, we carried out a study on image reconstruction from low-SNR patient data acquired with a dedicated breast CT by tailoring an iterative algorithm we developed. We demonstrate that iterative algorithms can improve on image quality over the currently used FBP-based algorithms when applied to low-SNR breast-CT data.

METHOD AND MATERIALS
We formulated image reconstruction in breast CT as a constrained-TV-minimization problem, and developed an ASD-POCS algorithm to obtain image reconstruction through solving the problem. Patient data were collected during an ongoing clinical trial performed at UC-Davis. From the collected low-SNR data, we reconstructed images by using ASD-POCS algorithms and compared to the images currently reconstructed by using FBP algorithms. Special attention in parameter selections was paid to minimize the blocky appearances that are typically observed in images reconstructed by use of TV-minimization-based algorithms from noisy data set. We performed image reconstruction of the whole breast volumes from more than 10 patient cases. The reconstruction programs were accelerated with CUDA programming.

RESULTS
Results of our study suggest that the ASD-POCS algorithm can yield images with improved spatial/contrast resolution over images currently reconstructed with FBP algorithms.

CONCLUSION
Our study indicates that the proposed iterative algorithm can improve image quality or be used for potential dose reduction in breast CT.

CLINICAL RELEVANCE/APPLICATION
The image quality improvement for the dedicated, cone-beam breast CT scanner may have impacts for breast cancer screening or diagnosis.

LL-PHS-WE4A • Ultra-high-Resolution CT of the Lung: Image Quality of a Prototype Scanner

Ryutaro Kakinuma MD, PhD (Presenter) ; Noriyuki Moriyama MD, PhD ; Yukio Muramatsu MD ; Masahiko Kusumoto MD ; Akiko Maeshima ; Hisao Asamura

PURPOSE
To evaluate the image noise and diagnostic performance of a prototype ultra-high-resolution CT (U-HRCT), compared with that of a conventional high-resolution CT (C-HRCT).

METHOD AND MATERIALS
A prototype U-HRCT scanner with 0.25 mm X 4 rows and 120 mAs was used. C-HRCT images were obtained using a 0.5 mm X 64 detector-row CT scanner operating at 150 mAs. Images were reconstructed at 0.1-mm intervals using both scanners; the slice thickness was 0.25 mm for the U-HRCT scanner and 0.5 mm for the C-HRCT scanner. For both modalities, the field of view was 8 cm, and all the images were displayed using lung field settings (WW1600, WL-600). Ten board-certified thoracic radiologists graded the U-HRCT and C-HRCT images of 53 slices derived from 36 lung nodules (21 resected adenocarcinomas and 15 miscellaneous nodules) using a five-point scale. The U-HRCT and C-HRCT images were presented to the observers randomly and in a blinded manner. The image noise of each scanner was evaluated using a phantom.

RESULTS
Despite a larger image noise, the diagnostic performance of the U-HRCT prototype scanner was significantly better than that of C-HRCT.

CONCLUSION
Clinical Relevance/Application
U-HRCT might improve the diagnostic accuracy of indeterminate nodules detected using low-dose CT lung cancer screening.

LL-PHS-WE5A • Objective Evaluation of Low-contrast Detectability and High-contrast Resolution for Different Breast Imaging Modalities by Means of Breast Simulating Phantoms with Arbitrary Positionable Inserts

Ann-Christin Roessler MSc (Presenter) ; Christian Steiding MSc * ; Daniel Kolditz PhD * ; Evelyn Wenkel MD ; Ruediger Schultz-Wendtland ; Willi A Kalender PhD *
Objective evaluation of image quality based on known phantom structures fixed in known positions is hard to do. We designed phantoms which allow arranging tumor-like masses, microcalcifications (µCa) and fibers freely with and without superpositioned structures to enable observer studies with the observer blinded to the ground truth.

METHOD AND MATERIALS
Phantoms were made of breast-equivalent material as a 40 mm slab and as a 14 cm diameter cylinder simulating the compressed breast for digital mammography (DM) and breast tomosynthesis (BT) and the pendant breast for breast CT (BCT), respectively. Both phantoms provide cavities (45x40² mm³) to insert structures such as cubes (10³ mm³) and plates with different thicknesses simulating normal breast tissue containing spherical soft-tissue masses (2-8 mm), µCa (0.1-0.4 mm) or connective tissue (fibers, 1 mm) which can be placed in different locations and superimpose each other. Measurements were done on clinical DM and BT systems and on a prototype high-resolution BCT system with and without superimposed structures. Exposure parameters for all systems were kept consistent with the standard clinical settings; i.e., spatial resolution was better than 100 µm and dose was kept below 5 mGy. Images were acquired using random structure arrangements; ROC curves were generated based on 5 observers.

RESULTS
For DM and BT, low-contrast masses down to 4 mm were recognized without and down to 6 mm with added superimposing structures. All µCa objects were detected down to 200 µm with and without superpositioned structures. Fibers were not seen in either arrangement. For BCT, low-contrast masses down to a size of 2 mm diameter, all µCa objects and all fibers were recognized by the observers. Standard ROC analysis revealed higher sensitivity and specificity for BCT in low-contrast detectability than for DM and BT.

CONCLUSION
Objective evaluation of low-contrast detectability with the reader blinded to structure type and position is feasible. In this test, high-resolution BCT showed performance superior to DM and BT, especially when confounding structures were superimposed.

CLINICAL RELEVANCE/APPLICATION
The proposed phantom setup allows conducting receiver operating characteristic (ROC) studies for the objective evaluation of scanners and scan protocols with ground truth clearly defined.

LL-PHS-W6A • Detecting Osteoporosis Using Photoacoustic Spectroscopy
Behnoosh Tavakoli (Presenter) ; Xiaoyu Guo ; Shadpour Demehri MD ; Abdullah Muhit PhD ; John A Carrino MD, MPH * ; Emad Docter PhD, MSc *

CONCLUSION
Photoacoustic spectroscopy is technically for detecting the osteoporosis at no radiation cost. This method may be sensitive to the micro structural changes in the bone. In addition with multi spectral imaging, it is possible to analyze different components of the bone tissue such as calcium by decomposing the photoacoustic spectrum to the standard tissue absorbers optical spectra.

Background
Osteoporosis, is the most common metabolic bone disorder. Monitoring the micro architectural deterioration of the bone tissue and the decrease of the bone mineral density are necessary for early detection the osteoporosis. Broadband attenuation of ultrasound signal is correlated with bone mineral density and its microstructure. In addition, the optical absorption spectrum of the bone tissue analyzes its mineral, water, lipid and oxy-deoxy hemoglobin content. Therefore photoacoustic spectroscopy as a hybrid functional method that combines both optical and ultrasound information is a promising technique for determination of osteoporosis in early stages.

Evaluation
In this study, the quantitative ultrasound calcaneal phantoms of normal and osteoporotic bone were imaged in the transmission mode and the corresponding photoacoustic spectra were obtained. Our photoacoustic imaging system includes a tunable Q-switch Nd:YAG laser followed by an OPO system generating pulses at the wavelength range of 690 nm-950 nm. The photoacoustic signal is detected with the FDA approved Sonix RP ultrasound system including a data acquisition device for recording the raw data. Multiple points of each phantom were evaluated using a linear US probe with 128 elements. Finally the maximum raw data was extracted from the elements and the value was normalized to the illuminating laser energy.

Discussion
The result revealed a general decrease in the spectrum of the osteoporotic phantom compared to the normal one. The trend matches the optical spectrum of the calcaneus bone tissue. In this test, there was about two times contrast between the normal and osteoporotic case. These phantoms were modeling the bone microstructure and more contrast is expected in the real bone tissue including other tissue absorbers.

LL-PHS-W7A • Automatic Coronary Calcium Scoring in ECG-triggered Cardiac CT
Jelmer M Wolterink MSc (Presenter) * ; Tim Leiner MD, PhD * ; Pim A de Jong MD, PhD ; Max A Viergever * ; Ivana Isgum PhD *

PURPOSE
Presence of coronary artery calcium (CAC) is a strong and independent predictor of cardiovascular events. Given the rapid increase in cardiac CT imaging, fully automated quantification of CAC is desired. We have developed an algorithm for quantification of CAC in routinely acquired cardiac CT employing a coronary calcium atlas and features previously proposed for automatic CAC scoring in non-ECG synchronized chest scans.

METHOD AND MATERIALS
The study included 161 consecutive cardiac patients who underwent CT for determination of CAC (256-detector row CT, 120 kV, 55 mA, 3 mm section thickness). In all scans CAC was manually scored by experts. These annotations served as the reference standard and were used for training the algorithm.

To automatically detect calcifications, scans were thresholded at 130 HU and all connected components were considered CAC candidates. These were described by size, intensity and spatial features. Spatial features were computed using a CAC atlas previously created with non ECG gated chest CT scans. Subsequently, true positives were identified by classification using a forest of extremely randomized trees. Ten-fold cross validation was performed. Using the detected calcifications, Agatston and volume CAC scores were computed for each patient. Agreement between reference and automatic scores was established with Spearman’s ρ. Patients were assigned to a cardiovascular risk category based on their Agatston score (0, 1-10, 11-100, 101-400, >400) and linearly weighted ρ was calculated to evaluate the agreement in category assignment.

RESULTS
24 cases with stents and beam hardening artifacts due to metal implants were excluded. In the remaining 137 patients median reference Agatston score was 8.8 (range: 0-4067) and automatic median score was 11.2 (range: 0-2793). Spearman’s ρ between automatic and reference scores was 0.93 for Agatston and 0.92 for volume. The correct risk category was assigned to 81% of patients, and 15% and 4% were one and two categories off, respectively (p < 0.85).

CONCLUSION
The presented algorithm performs fully automatic CAC scoring. Based on the derived CAC scores, the vast majority of patients were assigned to the correct cardiovascular risk category.

CLINICAL RELEVANCE/APPLICATION
Automatic CAC scoring in cardiac CT can be performed using the features and CAC atlas described for scoring in chest CT. This eliminates the necessity for constructing a population specific CAC atlas.
A study was performed to evaluate the conceptus doses from clinical radiation exposures in Computed Tomography (CT) using a series of pregnant female physical phantoms. The results of this evaluation will be used to validate Monte Carlo simulations performed on the phantom’s computational equivalent.

**METHOD AND MATERIALS**

Four female abdomen/pelvis phantoms were constructed to represent the 2 week, 15 week, 25 week, and 35 week post conception gestation stages of the UF reference pregnant female library. The phantoms were re-constructed from the computational phantoms using various 3D engraving machines to create the molds for the soft tissue-equivalent and bone-equivalent substitutes. Each phantom was designed to accommodate specific measurement locations by building the phantom into smaller components that have segmented organ/fetal dose points. A fiber-optic dosimetry system was employed to quantify absorbed dose. The dosimeter was fabricated to include a secondary detector of a different material to evaluate the beam spectra incident to the detector. By evaluating the incident energy spectra, the energy dependence of the dosimeter was greatly minimized and provided necessary information to calculate absorbed dose to various tissues types.

**RESULTS**

The dosimeter was characterized for CT irradiations and displayed an energy dependence of less than 3% when benchmarked against the ion chamber at minimal angular dependence, and excellent sensitivity and reproducibility. The phantom materials were characterized to be within the range of their accepted HU values, and a measured HVL at 120 kVp within 0.5 mm of the Monte Carlo simulated value. The measured conceptus doses for common chest-abdomen-pelvis exams were found to be consistent with other studies using physical phantoms and less than 50 mGy.

**CONCLUSION**

The tools and methods employed by this study accurately quantify conceptus doses associated with the low levels of ionizing radiation used in CT and offer a great resource for benchmarking computational data associated with the UF hybrid pregnant female phantoms.

**CLINICAL RELEVANCE/APPLICATION**

This study addresses the risk associated with clinical CT examinations to unborn children, by correlating measured radiation exposure to relevant radiobiological data.

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**RADIATION ONCOLOGY AND RADIobiology**

**Wednesday Posters and Exhibits (12:15pm - 12:45pm)**

**Wednesday, 12:15 PM - 12:45 PM • Lakeside Learning Center**

**LL-ROS-WEA • AMA PRA Category 1 Credit ™:0.5**

**Host**

Nina A Mayr, MD

**LL-ROS-WE1A • Treatment Outcome, Prognostic Factors and Toxicities of Combined Modality Therapy in Medulloblastoma-Single Institute Experience**

Subhashini John MD (Presenter); Rajesh Balakrishnan MBBS, MD; Saikat Das MBBS, MD; Rajesh Isiah; Patricia Solomon MBBS, MD

**ABSTRACT**

**Introduction:**

Medulloblastomas are one of the aggressive brain tumors found predominantly in childhood (20-30% compared to 1% in adults). In view of improved outcome with combined modality treatment (surgery, chemotherapy and radiation therapy), endocrine and neurological sequelae in long term survivors remain to be an important matter of investigation. Here we report our experience on treatment outcome, prognostic factors and treatment related toxicities in medulloblastoma.

**Materials and Methods:**

Data of fifty three patients with proven medulloblastoma, treated at our hospital between 2006 and 2012, were included in this retrospective analysis. All patients underwent craniospinal irradiation (CSI) following surgery. Treatment outcome was assessed based on local disease recurrence (recurrence free survival). The effect of residual disease volume, drop metastasis on disease recurrence was determined. Endocrinological and neurological functions (including hearing and visual assessment) were done at periodic intervals.

**Results:**

Forty patients (75 %) were pediatric (3 cm and 19 had residual tumor < 3 cm. CSF was positive for malignant cells in 5 patients (9.4%), negative in 27 patients (50.94%) and was not evaluable in 21 patients (39.62%). MRI spine was done in 44 patients and it was positive in 32 patients (72.72%). Radiation was initiated within 32.5 days after the surgery and majority of the patients (52%) completed planned dose of radiation. The median duration of RT was 50.11 days (range 40 - 76). The median dose to the posterior fossa 54.24 Gy (range 54 - 56), and to the spinal axis 35.71 Gy (range 36-45). Concurrent chemotherapy was given in 40 patients (75.47%) and adjuvant chemotherapy was given in 41 patients (77.35%). The median follow-up was 21.94 months (range 2-75). Complete response was seen in 62% patients, stable disease (8%) progressive disease (11%) and not evaluable (18%) at the last follow up. The median time to progression is 365 days and 50% of the patients who had residual tumor > 3 cm had disease recurrence. The toxicities that occurred during CSI were mainly alopecia, nausea and hematological toxicity. Other toxicities noted were sensory neuronal toxicity (6), probably chemotherapy induced and peripheral neuropathy (2, one had bilateral foot drop with bilateral polyradiculopathy) endocrine abnormalities (2, hypothyroidism) and vision defects (2).

**Conclusions:**

Multimodality treatment (Surgery, CSI) resulted in significant recurrence survival in this cohort and was well tolerated with minimal acute treatment related toxicity. The treatment of patients needs to be tailored to decrease toxicities as these patients have a good prognosis.

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**LL-ROS-WE2A • Dosimetric Comparison between Hippocampal Doses in Patients with Nasopharyngeal Cancer Treated with LA Based IMRT and Helical Tomotherapy**

Naveen B Mominmudi MBBS, MD (Presenter); Sarbani Laskar; Tejpal Gupta MD; Ashwini Budrukar MD; Vedang Murthy MD; Shashikant Juvekar; Vikas Kothavade; Ritu Raj Upreti MSc; Jalprakash K Agarwal

**PURPOSE**

In patients with Nasopharyngeal carcinoma, significant amount of temporal lobe and hippocampus might be irradiated consequentially increasing the chance of cognitive decline in long term survivors. The present study compares and describes the magnitude of possible dose restriction to Hippocampus in two different IMRT delivery settings.

**METHOD AND MATERIALS**

Between 2010 and 2012, 11 adult patients with stage III/IV nasopharyngeal cancer, previously treated with LA based Intensity Modulated Radiation Therapy (to a dose of 66 to 70 Gy) were chosen, if they had co-registered MRI (T1 weighted with contrast) for contouring target and organs at risk. Bilateral Hippocampi were contoured in accordance with the RTOG atlas. Volume and dose received by bilateral hippocampi were evaluated on Eclipse (v8.6) workstation. For three representative patients, Helical Tomotherapy (v4.2) plans with similar DVH parameters were generated (no attempt was made to restrict doses to Hippocampus). Further, LA based IMRT and Tomotherapy plans with specific dose constraints to Hippocampus were generated. A comparison was made between the doses received by the Hippocampi across the plans.
RESULTS
The average volume of Hippocampus was 1.63 cc (range 0.9 - 2.20 cc); the average maximum dose and mean dose received by Hippocampus on LA based IMRT plan were 44.96 Gy (range 7.10 - 68.90 Gy) and 19.95 Gy (range 3.30 - 42.80 Gy), respectively. The hypothetical Tomotherapy plan resulted in average maximum and mean doses of 35.70 Gy and 8.02 Gy respectively. When the hippocampal dose was restricted, average maximum and mean doses were 13.22 Gy and 4.22 Gy respectively with LA based IMRT plan; 9.71 Gy and 3.09 Gy respectively with Tomotherapy plan.

CONCLUSION
When no dose constraint was provided, Hippocampi received inadvertently higher doses of radiation with LA based IMRT and helical Tomotherapy. There is scope for restricting the hippocampal dose with both the techniques without compromising on dose homogeneity and target coverage. To test whether this dosimetric advantage prevents cognitive decline in paediatric and adult population needs to be tested in a prospective trial setting.

CLINICAL RELEVANCE/APPLICATION
Radiation dose to temporal lobe and hippocampus has been correlated with neurocognitive decline in patients with brain tumour and may hold true for long term survivors of nasopharyngeal malignancies.

LL-ROS-WE3A ● Ionizing Radiation Exposure as a Result of Diagnostic Imaging in Patients with Hodgkin Lymphoma and Non-Hodgkin Lymphoma

Maeve P Crowley MBCh, MRCP; Siobhan O’Neill MBCh (Presenter); Damien C O’Neill MBCh; Brian R Bird MBCh; Oisin J Flanagan MBCh, MRCP; Michael M Maher MD, FRCR; Mary R Cahill MD; Derville M O’Shea MBChB, PhD; Kevin N O’Regan MD

PURPOSE
Exposure to ionizing radiation has been linked both epidemiologically and experimentally to an increased risk of malignancy. An increasing majority of patients with lymphoma achieve long-term survival. Late complications of treatment have emerged as a significant cause of death and morbidity. Long-term survivors are at risk for developing second malignancies due to treatment. Ionizing radiation exposure through diagnostic imaging may increase this risk.

METHOD AND MATERIALS
A retrospective review of 486 consecutive patients with biopsy proven Hodgkin and Non-Hodgkin lymphoma that were discussed at a multidisciplinary lymphoma meeting between January 2009 and July 2012 was conducted. The number and type of radiological procedures were obtained from the radiology databases in each of the 5 participating centers. The cumulative effective radiation dose was calculated using standardized procedure-specific radiation dose levels.

RESULTS
Mean (SD) age at diagnosis of lymphoma was 59 (17) and 15% (n=73) were under 40 years. Fifty-nine percent were men. Sixteen percent (n=78) had Hodgkin lymphoma eighty-four percent (n=408) had Non-Hodgkin lymphoma. The median estimated total cumulative effective dose (CED; IQR) per subject over the study period was 69.4mSv (42-118). Of the subjects, 46% had a total CED >75mSv and 14% had a total CED >150mSv. CT contributed 89% of the radiation dose and PET-CT contributed 8%.

Patients aged under 40 had a median (IQR) CED of 89.44mSv (55.42-123.94). Patients who underwent a stem cell transplant had a median (IQR) CED at 161.94mSv (135.11-224.68). Fifty-nine percent of this group went on to have radiotherapy as part of their treatment protocol.

CONCLUSION
This study highlights the considerable ionizing radiation exposure from radiological imaging in lymphoma patients, especially in young people who would be considered the most radiosensitive and at highest risk for secondary malignancies.

CLINICAL RELEVANCE/APPLICATION
Low dose CT imaging and MRI are becoming increasingly important in the diagnosis of lymphoma as the focus moves towards minimizing treatment related morbidity.

LL-ROS-WE4A ● Dosimetric Variability of Supracavicular Irradiation in the Era of Image-guided Radiation Therapy of Breast Cancer

Indra J Das PhD (Presenter); Peng Zhou PhD; Gregory Bartlett BS; Foster Lasley MD; Jennifer E Zook MD

LL-ROS-WE5A ● Comparative Study of the Position and Volume of Esophagus between Quiet End-inspiration and End-expiration Three Dimensional CT Assisted with Active Breathing Control and Corresponding Phases in Four Dimensional CT

Huanpeng Qi (Presenter)

LL-ROS-WE6A ● Prostatectomy versus Radiotherapy for Gleason Score (GS) 8-10 Prostate Cancer at Biopsy: Comparison of Disease Control

John M Watkins MD (Presenter); Patricia Watkins MS; Tarek Dufan MD; Christopher Adducci; Nadim Koleilat

PURPOSE
To compare disease control outcomes between prostatectomy (RP) and radiotherapy (RT) for patients with high-grade prostate cancer at diagnosis.

METHOD AND MATERIALS
Retrospective comparative outcome analysis by treatment group. Eligible patients were identified by GS 8-10 prostate adenocarcinoma at biopsy, performed between 2003 and 2010, treated with either primary RP or RT. Owing to long-term hormone therapy (HT) use for the RT group, a minimum follow-up of 24 months post-treatment was required (unless prior recurrence or death). Patients with PSA >30 or clinically evident lymph node involvement at diagnosis were excluded. Standard definitions of disease recurrence were employed (RP: PSA of 0.2 and rising; RT: nadir plus 2; or at initiation of salvage HT for either group). Kaplan Meier curves were constructed to compare survival between groups and the log-rank test was used to determine statistically significant differences in survival.

RESULTS
Results: Between 2003 and 2010, 120 patients with GS 8-10 at biopsy were identified. Of these, 87 were eligible for the present analysis (41 RP, 46 RT). Race, PSA, clinical T-stage, primary Gleason grade, total GS, and bone scan at initial staging were similar between groups. RT patients were significantly older (median age 64 vs 73 years; p<.02 months, 30% >30 months). At a median follow-up of 52 months, 28 patients in the RP group and 39 patients had experienced disease recurrence (30 RP, 9 RT). Estimated 5-year disease control was 75% for RT (21% vs 74%); p

CONCLUSION
RT-based treatment of GS 8-10 prostate cancers appears to confer superior disease control when compared with RP; however, at 5 years, prostate cancer-specific survival appears similar. Prospective comparison with subset analyses is warranted in order to identify patients who may experience differential benefit from each approach.

CLINICAL RELEVANCE/APPLICATION
GS 8-10 prostate cancer is associated with poor disease control; in this population, up-front RT plus HT appears superior to RP for 5-year PSA control.

LL-ROE-WE7A ● Image Guided Treatment in Hepatobiliary System: Role of Imaging in Treatment Planning and Post Treatment Evaluation
**PURPOSE/AIM**
Rapid advancements have occurred in targeted therapies for hepatobiliary tumors. Newer treatments like Transarterial chemo-embolization (TACE), ablation, stereotactic radiotherapy and Irreversibile Electroporation (IRE) have emerged for their management. Advanced morphologic and functional imaging is integral for treatment delivery, in facilitating treatment plan and assessing response. This exhibit aims at discussing the principles of various therapies and describing the role of imaging in treatment planning and post treatment evaluation.

**CONTENT ORGANIZATION**
1. Review of principles and technique of new targeted therapies in the hepatobiliary system like TACE, ablation, stereotactic radiotherapy and IRE
2. Discuss the role of morphological and functional imaging (CT/MR perfusion, DWI, PET-CT/MR-PET) in pretreatment planning and monitoring response.
3. Describe the role of advanced post processing methods like image fusion, target definition and dose estimation in treatment evaluation.
4. Discuss the role of emerging molecular imaging technique in cancer gene therapy and intra-arterial oncolytic virotherapy.

**SUMMARY**
Imaging is crucial in the successful management of hepatobiliary tumors with novel targeted therapies. Knowledge of role of imaging in pretreatment planning, therapy guidance and post treatment evaluation is essential for optimal results.

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**Vascular/Interventional - Wednesday Posters and Exhibits (12:15pm - 12:45pm)**

**Wednesday, 12:15 PM - 12:45 PM • Lakeside Learning Center**

**LL-VIS-WE1A • Manual Compression for Puncture Site Hemostasis after Percutaneous Treatment of Abdominal Aortic Aneurysm Using a Low Profile Device: A Single Center Experience**

**Costantino Del Giudice** MD (Presenter) ; **Roberto Gandini** MD, PhD ; **Carlo Andrea Reale** ; **Giorgio Lorenzi** ; **Erald Vasili** ; **Giovanni Simonetti** MD

**PURPOSE**
To assess feasibility and efficacy of percutaneous endovascular abdominal aortic aneurysm (AAA) repair using Ovation Trivascular stent-graft with hemostasis at the puncture site through manual compression.

**METHOD AND MATERIALS**
A prospective study was conducted on 27 consecutive patients (26 males and 1 females; mean age: 73.5±6.2), with AAA treated between December 2010 and May 2012 using the Ovation stent-graft system with an entirely percutaneous approach. The mean AAA diameter was 56.1±7.6mm. Manual compression was performed to obtain postprocedural hemostasis.

**RESULTS**
The stent-graft was successfully implanted in all patients using an entirely percutaneous approach. Two patient (7.4%) presented a type II endoleak after stent-graft implantation with a spontaneous resolution in one case and treated with coil embolization in the other one. Manual hemostasis was achieved in all cases without complications. No surgical conversions were required. During follow-up, no aneurysm-related deaths were recorded. Through 24 months, each AAA shrunk by at least 5 mm and no device-related events were observed on imaging.

**CONCLUSION**
The Ovation stent-graft allows safe and effective treatment of AAAs with hemostasis of the puncture site by manual compression.

**CLINICAL RELEVANCE/APPLICATION**
This approach may allow abdominal aortic treatment without need of a surgical access and percutaneous closure device, reducing access related complications.

**LL-VIS-WE2A • Frequency of Growing Splenic Artery Aneurysms Detected by Multidetector Row CT Angiography in Patients with Chronic Liver Diseases**

**Takaharu Tsuda** MD, PhD (Presenter) ; **Hiroaki Tanaka** MD ; **Megumi Takechi** MD ; **Gen Koiwahara** ; **Teruhito Mochizuki** MD

**PURPOSE**

**METHOD AND MATERIALS**

**RESULTS**
Eight growing SAAs were found in seven patients. Every growing SAA was saccular and more than 10mm in diameter. Thus, 47% (8/17) of SAAs more than 10 mm in diameter showed growth. On the other hand, none of SAAs less than 10 mm in diameter showed growth. Four of seven patients with multiple SAAs had growing SAA. Every patient having growing SAA was liver cirrhosis. There was a single patient which needed coil embolization therapy in this study because of fast growing.

**CONCLUSION**
47% of SAA more than 10 mm in diameter showed growth in patients with liver cirrhosis. Specifically, patients with multiple SAAs were likely to have growing SAA. However, frequency of fast-growing SAA which needed therapy was relatively low.

**CLINICAL RELEVANCE/APPLICATION**
(dealing with CT angiography); In patients with chronic liver diseases, most of growing SAAs are more than 10 mm in diameter and patients with multiple SAAs may be high risk for growing SAA.

**LL-VIS-WE3A • Core Biopsies of Renal Masses: An Accurate Tool for Managing all That Is Indeterminate**

**Andrea Veltri** MD (Presenter) * ; **Irene Garetto** MD ; **Carlo Gazza** ; **Enrico Bollito** ; **Donatella Pacchioni** MD ; **Alessandro Volpe** MD ; **Mauro Papotti** MD

**PURPOSE**
The wider utilization of cross-sectional imaging has increased the detection of indeterminate cystic and solid enhancing renal masses (RM).Despite an accurate pre-operative radiological study, surgical extirpation still results in at least 20% of benignancy. Literature suggests that renal biopsy can be accurate and significantly impacting on clinical choices. Our aim is to evaluate the safety, accuracy and usefulness of image-guided core biopsy (CB) in the management of RM.
METHOD AND MATERIALS
In 258 consecutive patients (171 male; 16-88 y, m 65), 268 RM (10-160 mm, m 33; 19 cystic, 236 solid, 13 mixed) underwent CB (265 US-guided, 2 CT-guided, 1 US+CT guided), by coaxial technique (18G tru-cut needle inserted in a 17G styletted cannula).

Major and minor complications (according to SIR criteria) were recorded. The result of 50 CB was not assessable, due to patients lost at follow-up.

Of the remaining 218 RM, 101 underwent ablative treatments, so a gold standard diagnosis was not available. Therefore, accuracy was calculated on 117 CB, verified on the basis of histology after surgical resection (76), response to medical therapy (7) or outcome at imaging follow-up (3-104 months, m 35) (34: 25 benign and 9 malignant selected for active surveillance).

RESULTS
No major complications occurred (namely, no seedings). 10 minor complications (7 small perirenal hematomas, 1 macrohematuria not requiring transfusion, 1 self-resolving intercostal arteriovenous fistula and 1 hematoma in the abdominal wall) were managed on an outpatient basis.

Among the 218 assessable CB, the pathological diagnoses were 167 malignant (160 RCC, 4 NHL, 3 met) and 51 benign (38 renal cell tumors, including 28 oncocytoma and 7 AML).

According to the above gold standard criteria, TP were 75/117, FN 7, TN 35, FP 0. Sensitivity, specificity and diagnostic accuracy were 91.4%, 100% and 94%, respectively. PPV was 100%, NPV 83.3%. 142/218 RM (65.1%) were managed other than surgically.

CONCLUSION
CB is safe and accurate. We contribute to the growing number of series that are demonstrating the usefulness of CB in the clinical management of RM.

CLINICAL RELEVANCE/APPLICATION
Since low specificity or pitfalls of imaging can affect characterization of RM, causing unnecessary surgical resections, CB should be considered in the clinical management of all indeterminate lesions.

LL-VIS-WE4A • Non-invasive Prediction of Hepatic Transplant Portal Vein Stenosis - Experience at a Single High Volume Transplant Center

Marie A Vasher MD (Presenter) ; Danny R Lababidi MD ; Kamal Massis MD ; Bruce R Zwiebel MD ; Dana M Poletto MD ; Haydy Rojas RN ; Yougui Wu PhD

PURPOSE
We sought to compare Doppler ultrasound findings to transhepatic catheter portal venogram findings of hepatic transplant main portal vein stenoses, and to determine which Doppler ultrasound criteria are often the best non-invasive measures for diagnosing portal vein stenosis.

METHOD AND MATERIALS
32 post-hepatic transplant transhepatic catheter portal venograms following initial Doppler ultrasound were performed at our institution on 30 patients from November 1, 2004 to May 31, 2012 due to clinical, biochemical, Doppler ultrasound, CT and/or MRI abnormalities. Doppler ultrasound and catheter portal venograms were retrospectively reviewed. Doppler ultrasound criteria of main portal vein peak velocity, velocity step-up ratio, and change in velocity across the anastomosis were correlated with catheter portal venogram. Narrowing of the main portal vein of at least 50% on portal venogram was considered stenotic. 54 randomly chosen patients without suspicion of hepatic transplant portal anastomotic stenoses were assigned to our control group. Patients who underwent catheter portal venogram without findings of portal vein stenosis were also assigned to our control group.

RESULTS

CONCLUSION

CLINICAL RELEVANCE/APPLICATION
Applying the Doppler ultrasound criteria yielded in our study will result in selecting the most appropriate hepatic transplant patients with main portal vein stenosis for catheter portal venogram.

LL-VIE-WE6A • High Resolution Imaging with High Frequency Intravascular Ultrasound Improves Sensitivity in Cancer Staging when Vascular Encasement or Mass Effect is Suspected on Dynamic Computed Tomography: Special Cases in Hepatobiliary and Pancreatic Cancer

Cristian Coroian MD, MBA (Presenter) ; Brian A Bianco DO, MBA ; Wilbur B Bowne MD ; Alexander E Trebelev MD

PURPOSE
To present the emerging technique of high resolution intravascular ultrasound (IVUS) evaluation of arterial invasion by cancer. We demonstrate the ability to interrogate the three layers of the hepatic, superior mesenteric, splenic, and gastroduodenal arteries (including adventitia, media, and intima) with sub-millimeter resolution. By using IVUS, we more accurately stage hepatobiliary and pancreatic cancer in patients where dynamic computed tomography (CT) demonstrates cancer encasement or mass effect on an artery.

METHOD AND MATERIALS
A 6 Fr sheath is used to gain access and navigate a wire into the target vessel. The IVUS probe is then advanced while recording Chroma flow gray scale images through the arterial segment of interest. Start and end scan location is determined by fluoroscopic roadmap.

Patients with pancreatic cancer and hepatobiliary cancer are selected. As part of cancer staging, dynamic CT imaging is performed. In patients where the tumor mass encases or causes mass effect on the hepatic artery, superior mesenteric artery, splenic artery, or gastroduodenal artery, high frequency IVUS is performed (as described above) to evaluate invasion of the vascular adventitia, media, and intima. Pathological findings are correlated with IVUS images. Traditional methods of indirectly suggesting invasion by assessing vascular encasement or mass effect of a tumor on a vessel by dynamic CT are compared with IVUS results to determine sensitivity and specificity. Dynamic CT curved reformatted images are then correlated with IVUS images to determine exact location and integrity of the artery layers. The sub-millimeter spatial resolution of IVUS allows for grayscale anatomic identification and accurate determination of tumor invasion.

RESULTS

We present cases of cholangiocarcinoma and pancreatic cancer showcasing the accuracy of IVUS in resolving dynamic CT suspected vascular invasion with the highest spatial resolution. 100% accuracy is attained with no periprocedural complication.

CONCLUSION
High frequency IVUS is technically feasible in the splanchnic arteries. IVUS is an emerging technique in the staging of cancer, and in our experience, provides 100% accuracy in determining arterial vascular invasion.

CLINICAL RELEVANCE/APPLICATION
High frequency IVUS is an emerging technique in staging of cholangiocarcinoma and pancreatic cancer, and in our experience, provides 100% accuracy in determining arterial vascular invasion. 

LL-VIE-WE7A • Radiation Safety in the Interventional Radiology Suite

Prasad S Dalvie MD (Presenter) ; Narendra B Gutta MBBS, MD ; Orhan S Ozkan MD ; John C McDermott MD

PURPOSE
To review radiation risks to healthcare workers and patients during interventional procedures and demonstrate tips and techniques for...
opportunities to develop future applications that leverage this knowledge for diagnostic decision support and treatment planning.

This workshop will describe datasets and tools that enable research at the intersection of imaging and genomics, and that point to opportunity to discover key molecular processes associated with distinct image features, within one cancer type and across different cancer types. Linked imaging-genomic data provides exciting new opportunities to recognize imaging phenotypes that emerge from molecular images with semantic descriptors using controlled terminologies to record the visual characteristics of the diseases. The availability of these histogram statistics, image textures, and specialized features developed for particular acquisition modes. They are also annotating the extract image features from the MRI, CT and/or PET images in TCIA, including tumor volume, shape, margin sharpness, voxel-value.

Various omics data such as gene expression, microRNA expression, DNA methylation and mutation data. The community is beginning to matched molecular and image data for five cancer types, namely breast, lung, brain, prostate and kidney. The data in TCGA includes Radiogenomics is an emerging field that integrates medical images and genomic data for the purposes of improved clinical decision making and advancing discovery of critical disease processes. In cancer, both imaging and genomic data are becoming publicly available through The Cancer Imaging Archive (TCIA) and The Cancer Genome Atlas (TCGA) databases, respectively. The TCGA/TCGA provide examples of various imaging-genomic data provides exciting new opportunities to recognize imaging phenotypes that emerge from molecular characteristics of disease and that can potentially serve as biomarkers of disease and its response to treatment. They also provide an opportunity to discover key molecular processes associated with distinct image features, within one cancer type and across different cancer types. This workshop will describe datasets and tools that enable research at the intersection of imaging and genomics, and that point to opportunities to develop future applications that leverage this knowledge for diagnostic decision support and treatment planning.

**Correlating Imaging with Human Genomics**

**Wednesday, 12:30 PM - 02:00 PM • S401CD**

**Content Organization**

A. Radiation Physics & concept of ALARA B. Side effects of radiation (stochastic & deterministic) C. Radiation monitoring and documentation D. Standard precautions during IR procedures E. Guide to DSA settings and features (knobology) F. Special precautions (pregnancy, pediatric patients, large patient & complex procedures)

**Summary**

This exhibit will review a. Physics relevant to fluoroscopic and DSA procedures b. Radiation risks from interventional procedures c. Radiation monitoring and documentation d. Standard and special procedures to reduce radiation exposure.

**LL-VIE1293-WEA • Nonvascular Uses of Liquid Embolic Agents: Therapy for Biliary Leaks, Ureteral Leaks, Lymphatic Leaks, and Enterocutaneous Fistulas**

Karen Alderfer MD (Presenter); Ramon Ter-Oganesyan MD; Michael D Katz MD; Ilya Lekht MD; M. Victoria Marx MD; Sue E Hanks MD

**Purpose/Aim**

1. Overview of available liquid embolic agents and their conventional vascular uses. 2. Discussion of possible nonvascular uses. 3. Review of cases from our institution where liquid embolic agents have been utilized in nontraditional ways.

**Content Organization**

Liquid embolic agents

Review of currently available types of liquid embolic agents and traditional vascular uses

Discussion of nonvascular uses of liquid embolic agents

Hepatobiliary

Genitourinary

Gastrointestinal

Lymphatic Case discussion and imaging review

Detailed review of cases from our institution where liquid embolic agents have been used in non-vascular organ systems

**Summary**

NBCA glue (N- butyl cyanoacrylate) and Onyx® Liquid Embolic System (ethylene vinyl alcohol and DMSO (dimethyl sulfoxide)) have been used as vascular embolic agents in various parts of the body to arrest hemorrhage and shut down arteriovenous malformations. In our institution, the utility of these liquid embolic agents has been extended to nonvascular uses as well. In this presentation, we review several cases from our institution where liquid embolic agents have been utilized to achieve therapeutic success in biliary leaks, ureteral leaks, lymphatic leaks, and enterocutaneous fistulas.

**LL-VIE1303-WEA • Diagnosis and Endovascular Management of High Flow Peripheral Arterio-venous Malformations (AVMs)**

Anil K Pillai MD (Presenter); Jed A Hummel MD; Sanjeeva P Kalva MD *; Seth Toomay MD; Mark Reddick; Nancy K Rollins MD; Kenrick Lam BS

**Purpose/Aim**

1. Overview of available liquid embolic agents and their conventional vascular uses. 2. Discussion of possible nonvascular uses. 3. Review of cases from our institution where liquid embolic agents have been utilized in nontraditional ways.

**Content Organization**

This presentation will include classification, imaging features on CT/MRI and catheter angiography, anatomical and flow considerations in the selection of the embolic materials, the technical aspects and a brief review of literature eliciting the success rates of such therapy. The role of various embolic materials including alcohol, 3% sotradecol, n-butyl cyanoacrylate, ethylene vinyl copolymer, coils and vascular plug devices will be illustrated.

**Summary**

The high flow AVM are often associated with serious symptoms. The endovascular management of vascular malformations is gaining acceptance as the primary treatment. The viewer will gain a better understanding of classification, indications and contraindications for endovascular therapy, technical considerations, different embolic materials and complications following endovascular therapy of high flow peripheral arterio-venous malformations (AVMs).

**Correlating Imaging with Human Genomics**

**Wednesday, 12:30 PM - 02:00 PM • S401CD**

**ICIA42 • AMA PRA Category 1 Credit™:1.5 • ARRT Category A+ Credit:1.5**

Sandy Napel, PhD *

Daniel L Rubin, MD, MS *

Olivier Gevaert, PhD

**Learning Objectives**

1) Understand the methods for and the potential value of correlating radiological images with genomic data for research and clinical care. 2) Learn how to access genomic and imaging data from The Cancer Genome Atlas (TCGA) and The Cancer Imaging Archive (TCIA) databases, respectively. 3) Learn about methods and tools for annotating regions within images with semantic and computational features. 4) Learn about methods and tools for analyzing molecular data, generating molecular features and associating them with imaging features.

**Abstraction**

Radiogenomics is an emerging field that integrates medical images and genomic data for the purposes of improved clinical decision making and advancing discovery of critical disease processes. In cancer, both imaging and genomic data are becoming publicly available through The Cancer Imaging Archive (TCIA) and The Cancer Genome Atlas (TCGA) databases, respectively. The TCGA/TCGA provide examples of matched molecular and image data for five cancer types, namely breast, lung, brain, prostate and kidney. The data in TCGAs includes various omics data such as gene expression, microRNA expression, DNA methylation and mutation data. The community is beginning to extract image features from the MRI, CT and/or PET images in TCGA, including tumor volume, shape, margin sharpness, voxel-value histogram statistics, image textures, and specialized features developed for particular acquisition modes. They are also annotating the images with semantic descriptors using controlled terminologies to record the visual characteristics of the diseases. The availability of these linked imaging-genomic data provides exciting new opportunities to recognize imaging phenotypes that emerge from molecular characteristics of disease and that can potentially serve as biomarkers of disease and its response to treatment. They also provide an opportunity to discover key molecular processes associated with distinct image features, within one cancer type and across different cancer types. This workshop will describe datasets and tools that enable research at the intersection of imaging and genomics, and that point to opportunities to develop future applications that leverage this knowledge for diagnostic decision support and treatment planning.
Optimizing PowerPoint Slides

Wednesday, 12:30 PM - 02:00 PM • S401AB

**ICIW42 • AMA PRA Category 1 Credit ™:1.5 • ARRT Category A+ Credit:1.5**

**Moderator**

Ramin Khorasani, MD *

Curtis P Langlotz, MD, PhD *

**LEARNING OBJECTIVES**

1) Review the components of an optimal slide presentation.
2) Learn about common errors made in slide preparation and how they can be avoided.
3) Learn about how to improve the quality of a presentation by using optimal different slide backgrounds, font size and color, and image sizes.
4) Learn tips to ensure a smooth presentation.

**ABSTRACT**

Electronic presentations are very common in radiology practice. This hands-on demonstration and questions and answer session will show attendees how to optimize their presentations. The focus will be on the use of slide templates, color selection (font and background), font and image size, and animations. Additional review of image and video display and management will be covered. Demonstrations will include tips to decrease time creating and modifying presentations. Bring your questions!

Molecular Imaging - Wednesday Posters and Exhibits (12:45pm - 1:15pm)

Wednesday, 12:45 PM - 01:15 PM • S503AB

**CL-MIS-WE1B • Immune Cell Trafficking during Radiation Therapy-A Potential Predictive Marker for Therapeutic Response**

**Bryan Bednarz** PhD (Presenter) ; **Sean B Fain** PhD * ; **Jeremy Gordon** ; **Myriam Bouchlaka** ; **Christian Capitini** MD

**PURPOSE**

Given the cross talk between cancer and the host immune system, there is a compelling need to monitor immunogenic responses in vivo during radiotherapy treatment. Over the last year our collaboration has been working toward (1) developing the nonradioactive isotope fluorine-19 (19F), as a novel, clinically applicable tracking agent for immune cells using magnetic resonance imaging (MRI), and (2) investigating if local irradiation of tumors augments expression of "danger signals" that recruit and activates immune cells using 19F MRI.

**METHOD AND MATERIALS**

Using a high-resolution Varian 4.7 Tesla small animal MRI scanner several we have developed and optimize a 19F MR imaging platform that uses a volumetric fluorine coil. We have labeled human NK cells with 19F-PFPE and injected these labeled cells intravenously in immunocompromised mice. The mice were scanned ~1, 24, 48, 72, 120 hours after injection.

**RESULTS**

Initial optimization experiments have demonstrated excellent SNR uniformity provided by the volume coil. Excellent signal linearity was demonstrated by acquiring images of phantom vials with increasing concentrations of 19F-PFPE. We have also demonstrated the ability to perform whole-body NK cell trafficking. We have verified that NK cells injected into immunocompromised mice trafficked to the liver and spleen.

**CONCLUSION**

We are currently investigating the immunogenic response following irradiation of subcutaneous tumors in mice. The ability to monitor immune cell trafficking during therapy will help optimize the synergistic effects of radiation cytotoxicity and the host immune system.

**CLINICAL RELEVANCE/APPLICATION**

The ability to monitor the host immune system response during radiation therapy will help elucidate a more optimal treatment course for individual patients.

**CL-MIS-WE2B • In Vivo Magnetic Resonance Tracking of Endothelial Progenitor Cells Trafficking to Sites of Hepatoma Angiogenesis**

**Xiao Li Mai** MD, PhD ; **Bao Xin Li** (Presenter) ; **Hai Jian Fan** ; **Bin Han**

**PURPOSE**

The goal of this study was to use Micro-MR to track the migration and incorporation of intravenously injected, magnetically labeled rat peripheral blood endothelial progenitor cells (EPCs) into the blood vessels in a rapidly growing hepatoma model.

**METHOD AND MATERIALS**

This study was approved by the Institutional Committee on Animal Research. Transplanted hepatoma in 18 BALB/c nude mice was induced with injected 1x10⁹ cells from a H22 mouse hepatoma cell line into left hepatic lobe. Rat EPCs labeled (n=9) and unlabeled (n=9) with superparamagnetic particle Fe₃O₄-poly-L-lysine (PLL) complexes were injected intravenously, and MR imaging was obtained 3, 7, and 10 days after transplantation. Hepatoma-to-muscle contrast-to-noise ratios (CNRs) on T₂*WI were measured and compared to histomorphologic studies.

**RESULTS**

Rat EPCs could be efficiently labeled. Migration and incorporation of transplanted labeled cells into tumor neovascularature were documented with in vivo MR as low signal intensity at the tumor periphery as early as 3 days after EPCs administration in preformed tumors. However, low signal intensities were not observed in tumors implanted at the time of EPC administration until tumor size reached 1 cm at 10 to 14 days. CNRs on T₂*WI decreased significantly in the hepatoma 12 days after injection of EPCs. Prussian blue staining showed iron-positive cells at the sites corresponding to low signal intensity on MRI. The labeled cells initially localized in the edge of tumor
Assessing Tumor Vasculature Using a Liposomal CT/MRI Bimodal Contrast Agent

Guanshu Liu PhD (Presenter); Yuguo Li PhD; Yuan Qiao MD, PhD; Shiban Zhou MD, PhD; Peter C Van Zijl PhD *; Michael T McMahon PhD

PURPOSE
To develop a liposomal system that encapsulates clinically-used iodinated CT/X-ray contrast agent ioxixanol to be a CT/MRI bimodal contrast agent, simply using the Chemical Exchange Saturation Transfer (CEST) contrast from the CT agent.

METHOD AND MATERIALS
Iodixanol encapsulated liposomes (CT-lipo) were prepared according to literatures using a formulation of DPPC:cholesterol:DSPE-PEG-2000=57:40:3. The size, concentration and encapsulation ratio of CT-lipo were measured following our previous published methods. 24 hours before MRI and CT studies, 500 μL overnight-dialyzed liposomes (1000 mg/kg) were injected to the tail vein of Balb/c mice carrying subcutaneous CT26 murine colon tumours. In vivo CEST MR images were acquired using previous published methods. 6 3D CT images were acquired using an IVIS® Spectrum CT system (Perkin Elmer) with the following parameters: 50 kVp, 1 mA, and 50 msec exposure, totally 720 projections.

RESULTS
The results showed that iodixanol, both in liposomal (~160 nm) and non-liposomal forms, can also be detected using CEST MRI with a relatively high sensitivity at 4.3 ppm. The detection limit is estimated to be ~2nM liposomes, or ~1.4mM encapsulated iodixanol. At 24 hours after i.v. injection, mice injected with CT-lipo showed marked enhancement in tumor region, while those injected with blank liposomes (blank-lipo) did not show significant contrast enhancement. In MRI, the tumor of CT-lipo injected mice showed remarkable but non-uniform CEST contrast enhancement at 4.3 ppm as compared to those injected with blank-lipo, with a average tumor contrast enhancement (MTRasym) of 0.8% (n=2 for each group). More studies of CT and MRI acquisitions on additional animals and immunohistological validation are underway.

CONCLUSION
The present work demonstrated the feasibility of engineering a multimodality imaging system by encapsulating nanosized liposomes with a single clinically used CT contrast agent iodixanol. Our results showed that both CT and MRI could detect reliably the presence of iodixanol-encapsulating liposomes in tumors, enabling the bimodal assessment of tumor vasculature.

CLINICAL RELEVANCE/APPLICATION
The present nanoparticle system can be easily translated to the Clinical for imaging the vasculature of tumors and monitoring the effect of anti-angiogenic drugs using both MRI and CT.

CL-NM-WE6B • Assessing Tumor Vasculature Using a Liposomal CT/MRI Bimodal Contrast Agent

Guanshu Liu PhD (Presenter); Yuguo Li PhD; Yuan Qiao MD, PhD; Shiban Zhou MD, PhD; Peter C Van Zijl PhD *; Michael T McMahon PhD

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CLINICAL RELEVANCE/APPLICATION
The present nanoparticle system can be easily translated to the Clinical for imaging the vasculature of tumors and monitoring the effect of anti-angiogenic drugs using both MRI and CT.
Increased FDG Uptake in the Right Ventricle Indicates a Poor Prognosis in Patients with CTEPH: A Comparative Study between Hemodynamic Parameters and FDG PET/CT

Yoshio Uchino MD, PhD (Presenter)

PURPOSE
Many patients with severe brain injury in the chronic stage (SBIC) have epilepsy, so most of them need to continue antiepileptics (AEDs). However, AEDs have the influence on cognitive function. We studied the changes of the brain FDG uptake and functional improvement of the patients, before and after withdrawal of AEDs.

METHOD AND MATERIALS
Forty-two patients were included in this study, ranging from 19 to 70 (40±14, mean±SD). Time from head injury to the first PET was 3.2±2.7 years. The interval between 1st and 2nd scan was 24±7 months. We tried withdrawal from AEDs in all patients. The cases were divided into two groups based on whether or not AEDs were successfully withdrawn. One was 27 cases who needed to continue AEDs (continued-AEDs group), and the other was 15 cases with successful withdrawal of AEDs (discontinued-AEDs group). Each average SUV of bilateral thalamus (Th) and whole brain (WB) were obtained from each scan. Functional Improvement of the patients was defined as the increase of more than five points in the CHIBA score.

RESULTS
In the continued group, the SUVs of bilateral Th and WB have not changed between two scans, and three patients out of 27 (11%) have improved function. In the discontinued group, SUVs have significantly increased (right Th p=0.001, left Th p=0.002, and WB p

CONCLUSION
Brain FDG uptake was increased after withdrawal of antiepileptic drugs in patients with SBIC. In patients with functional improvement, thalamic FDG uptake also increased. Thalamus is the key structure for the functional improvement.

CLINICAL RELEVANCE/APPLICATION
Discontinuation of antiepileptics help to improve the patient's brain FDG uptake. Functional improvements can be expected in patients with preserved thalamic function.

Clinical Relevance of 30-Minute Retention Value in Diagnosing Rapid Gastric Emptying by 4-Hour Scintigraphy Test

Jesus R Diaz MD (Presenter); Arya Bagherpour DO; Joshua Reber; Soyoung Lee MS, MSc; Irene Sarosiek MD; Richard W McCallum MD; Alok K Dwivedi PhD; Chad Cooper MD

PURPOSE
Currently, a 60-minute measurement of a standardized gastric emptying scintigraphy (GES) is used for diagnosis of rapid gastric emptying, and shorter intervals such as the 30-min retention value have not been widely utilized. The purpose of our study is to determine the potential diagnostic power of the percent retention of the study meal at the 30-min interval.

METHOD AND MATERIALS
We retrospectively reviewed 450 results of 4-h GES test. Among these reports, 71% (n=320) were non-delayed, of which 38% (n=122) had a 30- and 60-min retention values recorded. Rapid emptying was defined as a retention of less than 25% of the initial activity at 3 min.

RESULTS
Of the 122 non-delayed GES reports with both 30- and 60-min retention values, 34% (n=42) were classified as normal at both time points, and 38% (n=46) met criteria as rapid at both intervals. Combined, the overall concordance was determined to be 72%.

CONCLUSION
Our analysis of GES reports with both 30- and 60-min retention values demonstrated that: 1) 30-min interval data, diagnosed an additional 27% of patients with rapid emptying as compared to the 60-min value alone; 2) The addition of the 30-min retention data significantly increases the diagnostic power of GES to identify rapid gastric emptying.

CLINICAL RELEVANCE/APPLICATION
Addition of a 30-min retention value to GES increases the detection of rapid gastric emptying.

Increased FDG Uptake in the Right Ventricle Indicates a Poor Prognosis in Patients with CTEPH: A Comparative Study between Hemodynamic Parameters and FDG PET/CT

Salih Ozgunen (Presenter); Fuat Dede; Bedrettin Yildizeli; Serpil Tas; Mehmet Yanartas; Serkan Gungor; Mustafa Aras; Tunc Ones; Sabahat Inanir; Tanju Y Erdil; Halil T Turoglu

PURPOSE
Chronic thromboembolic pulmonary hypertension (CTEPH), is a rare disease that occurs after acute pulmonary embolism and causes significant morbidity and mortality. Hemodynamic parameters plays a great role in the assessment of prognosis and severity of the disease. Right ventricular overload is an expected finding. In this study we investigated the relationship between right ventricular FDG uptake and the measured hemodynamical parameters.

METHOD AND MATERIALS
We performed FDG PET/CT before endarterectomy operation in order to distinguish thrombus / endovascular malignancy (angiosarcoma, etc.) which is seen as filling defects in main pulmonary artery and its branches. In FDG PET/CT study we measured the SSVmax, RV/LV SUVmax and RV/LV SUVmax ratio with the systolic (SPAP) and mean (MPAP) pulmonary artery pressures and pulmonary vascular resistance (PVR) values --which are measured by echocardiography and/or right heart catherization.

RESULTS
20 patients (11 women, 9 men) with a mean age of 52.2 ± 12.1 years were included in this study. We found statistically significant
positive relationship between the mean (± standard deviation) values of RV-SUVmax and SPAB (Spearman r = 0.48, P = 0.037), and between PVR and RV / LV ratio (Spearman r = 0.50, P = 0.024). There was no significant correlation found between other parameters.

CONCLUSION

Hemodynamic measurements are objective parameters in determining the severity and prognosis in patients with CTEPH. Increase in these values indicates poor prognosis. On the other hand, in those patients who had RV hypertrophy and decreased systolic function due to pulmonary hypertension, can be detected by routine echocardiography, right heart catheterization and CT-pulmonary angiography in the evaluation stage. In the literature, only few studies reported the relationship between the level of the RV FDG uptake in FDG PET/CT and the severity of pulmonary hypertension in pulmonary hypertensive patients.

CLINICAL RELEVANCE/APPLICATION

This study, we observed a positive correlation between the level of the right ventricular FDG uptake, PVR and SPAP in patients with CTEPH. Also increased RV-FDG uptake was shown to be a poor prognosis.

CL-NMS-W4B • Evaluation of Quantitative Accuracy in CZT-based Pre-clinical SPECT for Different Isotopes

Su-Jin Park (Presenter) ; A Ram Yu ; Hee-Joung Kim PhD

PURPOSE

In vivo pre-clinical SPECT is a valuable imaging tool for functional small animal imaging, but several physical factors such as scatter radiation limit the quantitative accuracy in conventional scintillation crystal-based SPECT. Semiconductor detectors such as CZT may overcome the deficiencies through superior energy resolution. To our knowledge, the quantitative analysis in CZT-based pre-clinical SPECT has not been investigated rigorously. The aim of this work is to assess the quantitative accuracy of CZT-based pre-clinical SPECT for four different isotopes: 125I, 201Tl, 99mTc, and 111In.

METHOD AND MATERIALS

The quantitative accuracy of the CZT-based Triumph X-SPECT (Gamma-Medica Ideas, Northridge, CA, USA) was compared with those of the conventional SPECT using GATE simulation. The quantitative errors due to the scatter effects were evaluated with the four different isotopes, and energy windows of 5, 10, and 20 %.

RESULTS

The CZT-based pre-clinical SPECT had overall higher quantitative accuracy than that of the conventional SPECT. Using the conventional SPECT with the energy window of 10 % as an example, the scatter effects degraded quantitative accuracy were by up to 33.74 %, 11.52 %, 5.10 %, and 1.73 % for 125I, 201Tl, 99mTc, and 111In, respectively. However, using the CZT-based pre-clinical SPECT, the degradations were by up to 15.20 %, 5.45 %, 2.40 %, and 1.41 % for 125I, 201Tl, 99mTc, and 111In, respectively. In addition, as the energy window was increased, the quantitative errors increased for both SPECT systems. Moreover, in CZT-based pre-clinical SPECT, the errors significantly increased when the energy window varies from the 5% to 10%.

CONCLUSION

The quantitative accuracy of CZT-based pre-clinical SPECT was evaluated for the different isotopes by the comparison of those of the conventional SPECT. Our results demonstrated that the CZT-based pre-clinical SPECT had overall lower quantitative errors due to the minimal scatter. Furthermore, we are planning to investigate the optimal energy window for each isotope in order to take the advantage of the high quantitative accuracy in CZT-based preclinical SPECT.

CLINICAL RELEVANCE/APPLICATION

Our results offer insights into the potential of CZT-based SPECT quantitative imaging in clinics, and may provide clinicians with useful reference information for the task-based quantitative study.

CL-NMS-W5B • Effect of Errors in MR-based Attenuation Maps of the Pelvis on PET Reconstructions in Simultaneous PET-MRI

David Lalush (Presenter) ; Meher Juttukonda * ; Hongyu An DSc

PURPOSE

MR-based attenuation maps of the pelvis do not completely account for bone and introduce errors into PET reconstructions. This study examines the effects of erroneous bone attenuation factors on PET reconstructions in a realistic simulation model.

METHOD AND MATERIALS

Simulations used the realistic body anatomy of the XCAT digital phantom. The phantom was generated with both simulated PET uptake and realistic attenuation factors. Two activity distribution maps were simulated: a uniform uptake distribution and a lesion-centric distribution including four high-uptake spherical lesions placed at different locations around the pelvis. PET lines of response were simulated for the Siemens Biograph mMR geometry, and attenuation effects of the true attenuation map (including bone) were applied to the set of oblique sinogram data. A series of erroneous attenuation maps for reconstruction were then applied to "correct" the sinogram data. Error maps included one where bone was given water-equivalent attenuation, and a series of others where a fraction (25%, 50%, and 75%) of bone voxels were correctly assigned bone attenuation. Reconstructions of the erroneously-corrected data were produced using Fourier rebinning followed by OSEM reconstruction. Reconstructions were compared to those using the true attenuation map by computing percentage errors in each voxel.

RESULTS

Error maps show that quantitative errors in the erroneously-mapped PET reconstructions are nonuniformly distributed and are most severe in the immediate vicinity of calcified bone, where they are as high as 40-50% relative to the reconstructions from the correct maps. Lesion quantitation was also shown to vary with location and ranged from 10-12% in some superior and inferior locations less impacted by the pelvic bone to 30-50% in locations in the planes of thickest calcified bone.

CONCLUSION

Reconstructions of PET data in the pelvic region from MR-based attenuation maps that do not fully account for bone will likely result in underestimation of PET uptake as compared to those from CT-based attenuation maps. Errors range from 10 - 50% and are location- and patient-dependent, further complicating the comparison of PET-MR acquisitions with those from PET-CT.

CLINICAL RELEVANCE/APPLICATION

Simultaneous PET-MRI is being considered in potential clinical applications, but the comparison with standard-of-care PET-CT will be impacted by errors due to bone attenuation.
Purpose/Aim
To implement a CT radiation dose program at a major US children's hospital and track our results.

Content Organization
A. To raise awareness, we made presentations at medical staff meetings, CME conferences and community hospitals to communicate the need to lower diagnostic radiation exposure to children. B. To provide alternatives to CT, we used "Lean" methodology to streamline access to MRI. We expanded the access of US. We offered interpretation of outside hospital CTs. C. We used stepwise dose reduction to find the lowest CT technique that yielded acceptable image quality. We implemented a low dose protocol to follow patients with ventricular catheters. D. We replaced aging equipment and performed "before and after" analysis to document the impact of new scanning technologies. E. We used the radiology information system to track utilization and dose (CTDIvol and DLP). We audited our own practices in the emergency department to ensure that our use of CT for head trauma adhered to published guidelines.

Summary
Through our combined efforts at the Mallinckrodt Institute of Radiology and St. Louis Children's Hospital, we were able to cut CT utilization in children roughly in half over a 7-year period. We provide acceptable CT image quality at lower dose while substantially reducing the population risk associated with excess medical radiation exposure.

CL-PDE-WE6B • Sonographic Assessment of the Joints in Pediatric Arthritis: A Pictorial Review
Gene M Weinstein MD; Anastasia L Hryhorczuk MD (Presenter); Julia G Rissmiller MD; Donald A Tracy MD

Purpose/Aim
The purpose of this exhibit is: (1) to highlight the utility of musculoskeletal ultrasound (US) in the evaluation of pediatric arthritis, (2) to demonstrate scanning techniques as well as the normal anatomy visualized in the sonographic assessment of pediatric joints, and (3) to illustrate the various pathologic entities that can be assessed using US in pediatric patients with arthritis.

Content Organization
A pictorial essay is presented illustrating: (1) the proper technique for musculoskeletal/joint US in the pediatric patient, (2) the normal anatomy of commonly scanned joints (elbow, wrist, hip, knee, ankle), and (3) examples of commonly seen sonographic joint findings in pediatric arthritis (effusions, synovitis, and erosions) with both radiographic and MR correlation.

Summary
US is a valuable tool for the assessment of pediatric arthritis. It is especially useful as a readily available, radiation-free, and sedation-free technique for serial evaluation of joints. We aim to provide a framework for those who wish to create or expand a pediatric joint ultrasound program, as this has the potential to serve as a cost-effective technique for sequential monitoring of pediatric arthritis patients.

CL-PDE-WE5B • 3rd Ventricular Mass Lesions in the Pediatric Population: Case Based Teaching Review
Rajan P Patel MD (Presenter); Roy G Jacob MD; Michael C Morriss MD

Purpose/Aim
Lesions in the 3rd ventricle can be broadly classified into anterior recess, posterior recess and intrinsic 3rd ventricular mass lesions. Imaging with MR is the key to their diagnosis. Management of these lesions can be surgical or nonsurgical depending on the diagnosis and presentation. Hence to have a reasonable differential diagnosis is very important. This electronic presentation outlines the following –

1. Review anatomy of the 3rd ventricular system.
2. Describe the imaging features of 3rd ventricular mass lesions seen in Pediatric population.

Content Organization
Material and Methods: A retrospective search of PACS was performed. Imaging studies depicting mass lesions in the third ventricle were identified. All studies were de-identified prior to image export. Results: Over 12 representative cases of the 3rd ventricular mass lesions including but not limited to Craniopharyngioma, Pitocytic and Pilomyxoid Astrocytoma, LCH, Hypothalamic hemartoma, Atyypical teratoid rhabdoid tumor (ATRT), Ependedymoma, Choroid plexus tumors, Germ cell tumors, Pineal parenchymal tumors were selected for inclusion.

Summary
Familiarity with the imaging of Pediatric 3rd ventricular mass lesions helps formulating a reasonable differential diagnosis. This exhibit is meant to concisely summarize the relevant imaging features of Pediatric 3rd ventricular mass lesions.

CL-PDS-WE1B • Dynamic Evaluation of the Pediatric Airway with Low Dose Volume CT Angiography: 'One Stop Shop' Protocol for Vascular Mediated Airway Compromise
Prakash M Masand MD (Presenter); Siddharth P Jadhav MD; Lamya A Atweh MD; Rajesh Krishnamurthy MD *

Purpose
CT is the gold standard for non-invasive evaluation of intrinsic and extrinsic components of airway compromise. We present a new low-dose dynamic volume CT angiographic technique for airway/vessel evaluation.

Method and Materials
25 patients (age range 1 month-18 years) were studied using this novel protocol. All scans were performed on a 320 detector CT scanner providing 16 cm coverage with a single rotation. 6-8 volumetric data sets were acquired at 80 kV and 20-60 mA based on age, gantry rotation time of 0.35-0.5 secs, with integrated adaptive iterative reconstruction, yielding an average total dose of < 1.5 mSv. 18 studies were performed in intermittent mode with acquisition every 1.4 seconds, and 7 using continuous (cine) mode, depending on respiratory and heart rate to achieve target sampling rate of less than half the respiratory cycle duration. Simultaneous IV contrast injection were performed in intermittent mode with acquisition every 1.4 seconds, and 7 using continuous (cine) mode, depending on respiratory and heart rate, to achieve target sampling rate of less than half the respiratory cycle duration. Simultaneous IV contrast injection provided first-pass angiographic assessment of the vessels. Studies were read by one reader and assessed for adequacy of sampling inspiration and expiration, demonstration of airway/vascular pathology, and feasibility of 3D reconstruction and virtual bronchoscopy. Correlation of imaging data with endoscopic and surgical findings is pending.

Results
All studies were technically successful in sampling inspiratory and expiratory phases of the respiratory cycle, for adequate opacification of the vasculature of the chest, and 3D reconstruction of the airway and vasculature. Fixed versus dynamic obstruction related to tracheobronchomalacia was assessed in all cases. Dynamic airway compromise was considered to be present when there was 50% reduction in cross sectional diameter in expiration. Underlying pathology of airway compromise demonstrated included vascular rings, cartilaginous rings with pulmonary sling, tracheal stenosis from prior tracheostomy, extrinsic compression from dilated pulmonary arteries, innominate artery compression and aortic root dilatation.

Conclusion
This low dose dynamic airway/vessel volumetric imaging protocol provides assessment of all relevant pathologic targets for intrinsic and extrinsic vascular mediated airway compromise, allowing decision making regarding management and obviating the need for more invasive diagnostic procedures.

Clinical Relevance/Application
This protocol has the potential to provide a comprehensive assessment of the dynamic and mechanical issues relating to the pediatric airway.

CL-PDS-WE2B • Comparison of Dose Reduction and Image Quality in Pediatric Chest CT with Different Adaptive Statistical Iterative Reconstruction Blending
Purpose

The purpose of this study was to compare radiation dose, noise and image quality of low-dose chest CT images reconstructed using an adaptive statistical iterative reconstruction (ASIR) with 70% ASIR and 30% ASIR blending.

Method and Materials

Forty-two children (study group with age 2m~11y, mean age 4.5 years) underwent low-dose chest CT with 70% ASIR. Age-dependent noise index (NI) in 20 patients (mean age 4.2 years) was 36.0±13.9 mGy/mAs. NI for the control group was set to NI=11 for 0~1 year old, NI=13 for 1~3 years old, and NI=15 for 3~18 years old. Two radiologists independently evaluated images for normal lung structures, abnormal CT findings, and image noise on a 5-point scale with 3 being clinically acceptable. Quantitative measures of radiation dose and image noise on left ventricle and muscle were also obtained and statistically compared between the two groups. The inter-observer agreement was tested with kappa statistics.

Results

The image noise for the study group was 13.10±4.90, slightly higher than 11.17±4.30 for the control group. However, the mean image quality scores for the study group and control group were 3.54±0.24 and 3.66±0.20, respectively, with no significant difference (p>0.05). All images were judged to be acceptable for clinical diagnosis, and there was good inter-observer agreement in diagnostic acceptability (k=0.50). On the other hand, the average CTDIvol for the study and control groups were 0.72±0.18mGy and 1.19±0.78mGy, respectively. The 70% ASIR provided 40% lower dose than the 30% ASIR reconstruction with significant difference (p<0.05).

Conclusion

Compared with 30% ASIR, low-dose CT with 70% ASIR provides additional 40% dose reduction in pediatric chest CT examinations, while maintaining diagnostically acceptable images.

Clinical Relevance/Application

The use of an adaptive statistical iterative reconstruction algorithm with 70% blending can further reduce radiation dose to pediatric patients undergoing chest CT with clinically acceptable images.

CL-PDS-WE3B • Evaluation of Image Quality and Radiation Dose in Paediatric Thoracic 256 Multidetector Computed Tomography (MDCT) without Sedation

Michaela I Cellina (Presenter); Beatrice Tagliaferri MD; Alberto Torresin MPH; Giuseppe Storniolo; Luca Trombetta; Michele Maddalo; Beatrice Tagliaferri

Purpose

To assess image quality and radiation dose of high resolution chest CT examination without sedation in children and toddlers on a 256 MDCT, considering that estimated dose from MDCT in children is an open problem. Methods for estimating radiation dose from CT examinations are not patient oriented but based on reference phantom.

Method and Materials

36 children and toddlers aged 1.5-14 years (7.9±3.8 y), 15 weighting >35 kg (range: 35-63; mean 41.8± 10.5 kg) and 21 weighting =35 kg (range: 15-35; mean 26.3± 5.8 kg) underwent thoracic CT on 256-slice CT scanner (Somatom Definition Flash, Siemens) without sedation. Main indications for high-resolution CT were: congenital airways or lung malformations, recurrent pneumonia, severe asthma unresponsive to therapy, suspected bronchiectasis, unexplained chronic cough. Acquisition parameters were as follows: tube voltage:100 kV; reference current: 130 mAs with attenuation-based tube current modulation (CARE Dose 4D); pitch:3; rotation time: 0.28 s; collimation: 3 x 0.6 mm; image reconstruction thickness: 3 mm; position increment: 3 mm. Inspiratory and expiratory datasets were acquired. Image quality, artifacts and diagnostic confidence were evaluated by 2 experienced radiologists in consensus using a 5-point grading scale (1=unacceptable; 5= perfect). Image noise was calculated by placing a region of interest of 1 cm2 in the ascending aorta measuring the average of the standard deviations in HU. CTDIvol and DLP were recorded; effective dose was calculated for each patient using accepted age-dependent-convertion factors (Bongartz et al., 2004).

Results

All exams were successfully acquired. Images of diagnostic quality (= 4) were obtained in all patients. Mean image quality was 4.4±0.4; mean artifacts: 4.4±0.5. Image noise was: 10.6±8.2 for patients = 35 kg and 9±4.2 for patients >35 kg. DLP were: 42.6 ±10.3 (= 35 kg) and 92.9±4.86 (>35 kg) mGy/cm; CTDIvol: 1.62±0.3 mGy (35 kg) and 3.0±0.8 mGy (>35 kg). Effective doses were: 1.33±0.35 mSv for patients = 35 kg and 2.5±0.9 for those >35kg.

Conclusion

As long as the CT examination is justified, it is possible to obtain optimum image quality without the need of sedation and with acceptable radiation exposure.

Clinical Relevance/Application

In pediatric patients with suspected severe or malformative airways pathology with non diagnostic X rays, new generation CT are a good compromise between diagnostic information and radiation exposure.

CL-PDS-WE4B • Role of Free-breathing MDCT Study in Pediatric Patients with Upper Respiratory Tract Obstruction and Sleep Apnea Syndrome: Direct Comparison with Sleep Endoscopy Procedure

Alessandro Masetto MD (Presenter); Francesca Rossi; Davide Ippolito MD; Pietro A Bonaffini MD; Camillo R Talei Franzesi; Sandro Sironi MD

Purpose

To evaluate the accuracy of multidetector CT examination for the evaluation of the upper airways tract (UAT) in pediatric patients with obstructive syndromes and sleep apnea syndrome in comparison with sleep endoscopy (SE), considered as gold standard.

Method and Materials

Thirty-six pediatric patients affected by a variety of diseases determining obstructive syndromes, particularly during sleep, were submitted to an inspiratory low-dose CT study of the UAT; among them, 8 patients (4 males, mean age 4.2 years old), 3 mucopolysaccharidosis IV, 1 mucopolysaccharidosis VI, 1 Down syndrome, 1 bronchodysplasia, 1 complex syndromic pathology, 1 obstructive sleep apnea syndrome underwent a CT study. Both procedures were performed under sedation. A radiologist performed planimetric measurement and virtual endoscopy reconstructions, evaluated the quality of the CT scan (score: A=good/very good, B=fair, C=poor) dividing the UAT in nasal fossa, rhinopharynx, oro- and hypopharynx, trachea (further divided in proximal, medium and distal third) and carina; stenoses were pointed out and a semiquantitative score was given (mild, moderate, severe, obliteration). An otolarynologist reviewed the SE videos, evaluating the same parameters with the same score. Last, radiologist and otolorinaryngologist compared the results side by side to clarify discrepancies.

Results

CT image quality was overall good (A=6, B=1, C=1); concordance between CT and SE was high in 8/8 patients for the evaluation of nasal fossa, rhinopharynx, trachea and carina. For the evaluation of oro- and hypopharynx concordance was high in 3/8 patients, medium in 2/8, low in 3/8. CT could evidence the location of stenosis in 6/8 patients.

Conclusion

Free-breathing low-dose CT provides generally an accurate representation of the UAT, but it is not reliable for the evaluation of structures characterized by excessive movement during breathing; a dynamic endoscopic assessment offers much more information, and it is not replaceable by CT.
CLINICAL RELEVANCE/APPLICATION
CT may be a useful assessment tool for pre-operative airways assessment and planning in pediatric patients with upper obstructive syndromes, in particular for evaluation of rhinopharynx and trachea.

Breast - Wednesday Posters and Exhibits (12:45PM - 1:15PM)
Wednesday, 12:45 PM - 01:15 PM • Lakeside Learning Center

LL-BRS-WEB • AMA PRA Category 1 Credit ™:0.5

LL-BRS-WEB1 • The Yield of Pre-operative Breast MRI in Patients with Fat Density Breasts

Neera Malik MD (Presenter) ; Jean M Seely MD ; Barbara Deren ; Jacqueline C Lau MD ; Angel Arnaout MD, MSc

PURPOSE
To determine the yield of pre-operative breast MRI in patients with fat-density breasts.

METHOD AND MATERIALS
Patients who underwent breast MRI in 2009 for pre-operative staging of breast cancer were recorded. Of these, those with mammography performed at our institution within 3 years of the breast MRI were identified. Patients for whom mammography had been performed elsewhere and for whom imaging was unavailable were included if mammographic findings were indicated in the breast MRI report. For patients meeting these criteria, mammographic breast density and the presence of additional multifocal, multicentric, and contralateral lesions on breast MRI not identified on mammography were recorded.

RESULTS
570 pre-operative breast MRIs were performed in 2009 in patients with breast cancer, of which mammographic density within 3 years of breast MRI was available in 267 cases. Of these, 33 had fat density breasts with MRI identifying additional lesions in 18% of cases. Additional lesions included multifocal disease (n=1), multicentric disease (n=3), stromal fibrosis and sclerosing adenosis (n=1), and papilloma (n=1). Of the 33 patients with fat density breasts, MRI altered management in the 4 patients with new multifocal and multicentric disease (12%). 100 patients had scattered fibroglandular breasts, with MRI identifying 41 additional lesions; 92 patients had heterogeneously dense breasts, with MRI identifying 44 additional lesions; and 37 patients had dense breasts, with MRI identifying 22 additional lesions. Chi-squared analysis showed a statistically significant difference between breast density and number of additional findings on MRI (p

CONCLUSION
Although patients with fat density breasts are 6.6X less likely to have additional findings on pre-operative breast MRI in comparison to patients with dense breasts, 12% of patients with fat density breasts had additional MRI findings that altered management. Thus, if selective use of pre-operative MRI is considered, patients with fat density breasts show relatively low benefit.

CLINICAL RELEVANCE/APPLICATION
Identifying a subset of patients in whom pre-operative breast MRI is of low yield and can be obviated will result in more optimal allocation of health care resources and more timely management.

LL-BRS-WE2B • The Hypervascularity Paradox: Association between Asymmetric Increase in Breast Vascularity and Response to Neoadjuvant Chemotherapy in Locally Advanced Breast Cancer

Marialuisa Di Matteo (Presenter) ; Paolo Belli MD ; Giovanni Giuseppe Giardina MD ; Federico Padovano ; Enida Bufi ; Lorenzo Bonomo MD

PURPOSE
The purpose of the present investigation was twofold. First, we aimed to determine the association of asymmetric increase in breast vascularity (AIBV) with clinical/pathologic and molecular profiles of breast cancer. Second, we addressed the prognostic performance of AIBV and of vascular maps reduction after Neoadjuvant Chemotherapy (NAC) in predicting the complete pathological response (pCR) to NAC.

METHOD AND MATERIALS
Two hundred and nineteen patients with unilateral locally advanced breast cancer (LABC) that underwent magnetic resonance imaging (MRI) before and after NAC were retrospectively enrolled. MRI included morphological assessment and DWI with apparent diffusion coefficient (ADC). Axial, sagittal and coronal maximum intensity projection images were obtained to allow a subjective comparative evaluation based on a combination of vessels numbers, diameter and signal intensity to define asymmetrical or symmetrical breasts vascularity. The pCR was assessed (Mandard classification).

RESULTS
In 62,5% cases, there was an AIBV ipsilateral to the LABC (p

CONCLUSION
LABC with ipsilateral AIBV is associated with more aggressive clinical/pathologic and molecular profiles. Nonetheless, is more sensitive to NAC and shows a higher frequency of pCR.

CLINICAL RELEVANCE/APPLICATION
The assessment of breast vascular maps may represent an additional tool in LABC treatment planning and in predicting tumor response to NAC, without acquisition time or cost increment.

LL-BRS-WE3B • Follow-up Breast MR Imaging after Adjuvant Endocrine Therapy: Factors Influencing the Evaluation of Background Parenchymal Enhancement

Ji Hyun Youk MD (Presenter) ; Eun Ju Son MD, PhD ; Jeong-Ah Kim MD, PhD

PURPOSE
To investigate factors influencing the evaluation of background parenchymal enhancement (BPE) at follow-up breast MR imaging after adjuvant endocrine therapy.

METHOD AND MATERIALS
A total of 144 MR studies in 122 women with breast cancer and MR imaging findings of contralateral unaffected breast, before and after adjuvant endocrine therapy between January 2007 and March 2012 were retrospectively identified. Two readers working in consensus performed blinded side-by-side comparison of BPE before and after therapy. BPE was classified as the same or greater on one of the two MR studies and by using categorical scales: minimal, mild, moderate, or marked. The sign test was used to conduct a side-by-side comparison of BPE between two MR studies. Age, body mass index (BMI), menopausal status, the type of endocrine therapy (selective estrogen receptor modulator (SERM) or aromatase inhibitor (AI)), concomitant chemotherapy, follow-up duration from treatment to follow-up MR, BPE at baseline MR imaging before therapy, field strength of MR system used before and after therapy, and recurrence of breast cancer were analyzed for their association with BPE by using the ? test, independent t-test, and multivariate analysis.

RESULTS


A decrease in BPE occurred in 82.6% (119 of 144; SERM 89.6%, AI 68.8%) of women after therapy (P < .0001).

CONCLUSION
The different field strength of MR system used before and after therapy and moderate/marked BPE at baseline MR imaging before therapy were associated with the decrease of BPE at follow-up breast MR imaging after adjuvant endocrine therapy.

CLINICAL RELEVANCE/APPLICATION
When the change of BPE at follow-up MR imaging after adjuvant endocrine therapy is evaluated, the different field strength of MR system after therapy and BPE at baseline MR study should be considered.

LL-BRS-WE4B • MRI-Detected Additional Suspicious Lesions in Breast Cancer Patients: Probability of Malignancy according to Molecular Subtypes of Index Tumors

So Yoon Park (Presenter) ; Boo-Kyung Han MD, PhD ; Eun Sook Ko MD ; Eun Young Ko MD, PhD ; Soo Yeon Hahn MD

PURPOSE
To evaluate the difference of the incidence and the probability of malignancy of MRI-detected additional suspicious lesions in breast cancer patients according to the molecular subtype of index tumor.

METHOD AND MATERIALS
584 patients with breast cancer undergoing preoperative MRI were included in this study. Two radiologists reviewed their MRI findings and identified MRI-detected additional suspicious lesions. MRI-detected additional suspicious lesions were defined as the lesions seen only on MRI assessed more than BI-RADS category 4 (mammographically, sonographically and clinically occult). We reviewed MRI findings (mass or non-mass enhancement) and the pathologic outcomes of these lesions. According to the estrogen receptor (ER), progesterone receptor (PR) and human epidermal growth factor receptor 2 (HER2) status of index tumor, we divided the patients into 4 groups; ER+/HER2-, ER+/HER2+, ER-/HER2-, and triple-negative group. We compared the incidence and pathologic outcomes of additional suspicious lesions and the positive predictive value (PPV) of MRI among each group.

RESULTS
Among 584 patients, 129 (22.1%) had additional suspicious lesions on MRI. Of these, 80 (13.7%) lesions were malignant. In terms of molecular subtypes, there were ER+/HER2- breast cancer in 342 (58.3%), ER+/HER2+ breast cancer in 114 (19.5%), ER-/HER2+ breast cancer in 66 (11.3%), and triple-negative breast cancer in 62 (10.6%). On MRI, 72 lesions were masses (33; benign, 39; malignant), and 57 were non-mass enhancement (16; benign, 41; malignant). In triple-negative breast cancers, the malignancy rate of additional suspicious lesions was significantly lower in triple-negative breast cancer group than other groups (p=0.025) whereas the incidence of the MRI-detected additional suspicious lesions was not significantly different (p=0.066) compared with other molecular subtypes. PPV of MRI assessment did not show significant difference according to molecular subtypes (p = 0.266).

CONCLUSION
Although the incidence of MRI-detected additional suspicious lesion was similar according to molecular subtypes of index tumors, the malignancy rate of additional suspicious lesions on MRI was lower in triple-negative breast cancers.

CLINICAL RELEVANCE/APPLICATION
Little is known about malignancy rate of MRI-detected additional suspicious lesion in breast cancer patients according to molecular subtype.

LL-BRS-WE5B • Downgrading BI-RADS 4a and 4b Benign Masses Using Functional Images of Hemoglobin and Blood Oxygen Saturation Co-registered with Ultrasound Provide Differentiation of Breast Tumors

Pamela M Otto MD (Presenter) * ; Kenneth Kist MD * ; N. Carol Dornbluth MD ; A. Thomas Stavros MD * ; Michael J Ulissey MD * ; Philip T Lavin PhD

CONCLUSION
The fused functional OA and gray scale anatomic information significantly improved downgrading of benign breast masses, especially within the critical BI-RADS 4a and 4b categories.

Background
Patients with breast masses were assessed with Opto-acoustics(OA). All masses were biopsied and histology was the gold standard. OA employs near-infrared laser pulses at two different wavelengths (to provide contrast between oxygenated hemoglobin in benign lesions and de-oxygenated hemoglobin in malignant lesions) to illuminate tissues through a fiberoptic bundle incorporated into a hand-held opto-acoustic probe. It detects the laser pulse induced acoustic pressure waves that are then used for reconstruction of two-dimensional functional and anatomical images. OA maps of total hemoglobin and blood oxygen saturation provide functional information that is co-registered with the morphological information from B-mode gray scale ultrasound images.

Evaluation
Five blinded readers independently assessed POM for OA without clinical data for 74 breast masses. All 34 cancer masses remained at original BI-RADS per site PI while, for 40 benign masses, downgrades were achieved for 12/22 BI-RADS 4a to 3 and for 3/13 BI-RADS 4b to 3. OA could potentially spare 50% of BI-RADS 4a cases and 20% of BI-RADS 4b cases.

Discussion
OA allows visualization of blood pooling and vascular structures superimposed onto co-registered gray scale.

LL-BRS-WE6B • Treatment Response in Patients Receiving HER-2/neu Pulsed Dendritic Cell Vaccine for DCIS: Can Breast MRI Predict Response?

Charles N Weber MD (Presenter) ; Susan P Weinstein MD ; Harvey L Nisenbaum MD ; Paul Zhang MD, PhD ; Elizabeth Fitzpatrick ; Jeanne Kobilnyk ; Brian J Czerniecki MD,PHD ; Susan G Roth MD

PURPOSE
The HER-2/neu pulsed dendritic cell vaccine is currently an investigational therapy for treatment of HER-2/neu over-expressing DCIS. The purpose of this study is to evaluate the utility of breast MRI in predicting treatment response in patients undergoing vaccine therapy prior to definitive surgery.

METHOD AND MATERIALS
Patients with HER-2/neu over-expressing DCIS tumors participated in a vaccine trial. Each patient underwent a contrast enhanced breast MRI prior to and at the end of the vaccine therapy. After completion of the vaccination protocol, the patients had definitive surgical therapy. The patient’s pre- and post-vaccination MRI studies were reviewed to assess for response to vaccine therapy. The degree of contrast enhancement in the region of the DCIS was qualitatively assessed. The imaging findings were correlated with the pathology results.

RESULTS
58 patients were included in our study. Following vaccination, 9 demonstrated decreased enhancement on MRI, 10 demonstrated increased enhancement, 27 demonstrated no change, and 12 were negative for suspicious findings. 6 (50%) of the negative studies were proven to have no tumor at resection, while an additional 2 (16.7%) were found to have HER-2/neu negative tumor. 6 (66.7%) of 9 patients with decreased enhancement had interval decreased HER-2/neu receptor activity. A correlation with estrogen receptor (ER) and progesterone receptor (PR) status was noted. 7 (87.5%) of the 8 patients found to have decreased enhancement were ER+ and 4 (66.7%) of 6 were PR+. Conversely, 8 (88.9%) of 9 patients with increased enhancement were ER-/PR-. There was a false positive rate of 8.7% on post-vaccination MRI.
CONCLUSION
Breast MRI may be useful in evaluating treatment response during HER-2/neu pulsed dendritic cell vaccine therapy for DCIS. Greatest response was seen in cases of tumor eradication or conversion to HER-2/neu negative status. There is suggestion of positive correlations between increased and decreased post-vaccination enhancement with ER+/PR+ and ER-/PR- receptor status respectively, which may be related to differing immune responses in these groups.

CLINICAL RELEVANCE/APPLICATION
Breast MRI may be useful in predicting treatment response in patients undergoing HER-2/neu pulsed dendritic cell vaccine therapy for DCIS.

LL-BRS-WE7B • Cost-Effectiveness of Tomosynthesis in Screening Mammography: Analysis by Breast Density and Patient Age

Vivek B Kalra MD (Presenter); Brian Haas MD; Liane E Philpotts MD *

PURPOSE
To determine the cost-effectiveness of tomosynthesis in screening mammography compared to 2D mammography based on relative and absolute direct costs resulting from unnecessary diagnostic workups from recalled patients between modalities.

METHOD AND MATERIALS
The diagnostic workups resulting from screening recalls performed with tomosynthesis and 2D mammography were tabulated from a one year period at a single institution in a HIPAA compliant, IRB- waived study. Unnecessary diagnostic workups were defined as those that subsequently returned to screening or had biopsies with non-malignant pathology. All imaging was performed on Selenia Dimensions units (Hologic, Bedford, MA). Patients were evaluated with tomosynthesis or 2D without preferential assignment. The direct costs of basic diagnostic mammographic imaging, advanced diagnostic imaging, biopsy procedure costs, and pathology interpretation costs were assessed using 2013 regional facility Medicare payment values.

RESULTS
During the one-year period, 13,174 patients underwent screening mammography, of which 6,116 had tomosynthesis and 7,058 had 2D mammograms. 516 (8.4%) of tomosynthesis patients were recalled and 826 (11.7%) of 2D screening mammography patients were recalled (p = 0.002), P4 13.2/5.9 (p = 0.001), P5 19.7/10.1 (p < 0.5).

CONCLUSION
Screening tomosynthesis decreased the overall costs of unnecessary diagnostic workups by 17.1%. Much larger cost savings were seen in younger patients and those with dense breasts, with a decrease of 46.6% in extremely dense breasts and 50.9% in patients under 40.

CLINICAL RELEVANCE/APPLICATION
Patients with dense breasts and younger patients demonstrate greater cost-effectiveness in screening tomosynthesis, which had an overall relative cost savings of 17.1% compared to 2D mammography.

LL-BRE-WEBB • Tumor Response to Neoadjuvant Chemotherapy by Dynamic Contrast-enhanced Breast MRI: A Pictorial Review of How to Assess Response and Recognize Pitfalls and Limitations

Laura Martincich MD (Presenter) *; Silvia Carabalona MD; Eleonora Rachetta MD; Rita Giada Spinelli MD; Filippo Montemurro MD; Daniele Regge MD

PURPOSE/AIM
1) To review and show how to assess tumor response to neoadjuvant chemotherapy (NCT). 2) To review and illustrate imaging and clinical reasons for pitfalls and limitations in monitoring the response to NCT. 3) To illustrate a diagnostic work-up in the evaluation of Breast MRI when assessing the response to NCT.

CONTENT ORGANIZATION
SUMMARY
The exhibit will familiarize radiologists with both the assessment of tumor response to NCT by Breast MRI and the common pitfalls and limitations of the examination. An additional teaching point will be to provide a work-up for the evaluation of Breast MR exams when monitoring NCT.

Cardiac - Wednesday Posters and Exhibits (12:45pm - 1:15pm)

Wednesday, 12:45 PM - 01:15 PM • Lakeside Learning Center
LL-CAS-WE2B • Combined Assessment of Coronary CT Angiography and Adenosine Triphosphate Stress Dynamic Myocardial Perfusion CT Using 256-slice Multi-detector CT in the Detection of Coronary Artery Disease

Naoto Kawaguchi MD (Presenter); Teruhito Kido; Yuki Tanabe; Rami Yokoyama; Masashi Nakamura; Takuya Matsuda; Yoshiko Nishiyama MD; Tomoyuki Kido; Akira Kurata; Masao Miyagawa MD, PhD; Akiyoshi Ogimoto; Teruhito Mochizuki MD

PURPOSE
Coronary CT angiography (CTA) has been widely spread in the clinical practice to assess coronary stenosis. But the assessment of CTA actually had uncertain segments because of severe calcification, motion artifacts and stent placement. The purpose of this study was to assess the usefulness of combined assessment of CTA and adenosine triphosphate (ATP) stress dynamic myocardial CT perfusion (CTP) in the detection of coronary artery disease (CAD).

METHOD AND MATERIALS

RESULTS

CONCLUSION
Combined assessment of CTA and CTP improves the detection of significant CAD.

CLINICAL RELEVANCE/APPLICATION
Combined assessment of coronary CT angiography and adenosine triphosphate stress dynamic myocardial CT perfusion is useful in the detection of coronary artery disease.

LL-CAS-WE3B • Quantitative CT Coronary Angiography: Does It Predict Functionally Significant Coronary Lesions?

Alexia Rossi MD (Presenter); Francesca Pugliese MD, PhD; Stella-Lida Papadopoulou DMD; Brunella Russo MD; Anoeshka S Dharampal MD; Pieter Ktsior; Robert J Van Geuns MD; Steffen E Petersen; Pim J De Feyter MD, PhD; Gabriel P Krestin MD, PhD *

PURPOSE
Studies using intravascular ultrasound (IVUS) have demonstrated that cross-sectional measurements of coronary artery stenosis are correlated with fractional flow reserve (FFR). Similarly to IVUS, CT coronary angiography (CTCA), using automated border lumen detection algorithms, allows assessment of quantitative cross-sectional parameters. The aim of our study was to compare the diagnostic performance of quantitative CTCA-derived cross-sectional parameters with visual CTCA in the detection of functionally significant coronary lesions as determined by FFR.

METHOD AND MATERIALS

CTCA and FFR measurements were obtained in 99 patients with stable chest pain. In total, 144 coronary lesions detected on CTCA were visually graded for stenosis severity. Coronary lesions with lumen narrowing >50% were considered as obstructive. Quantitative CTCA-derived cross-sectional parameters were obtained by using semi-automated plaque analysis software and included lesion minimal lumen area (MLA), percentage area stenosis (%AS) and plaque burden [((vessel area – lumen area)/vessel area)*100]. Optimal cut-off values of quantitative CTCA-derived cross-sectional parameters were determined and their diagnostic accuracy to detect flow-limiting coronary lesions (FFR =0.80) was compared to visual CTCA.

RESULTS

FFR was =0.80 in 54/144 (38%) coronary lesions. Receiver operating characteristic (ROC) curve analysis yielded an area under the curve (AUC) of 0.82 (0.75-0.89) for MLA, 0.83 (0.75-0.90) for %AS and 0.80 (0.73-0.87) for plaque burden. Optimal cut-off values of quantitative CTCA-derived cross-sectional parameters were determined and their diagnostic accuracy to detect flow-limiting coronary lesions (FFR =0.80) was compared to visual CTCA.

CONCLUSION
Quantitative CTCA has higher specificity than visual CTCA to detect functionally significant coronary lesions but remains insufficient for clinical routine.

CLINICAL RELEVANCE/APPLICATION
Quantitative CTCA improves the prediction of functionally significant coronary lesions compared to visual CTCA but remains insufficient. Functional assessment is still needed for patient management.

LL-CAS-WE4B • Using Recursive Partitioning Modeling to Develop Classification Trees to Predict Progression of Aortic Stiffness: Results from the Dallas Heart Study

Akshay Goel BS (Presenter); Kevin S King MD; Christopher Maroules MD; Colby Ayers MS; Roderick McColl PhD; Ronald M Peshock MD

PURPOSE
Aortic pulse wave velocity (APWV) is a non-invasive measure of aortic stiffness, independently associated with end organ damage and mortality. We used recursive partitioning modeling (RPM) to predict the progression of aortic stiffness in a large, multi-ethnic population based cohort and compared it to standard Backward Elimination Logistic Regression (BELR) analysis.

METHOD AND MATERIALS

RESULTS

CONCLUSION
RPM produces a decision tree that predicts an increase in APWV with a comparable accuracy to BELR. Such decision trees are particularly applicable in routine clinical management, as they do not require explicit calculations.

CLINICAL RELEVANCE/APPLICATION
Recursive partitioning modeling can be used to develop classification trees to predict a change in APWV. Such models may aid in routine clinical management.

LL-CAS-WE5B • Comparison of Plaque Characteristics between 256-MSCT Based on the Diluted Test Injection Protocol and IB-IVUS

Masashi Nakamura (Presenter); Teruhito Kido; Yuki Tanabe; Rami Yokoyama; Takuya Matsuda; Naoto Kawaguchi MD; Yoshiko Nishiyama MD; Tomoyuki Kido; Masao Miyagawa MD, PhD; Teruhito Mochizuki MD

PURPOSE
Primary aim of this study was to evaluate whether 256-MSCT can assess plaque characteristics (amount of lipid component), by
comparing plaque characteristics by IB-IVUS. Secondary aim was to make a comparison plaque CT density value obtained by 256-MSCT with that of 64-sliced MDCT in previous study.

METHOD AND MATERIALS
Since coronary plaque density (HU) depends on lumen density, we uniformed coronary lumen density (enhancement) using diluted test injection protocol. Then, average plaque CT density value (HU) at the minimum coronary diameter was compared with % lipid area of IB-IVUS in 21 patients who performed both 256-MSCT and IB-IVUS. We evaluated plaques without calcification.

RESULTS

CONCLUSION
When uniforming the coronary enhancement (HU), CT could assess high risk coronary plaques as well as IB-IVUS. In addition, plaque CT density value could be measured more correctly by 256-MSCT than 64-sliced MDCT.

CLINICAL RELEVANCE/APPLICATION
By 256-MSCT, We could measure plaque CT density value correctly and could assess plaque characteristics more precisely with high temporal resolution.

LL-CAS-W66B • Prognostic Value of CT Angiography in Coronary Bypass Patients: A 73 Months Follow-up Study

Daniele Andreini MD ; Gianluca Pontone MD (Presenter) ; Saima Mushtaq ; Erika Bertella ; Edoardo Conte ; Andrea Baggiano ; Andrea Daniele Annoni MD ; Alberto Formenti ; Mauro Pepi

PURPOSE
Multidetector computed tomography coronary angiography (MDCT-CA) is a non-invasive and accurate tool for the detection of obstructive coronary artery disease and for the evaluation of coronary artery bypass graft (CABG) patency and MDCT-CA appears to have prognostic value in patients without previous revascularization. However, the prognostic value of MDCT-CA in CABG patients is still unclear. Aim of the present study is to investigate the long-term prognostic value of MDCT-CA in a large population of CABG patients

METHOD AND MATERIALS
Between March 2005 and April 2009, 721 CABG patients (mean age 66.8±8.4, 577 males) were enrolled in our study. Patients were classified by unprotected coronary territory (UCTs) or a summary of native vessel disease and graft patency: the coronary artery protection score (CAPS). The composite rate of hard cardiac events (cardiac death, non-fatal myocardial infarction, unstable angina) and all cardiac events (including revascularization) were end points of the study

RESULTS
10 patients were excluded because MDCT-CA data set was uninterpretable. Of the remaining 711, clinical follow up (mean 73.5±14 months) was obtained in 698 patients. By univariate analysis, the strongest MDCT-CA predictors of hard and all events were UCT 2 and 3 and CAPS 4 and 8. Cumulative event-free survival was 85% for hard events and 75% for all events in patients with UCT 0, 75% for hard events and 50% for all events in patients with UCT 1, 30% for hard events and 8% for all events in patients with UCT 2 and 10% for hard events and 90% for all events in patients with CAPS 2 and 3% for hard events and 2% for all events in patients with CAPS 4.

CONCLUSION
MDCT-CA appears to be a promising tool for long-term risk stratification of CABG patients. Particularly, assessing prognosis by UCTs appears to have prognostic value in CABG patients more than CAPS score.

CLINICAL RELEVANCE/APPLICATION
MDCT-CA appears to be a promising tool for long-term risk stratification of CABG patients

LL-CAS-W67B • The Prevalence of Coronary Artery Disease in Liver Cirrhosis: Is Screening Cardiac CT Necessary before Liver Transplantation?

Hyun Jung Koo MD (Presenter) ; Joon-Won Kang MD ; Hwa Jung Kim ; Dong Hyun Yang MD ; Tae-Hwan Lim MD, PhD

PURPOSE
To investigate whether liver cirrhosis (LC) is associated with coronary artery disease (CAD) compared to general population

METHOD AND MATERIALS
Between 2008 and 2012, 716 patients (M:F=548:168) patients with LC underwent cardiac CT for preoperative evaluation of CAD before liver transplantation. Among them, 688 patients (M:F=528:160) were matched (1:1) to controls by Framingham risk score, and the presence of CAD was individually compared in males and females. As a control group, a total of 2,652 patients (M:F=1810:842) with no history of liver disease or a history of liver cirrhosis were enrolled without known liver disease or a history of liver cirrhosis. Between March 2008 and 2012, 716 patients (M:F=548:168) patients with LC underwent cardiac CT for preoperative evaluation of CAD before liver transplantation. Among them, 688 patients (M:F=528:160) were matched (1:1) to controls by Framingham risk score, and the presence of CAD was individually compared in males and females. As a control group, a total of 2,652 patients (M:F=1810:842) with no history of liver disease or a history of liver cirrhosis were enrolled without known liver disease or a history of liver cirrhosis. Between 2008 and 2012, 716 patients (M:F=548:168) patients with LC underwent cardiac CT for preoperative evaluation of CAD before liver transplantation. Among them, 688 patients (M:F=528:160) were matched (1:1) to controls by Framingham risk score, and the presence of CAD was individually compared in males and females. As a control group, a total of 2,652 patients (M:F=1810:842) with no history of liver disease or a history of liver cirrhosis were enrolled without known liver disease or a history of liver cirrhosis.

RESULTS
The initial distributions of the Framingham risk score in liver cirrhosis and controls were different (p< 0.0001). The risk of CAD in LC patients is not increased compared to general population. Routine preoperative cardiac CT before liver transplantation might not be necessary, and cardiac CT could be recommended for only high risk CAD patients.

CONCLUSION
There was no significant prevalence of CAD in patient with liver cirrhosis, and this finding suggests that the controversy of the relationship between CAD and LC could be ended.

LL-CAE-W68B • Demonstration of Mechanical Deformity in Coronary Stent Using Cardiac Computed Tomography

Mi Sun Chung MD (Presenter) ; Dong Hyun Yang MD ; Joon-Won Kang MD ; Young-Hak Kim ; Tae-Hwan Lim MD, PhD

PURPOSE/AIM
1- To describe imaging findings of mechanical deformity in coronary stent and its complication on cardiac CT
2- To learn technical tips for optimal CT imaging of coronary stent and diagnostic clues to differentiate mechanical deformities and normal post-procedure findings.

CONTENT ORGANIZATION
1. Tips for good image quality of coronary stent on CT
- Image acquisition
- Image reconstruction 2. Mechanical deformity and its complication
A. Mechanical deformities of coronary stents
  - Stent fracture: partial fracture, complete fracture
  - Longitudinal compression of stent
  - Radial stent compression by coronary plaque
B. Normal post-procedure finding mimicking pathology
  - Stent overlap
  - Two stents in bifurcation lesion: crushed stent in the bifurcation lesion
- Side branch ballooning
- Complication of deformed coronary stent
- Aneurysm
- In stent restenosis (ISR)
- Jailed branches
- Edge stenosis

A. Technical pitfalls in evaluating coronary stents
- Small stents
- Calcified plaque
- Motion artifact and metal artifact

B. Remedy

SUMMARY
We described various imaging findings of mechanical deformity in coronary stent and its complication on cardiac CT. Cardiac CT may be used as noninvasive imaging modality to evaluate a mechanical deformity of coronary stent as well as stent patency.

LL-CAE1175-WEB ● Single Ventricle Physiology and the Role of Imaging

Rachael M Edwards MD (Presenter); Demetrius L Dicks MD; Daniel Ocazionez MD; Gregory Kicska MD, PhD *; Mark R Ferguson MD; Randolph K Otto MD; Gautham P Reddy MD

PURPOSE/AIM
1. To discuss the spectrum of congenital cardiac conditions representing a functional single ventricle.
2. To describe the imaging of common operative therapies.
3. To describe the role of imaging in evaluation and management of a functional single ventricle.

CONTENT ORGANIZATION
1. Overview
   a. Physiology
   b. Clinical presentation
2. Single Ventricle Anomalies
   a. Dominant Left Ventricle
   - Mitral valve atresia
   - Aortic atresia
   - Double inlet left ventricle
   - Unbalanced atroventricular canal (AVC)
   - Hypoplastic right ventricle
   b. Dominant Right Ventricle
   - Hypoplastic left ventricle
   - Tricuspid atresia
   - Double inlet/outlet right ventricle
   - Unbalanced AVC
3. Operative procedures
   a. Three stage palliation
   b. Pre-operative evaluation
   c. Common surgical procedures
   - Norwood
   - Pulmonary artery banding
   - Bidirectional cavopulmonary anastomosis
   - Fontan
   - Conduits
4. Imaging modalities
   a. MRI
   b. CT
   c. Echo
   d. Angiography

SUMMARY
1. Numerous cardiac anomalies present with single ventricle physiology. Knowledge of the underlying anatomy, physiology, and surgical interventions is necessary to effectively contribute to the complex evaluation of these disorders.
2. MRI, CT, and other imaging modalities can be utilized to evaluate the anatomy and functionality of single ventricle lesions and assist in management.

Chest - Wednesday Posters and Exhibits (12:45pm - 1:15pm)

Wednesday, 12:45 PM - 01:15 PM ● Lakeside Learning Center

LL-CHS-WE1B ● Feasibility and Utility of Xenon Ventilation CT for COPD and CPFE Patients

Masahiro Kobayashi MD (Presenter); Nobuyuki Shiraiga MD; Kenichi Suzuki; Yoshiyuki Okada; Keishi Sugino; Sakae Honma MD, PhD

PURPOSE
To evaluate the usefulness of single inhalation xenon ventilation CT for patients with COPD and CPFE.

METHOD AND MATERIALS
Institutional review board approval and written informed consent were obtained. Thirty seven patients with chronic obstructive pulmonary disease (COPD, mean age: 74.1 years, range: 56-87 years) and 28 patients with combined pulmonary fibrosis and emphysema (CPFE, mean age: 74.0 years, range: 63-83 years) underwent xenon ventilation CT using dual energy technique with single inhalation of 35% xenon gas. After three dimensional reconstruction of xenon enhanced images, mean xenon enhancement values were calculated using three material decomposition methods, and correlated with pulmonary function test results. LAA% scores were also calculated and correlated with pulmonary function test results.

RESULTS
We could successfully obtain xenon enhanced images calculated by using three material decomposition methods for all subjects. No significant complications were noted with 35% xenon gas inhalation. In COPD cases, mean xenon enhancement values showed significant positive correlations with forced expiratory volume [FEV1, r=0.45, p<0.05], FEV1/FVC (r=0.13, p>0.05), and PEF (r=0.29, p>0.05). There were three COPD cases which had severe discrepancies between LAA% and xenon enhancement values. Those cases were thought to be airway-predominant COPD. In CPFE cases, xenon enhancement values were lower than normal lung in both emphysema and fibrosis area. Comparing with these two areas, xenon enhancement values in emphysema areas were lower than those in fibrosis areas. Thus, we could accurately evaluate the ratio of fibrosis, emphysema and normal lung parenchyma.
CONCLUSION
Xenon ventilation CT is useful to evaluate the grade and phenotype of COPD. In CPFE patients, this method can differentiate and measure each volume of fibrosis, emphysema and normal lung parenchyma correctly, which has the potential to construct a new classification and grades of this complex disease.

CLINICAL RELEVANCE/APPLICATION
Xenon enhancement CT can evaluate the regional ventilation in patients with both type of COPD. It has the potential to construct a new classification and grades of CPFE.

LL-CHS-WE2B • Emphysema Quantification on Low-dose CT by Percentage of Low-attenuation Volume and Size Distribution Analysis of Low-attenuation Clusters: Effect of Adaptive Iterative Dose Reduction Using 3D Processing

Mizuho Nishio MD (Presenter) *; Sumiaki Matsumoto MD, PhD *; Hisanobu Koyama MD; Takeshi Yoshikawa MD *; Yoshiharu Ohno MD, PhD *; Yasuko Fujisawa MS *; Naoki Sugihara MENG *; Kazuro Sugimura MD, PhD *

PURPOSE
To evaluate the effect of adaptive iterative dose reduction using three-dimensional processing (AIDR 3D) on two types of emphysema quantification: one using the percentage of low-attenuation volume in lungs (LAV%) and the other based on size distribution analysis of low-attenuation clusters.

METHOD AND MATERIALS
Fifty-two patients (32 men, 20 women; age, 69.2 ± 8.45 years) who had undergone standard-dose (150 mAs) and low-dose (25 mAs) CT scans were included in this retrospective study. The remaining CT parameters were: tube voltage, 120 kV; detector configuration, 160x0.5 mm; beam pitch, 0.94; gantry rotation time, 0.5 s; slice thickness, 1 mm. Emphysema quantification was performed on standard-dose CT (SDCT) images reconstructed without AIDR 3D as well as low-dose CT (LDCT) images reconstructed without and with AIDR 3D. First, LAV% was computed at 10 thresholds ranging from -990 to -990 HU. Next, at the same thresholds, the power law exponent (D) for cumulative frequency-size distribution of low-attenuation clusters was computed by means of linear regression on a log-log plot. Concerning LAV% and D, Bland-Altman analysis was used to assess whether the agreement between emphysema quantification on LDCT and that on SDCT was improved by the use of AIDR 3D.

RESULTS
When comparing at the 10 thresholds, LAV% showed mean relative differences between LDCT without AIDR 3D and SDCT ranging from 3.91% to 88.6%, and those between LDCT with AIDR 3D and SDCT ranging from -6.43% to 0.693%. Moreover, the exponent D showed mean relative differences between LDCT without AIDR 3D and SDCT ranging from 8.03% to 19.2%, and those between LDCT with AIDR 3D and SDCT ranging from 1.79% to 4.85%. When assessed by the Bland-Altman analysis at the 10 thresholds, the agreements of LAV% and D, Bland-Altman analysis was used to assess whether the agreement between emphysema quantification on LDCT and that on SDCT was improved by the use of AIDR 3D.

CONCLUSION
With regard to both LAV% and D computed at multiple thresholds, the use of AIDR 3D resulted in greater consistency of emphysema quantification on low-dose CT with quantification on standard-dose CT.

CLINICAL RELEVANCE/APPLICATION
The measurement error of emphysema quantification caused by low-dose CT can be improved by the use of AIDR 3D.

LL-CHS-WE3B • Inappropriate Portable Chest X-ray Utilization in the MICU and Utilization of the SAPS 3 Score as a Predictor

Ronald D Novak PhD (Presenter); Bahar Mansoori MD *; Nicholas J Novak; Rana Hejal MD; Jonn-Terje Geitung MD, PhD; Gunhild E Aandal MD; Pablo R Ros MD, PhD *

PURPOSE
To assess the frequency of inappropriate use of portable chest x-ray (PCXR) in the MICU for critical care patients and evaluate the Simplified Acute Physiology Score (SAPS 3) at admission to the MICU as a predictor of total and inappropriate PCXR utilization.

METHOD AND MATERIALS
As part of a larger IRB approved study, 169 MICU patients over a 3 mo. period had each portable chest x-ray performed during their term in the MICU retrospectively evaluated for inappropriate use using the ACR appropriateness criteria. The Simplified Acute Physiology Score (SAPS 3), a measure of probable ICU mortality was calculated based on data available at admission to the MICU to determine the relation of the score to measures of inappropriate PCXR utilization. The total number of PCXR, inappropriate PCXR, inappropriate/total PCXR ratio and length of stay (LOS) in MICU were also calculated. The Pearson correlation coefficient was used to determine relationships between the parameters measured. P-values less than 0.01 were considered to be significant.

RESULTS
The patient sample consisted of 92 F and 77 M, age 60 ± 15.7 yrs. Average LOS was 6.6 ± 4.4 days and the average number of PCXRs was 6.4 ± 5.8 for the duration of MICU stay. The mean number of inappropriate PCXRs was 2.1 ± 3.2 or approximately every third PCXR performed during MICU tenure and the inappropriate/total PCXR ratio was 26.4 ± 26.5 %. SAPS 3 score was significantly correlated with age and LOS (r=0.3, P=0.0009: r=.32, P=0.0002) respectively. LOS was significantly correlated with both the total number of PCXR performed (r=0.73, P)

CONCLUSION
Our results suggest that one quarter to one third of all PCXR performed in the MICU of an academic medical center are inappropriate by ACR guidelines. The likelihood that both total and inappropriate PCXRs will be performed is correlated with the length of stay in MICU. The SAPS 3 score is an easily calculated measure that may predict LOS and the likelihood of significant inappropriate use of PCXR in the MICU.

CLINICAL RELEVANCE/APPLICATION
PCXR is a frequently utilized radiological procedure in the MICU that is often used inappropriately. A SAPS 3 score may identify patients with longer LOS and greater risk of inappropriate use.

LL-CHS-WE4B • Imaging Findings in Metastatic Melanoma Patients Following Adoptive Cell Therapy-Is It the Time to Revise Traditional RECIST Criteria?

Shai Shrot (Presenter); Ronnie Shapiro-Frommer; Michal J Besser; Jacob Schachter; Sara Apter MD

PURPOSE
Metastatic melanoma is a highly aggressive cancer. Among the current immunotherapeutic approaches, adoptive T cell therapy using infusion of autologous tumor infiltrating lymphocytes (TIL) has shown to be an effective treatment for patients with metastatic melanoma and can maintain objective response rates of 50–70%. Nowadays, response criteria for solid tumors are based mainly upon tumor burden and early increases in tumor size are classified as progression of disease. Introducing immunotherapy in oncology has led to novel patterns of imaging findings in responding patients, due to their unique mode of action. TIL induced tumor response has not been described in the literature. Our aim is to describe the novel imaging findings in metastatic melanoma patients treated with TIL.

METHOD AND MATERIALS
An IBR-approved retrospective observational study was conducted on 69 melanoma patients treated with TIL in our center (2006-2011). Each patient had pre-treatment baseline CT, follow-up CTs one month, three months after the TIL infusion and every three months thereafter. CTs were assessed according to the RECIST criteria and the radiological appearances of response were recorded.
Comparison to Autopsy

CONCLUSION
Assessment of the change in tumor burden is an important component of the clinical evaluation of cancer therapeutics. The standard RECIST criteria are designed to capture the effects of chemotherapeutic agents and are dependent on tumor shrinkage to demonstrate response. Unusual response patterns, as observed in our post-TIL immunotherapy patients, emphasize the need for revise current imaging criteria to assess response following immunotherapy generally and TIL specifically.

CLINICAL RELEVANCE/APPLICATION
Radiologists working in an oncology setting should be familiar with novel response patterns after TIL infusion and apply the appropriate response criteria not based solely on tumor burden.

LL-CHS-WE5B • The Utility of CT in Evaluation of Human Lungs after Ex-vivo Lung Perfusion (EVLP)

Saoawanee Srirattanapong MD (Presenter) ; Katherine R Birchard MD ; Thomas M Egan MD ; Will Simmons ; John Blackwell

PURPOSE
The purpose of the study was to assess the utility of CT in evaluation of lungs after EVLP for transplant suitability. The pool of transplantable lungs remains well below the demand, but EVLP has emerged as a technique that can assess and possibly recondition lungs, making them potentially transplantable. However, physiologic parameters alone may be unreliable predictors of transplant suitability; CT imaging may be a valuable adjunct to assess suitability for transplant.

METHOD AND MATERIALS

RESULTS
A total of 22 lung blocks underwent EVLP and CT scan. CT showed that all had some septal thickening and ground glass opacities (probably edema). Six lung blocks were considered acceptable by clinical and physiologic parameters, but unacceptable by CT due to presence of cavitory lesions, emphysema, or consolidation. Two lung blocks were potentially transplantable by PaO2/FiO2 and clinical parameters, and potential recipients were called in for assessment, but CT findings deemed the lungs not suitable for transplant.

CONCLUSION
CT provided additional useful information in evaluating lungs after EVLP; clinical and physiologic data alone were not adequate to assess acceptability for transplant in some lungs.

CLINICAL RELEVANCE/APPLICATION
CT can increase the overall safety of transplant of conventional and NHBD lungs after EVLP, and potentially improve patient outcomes.

Emergency Radiology - Wednesday Posters and Exhibits (12:45pm - 1:15pm)

Wednesday, 12:45 PM - 01:15 PM • Lakeside Learning Center

LL-ERS-WEB • Illegal Intracorporeal Packets: Assessment of the Cocaine Concentration by Dual CT Imaging

Pierre-Alexandre A Poletti MD (Presenter) ; Alexandra Platon MD ; Thomas Perneger ; Eric Lock ; Hans Wolff ; Christoph D Becker MD

PURPOSE
To evaluate whether dual energy CT can be used to assess the concentration of cocaine of intra-intestinal illegal packets.

METHOD AND MATERIALS
All consecutive conveyers in whom a low-dose abdominal CT revealed the presence of illegal drug packets underwent a dual energy CT series (GE 750 HD), targeted on one container. The mean radiodensity value (HU) of this packet was obtained on the standard series. The effective atomic number (Zeff) was inferred from the 70keV monochromatic series. A chemical analyze was performed after expulsion to select cocaine containing packets, and determine their cocaine concentration. Packets filled with other substances than cocaine were excluded from the series. A correlation analysis was performed between HU, Zeff and the percentage of cocaine. This study received the IRB approval.

RESULTS
26 conveyers were included. The mean cocaine content of the packets was 34.5% (SD 14.5%, range 10 to 65%), the mean Zeff was 8.7 (SD 0.7, range 7.7 to 9.9), and the mean radiologic density was 93.8 HU (SD 89.3 HU, range -26 to 307). The cocaine content was strongly correlated with the Zeff (r=0.78, p<.001). Packages containing packets with other substances than cocaine were excluded from the series.

CONCLUSION
The Zeff of ingested packets, measured by dual energy CT, is closely correlated with their cocaine content. This imaging procedure could help identify conveyers who are at high risk of lethal cocaine poisoning from a packet rupture.

CLINICAL RELEVANCE/APPLICATION
Dual energy CT can estimate the cocaine concentration of illegal intra-corporeal packets. This information might be useful in the management of drug conveyers until complete expulsion of the packets.

LL-ERS-WE2B • Post-mortem Whole Body Computed Tomography of Heroin and Methadone Fatalities: Frequent Findings and Comparison to Autopsy

Sebastian Winkloher MD (Presenter) ; Eddie Surer ; Garyfallia Ampanozi MD ; Thomas D Ruder MD ; Paul Stolzmann MD ; Andrea Oestreich PhD ; Thomas Kraemer PhD ; Hatem Alkadhi MD ; Michael J Thali MD ; Wolf Schweitzer MD

PURPOSE
Aim of the study was to assess and to analyze frequent findings in whole body postmortem computed tomography (PMCT) in cases of fatal heroin and methadone intoxication.

METHOD AND MATERIALS
Routinely performed whole body PMCT scans of 55 cases (16 women; 39 men; median age 37.9 years) of non-traumatic death, in which heroin and/or methadone had been found responsible for death were retrospectively evaluated (drug group). PMCT data as well as the CT images of an age and sex matched control group (n=55, 16 women; 39 men; median age 37.9 years) were analyzed for pathologic findings and imaging results were compared with conventional autopsy results.

RESULTS
Most common findings in the drug-cases were: pulmonary edema (95%), aspiration (66%), distended urinary bladder (60%), cerebral heroin and/or methadone had been found responsible for death were retrospectively evaluated (drug group). PMCT data as well as the CT images of an age and sex matched control group (n=55, 16 women; 39 men; median age 37.9 years) were analyzed for pathologic findings and imaging results were compared with conventional autopsy results.
Most common findings in the drug-cases were: pulmonary edema (95%), aspiration (66%), distended urinary bladder (60%), cerebral edema (49%), pulmonary emphysema (49%), and fatty liver disease (36%). A significant correlation (p < .05) between frequent PMCT findings for the diagnosis of drug-associated death compared to the control group was found for brain edema and pulmonary edema, pulmonary emphysema, aspiration, fatty liver disease and distended bladder. The combination of lung edema, brain edema and a full urinary bladder was seen in 1.4 cases (26%) in the drug group, and none in the control group. Defining those three findings as indicative for drug-related death, a sensitivity of 26% and a specificity of 100% were calculated. The sensitivity for detection of pathologic findings in CT compared to autopsy as reference standard showed a wide range from 51% (brain edema) to 95% (pulmonary edema).

CONCLUSION
This study demonstrates characteristic findings of whole body PMCT in cases of fatal heroin and methadone intoxication. The characteristic constellation of brain edema, lung edema and a distended full urinary bladder was highly specific for heroin and methadone associated cases of death. Their combination in PMCT should raise suspicion of intoxication.

CLINICAL RELEVANCE/APPLICATION
Post-mortem whole body CT in cases of heroin and/or methadone intoxication demonstrates characteristic pathologic findings (50%) and can be a helpful tool for the daily work of forensic pathologists.

LL-ERS-WE3B • Utility of Post Mortem CT Angiography in Injuries Caused by Falls from Extreme Heights: About Seven Lethal Cases

Fatima-Zohra Mokrane MD (Presenter) ; Frederic Savall MD ; Camille Rerolle ; Antony Blanc ; David Gainza ; Daniel Rouge MD, PhD ; Herve P Rousseau MD ; Norbert Telmon ; Fabrice Dedouit

PURPOSE
Multi Slice Computed Tomography (MSCT) is used in forensic sciences since the last decade, and has proven its efficiency, especially for bone injuries. The use of enhanced multislice computed tomography (MSCT) in forensic sciences has been recently developed in order to improve radiological vascular and organs injuries detection. Seven cases of great height falls had been studied by Multi-phase postmortem computed tomography angiography (MPMCTA). At this occasion, a review of the literature was made in order to compare the observed cases with the actual knowledge, and to establish the contribution of MPMCTA to the forensic purpose.

METHOD AND MATERIALS
Seven suicidal cases of great height falls (4 women, and 3 men) underwent a MPMCTA examination before medico-legal autopsy. The estimated height falls varied from 5 to 15 meters. All corpses were prepared with a surgical cannulation of femoral vessels. After a non enhanced MSCT exploration, a controlled perfusion device was used with paraffin oil mixed with specific contrast agent, allowing three time-different acquisitions (arterial, venous, dynamic). Two radiologists proceeded to images analysis. The forensic pathologist undergoing autopsies knew preliminary imaging results.

RESULTS
Comparisons between MPMCTA and autopsy findings underwent to some differences. MPMCTA was better to diagnose gas, bone fractures, and vascular ruptures. Superficial skin lesions, easily accessible to external examination, were better diagnosed by autopsies. Both techniques were able to diagnose classical bone, visceral and vascular lesions. Furthermore, rare injuries were found in our study. Cases of coronary artery desinsertion, double thoracic aortic rupture, inferior vena cava extensive laceration and pulmonary vein disruption were easily diagnosed by MPMCTA. Even if these lesions were also found during autopsies, MPMCTA allowed better in situ lesions illustration and documentation. Also, practice of different time-acquisitions was essential for understanding abnormal traumatic communication between cardiac cavities.

CONCLUSION
MPMCTA offers a great opportunity to study forensic corpses, especially for traumatic deaths. Also, this new technique allows also a better comprehension of lesions and their chronology in death mechanisms.

CLINICAL RELEVANCE/APPLICATION
Post mortem CT angiography is a complementary technique to autopsy, especially in traumatic cases, like in cases of lethal great height falls.

LL-ERE-W4E4B • ‘Don’t Swallow That!’: A Review of Ingested and Inhaled Foreign Bodies in Children and Their Clinical Significance for Radiologists

Brian S Pugmire MD (Presenter) ; Ruth Lim MD * ; Laura L Avery MD

PURPOSE/AIM
This will be an exhibit directed primarily toward radiology trainees preparing for on-call duties in the emergency department with the following aims:
1. Review commonly ingested/aspirated foreign bodies in children.
2. Discuss the appropriate imaging evaluation for a patient suspected of having an ingested or aspirated foreign body.
3. Review the imaging appearance and clinical management of various foreign bodies.

CONTENT ORGANIZATION
1. Focused review of the epidemiology of ingested/aspirated foreign bodies.
2. Focused review of the clinical approach to pediatric patients suspected of having an ingested/aspirated foreign body with a discussion of the appropriate imaging strategy.
3. Case-based imaging review of common foreign bodies including: magnets, batteries, coins, etc. with an emphasis on immediate recognition and the clinical implications of radiographic findings.

SUMMARY
Ingestion and inhalation of foreign bodies by patients (particularly children) is commonly encountered in the Emergency Department. Frequently, the exact foreign body is unknown and the radiologist’s recognition of specific foreign bodies may be critical for prompt and appropriate treatment. This exhibit will increase the radiologist’s understanding of commonly ingested/aspirated foreign bodies, thus improving their ability to provide appropriate clinical guidance.

LL-ERE-WESB • Diaphragm-o-rama: A Practical Guide to Diaphragmatic Injury Evaluation in Blunt and Penetrating Trauma

Mark M Hammer MD ; Demetrios A Raptis MD ; Vincent M Mellnick MD ; Christine O Menias MD ; Sanjeev Bhalla MD ; Constantine A Raptis MD (Presenter)

PURPOSE/AIM
In the era of routine MDCT in the setting of trauma, it is incumbent upon the radiologist to recognize diaphragmatic injuries. While the literature describes the association of many imaging signs with diaphragmatic injury, little work has been done in determining which of these signs are more likely to be associated with blunt or penetrating trauma, despite the fact that the features of diaphragmatic injury in these two groups are often very different. The purpose of this exhibit is to review the various signs of diaphragmatic injury and explore their relevance in a cohort of over 90 cases of surgically proven diaphragmatic injury from our Level I trauma center.

CONTENT ORGANIZATION
1. Review of imaging signs associated with diaphragmatic injury:
- At least 12 signs described in the literature that are specifically associated with diaphragm injury
Gastrointestinal - Wednesday Posters and Exhibits (12:45pm - 1:15pm)

Wednesday, 12:45 PM - 01:15 PM • Lakeside Learning Center

LL-GIS-WEB • AMA PRA Category 1 Credit ™:0.5

LL-GIE-W9B • Complications of Bariatric Surgery: Review of CT Findings with Fluoroscopy Correlation

Viktoriya Paroder MD; Sarah K Oh MD; Zina J Ricci MD; Ellen L Wolf MD; Alla M Rozenblit MD; Fernanda S Mazzariol MD (Presenter); Victoria Chernyak MD *

PURPOSE/AIM
Complications of bariatric surgery are increasingly recognized on postoperative CT scans. This exhibit will review the CT findings of complications of bariatric surgery to aid in making a confident diagnosis. Upper gastrointestinal fluoroscopic correlation will be provided in selected cases.

CONTENT ORGANIZATION

SUMMARY
TEACHING POINTS: 1. Review CT appearances of various postoperative complications 2. Highlight imaging clues to allow for confident diagnosis 3. Differentiate normal post surgical findings from pathologic conditions CONCLUSIONS: The increased performance of bariatric surgery warrants a better understanding of postsurgical anatomy and the CT appearance of complications. After of this review, the radiologist will be more confident recognizing various complications of bariatric surgery on CT scan.

LL-GIE-W10B • CT and US Imaging of Bowel Perforation Caused by Ingested Foreign Bodies: Pictorial Review

Siarhei Kuzmich MD (Presenter); Tatsiana Kuzmich MD; Mark Farrugia; Christopher J Burke MBChB, FRCP; Deena Neriman MD; James Burn MBBS, BSc; Ali Alsafi MBBS; An T Ngo BMBS, MRCR; Ioanna Papadopoulou MD; Christopher J Harvey MBBS

PURPOSE/AIM
This purpose of this exhibit is to familiarize the viewer with the spectrum of CT and US findings in perforation of small and large bowel caused by various ingested foreign bodies and describe optimal imaging techniques for confident diagnosis.

CONTENT ORGANIZATION
Illustrated review with CT and US visuals based on movie clips will include description of indirect signs of perforation, appearances of various perforating foreign bodies such as fish and chickenbones and toothpicks, features of mall bowel perforation and large bowel perforation, pearls and pitfalls.

SUMMARY
The radiologist is usually the first to suggest preoperative diagnosis of perforating ingested foreign body since clinical presentation is nonspecific. Because US or/and CT are frequently the initial tests chosen in patients with localized abdominal symptoms, familiarity with characteristic appearances will allow the radiologist to make a timely diagnosis. This exhibit will enable the viewer to make the correct diagnosis of bowel perforation caused by various ingested foreign bodies based on CT or US imaging features. The viewer will gain understanding of optimal techniques, pitfalls and limitations.

LL-GIE-W11B • Rear View: Anatomy and Pathology of the Anal Canal

Mariya Kobi MD (Presenter); Fernanda S Mazzariol MD; Sarah K Oh MD; Milana Flusberg MD; Alla M Rozenblit MD; Victoria Chernyak MD *

PURPOSE/AIM
Understanding the anatomy of the anal sphincter is important in order to detect pathology and provide accurate information to the referring physician. Optimization of MR imaging techniques is required for detailed evaluation of the anal/perianal region.

CONTENT ORGANIZATION
Review of MR protocol and post processing techniques optimizing imaging of the anal canal. The exhibit will include the review of the following but is not limited to: 1. Atrophy and tears of the external anal sphincter 2. Intrinsic abnormalities of internal anal sphincter a. Thickening in the setting anismus b. Atrophy and fibrosis following surgery and radiation therapy. 3. Perianal fistulas a. Intersphincteric b. Transsphincteric c. Translevator d. Anovaginal fistulas following obstetric trauma 4. Postsurgical appearance of internal and external anal sphincter muscles 5. Pilonidal disease of the anal canal 6. Suppurative hydradenitis of the anal sphincter 7. Sarcoma invading the anal canal.

SUMMARY
A. Review optimal MR imaging protocol including sequences, imaging planes and postprocessing techniques. B. Review anatomy and both intrinsic and extrinsic abnormalities of the anal canal. C. Review of the classification of perianal fistulas.

LL-GIE-W12B • Segmental Biliary Ductal Dilatation: Causes and Importance of Follow-up

Ryan O'Malley MD (Presenter); Neil Hansen MD; Zachary W Washburn MD; Mahmoud M Al-Hawary MD; Peter S Liu MD; Hero K Hussain MD *

PURPOSE/AIM
This exhibit is to review the pathophysiologic causes of biliary ductal dilatation (BDD), with emphasis on malignant BDD. The exhibit will review the radiological appearance of dilated ducts and the importance of follow-up radiological imaging. A critical emphasis will be placed on the appropriate follow-up imaging to evaluate response to treatment and recurrent disease.
To review causes of segmental biliary ductal dilatation, specifically emphasizing malignant obstruction. Use cases to illustrate useful findings, while noting the difficulty identifying the underlying etiology. Emphasize importance of follow-up imaging when underlying cause is not initially identified (as a significant proportion ultimately show a malignant lesion).

CONTENT ORGANIZATION
Review causes of segmental biliary ductal dilatation:
- Benign - cholangitis, post-therapy
- Malignant - cholangiocarcinoma, hepatocellular carcinoma, metastases

Present examples, particularly cases where the underlying lesion is subtle or difficult to identify. Use cases to demonstrate important findings and use of complementary sequences (e.g. DWI) to help suggest the etiology. Emphasize the importance of identifying focal biliary ductal dilatation and, when present, careful scrutiny for malignant cause. Without a clear underlying etiology, close follow-up is essential to exclude developing malignancy (frequently identified on subsequent imaging).

SUMMARY
Segmental biliary ductal dilatation is an important finding for radiologists to identify and scrutinize carefully. An underlying malignant cause is often subtle or difficult to identify at presentation, which makes close follow-up and referral to hepatobiliary subspecialists extremely important.

**LL-GIS-WE1B • Quantitative Iodine-based Material Decomposition Images with Spectral CT for Assessment of Activity in Crohn’s Disease**

**Jiong Zhu MD, PhD (Presenter) ; Hongxia Gong ; Jianrong Xu**

**PURPOSE**
To evaluate the role of quantitative iodine-based material decomposition images with spectral CT in predicting the disease activity of Crohn’s disease(CD)

**METHOD AND MATERIALS**
63 patients with a proven diagnosis of CD participated in this prospective study. CD was diagnosed by clinical, enteroscopic and pathologic manifestations. Clinical remission was identified by experienced gastroenterologists using the criteria of clinical, endoscopy and laboratory tests. All patients underwent CT enterography (CTE) with spectral imaging mode on a GE Discovery CT750HD scanner. The iodine densities of disorder bowel walls, which were normalized to those of the psoas muscle, were measured and statistically compared on iodine-based-material-decomposition CT images. The ROI sizes range from 15 mm2 to 30 mm2 based on the lesion size. The iodine densities were measured on both arterial phase (AP) and venous phase (VP). The two-sample t test was performed to compare quantitative parameters between active and remittent CD.

**RESULTS**
A total of 44 disorder bowel segments were detected on CTE in 19 patients to have active disease(n=44), while 49 segments were detected in 23 patients to be remission(n=49). There was a significant difference for the normalized iodine density of the bowel wall between the patients to have active CD [4.66mg/mL(3.37 to 7.09 mg/mL)] and the patients to be remission [2.59mg/mL(1.00 to 3.80 mg/mL)] on AP (DF=40 P < 0.0001). And there was also a significant difference of the bowel wall iodine density between the patients with active CD [3.75 mg/mL(1.91-6.63 mg/mL)] and those to be remission [2.78 mg/mL(1.76-3.95 mg/mL)] on VP (DF=40 P = 0.0001).

**CONCLUSION**
It is feasible to perform quantitative iodine-based material decomposition images with spectral CT for evaluation of CD, and this method may be used as a predictor in distinguishing active and remittent CD.

**CLINICAL RELEVANCE/APPLICATION**
Quantitative iodine-based material decomposition images with spectral CT can be used to evaluate the activity of Crohn’s disease.

**LL-GIS-WE2B • Internal Hernias and Their Mimics: How Would Radiologists Help?**

**Ahmed Hamimi A Hamimi MD, PhD (Presenter)**

**PURPOSE**
Trying to define the most valuable radiological sign (s) for the diagnosis of internal hernias and their mimics; mainly cocoon syndrome and adhesions.

**METHOD AND MATERIALS**
In a period of 32 consecutive months; a total of 240 patients were admitted with abdominal pain with signs of remittent or persistent intestinal obstruction. Among those patients; 180 cases had history of previous abdominal operative intervention. All cases are subjected to multislice CT examination of the abdomen and pelvis using IV contrast and positive oral water soluble contrast 30 minutes prior to examination. The examination is done in single porto-venous phase. Thirteen cases were definitely diagnosed by laparoscopy as internal hernias. The cases radiological profiles were revised in retrograde manner. The radiological diagnosis of possible internal hernia was wrong in three other cases. Two cases were finally diagnosed as cocoon syndrome.

**RESULTS**
The age of the patients varies between 22 and 63 years with average age of 36 +/- 2.3 years. Most of the patients were females with ratio of 2:1. The radiological signs used for the radiological diagnosis were: Swirl sign Local bowel gathering Bowel dilatation Abnormal position of the duodenojejunal Junction Bowel other than duodenum posterior to the superior mesenteric artery. Distal jejunal anastomosis located to the right side Mushroom appearance No single sign alone was efficient and consistent in the diagnosis of internal hernia. There were no definite sign to differentiate between cocoon syndrome and internal hernia. Both cases have been operated and diagnosis was made intra-operatively.

**CONCLUSION**
A single sign is not enough for the diagnosis of internal hernia. I suggest a combination of Swirl sign, local bowel gathering and bowel dilatation in appropriate clinical settings for diagnosis of internal hernia. Still disease like cocoon syndrome will remain difficult to diagnosis in radiology

**CLINICAL RELEVANCE/APPLICATION**
The prevalence of internal hernia is increasing due to increased rate of operative abdominal intervention. Prompt radiological diagnosis is crucial to avoid unwanted surgery in a non-virgin abdomen.

**LL-GIS-WE3B • The Use of Contrast-enhanced Transperineal and Endoanal Ultrasonography in the Management of Perianal Fistulas**

**Alice Arcidiacono (Presenter) ; Francesca Nosenzo ; Angelo Corazza MD ; Silvia Perugin Bernardi MChir ; Giovanni Turtulici ; Enzo Silvestri MD**

**PURPOSE**
The aim of our study is to compare the accuracy and sensitivity of standard non contrast ultrasonography (US) with contrast-enhanced ultrasonography (CEUS) in the diagnosis of anal fistulas. Because current imaging techniques tend to underestimate the extent, location and course of perianal fistulas, crucial information for surgical planning, we evaluated whether transperineal and endoanal CEUS...
METHOD AND MATERIALS
15 patients (10 male, 5 female; mean age 50 ± 10 yrs) with clinical diagnosis of perianal fistula, with visible external opening, were examined by performing US and CEUS, with both 7–12 Mhz linear probe and 5–9 Mhz endocavitral probe. After non-contrast US, 4.8 ml of Bracco Sonovue with 20 cc of saline solution was injected in the cannulated fistula and US examination was repeated. In all patients we identify the type, the complexity and the entire course of anal fistulas (including their relation to the internal and external sphincters and the levator ani muscle), as well as the location of the internal openings. This depiction of fistulas permits an accurate classification, which facilitates surgical planning.

RESULTS
All fistulas were identified by non-contrast and contrast-enhanced endoanal and transperineal US. The US findings have been confirmed intraoperatively. Results showed that CEUS was more sensitive in diagnosing the type of anal fistulas than non-contrast US giving more detailed information about the location of the fistula in relation to the anal lumen and sphincters; moreover, CEUS showed higher sensitivity than non-contrast US in demonstrating internal openings (100% and 87% respectively).

CONCLUSION
The application of transperineal and endoanal CEUS was found to be a useful technique for documentation of the presence, number, anatomotopographic localization and internal course of perianal fistulas and for characterization of abnormalities not adequately seen at non-contrast US. In addition, the technique permitted surgeons to stratify patients into treatment groups so it has been especially useful for planning surgical treatments.

CLINICAL RELEVANCE/APPLICATION
The application of endoanal and transperineal CEUS offers a more detailed perianal fistulas imaging than standard non-contrast US, being very useful for surgical planning.

LL-GIS-WE4B • Schatzki Ring Treatment with Acid-suppressive Medication Improves Symptoms and Ring Diameter

Sean Novak MD (Presenter) * ; Michael J Shortsleeve MD

PURPOSE
Schatzki (lower esophageal) rings are a common cause of dysphagia and esophageal food impaction. While many of these rings are diagnosed radiographically on double-contrast fluoroscopic examinations, typical therapy involves referral to a gastroenterology specialist for procedural dilation with an endoscopic balloon or other device. The dilation procedures are invasive and expose the patient to the risk of esophageal perforation. There is a partial association between acid reflux and Schatzki rings, although many of these rings occur in patients without known gastroesophageal reflux disease. We hypothesized that medical treatment with acid-suppressive medications, particularly proton-pump inhibitors, might be a reasonable alternative for Schatzki ring treatment.

METHOD AND MATERIALS
In this proof-of-concept study, we treated three patients who had symptomatic Schatzki rings with an oral proton-pump inhibitor (omeprazole) for a mean of 10 months (range 5 to 12 months). Double-contrast barium esophagrams were performed prior to and following treatment for all patients. In two patients, pre- and post-treatment 13 mm barium tablet swallowing testing was performed.

RESULTS
Prior to treatment, the mean Schatzki ring diameter was 11 mm (range 9 to 13 mm). After treatment, the mean ring diameter increased to 15 mm (range 14 to 15 mm). All patients reported subjective improvement in dysphagia symptoms. Of the two patients with 13 mm barium tablet swallowed test, pre-treatment the tablet paused at the ring for 3 minutes for the first patient, and briefly for the second patient. Post-treatment, the tablet passed easily without pause or obstruction for both patients. All patients tolerated the treatment well. There were no complications.

CONCLUSION
Acid-suppressive medication improves dysphagia symptoms and ring diameter in patients with symptomatic Schatzki rings, and is an effective alternative to procedural dilation.

CLINICAL RELEVANCE/APPLICATION
Dysphagia in patients with Schatzki rings can be treated with acid-suppressive medication as an effective alternative or addition to procedural dilation.

LL-GIS-WE5B • Determining Optimal Iodine Dose with 80-kVp CT Imaging: Part I- Detection of Liver Metastasis

Satoshi Goshima MD, PhD ; Yoshifumi Noda MD ; Hiroshi Kondo MD ; Haruo Watanabe MD ; Hiroshi Kawada MD ; Tomohiro Ando MD (Presenter) ; Masayuki Kanematsu MD ; Kyongtae T Bae MD, PhD *

PURPOSE
To determine the optimal iodine dose required for the detection of liver metastasis based on i) total body weight (TBW) and ii) body surface area (BSA) at 80-kVp CT imaging of the liver.

METHOD AND MATERIALS
RESULTS
CONCLUSION
With the use of 80-kVp CT imaging, iodine dose required for hepatic enhancement can be substantially reduced. The iodine dose estimated to achieve the hepatic parenchymal enhancement of 50 HU was 310 mgI/kg or 10.2 mgI/m2.

CLINICAL RELEVANCE/APPLICATION
Our study estimated the optimal amount of iodine-dose for the detection of liver metastasis in 80kVp CT imaging. This information is useful for designing routine hepatic CT imaging.

LL-GIE-WE6B • Lasers and Livers: Laser Photocoagulation Following High-Risk Percutaneous Liver Biopsy To Prevent Bleeding Complications

Nikunj R Chauhan ; Paul B Shyn MD ; Jeffrey F Chick MD (Presenter) ; Vincent M Levesque MA ; Stuart G Silverman MD *

PURPOSE/AIM
Outline the rationale for percutaneous liver biopsy followed by laser photocoagulation as an alternative to transjugular liver biopsy in patients with coagulopathy and demonstrate the efficacy and safety of the procedure.

CONTENT ORGANIZATION
1. Define coagulopathy.
2. Discuss benefits and drawbacks of transjugular and percutaneous liver biopsy.
4. Outline the rationale for percutaneous liver biopsy followed by laser photocoagulation in patients with coagulopathy.
5. Describe the photocoagulation technique.
6. Present cases of percutaneous liver biopsy followed by laser photocoagulation.

SUMMARY
Genitourinary/Uroradiology - Wednesday Posters and Exhibits (12:45pm - 1:15pm)

Wednesday, 12:45 PM - 01:15 PM • Lakeside Learning Center

LL-GIS-WE8B • AMA PRA Category 1 Credit ™: 0.5

LL-URE1139-WEB • Image Guided Ablation in Renal Cell Carcinoma: Which, Why, When and How to Do It?

Shaunagh McDermott FFRRCSI (Presenter); Avinash R Kambadakone MD, FCR; Raul N Uppot MD; Debra A Gervais MD; Ronald S Arellano MD

PURPOSE/AIM
Percutaneous image guided ablation are increasingly used for treatment of renal cell carcinoma. Availability of various ablative technologies makes it imperative to choose the right ablation technique to achieve improved results. The purpose of this exhibit is to provide the radiologist with a guide to ensure effective ablative treatment of renal cell carcinoma.

CONTENT ORGANIZATION
1. Review the various ablative technologies available for treatment of renal cell carcinoma such as radiofrequency ablation, microwave ablation, cryoablation, and irreversible electroporation.
2. Discuss the advantages and disadvantages, indications and technique of each ablation technology in treatment of renal cell carcinoma of each ablative technique.
3. Describe the various adjunctive methods employed to prevent adjacent structure injury.
4. Illustrate the technique by citing examples of routine and challenging cases in a pictorial review.
5. Discuss the principles of effective pre, peri and post procedure management guidelines for each ablative technology.

SUMMARY
Image guided ablation is an established technique increasingly used in the treatment of renal cell carcinoma. Appropriate selection of ablation technique is imperative to achieve successful results in treatment of renal cell carcinoma.
Daniel Hausmann MD (Presenter) ; Ulrike I Attenberger MD * ; Ralph Strecker * ; Andre De Oliveira * ; Daniel B Peixinho Lima ; Stefan O Schoenberg MD, PhD * ; Emerson L Gasparetto MD ; Leonardo K Bittencourt MD, MSc

PURPOSE
Although 3T is proven to be superior to 1.5T for the detection of prostate cancer due to the higher intrinsic SNR, distortion artifacts arising from local susceptibility differences related to the vicinity of air-filled rectum are more pronounced. Small FOV imaging strategies were recently introduced to overcome these shortcomings, based on the use of 2D radiofrequency excitation pulses for the excitation of a small volume of the prostate region only. The purpose of this study was to evaluate the impact of small-field computed b=1400 s/mm² (M-b1400) vs measured b=1400 s/mm² diffusion-weighted images (DWI) on lesion detection rate, image quality and quality of lesion demarcation.

METHOD AND MATERIALS

RESULTS
27 lesions were detected on the C-b1400 images, whereas 24 lesions were detected on the M-b1400 images (p=0.08). Overall image quality was rated significantly better and SI ratios were significantly higher on C-b1400 (2.3±0.8 vs 3.1±1.0, p<0.001). Calculation of an ultra-high b-value image may contribute to increase diagnostic accuracy of DWI due to an improved signal-to-noise ratio and image quality compared to a measured ultra-high b-value image.

CLINICAL RELEVANCE/APPLICATION
Computed ultra-high b-values may contribute to increase diagnostic accuracy of DWI without an increase of acquisition time or loss of overall SNR.

LL-GUS-WE2B • Differentiation between T2- and T3 Urothelial Cancer by Using MDCT: Proposal of New Diagnostic Criteria

Yukiko Honda MD (Presenter) ; Keisuke Goto ; Kenichiro Ikeda ; Toru Higaki PhD ; Shuji Date ; Kazuo Awai MD *

PURPOSE
Staging of urothelial cancer depends only on the T factor in the early stages. Many urologists consider that neoadjuvant chemotherapy before surgical operation is necessary for T3 tumors, but it is not necessary for T2 tumors. Furthermore, T3 tumors have higher frequency of lymph node metastases than T2 tumors. Thus, presurgical differentiation between T2 and T3 is very important, however, CT diagnostic criteria remain to be established. We propose new diagnostic criteria that stage the disease as having a T factor less or more than T3. The purpose of this study was to investigate the diagnostic applicability of the proposed criteria.

METHOD AND MATERIALS
We retrospectively reviewed CT and pathological findings on 30 patients with urothelial cancer who underwent surgery. We obtained pre-enhanced and contrast-enhanced scans (100 and 600 sec after the start of contrast injection) on 16- or 64-detector CT scanners (GE). We devised a CT grading system that focused on spiculation and mass formation along the ureter on CT images where grade A = defect of both spiculation and mass within/around the ureter or presence of spiculation but defect of mass; grade B = presence of both spiculation and mass within/around the ureter or diffuse soft tissue tumor along the ureter. We hypothesized that grade A corresponded to T2 or less and grade B to T3 or more. Three diagnostic radiologists participated in an observer performance study. We used the Jackknife receiver operating characteristic (ROC) analysis with random readers and random cases to compare their diagnostic ability without and with our new diagnostic criteria.

RESULTS
The mean area under curve (AUC) for the 3 radiologists without and with our criteria was 0.54 ± 0.09 (SD) and 0.73 ± 0.08, respectively, indicating statistically significant difference (p<0.001). Our proposed CT grading system could accurately differentiate between patients with disease stage T2 or less and those with disease stage T3 or more.

CLINICAL RELEVANCE/APPLICATION
Our CT grading system which is based on the presence of spiculation and mass within/around the ureter is of diagnostic value for distinguishing between disease of stage T2 or less and T3 or more.

LL-GUS-WE3B • Radiologists’ Adherence to the 2010 Society of Radiologists in Ultrasound Guidelines for the Management of Incidental Adnexal Cysts Imaged at Ultrasound: Frequency and Associated Factors

Andrea S Kierans MD (Presenter) ; Andrew B Rosenkrantz MD

PURPOSE
To evaluate adherence to the 2010 Society of Radiologists in Ultrasound (SRU) guidelines for management of incidental adnexal cysts imaged at ultrasound.

METHOD AND MATERIALS
398 adnexal cysts initially detected at ultrasound were included; all studies had been performed after publication of the SRU guidelines and guideline review at departmental conferences. The ultrasound reports were retrospectively reviewed to determine whether the management recommendations were adherent to the guidelines. Non-adherent cases were categorized as over-management, under-management, or as incomplete in their recommendation. Impact of categories determining appropriate recommendation (menopausal status, cyst size, and other cyst imaging features) was assessed via the chi-square test, and the primary cause for non-adherence (over- vs. under-management) in each sub-category was identified.

RESULTS
Among all 398 adnexal cysts, the frequency of adherence was 55%, over-management was 27%, under-management was 12%, and incomplete recommendation was 6%. Menopausal status, cyst size, and other cyst imaging features all significantly impacted adherence rate (all p<0.05). Adherence was 24% (under-management in 42%). Lesions adherent in most instances were simple cysts (58%), para-ovarian cysts (71%), corpus luteum (88%), and cysts suggestive of, but not classic for, a hemorrhagic cyst, endometrioma, or dermoid (57%). Lesions with under-management in most instances were cysts with multiple thin septations (83%), thick irregular septations (33%), or an avascular nodule (67%), and dermoids (78%). Lesion with under-management in most instances was cyst with one thin septation (64%).

CONCLUSION
Radiologists at our institution adhered to the SRU guidelines for incidental adnexal cysts at ultrasound in 55% of cases. Non-adherence was greater in post-menopausal patients, larger cysts, and cysts with greater complexity.

CLINICAL RELEVANCE/APPLICATION
Our findings will be used to direct future efforts to improve adherence to the SRU guidelines, which in turn will improve patient care. Causes of both under- and over-management will be addressed.

LL-GUS-WE4B • Computed Diffusion-Weighted MR Imaging for Prostate Cancer Detection: Which Combination of b-Values is Appropriate for Generating Ultra-High b-Value Images?
PURPOSE

Computed diffusion-weighted MR imaging (cDWI) is a mathematical technique to generate DWI at any b-value from acquired DWIs, which are obtained at two different b-values. The purpose of this study was to determine the appropriate b-value combination for cDWI generation for prostate cancer (PCa) detection as compared with acquired DWI at ultra-high b-value (b=2000 s/mm²: aDWI2000).

METHOD AND MATERIALS

31 consecutive pathologically diagnosed PCa patients (mean age, 65 years) underwent DWI obtained at four different b-values (0, 500, 1000, 2000 s/mm²) at 3T MR system before surgical treatment. The histopathological findings revealed 121 PCa-positive sites and 127 PCa-negative sites. Then, cDWIs at b=2000 s/mm² were generated from the following three b-value combinations: 1) between 0 and 500 s/mm² (cDWI0-500) and 3) between 500 and 1000 s/mm², cDWI500-1000, respectively. To compare the contrast resolution for each DWI, ROC analyses were performed and sensitivity (SE), specificity (SP) and accuracy (AC) of each DWI were compared by using McNemar’s test.

RESULTS

CRs of each cDWI (cDWI0-500: 0.53±0.2; cDWI0-1000: 0.46±0.2; and cDWI500-1000: 0.50±0.1) were significantly higher than that of aDWI2000 (0.37±0.1, p=0.08) and significantly smaller than that of others (cDWI0-1000: Az=0.74, p500-1000: Az=0.78, p2000: Az=0.74, p500-1000 was significantly higher than that of cDWI0-500 (64.9 [161/248] %, p2000 (66.5 [165/248] %, p

CONCLUSION

cDWI500-1000 had better diagnostic specificity and accuracy than cDWI0-500 and aDWI2000, and demonstrated high contrast resolution.

CLINICAL RELEVANCE/APPLICATION

For prostate cancer detection, computed DWI from appropriate b-values setting has a potential to offer a better detectability than acquired DWI at b=2000 s/mm² with better contrast resolution.

LL-GUS-WE5B • Radiological Findings of Papillomas and Inverted Papillomas of the Bladder

Michael Y Park MD (Presenter) ; Sung Eun Rha MD ; Seung Eun Jung MD ; Soon Nam Oh MD ; Young Joon Lee MD ; Jae Young Byun MD

PURPOSE

To describe the previously unreported radiological findings of papillomas and inverted papillomas of the bladder.

METHOD AND MATERIALS

The reports of 1,567 urology department patients with bladder pathology reports between January 2003 and March 2011 were searched for papillomas and inverted papillomas. A total 20 cases were found, with five cases of papillomas and eight cases of inverted papillomas having CT scans with visible bladder lesions. Also, six cases of inverted papillomas and two cases of papillomas had intravenous urography (IVU) or ultrasound (US) with visible bladder lesions. Two radiologists in consensus reviewed the imaging findings including shape, location, width/height ratio, pedunculated-like appearance, multiplicity and whether adjacent bladder wall thickening, perivesical fat infiltrations, lymphadenopathy, and calcifications were seen.

RESULTS

On CT a mixture of papillary/fingerlike (n=5, 38%), ovoid (n=5, 38%), and focal wall thickening-like (n=3, 23%) lesions were noted. All of the lesions were located at the posterior wall of the bladder with nine (69%) located at the bladder trigone or neck. Seven cases (53%) showed a taller-than-wide appearance with five cases (38%) showing a pedunculated-like appearance. None of the lesions had fat infiltrations, lymphadenopathy, and calcifications were seen.

CONCLUSION

The imaging findings of papillomas and inverted papillomas overlap with urothelial cell carcinomas with a less than T3 staging. They arise from the bladder neck or trigone, sometimes show a pedunculated-like appearance, and do not show aggressive or invasive findings on imaging modalities.

CLINICAL RELEVANCE/APPLICATION

Bladder papillomas and inverted papillomas are mostly benign, but show a similar appearance to urothelial cell carcinomas with a less than T3 staging, and arise at the bladder neck or trigone.

LL-URE-WE6B • Tucked Under: MRI of the Penis and Scrotum

Christine O Menias MD (Presenter) ; Kumaresan Sandrasegaran MD * ; Alireza Radmanesh MD ; Sadhna Verma MD * ; Motoyo Yano MD, PhD ; Maryam Rezvani MD ; Cary L Siegel MD

PURPOSE/AIM

• To review the spectrum of penile and scrotal pathology on MR imaging
• To review MRI protocol of the penis and scrotum
• To discuss the differential and mimics

CONTENT ORGANIZATION

A spectrum of MRI cases that demonstrate benign, malignant, vascular, and iatrogenic conditions that affect the penis and scrotum will be presented.

Cases include, but are not limited to the following:

Hemangioma

"Burnt out" Germ cell tumors
Malignancy (Germ cell tumors, penile carcinoma, metastases)
Aggressive angiomyxoma
Scrotal infection/abscess
Varicocele
Penile fracture
Peyronies
Penile implant complications
Fistulae

Suggestions for protocols to evaluate the penis and scrotum.

SUMMARY

Though MRI is not typically the primary imaging modality for evaluation of the penis and scrotum, MR imaging can be useful as a problem-solving tool. Understanding the MR characteristics of various benign and malignant scrotal and penile lesions is important, and can often guide management. This exhibit will review the spectrum of penile and scrotal pathology on MR examinations.
Wednesday, 12:45 PM - 01:15 PM • Lakeside Learning Center

RESULTS
The files indicate procedure volume for each code in the nationwide Medicare fee-for-service population (36.3 million in 2011).

METHOD AND MATERIALS
The Medicare Part B Physician/Supplier Procedure Summary Master Files for 2001, 2006, and 2011 were our data source. CPT codes 71250 (CT thorax without contrast), 71260 (CT thorax with contrast), and 71270 (CT thorax without, followed by with contrast) were selected. These cases with abnormal imaging findings (including non-acute finding, i.e. pneumonia) and a subset of 63 cases with acute conditions. For these patients with acute findings, the time interval of communication was less than 2 hours for 60.57% of cases.

CONCLUSION
Communication of acute imaging findings to the referring physician is critical for patient care. In our study, we found that in a majority of time, there is complete documentation and timely communication. However, there is also high variance in radiologist documentation and communication. As a result, there remains an important opportunity for quality improvement in the communication of acute findings.

CLINICAL RELEVANCE/APPLICATION
Ensuring high quality radiology reporting requires both proper documentation of radiologist to referring physician communication and timely communication, particularly in the setting of acute findings.

LL-HPS-WE2B • Evaluation of the Appropriateness of CT Chest Examinations in a Canadian Setting

Julie O'Brien MBCh, FFRRCSI (Presenter); Catherine M Jones MBBS; Max Sun; John R Mayo MD *

PURPOSE
We evaluated the appropriateness of chest CT referrals in an urban setting in Canada. It has been suggested that up to 30% of all CT exams may be inappropriate based on data arising from the US and Italy. Inappropriate CT exams waste limited health care dollars and expose patients to substantial doses of unnecessary medical radiation. Given the 59% lower rate of CT exams per capita in Canada compared with the US, we hypothesized that the 30% rate might not accurately reflect and may overestimate the rate of inappropriate CT exams in Canada.

METHOD AND MATERIALS
Following IRB approval and using the institutional PACS system, we performed a retrospective review of the clinical indication on the ordering request for 550 consecutive CT chest exams performed in 3 hospitals in the urban Vancouver Coastal Health system. Clinical indication and patient demographics were evaluated by 4 observers [2 fellowship trained chest radiologists, 1 senior chest radiologist (24 yrs experience), 1 internal medicine physician]. Indications were classified using the ACR appropriateness guidelines into inappropriate (ACR 1,2,3), maybe appropriate (ACR 4,5,6) and inappropriate (ACR 7,8,9) levels. Referring physician specialty, patient location, and radiation dose were also recorded.

RESULTS
Of the total 550 requests evaluated, 349 examinations were performed in academic teaching centers and 201 in an affiliated community hospital. In total 432 requests(79%) were deemed appropriate by all 4 readers, 516(94%) requests were deemed appropriate by 3 or more readers. Analysing the lowest given score in each case, 412(75%) were deemed appropriate, 125(22.7%) maybe and 13(2.4%), inappropriate. Reasons for inappropriate scores included suspected duplicate ordering, illegible or confusing requisitions, and lack of radiographs in some cases.

CONCLUSION
Findings show the rate of inappropriate chest CT examinations performed in an urban Canadian setting is lower than that previously reported in the literature. This study however, highlights the variability in determining appropriateness given the limited clinical history available on radiology requisitions that may not adequately reflect the actual indication in a complicated clinical setting.

CLINICAL RELEVANCE/APPLICATION
It has been suggested that 30% of clinical radiologic examinations are inappropriate, we examined 550 consecutive CT chest requisitions in an academic setting in Canada, to evaluate this allegation.

LL-HPS-WE3B • Are "Double" CT Scans of the Thorax Being Overused?

David C Levin MD (Presenter) *; Vijay M Rao MD; Laurence Parker PhD; Andrea J Frangos MPH

PURPOSE
A front page article in the New York Times of 6/17/11 reported that Medicare claims showed overuse of "double" CT scans of the thorax (i.e. CT without plus with contrast). Some hospitals were found to do these types of exams 60-90% of the time. Most radiologists agree that they should be done only on rare occasions. Our goal was to see what proportion of all thoracic CTs are done without plus with contrast in the Medicare population.

METHOD AND MATERIALS
The Medicare Part B Physician/Supplier Procedure Summary Master Files for 2001, 2006, and 2011 were our data source. CPT codes 71250 (CT thorax without contrast), 71260 (CT thorax with contrast), and 71270 (CT thorax without, followed by with contrast) were selected. The files indicate procedure volume for each code in the nationwide Medicare fee-for-service population (36.3 million in 2011). The percent of scans performed without + with contrast was calculated.

RESULTS
In 2011 in Medicare, there were 3,316,188 thoracic CTs performed – 1,429,885 without contrast; 1,747,672 with contrast; and 138,631 without + with contrast. The latter study thus comprised 4.2% of all thoracic CTs that year. In 2006, there had been a total of 3,491,960 thoracic CTs performed, of which 212,805 were without + with contrast (6.1%). In 2001, there had been 2,016,441 thoracic CTs performed, of which 123,797 were without + with contrast (also 6.1%).

CONCLUSION
Although the New York Times article clearly identified a problem that existed in some institutions, only a small proportion (4.2%) of thoracic CT scans nationwide in 2011 were done both without and with contrast. Moreover, the proportion of thoracic CTs done that way dropped by almost one-third from 2001 and 2006 to 2011, suggesting that the practice is declining. This 4.2% figure can be used as a benchmark against which to judge radiology facilities in the future.

CLINICAL RELEVANCE/APPLICATION
Not applicable.

LL-HPS-WE4B • Bacterial Contamination of Radiologist Workstations: Incidence and Potential Health Implications

Brandi D Lanier MD (Presenter) ; Austin Tubbs ; Mary Ogilvie ; Sandra Thompson-Jaeger ; Richard Duszak MD

PURPOSE
Bacterial contamination of electronic and other devices in the hospital setting is common and creates nosocomial infectious risks to patients and staff alike. This public health issue has received little attention in the radiology community. We aimed to quantify and characterize bacterial contamination of radiologist workstations and consider its implications.

METHOD AND MATERIALS
Dictation microphones and computer mice at the most frequently used radiologist workstations from 2 inpatient and 2 outpatient reading rooms each at 2 teaching hospitals in 2 states were sampled for bacteria. Reference toilet seat and doorknob sampling was performed in the restroom nearest each of those 4 reading rooms. One microphone and one mouse in each reading room were chosen at random, and repeat sampling was performed after quickly wiping each surface with an inexpensive commercially available antiseptic pad. Sampling was performed using direct trypticase soy agar plating, with sampled areas uniformly approximating 50 sq cm. Colonies were quantified and characterized after 24 hours.

RESULTS

CONCLUSION
Bacterial contamination of dictation microphones and computer mice at radiologist workstations is extremely common, with average bacterial colonization significantly greater than that of neighboring restroom toilet seats and doorknobs. Simple, rapid, and inexpensive disinfection techniques nearly completely eradicate radiologist workstation microbial contamination and likely minimize radiologist exposure and cross-contamination risk to other staff and patients alike.

CLINICAL RELEVANCE/APPLICATION
Bacterial contamination of radiologist workstations is common- 5x higher than nearby restroom toilet seats and doorknobs. Simple disinfection techniques are highly effective and strongly advised.

LL-HPS-WE5B • Legal Ramifications of Computer Aided Detection in Mammography

Jonathan Mezrich MD (Presenter) ; Cristina I Campassi MD ; Eliot L Siegel MD *

PURPOSE
Computer assisted detection (CAD) is increasingly utilized in radiology, and its use is presently most prevalent in screening mammography. While CAD may be helpful to the clinician in highlighting findings the clinician may not have observed, it is not without legal ramifications. To what extent is CAD use becoming the standard of care in the subspecialty? If CAD is performed, is one then obligated to follow or biopsy CAD findings one finds questionable or would have otherwise ignored? Will a questionable finding not mentioned or dismissed by the radiologist, but marked by CAD, which ultimately did develop into a malignancy, be grounds for malpractice? To what extent do clinicians archive CAD markings, and if not, is there a worry that future better versions of CAD might be used in the courtroom to show that findings were ”CAD evident”? If CAD markings are discarded, is this not a case of ”spoliation” that should be determined in favor of an injured plaintiff?

METHOD AND MATERIALS
A link to a SurveyMonkey survey was posted on the website of the Society of Breast Imaging and circulated to subscribers of Diagnostic Imaging.com, in order to evaluate opinions regarding CAD use and its underlying legal issues. There were 45 responses.

RESULTS

91.1% of respondents indicated they always use CAD in their screenings, and 79.5% consider CAD use in conjunction with their own analysis the standard of care in mammography. 24.4% routinely archive CAD output into PACS along with the study, while 71.1% rarely or never do. 82.2% of respondents worry that archived CAD markings may lead to more lawsuits or greater liability, and 80.0% indicate that CAD results may influence their willingness to take a position as an expert witness in a malpractice case.

CONCLUSION
This study suggests that a majority of breast radiologists consider CAD use the standard of care in screening mammography, and worry about CAD’s potential to increase litigation or liability. The majority of respondents indicated they are not archiving CAD results. CAD is a tool with potential legal ramifications, and radiologists should carefully consider how best to integrate CAD into their archiving policies and within their reports.

CLINICAL RELEVANCE/APPLICATION
This study is of interest to all radiologists who use computer aided detection in their practices and are concerned or cognizant of the legal ramifications of such technology.

Informatics - Wednesday Posters and Exhibits (12:45pm - 1:15pm)

Wednesday, 12:45 PM - 01:15 PM • Lakeside Learning Center

LL-INS-WE1B • Why Isn't There More High-Fidelity Simulation Training in Diagnostic Radiology? Results of a Survey of Academic Radiologists

Chun-Der L Li MD (Presenter) ; Jessica Hernandez MD ; Benjamin L Yam MD ; Mary H Scanlon MD, FACR ; Curtis P Langlotz MD, PhD * ; Tessa S Cook MD, PhD

PURPOSE
High-fidelity simulation training is performed in other medical specialties, as well as in interventional radiology. We sought to gather attitudes toward simulation training in radiology and identify perceived barriers or challenges.
RESULTS
More than half of the 63 respondents are program directors or other faculty. Call preparation most commonly involves lectures, shadowing senior residents and baby call. Most programs also prepare residents to protocol studies and communicate with technologists and referring physicians. About half specifically train residents to triage phone calls and multi-task while on call. Very few programs report formal training on professionalism, citing daily practice and observation of senior residents and faculty as sufficient. Evaluation of resident call performance commonly falls to the faculty who review call cases. A few programs can track report changes and notify residents, but this is not widespread. Most programs consider baby call to represent a mimic of the call environment, however, a few report having simulators that provide on-call cases to first-year residents without adding common on-call distractions. The main perceived barriers to a simulated call environment are lack of time and expertise in simulation training within the department. Some feel that this type of training is not necessary as it is supplanted by the first year of residency.

CONCLUSION
The main barriers to high-fidelity diagnostic radiology simulation training include lack of faculty time/expertise in simulation design and a lack of perceived need. Most programs focus call preparation on learning content rather than dealing with the added challenges of time pressure, distractions and communication encountered on call.

CLINICAL RELEVANCE/APPLICATION
High-fidelity simulation training is not heavily used for call preparation in diagnostic radiology; the barriers to its use are primarily lack of time, simulation expertise and perceived need.

LL-INS-WE2B • Quality Assurance in Pipeline Processing of Clinical Brain MRI for Research Applications
Mikhail V Milchenko PhD (Presenter) ; Pamela Lamontagne PhD ; Abraham Z Snyder PhD ; Joshua S Shimony MD, PhD ; Tammie S Benzinger MD, PhD * ; Sarah C Jost MD ; Daniel S Marcus PhD *

CONCLUSION
Our findings indicate that the reliability of automated processing of multi-center clinical imaging studies would be improved by secure image-based methods for determining head orientation and tight control over clinical study acquisition protocols, including file naming conventions. These measures offer the potential to significantly improve large scale, clinical imaging research studies.

Background
Processing pipelines for large neuroimaging clinical research projects must be reliable. This is challenging in multi-site studies because inconsistent acquisition protocols cannot be entirely avoided. We report our experience with the pipeline developed to automatically preprocess and co-register multispectral MRI data acquired by the Comprehensive Neuro-oncology Data Repository (CONDOR) project, and analyze the most common reasons of automatic processing failures.

Evaluation
A typical CONDR MR study contains several T1-, T2- and susceptibility-weighted images plus dynamic susceptibility contrast (DSC) perfusion and diffusion sensitized sequences. Our CONDR processing pipeline includes detection of available DICOM scans, identification of known scan types, generation of perfusion and diffusion maps and spatial co-registration of all image data to a pre-selected atlas. Although this preprocessing is intended to be fully automatic, variable patient anatomy (brain distortion consequent to mass lesions) and inconsistent sequence settings may result in a processing failure. We evaluated the most common reasons for pre-processing failure in over 60 tumor studies acquired in two different institutions.

Discussion
Diffusion processing failures were most often attributable to incorrectly detected scan orientation because of missing DICOM metadata. Image registration failures were most commonly attributable to pathologic anatomical distortions and highly anisotropic voxels (i.e., thick slices with high in-plane resolution). A minority of studies failed processing because the required scans were either absent or not detected because of naming inconsistencies.

LL-INS-WE3B • The Translational Imaging Platform (TIP)
Daniel S Marcus PhD (Presenter) * ; Mikhail V Milchenko PhD ; Rick Herrick * ; Abraham Z Snyder PhD ; Joshua S Shimony MD, PhD ; Eric Leuthardt ; Carl Hacker ; Tammie S Benzinger MD, PhD *

CONCLUSION
The TIP has enabled streamlined integration of research-based image processing tools into clinical workflows, allowing both clinical use and bidirectional feedback between clinicians and research scientists. The TIP is open source and can be downloaded from the XNAT Marketplace website.

Background
Quantitative imaging processing tools developed in research settings have the potential to enhance clinical diagnostic practice. Conversely, feedback from clinical use could be used to researchers to continue to improve algorithms and functionality. However, integrating these tools into clinical workflows is often a difficult and time consuming process. We have developed a customized version of the XNAT imaging informatics platform to overcome these obstacles. This system is referred to as the Translational Imaging Platform (TIP).

Evaluation
The TIP includes a user interface to retrieve specific patient imaging studies from a selected PACS system using standard DICOM query/retrieve services. Selected patients can be selected and automatically imported to the TIP repository. Once in TIP, the study can be processed with automated image processing pipelines. The TIP uses XNAT’s pipeline engine service to configure and execute these pipelines. The pipelines are designed to produce additional DICOM series that may include derived images and/or structured reports. This generated content can be reviewed by qualified personnel and then sent to the PACS for clinical use.

Discussion
The TIP has been deployed at the Washington University School of Medicine and is jointly managed by BJC Hospital information technology department and the Mallinckrodt Institute of Radiology Division of Radiological Sciences. The initial pipeline within the TIP generates a series of brain network maps from resting state functional MRI data (rfMRI). These maps are used by neuroradiology and neurosurgery teams to develop surgical navigation plans. An additional pipeline is in development to generate quantitative brain region volumetry reports for use in Alzheimer’s Disease diagnosis.

LL-INS-WE4B • Simulation of Adverse Contrast Reactions-An Educational Tool for Team Training
Taj Kattapparam MD (Presenter) ; Gloria M Salazar MD ; Elkan F Halpern PhD * ; Preston D Stingley MA, MBA ; Shawn Bonk ; Emily Hayden ; Margaret Sande ; James Gordon MD ; Bethany L Niell MD

PURPOSE
Successful management of a serious adverse reaction to contrast media requires prompt recognition and treatment, as well as effective team dynamics among radiologists, technologists, and nurses. Our radiology department implemented an educational simulation program in which teams of nurses, technologists, and physicians are required to manage simulated adverse contrast reactions. This study evaluates whether simulation training emphasizing team dynamics improved an individual’s self-actualization of the management of an...
adverse contrast reaction.

METHOD AND MATERIALS
Following IRB approval, 56 physicians, 7 nurses, and 56 technologists worked in interprofessional teams of four to manage two cases of simulated adverse contrast reactions. A standardized debriefing occurred immediately following each simulated case, focusing on medical management of adverse contrast reactions, an institutional adverse contrast reaction kit, and team dynamics including role clarity, closed-loop communication, event managers, etc. Participants individually completed pre- and post-simulation questionnaires which included knowledge-based questions regarding the appropriate management of contrast reactions, as well as questions about participants’ perception of their ability to manage adverse contrast reactions. Self-actualization was measured using McNemar's test with a p value

RESULTS
Following completion of simulation training, radiologists, technologists, and nurses reported a statistically significant improvement in their ability to function as a team during a medical emergency, including an adverse contrast reaction (p-value

CONCLUSION
This simulation training program with its emphasis on team training and adverse contrast reaction management was perceived by the participants as an effective tool to improve the self-actualization of radiology personnel managing adverse contrast reactions.

CLINICAL RELEVANCE/APPLICATION
Simulation training is recommended to educate radiology personnel on effective team dynamics in the management of adverse contrast reactions.

LL-INE-WESB ● The Evolving Role of the Radiologist: Communicator, Educator and Mediator

Inggy Hanna MD ; Mark A Flyer MD ; Jacquelyn Copeland MD (Presenter)

Background
The growing dependence of medical diagnosis on imaging has made the radiologist a central player on the medical team. Beyond the correct diagnosis there is much that the radiologist is responsible for and can contribute to optimizing patient care. The timely communication of radiologic findings, educating referring physicians and patients about appropriate evidence based imaging options and protection of patient and staff against unnecessary radiation exposure are all responsibilities that fall squarely on the radiologist.

Evaluation
Failure to communicate significant findings is increasingly the cause for radiologist liability. Every institution should have methods for the timely communication of information and a list of which findings require prompt correspondence. Growing media attention to medical radiation is a major factor in the increased conscientiousness of physicians and patients when obtaining imaging, causing many patients to question the safety of imaging. It is the radiologists’ duty to minimize unnecessary radiation exposure while optimizing image quality as well as play an active role in educating physicians and patients. Imaging of the pediatric and pregnant patient has markedly increased, making the creation of safety measures for this group of patients imperative.

Discussion
We discuss our institutional protocol to ensure prompt communication of significant findings and the standardization of "critical" and "significant unexpected" findings. Also presented are informative resources the radiologist can use when discussing appropriate imaging with the referring physician or the risks/benefits of imaging with the patient. Safety measures for limiting radiation exposure while optimizing image quality are presented, with special attention to the pediatric and pregnant patient, as well as methodology for monitoring individual patient radiation exposure.

CONCLUSION
Prompt communication of significant findings, referring physician and patient education, and mediation of radiation exposure composes the foundation for safe and effective patient care when providing imaging.

LL-INE-WE6B ● Medical School Graduate Interest in Radiology Residency Programs as Depicted by Online Search Tools

Nora M Haney BS ; Stuart D Kinsella BA ; Jose Morey MD (Presenter)

Background
Recent media publications have indicated a marked decrease in specialty positions available to medical school graduates, specifically in the field of radiology. Internet search tools have proven useful in the prediction of certain diseases based on the search volume index (SVI) for a specific term. We hypothesize online search data may be useful in the prediction of unfilled residency positions in radiology. The purpose of this study was to gauge medical school graduate interest in the field of radiology by comparing data from Google Trends and the National Residency Match Program (NRMP).

CONCLUSION
In summary, online search data may be a useful insight into medical school graduate interest in residency specialties and may be predictive of unfilled radiology residency positions and eventual increased shortages of community radiologists.

LL-INE3219-WEB ● Access Path Optimization for Software-assisted Radiofrequency Ablation Planning

Christian Rieder ; Sabrina Haase (Presenter) ; Christian Schumann ; Philipp Suess ; Katrin Teichert ; Karl-Heinz Kuefer ; Tobias Preusser

PURPOSE/AIM
For planning of needle-based ablation therapies, the consideration of multiple criteria is a challenging task. To support the radiologist, a novel software tool to interactively plan the access path of the needle is proposed.

CONTENT ORGANIZATION
The presentation is intended to evaluate the feasibility of novel interaction methods for patient-specific access path planning. This is exemplified on planning of radiofrequency ablation, where criteria such as expected thermal necrosis, distance of possible paths to the extracted risk structures as well as the path length are evaluated based on image processing. The system allows for rapid evaluation of possible trajectories, which fulfill the specified criteria. It determines a set of optimal paths such that an interpolation between these paths yields valid paths too. All valid paths can be interactively explored by selecting target values for the criteria and by interpolating the current path from the pre-computed set of valid paths.

SUMMARY
The proposed methods are integrated into a clinical software assistant. The radiologist may interact with the system by iteratively adapting the target values. A combined visualization of the patient anatomy, the currently selected access path and the expected coagulation necrosis incorporating the heat-sink effects of the surrounding blood vessels is updated in real-time.

LL-INE3223-WEB ● A Vendor and Location Independent Workstation Tool for Case Consultation in Private or in a Cloud Based Environment

Roland S Talanow MD,PhD (Presenter)

Background
Especially general and solo radiologists face often situations in which they are in need for a peer consultation for a difficult case. This becomes not only a workflow issue since time consuming literature research might delay the routine work but also a medical-legal issue if providing potentially an inaccurate report. A solution is desired where radiologists who are in need for a case consultation receive such in a timely and convenient manner.
Evaluation
This tool allows radiologists taking images from the current case study and sending it to a dedicated section in a protected community of over 10,000 Radiology professionals or directly to a specialist's workstation. This community has been used for several years for case consultation and opinions about cases are usually provided within minutes to hours. No installation is needed and thus can be used in an environment with limited user rights. The program design is intuitive and provides options for taking the image from the workstation, a title, short description where a question can be placed and optional case relevant parameters. With one mouse click the case is sent to the community of professionals or directly to a person. Cases can be discussed amongst a group of peers/specialists or in a private consultation - also as realtime chat. This tool provides additional useful features like an integrated Radiology specific search engine, image editing, export options and more.

Discussion
This vendor-independent solution allows exporting cases and taking images directly from the screen and sending them through an intuitive interface to a protected community of Radiology professionals or directly to a specialist's workstation for immediate consultation. This tool can be integrated in other communities, practices or hospitals to provide a quick case consult without the need to purchase expensive software.

CONCLUSION
This free clinical tool for radiologists allows receiving quickly and easily consultations from peers / specialists for their difficult cases. This tool helps especially solo radiologists or radiologists in remote locations improving their workflow and decreasing medical-legal liability by increasing the accuracy of the reports.

LL-INE3180-WEB • Cardiac Computational Anatomy Works (CAWorks): An Integrated Software Tool to Perform Cardiac Shape Analysis

Siama Ardekan MD, PhD; Michael Bowers; Joseph G Hennessy; Saurabh Jain PhD (Presenter); Geoffrey Gunter; Anthony Kolansky PhD; Tilak Ratnanahter; Rai Winslow PhD; Michael J Miller RT*; Laurent Younes

Background
Global metrics such as left ventricular (LV) mass, volume, or ejection fraction are not sufficient to address the complex nature of cardiac remodeling. Here we present a software framework (Computational Anatomy Works) for studying local LV shape features. CAWorks can be used to construct an LV atlas. Local shape features can then be studied by mapping this atlas onto individual cardiac images. By studying the atlas to subject mapping, one can identify quantitative shape differences between diseased and normal hearts, or between two disease states. This software is available via the CardioVascular Research Grid portal (https://portal.cvrgrid.org/).

Evaluation
CAWorks, an extension to the open source visualization tool: ParaView, is a multiplatform software with the following capabilities: 1) Interactive landmark placement to create segmentation (masks) of desired regions of interest; 2) Support for multiple Medical Imaging data formats, such as Nifti and Analyze; 3) Tri or Quadra Planar view depending on the version; 4) Shape Analysis plugin modules, such as the Large Deformation Diffeomorphic Metric Mapping (LDDMM) algorithm. CAWorks has a client-server architecture to facilitate remote visualization and processing and currently being used with computed tomography data.

Discussion
Figure illustrates the CAWorks cardiac landmarking panel. The user uploads images into the CAWorks client and identifies landmarks in the atlas and subject's images. These landmarks will be used to perform an initial rigid mapping followed by an intensity based non-rigid mapping using the LDDMM algorithm. The mapping describes how much regional displacement is required to deform the reference LV geometry to the shape of individual subject's LV geometry. Large displacement indicates large deviation of the subject's LV geometry from the atlas, and can potentially indicate abnormal structure.

CONCLUSION
We presented a software tool that performs quantitative shape analysis of cardiac images. This process is computationally expensive however the software design allows that the mapping process to be conducted remotely therefore eliminating the high cost associated with acquiring and maintaining computer hardware.

Muscloskeletal - Wednesday Posters and Exhibits (12:45pm - 1:15pm)

Wednesday, 12:45 PM - 01:15 PM • Lakeside Learning Center

LL-MKS-WEB • AMA PRA Category 1 Credit ™:0.5

LL-MKS-WE1B • Effect of Intravenous Contrast on Attenuation Measurements of the Lumbar Vertebrae on Clinical CT: Application to Bone Density Assessment

Matthew J Kruse MD (Presenter); Shadpour Demehri MD; John A Carrino MD, MPH*; Stanley S Siegelman MD

PURPOSE
There is increasing interest in the use of clinical CT exams as a tool to assess bone density. Our purpose was to evaluate the effect of intravenous contrast on attenuation measurements in the lumbar vertebrae.

METHOD AND MATERIALS
Subjects were 200 patients (133 male, age 67 ± 11.7, range 30-97) undergoing unenhanced and multiple-phase contrast-enhanced abdominal CT exams (unenhanced, arterial, venous, and delayed acquisitions). The mean attenuation (HU) was recorded using an elliptical ROI placed over the trabecular bone of L1, L2, and L3 in a standardized fashion (central sagittal image of intended vertebrae). Mean attenuation was also measured in a 1 cm diameter ROI within the aorta at the level of the SMA take-off. Corrected vertebral attenuation and aortic attenuation values were calculated by multiplying by an adjustment factor, 250 HU/measured aortic HU (where 250 HU is considered standard attenuation of the arterial phase aorta). The correlation between arterial aorta and lumbar vertebrae attenuation values and the association of patient age/gender with attenuation values was assessed.

RESULTS
The absolute change in vertebral attenuation (compared to unenhanced) was 8 ± 8.6, 19 ± 8.8, and 7 ± 6.9 for the arterial, venous, and delayed acquisitions, respectively. The percent change in vertebral attenuation (compared to the unenhanced) was 8 ± 10.4, 18.7 ± 16.8, and 7.2 ± 9.7 for the arterial, venous, and delayed acquisitions, respectively. The corrected percent change in vertebral attenuation was 7.1 ± 9.8, 16.3 ± 14.8, and 6.2 ± 9 for the arterial, venous, and delayed acquisitions, respectively. Both absolute and percentage change in vertebral attenuation values were poorly correlated with the aortic attenuation value (r= 0.15-0.17). Increased patient age trended toward greater enhancement on delayed phase acquisition (p=0.12, Fisher's Exact Test).

CONCLUSION
Administration of intravenous contrast is associated with only a modest increase in vertebral attenuation independent of attenuation values in the aorta.

CLINICAL RELEVANCE/APPLICATION
Contrast-enhanced clinical CT examinations may be suitable for bone density assessment. Further investigation is needed to fully characterize the effect of contrast on vertebral attenuation values.
**LL-MKS-WE2B • A Comparison of the Diagnostic Accuracy between the Use of Two Different Bone Biopsy Systems**

**Gunnhild E Aandal** MD (Presenter) ; **Ronald D Novak** PhD ; **Salim E Abboud** MD ; **Christos Kosmas** MD ; **Mark R Robbin** MD

**PURPOSE**
Two of the most common bone biopsy systems used in CT guided bone biopsy procedures are Laurane Bone Biopsy Kit and Bonopony Bone Biopsy Kit. In our department, we changed from using the Bonopony system to using the Laurane system in October 2008. The Laurane system was considered by our MSK radiologists to be both technically easier to use and appeared to generate larger osseous sample cores. The purpose of this study was to compare the two systems to determine which provided the best accuracy compared to the final clinical diagnosis.

**METHOD AND MATERIALS**
This retrospective study was a review of bone biopsies performed in which the Laurane Biopsy Kit was used in 88 consecutive patients and the Bonopony Biopsy Kit was used in 93 consecutive patients. The Laurane cohort consisted of 58% females and 42% males with a mean age of 60.8 years (median = 62.4 years). The Bonopony cohort consisted of 64% females and 36% males with a mean age of 62.9 years (median = 64.4 years). All biopsies were core samples from suspected neoplasms. Spine biopsies for evaluation of discitis/osteomyelitis were excluded from this study. Differences in proportions of accurate diagnoses were measured using the Chi-Square differences in proportions test. P-values less than 0.05 were considered to be significant.

**RESULTS**
A comparison of diagnostic accuracy derived from Laurane and Bonopony samples was not found to be statistically significantly different, 87.5%(Laurane) vs 79.6%(Bonopony), p=0.212. Retrospective review of pathology reports showed there was no significant difference in sample quality provided to pathology when the two biopsy systems were compared (p=0.455). Lesion location and prevalence of malignant versus benign disease were also not significantly different between the two patient cohorts.

**CONCLUSION**
The results of this pilot study suggest that there is no statistically significant difference in diagnostic accuracy of core samples derived from osseous lesions using either of the bone biopsy systems. Other factors (cost, availability, convenience, etc.) may be considered in the determination of which bone biopsy system to be used.

**CLINICAL RELEVANCE/APPLICATION**
A comparison of two commercially available bone biopsy systems did not demonstrate significantly different diagnostic accuracy, exeming accuracy as a criterion for either purchase and/or utilization

**LL-MKS-WE4B • Pseudo-chondrosarcomas Following Total Knee Arthroplasty**

**Sahar Shiraj** MD (Presenter) ; **Carl S Winalski** MD * ; **Erika Schneider** PhD * ; **Flavia A Sakamoto** MD ; **Jonathan L Schaffer** MD *

**Hakan Ilaslan** MD

**PURPOSE**
Radiographic change in cartilage tumor calcifications is considered a sign of chondrosarcoma. During total knee arthroplasty (TKA) enchondromas may be disrupted by an intramedullary (IM) guide rod. Our purpose was to describe the expected radiographic changes in enchondromas after TKA.

**METHOD AND MATERIALS**
Medical records search between 2000-2013 identified 214 of 9,167 TKA patients seen at our institution with radiographic reports mentioning enchondroma. Study group had enchondromas in the operated knee while the controls had enchondromas in the non-operated knee. Both groups had pre- and postop radiographs. Tumor size, location (eccentric/central), calcification pattern and changes were judged in consensus by 2 MSK radiologists for preop, early postop and longest followup postop radiographs.

**RESULTS**
Study group was 36 patients (16 men, mean age 72) with 39 enchondromas (31 femur, 8 tibia). 15 controls (6 male, mean age 71) with 15 enchondromas (13 femur, 2 tibia). Mean time (months) between imaging and surgery was: pre-op 3.6; early post-op 1.3; longest followup 28.4. In the study group, 32/39 enchondromas appeared disrupted on early postop images with calcifications appearing more spread out in 18 of 32. Subtle central clearing (5) and partial loss of the calcifications (2) were also seen. Tibial lesions were more often replaced (3) or pushed inferiorly (2) by the component. Median change in calcification length was 0.9cm (max 6.9cm). Of 7 unchanged enchondromas, 3 were eccentric and 3 were so thin that the IM rod likely missed the lesion; in 1 no rod was used. At longer followup, 12/20 showed partial (11) or complete (1) disappearance of calcifications with no change in 8. Control group showed no change in lesion appearance or size.

**CONCLUSION**
Changes in radiographic appearance of enchondroma calcifications commonly occur following TKA surgery when an IM guide rod is used. Longitudinal spreading, subtle central clearing or partial loss of the calcifications are most common. When the changes occur at the time of surgery, they should not be misinterpreted as signs of chondrosarcoma. No long term consequence of surgical disruption of enchondromas was identified.

**CLINICAL RELEVANCE/APPLICATION**
Radiographic changes in femoral and tibial enchondromas after total knee arthroplasty may result from surgical technique. Awareness of this phenomenon may help avoid confusion with malignancy.

**LL-MKS-WE5B • The Value of T2 Color Maps in the Patellar Cartilage Grading Injury**

**Shao Wu Wang** (Presenter) ; **Qian Cui** ; **Yue Dong** ; **Shaowei Zheng** ; **Qingwei Song** BS, BEng

**PURPOSE**
To investigate value of T2 color maps in assessment of patellar cartilage injury grading.

**METHOD AND MATERIALS**
62 patients who underwent knee MR and arthroscopic surgery patients were collected, including 32 males and 30 females, aged 30-51 years, mean 40.7 years. GE Company Signa3.0T MR was used. The scan sequence include: T2WI, FS-FSE-PDWI and T2 mapping. T2 mapping images were sent to the GE-ADW 4.3 workstation to generate T2 color maps of patellar cartilage. Arthroscopic patellar cartilage grading standards, to explore T2 color maps value of the patellar cartilage grading injury.

**RESULTS**

**CONCLUSION**
T2 color maps would be reliable in classification of patellar cartilage damage assessment.

**CLINICAL RELEVANCE/APPLICATION**

**LL-MKS-WE6B • Diagnostic Value of MRI with Diffusion Weighted Images for Evaluation of the Treatment Response of Bone Marrow Lesions, in Patients with Multiple Myeloma (MM)**

**Fabrizio Mazzamurro** MD (Presenter) ; **Francesca Maccioni** MD ; **Carlo De Felice** MD ; **Najwa Al Ansari** MD ; **Pietro Gueris** MD ; **Carlo Catalano** MD

**PURPOSE**
Mapping. Color maps would be reliable in classification of patellar cartilage damage assessment.
The purpose of this study is to define the anatomy of the metacarpophalangeal and interphalangeal joints of the thumb and fingers with high resolution imaging will further ameliorate the radiologist’s understanding of pathologic lesions and injury involving those joints.

**LL-MKE-WE7B • Demystifying Injuries of the Thumb and Fingers: Anatomic Characterization at 11.7T with Demonstration of Commonly Encountered Pathology Using Clinical MR Protocols at 1.5 and 3.0T**

**Cosette M Stahl** DO (Presenter) ; **Eric Y Chang** MD ; **Paul A DiCamillo** MD, PhD ; **Sheronda Statum** ; **Graeme M Bydder** MBChB * ; **Christine B Chung** MD

**PURPOSE/AIM**

The anatomy and structure of the thumb and fingers will be profiled using high resolution MR imaging at 11.7T in human cadaveric donors. Commonly encountered pathologic lesions involving these joints will be depicted with clinical protocols at 1.5 and 3.0T, emphasizing diagnostic criteria.

**CONTENT ORGANIZATION**

The anatomy and structure of the thumb and fingers will be profiled using high resolution MR imaging at 11.7T in human cadaveric donors. Commonly encountered pathologic lesions involving these joints will be depicted with clinical protocols at 1.5 and 3.0T, emphasizing diagnostic criteria.

**SUMMARY**

Review of the complex anatomic structures of the thumb and fingers with high resolution imaging will further ameliorate the radiologist’s understanding of pathologic lesions and injury involving those joints.

**LL-MKE-WE8B • The Spring in Your Step: High Resolution 3T MRI of the Spring Ligament**

**Hythem A Omar** MD ; **Mina F Hanna** MBCh (Presenter) ; **Lena A Omar** MD ; **Daniel S Moore** MD ; **Gina Cho Sims** MD ; **George Liu** ; **Avneesh Chhabra** MD *

**PURPOSE/AIM**

1. Review the normal high resolution 3T MR appearance of the various components of the spring ligament of the ankle, with an emphasis on those components critical to stability 2. Identify/grade the MR appearance of injury to the various components of the spring ligament including frequently associated ligament/tendon injuries and related syndromes 3. Discuss the current treatments of spring ligament injury

**CONTENT ORGANIZATION**

1. High resolution 3T MR imaging of the various components of the spring ligament
   - Sample cases with pointers to help identify normal components
2. MR/intraoperative imaging of spring ligament injury
   - Sample cases
   - Associated ligament/tendon injuries
   - Associated syndromes
3. Treatment algorithm
   - Discussion of which components are most important clinically to our orthopedic/podiatry colleagues

**SUMMARY**

The spring ligament is a complex support structure of the foot and ankle. High resolution 3T MR imaging has enabled superb visualization. Understanding the anatomy and associated injuries/syndromes is critical for the radiologist, as is knowing which components are the most important from a clinical point of view.
The Bethesda System for reporting thyroid cytopathology (2009) created category III: AUS or FLUS, which often requires further invasive testing or surgery. The major teaching points of this educational exhibit are: 1. While uncomplicated cases of primary hyperparathyroidism can be treated with direct surgical exploration without imaging, recurrent/residual disease can be a complex problem to image and treat. 2. Multimodality imaging with dynamic CT, MRI, ultrasound, and/or dual isotope nuclear medicine scintigraphy can help localize ectopic adenomas and multifocal disease. 3. The ability to effectively utilize all these modalities when necessary can help limit surgical exploration, treat recurrent disease, and deal with more complex cases, including secondary hyperparathyroidism.
At our institution, we have been conducting phase I and II studies of super-selective intra-arterial cerebral infusion (SIACI) of bevacizumab (BV) in the setting of recurrent glioblastoma multiforme (GBM). BV is known to reduce vessel permeability, which contributes to changes in enhancement features and potentially confounds the relationship between enhancement and tumor biology. Hence, the ability of conventional MRI to determine tumor response, progression, and post-treatment effects is limited. Here we have begun to evaluate the potential for using dynamic susceptibility contrast imaging (DSC-MRI)-derived maps of relative cerebral blood volume (rCBV) to determine early GBM tumor response to super-selective intra-arterial BV treatment. These rCBVs will then be correlated with tumor progression and patient survival.

**METHOD AND MATERIALS**

Forty adult patients with recurrent WHO grade IV glioma from an ongoing serial Phase I/II study of SIACI of BV were retrospectively studied. BV treatments were performed using a femoral catheter. Functional rCBV maps were obtained within the time frame of a few days prior to and 3-5 weeks after intra-arterial infusion of BV. Functional rCBV maps have been obtained on a GE Advantage Workstation (AW) V4.3 running functools MR perfusion software. Two distinct regions of interest (ROIs) were chosen from the rCBV maps: 1) area of highest rCBV in tumor region and 2) normal appearing white matter (NAWM) in the contralateral side which was used to normalize rCBV maps.

**RESULTS**

Preliminary results from 18 patients in the cohort looking at normalized rCBV have been promising. The median percentage change in normalized rCBV at 1 month post-SIACI BV is -39.9% for patients with survival greater than 100 days post-treatment, -3.6% for patients who survived less than 100 days, and -38.8% overall. Of the 13 patients who remained in the trial without further SIACI treatments, the Pearson correlation coefficient between BV dose and normalized rCBV change at 1 month was -.80 (n = 13, p-value of .001).

**CONCLUSION**


**CLINICAL RELEVANCE/APPLICATION**

By looking at local rCBV changes following intra-arterial bevacizumab treatment, this study aims to gain further insight into predicting glioblastoma tumor response and ultimately patient survival.

**LL-NRS-WE5B • Evaluation of Cerebral Perfusion by Using 3D-arterial Spin Labeling and FLAIR MR Imaging in Patients with Chronic Cerebrovascular Stenosis: A Comparative Study with I-123-Iodoaethamphetamine Single Photon Emission CT**

**Matakazu Furukawa MD (Presenter); Etsushi Iida; Naofumi Matsunaga MD, PhD**

**PURPOSE**

Although arterial spin labeling (ASL) MR imaging is an emerging technique for noninvasive measurement of cerebral blood flow (CBF), intravascular signal (IVS) often complicates the calculation of quantitative CBF. We assessed whether ASL with single post-label delay time and IVS on flat attenuated inversion recovery (FLAIR) image could identify the CBF deficiency in patients with chronic cerebrovascular diseases, using 123I-IMP SPECT as a standard reference.

**METHOD AND MATERIALS**

Fifty-three patients with unilateral (n=35) or bilateral (n=18) cerebrovascular stenosis underwent CBF evaluation by 3D-GRASE ASL (FOV 256 mm, matrix 64 x 64, 32 slices, TR/TE/TI 5,000/16/1,800 msec) and 123I-IMP SPECT within a mean interval of four days (range: 0-28 days). Quantitative CBF and cerebrovascular reserve (CVR) measurement by 123I-IMP-SPECT was used as a standard reference. Side-by-side difference on 3D-ASL and IVS on FLAIR image were evaluated visually by two radiologists, and those were compared with the SPECT findings for the middle cerebral artery (MCA) territory.

**RESULTS**

The agreement between readers for ASL and IVS on FLAIR was strong, with a weighted Kappa value of 0.73 and 0.87, respectively. When a cut-off value of 10% was used in the 123I-IMP-SPECT, 22 of 53 patients showed CBF difference between bilateral MCA territories. On 3D-ASL, 45 patients showed visual CBF difference, and the sensitivity, specificity, diagnostic accuracy of 3D-ASL were 91%, 19%, and 49%, respectively. Although the sensitivity was poor, 16 of 25 false-positive patients on 3D-ASL showed >10% CBF difference on post-acetazolamide 123I-IMP-SPECT, predicting the CVR impairment. IVS on FLAIR image was seen in 19 patients, and the sensitivity, specificity, diagnostic accuracy to rest 123I-IMP-SPECT were 55%, 77%, and 68%, respectively. The specificity and PPV of IVS on FLAIR was both 100% with a sensitivity of 49% to post-acetazolamide 123I-IMP-SPECT.

**CONCLUSION**

Although 3D-ASL MR imaging showed a low specificity, 3D-ASL and IVS on FLAIR imaging would potentially provide valuable information regarding the impaired vasoactivity. ASL perfusion MR imaging showed high sensitivity and would be clinically applicable, especially for a screening of a cerebral hypoperfusion.

**CLINICAL RELEVANCE/APPLICATION**

3D-ASL perfusion MR imaging combined with intravascular signal on FLAIR imaging would be clinically applicable, especially for a screening of chronic cerebral hypoperfusion.

**LL-NRS-WE5B • Evaluating the Optimum MR Based Attenuation Correction Method for F-18 Florbetapir Imaging on Hybrid PET/MR**

**Sebastian R McWilliams MBCh (Presenter); Yi Su PhD; Richard Laforest PhD; Brian Rubin; Jonathan E McConathy MD, PhD; Agus Priatna PhD; Tammie S Benzinger MD, PhD**

**PURPOSE**

MR attenuation correction (MRAC) in hybrid PET/MR imaging poses challenges for accurate quantification. CT attenuation correction (CTAC) provides an approximation of mass attenuation based on tissue density. To assess the accuracy of factory MRAC methods, two methods were compared to CTAC for a series of patients that had PET/CT and PET/MR as part of the cerebral amyloid PET study.

**METHOD AND MATERIALS**

Study patients received a single injection of F-18-Florbetapir imaging on a Biograph mMR scanner with reference PET/CT images acquired on a Biograph 40 PET/CT scanner utilizing the same tracer injection; emission images used for analysis were acquired from 50-70 minutes post-injection. Dixon and UTE-based MRAC were performed on the PET/MR-acquired data and attenuation maps generated. The CTAC attenuation map (mu-map) was co-registered with the MRAC calculated maps. In order to analyze structure dependent variation, segmentation of the cerebral structures was performed using FreeSurfer on T1-weighted MR data and PET emission data. Standardized uptake value ratios (SUVRs) were calculated relative to the cerebellar cortex for MRAC and CTAC data and their correlation assessed with a linear best-fit line.

**RESULTS**

UTE MRAC incorrectly assigned air attenuation coefficients to intracranial structures thus was excluded from analysis. Compared to CTAC, there was a 9.6% underestimation of activities in all regions by Dixon MRAC. The inferior temporal cortex (-18.2%), parietal lobes (-16.3%), and lateral occipital cortex (-14.4%) had the highest percent error. Accuracy improved for deeper structures including the precuneus (-2.6%), thalamus (+1.9%), and cerebellar cortex (-9.6%). The precuneus SUVR was overestimated by 7.8% and the mean cortical SUVR (MCSURV) by 5.3%. The SUVR values were correlated at the precuneus (r=0.95) and for the MCSURV (r=0.97).

**CONCLUSION**

When compared to CTAC-corrected activities and SUVRs, Dixon MRAC generally led to underestimation of values with spatial variation. There was strong correlation of SUVRs between the two methods. Further patients are being analyzed to identify the most accurate
method of MRAC when applied to cerebral amyloid PET/MR imaging.

CLINICAL RELEVANCE/APPLICATION
The optimum MR attenuation correction method for PET/MR is not established in cerebral amyloid PET. Comparison with coregistered CTAC images allows accuracy of different MRAC methods to be assessed.

**LL-NRS-WEBB** • **Therapeutic Effect of Ultrasound-guided Radiofrequency Ablation for Small Recurrent Thyroid Cancers: Comparison with Reoperation**

Ji-Hoon Kim MD (Presenter) ; Chul Ho Sohn MD ; Seung Hong Choi MD, PhD ; Tae Jin Yun MD

PURPOSE
Treatment of small recurrent thyroid cancer is a therapeutic dilemma. The purpose of this retrospective study was to compare the therapeutic effect of radiofrequency ablation (RFA) for small recurrent thyroid cancer with that of reoperation.

METHOD AND MATERIALS
Between February 2008 and November 2011, 101 patients (27 men, 74 women; mean age, 51.3 years) with small recurrent thyroid cancers were included with the following criteria: (1) 3 or fewer recurrent well-differentiated thyroid cancers of 1.5 cm or less in size (2) no recent cancer beyond the target lesion (3) 1 year or more of follow-up. Under the guidance of ultrasound, 32 patients underwent RFA by using RF generator and 18-gauge internally cooled electrodes. In 69 patients, selective neck dissections were generally performed to include all compartments with evidence of disease and the compartments immediately adjacent if they had not previously undergone complete dissection. In addition to clinical and biochemical parameters at initial surgery and final recurrence, clinical and biochemical outcome and procedure-related complications were compared between RFA and reoperation groups with a review of medical records.

RESULTS
With regard to the patients’ demographics, pathologic findings, and method of surgery at initial surgery, there was no significant difference between two groups. At the time of RFA or reoperation for tumor recurrence, the number of previous re-operation, the number, size, location of the recurrent tumors, and serum thyroglobulin showed also no significant difference. During mean 23 months follow-up, the rate of tumor recurrence (6.7% vs. 4.3%) and negative conversion rate of serum thyroglobulin (68.4% vs. 68.3%) were not significantly different between RFA and reoperation groups. However, in contrast to no occurrence in RFA group, post-procedure hypocalcemia occurred exclusively in reoperation group (13.1%). The rate of post-procedure hoarseness (3.3% vs. 7.2%) was not significantly different between RFA and reoperation groups.

CONCLUSION
RFA appears to be an effective and safe alternative option to reoperation for controlling small recurrent thyroid cancers.

CLINICAL RELEVANCE/APPLICATION
For controlling small recurrent thyroid cancers, radiofrequency ablation appears to be an effective and safe alternative option to reoperation.

**LL-NRE-WEBB** • **The Eyes Never Lie: Imaging Manifestations of Systemic Diseases in the Orbits**

Michael Lanfranchi MD (Presenter) ; William A Mehan MD, MBA ; Neel Madan MD * ; Harprit S Bedi MD ; Daniel D Do-Dai MD

PURPOSE/AIM
Our intent is to present the imaging features of a spectrum of systemic diseases that can manifest with abnormal findings in the orbits.

CONTENT ORGANIZATION
(1) The clinical features and systemic manifestations of a spectrum of entities that can involve the orbits will be presented. (2) The diverse orbital imaging appearances of a variety of systemic diseases will be depicted. Cases include sarcoidosis, lymphoma, Mikulicz disease (IgG related chronic dacryoadenitis), Toloso-Hunt Syndrome, neurofibromatosis type I, thyroid orbitopathy, Sjogren’s Syndrome, disseminated aspergillosis, orbital plasmacytoma, and autoimmune optic neuropathy.

SUMMARY
Although often featuring nonspecific imaging findings, a diverse spectrum of systemic diseases with assorted etiologies including infectious, inflammatory, metabolic, congenital, and idiopathic can manifest with abnormal orbital findings on imaging. Radiologists’ familiarity with these diseases may help to establish an accurate diagnosis and facilitate earlier initiation of therapy that could have potential prognostic implications.

**LL-NRE-WEBB** • **MRI Findings in Krabbe Disease Patients Predict Phenotype: Results of the World-wide Krabbe Registry**
Purpose/Aim
The purpose of this exhibit is:
1. To review the initial MRI findings in patients with different phenotypes of Krabbe disease.
2. To learn how to classify different phenotypes based on MRI findings.
3. To be aware how valuable MRI will be in predicting the phenotype in the newborn period to identify patients that will benefit from hematopoietic cell transplantation.

Content Organization
1. Brief introduction about pathophysiology of Krabbe disease.
2. Review of MRI findings in the 5 different phenotypes of Krabbe disease: including early infantile (onset 0-6 months), late infantile (onset 7-12 months), later onset (onset 13 months -10 years), adolescent (onset 11-20 years) and adult (onset >20 years).
3. Identify the characteristic MRI findings of each phenotype.
4. Show sample cases.
5. Focus on Future directions of newborn screening and role of early MRI imaging

Summary
In contrast later onset Krabbe disease will show extensive involvement of parieto-occipital white matter, posterior corpus callosum and posterior internal capsule. Isolated corticospinal tract involvement is a characteristic finding in adult onset disease.

LL-NRE3139-WEB • Predicting the Spread of Glial Tumors: Insights from the Posterior and Retrosplenial Cingulate Cortex (BA 23, 31, 29, and 30)

Jackson D Hamilton MD (Presenter) ; Jill V Hunter MD ; Lakshmi Chavali BS * ; Vinodh A Kumar MD ; Claro Ison MD ; Sujit Prabhu MD ; Komal B Shah MD ; Christiane Matuschek ; Edwin Boelke ; Rivka R Colen MD ; T. Linda Chi MD ; David Schellingerhout MD ; Gregory N Fuller MD, PhD ; L. Anne Hayman MD * ; Ashok J Kumar MD

Purpose/Aim
To describe the common spread pattern behavior of gliomas of the posterior cingulate and retro-cingulate cortex using confocal reconstructions of MR images and Brodmann nomenclature.

Content Organization
Twenty diffuse glioma cases involving the posterior cingulate (Brodmann area [BA] 23 and 31) and 5 cases involving the retro-cingulate cortex (BA 26,29, and 30) were retrospectively analyzed. The posterior cingulate spread pattern follows the white matter pathways with an often discontinuous, sagittal, “double barrel” pattern. This must be differentiated from primary or secondary involvement of the callosal fibers which can rapidly disseminate to the superomedial frontoparietal lobes coronally. In 3 cases, growth of a callosal tumor will cause herniation through the thin callosal isthmus into the ventricles. Retrosplenial tissues can be reached by the spread from the posterior parahippocampus, optic radiations, or the posterior callosus. Functional and neurosurgical importance will be discussed.

Summary
Posterior cingulate gliomas spread via white matter tracts in predictable patterns with clinical ramifications.

Physics - Wednesday Posters and Exhibits (12:45PM - 1:15PM)
Wednesday, 12:45 PM - 01:15 PM • Lakeside Learning Center

LL-PHS-WEB • AMA PRA Category 1 Credit ™: 0.5


David R Veal MD (Presenter) ; Sachin Jambawalikar PhD ; Martin R Prince MD, PhD *

Purpose/Aim
Navigating the literature of magnetic resonance imaging physics and understanding how different pulse sequences are performed can be challenging because the subject is intricate and resources on the topic frequently become technically overwhelming in scope or detail. In addition, the myriad of acronyms across different vendors only add to the confusion. This exhibit provides residents and radiologists an intuitive, step-by-step, and focused understanding of the different types of sequences and how commonly used sequences generate MR images. Key differences between the sequences as related to their clinical application will be reviewed.

Content Organization
1. Review of MR Physics Principles
2. Introduction to the Pulse Sequence Diagram
3. Two Households: Spin Echo versus Gradient Echo
4. Spin Echo Variations
5. Gradient Echo Variations
6. Review and Comparisons
7. Quiz Questions

Summary
Understanding how MRI physics and pulse sequences generate images can become technically overwhelming, and sorting through the various acronyms of pulse sequences can be confusing. This exhibit will provide a more intuitive, step-by-step explanation of commonly used pulse sequences, and review how each of these different sequences are applied clinically.

LL-PHS-W1E1 • Size Specific Dose Estimates in Chest, Abdominal and Pelvis CT: Impact of Z-axis Variations in Patient Size

Shuai Leng PhD (Presenter) ; Maria Shiung ; Xinhui Duan PhD ; Lifeng Yu PhD ; Yi Zhang ; Cynthia H McCollough PhD *

Purpose
To develop software for automatic size specific dose estimates (SSDE) and use it to investigate the impact of z-axis variations in patient size on SSDE in CT exams of the chest, abdomen and pelvis.

To develop software for automatic size specific dose estimates (SSDE) and use it to investigate the impact of z-axis variations in patient size on SSDE in CT exams of the chest, abdomen and pelvis.
METHOD AND MATERIALS
Images from 102 consecutive chest, abdomen and pelvis CT exams were evaluated with a Matlab program developed to calculate SSDE. The program automatically removed the patient table and calculated water equivalent diameter (Dw) at every image position, from which conversion factors were calculated using AAPM Report 204. SSDE was calculated in two ways and compared: Method 1: SSDE at each position was calculated based on Dw and CTDIvol at the corresponding image position, and mean SSDE over the scan range calculated. Method 2: Mean CTDIvol over the scan range was used with the conversion factor corresponding to Dw at the middle of the scan range.

RESULTS
A range of body sizes were included, with weight ranging from 36.9 to 183.1 kg and BMI from 14.7 to 56.6. The average difference between maximal Dw and minimal Dw was 5.2, 4.9, 2.5, 5.6 and 6.5 cm within a chest, abdomen, pelvis, AP, or CAP exam, respectively (maximum difference in any scan was 10.8 cm). The standard deviation of Dw values within each patients’ scan range was, on average, 1.4, 1.3, 0.8, 1.4 and 2.0 cm. The root mean square difference between the two groups of SSDE values was 0.9, 0.5, 0.5, 1.0, and 1.1 mGy for the 5 types of exams.

CONCLUSION
For chest, abdomen and pelvis CT exams, the difference was very small between the mean SSDE values calculated using 1) the mean CTDIvol over the scan range and Dw at the middle of the scan range and 2) the CTDIvol and Dw at each position in the scan range. Although patient size varies in the longitudinal direction, Dw at the middle of scan range was adequately representative of the overall patient attenuation in the scan range.

CLINICAL RELEVANCE/APPLICATION
SSDE can be calculated based on mean CTDIvol and Dw at the middle of the scan range, which is easier to implement compared to calculating SSDE for each individual image.

LL-PHS-WE2B • A Photon-counting Silicon Strip Detector for Spectral-resolved Computed Tomography
Ben Huber (Presenter); Hans Bornefalk MS; Han Chen; Mats Danielsson PhD *; Staffan Karlsson; Xuejin Liu; Mats Persson *; Cheng Xu

PURPOSE
Spectral-resolved computed tomography (spectral CT) aims to complement conventional morphological CT imaging by additionally accessing spectral attenuation properties of the scanned object. One of the important benefits of a clinical application of spectral CT could be the quantification of different material compositions in the object, e.g. tissue and contrast-filled vessels.

METHOD AND MATERIALS
We have constructed a photon-counting silicon strip detector for spectral CT that enables energy-discrimination of incident X-ray photons with up to eight programmable energy thresholds. The edge-on geometry of the detector provides sub-millimeter pixel sizes and is optimized in order to obtain a high detection efficiency for typical CT X-ray spectra. The X-ray-induced pulses are read out with a dedicated ultra-fast application specific integrated circuit (ASIC) designed to cope with very high count rates, as they are expected in CT applications.

Making use of a first prototype detector, we evaluate the detector performance with respect to energy resolution, gain, charge collection efficiency and homogeneity of energy thresholds among the individual pixels.

In spectral CT, a homogenous distribution of energy thresholds across the different detector elements is crucial in order to avoid images that suffer from ring artefacts.

RESULTS
We will present the current status of our silicon strip detector for spectral CT and will discuss its performance in clinical CT environments. With the aid of synchrotron sources we have measured the energy resolution and gain, and we have characterized the dispersion of energy thresholds among different detector elements. Furthermore, we have evaluated the detector’s count rate performance and the its charge collection efficiency.

CONCLUSION
We have developed a silicon strip detector for spectral CT applications, ready to be used in more advanced studies pointing towards clinical applications. The detector modules described here will be utilized in a full state-of-art CT gantry.

CLINICAL RELEVANCE/APPLICATION
One of the important benefits of a clinical application of spectral CT could be the quantification of different material compositions in the object, e.g. tissue and contrast-filled vessels.

LL-PHS-WE3B • The T2 of Water in the Human Liver Changes with Age and Adiposity
Ronald Ouwerkerk PhD (Presenter); Ahmed M Gharib MBChB; Roderic I Pettigrew MD, PhD

PURPOSE
To investigate changes in the liver with adiposity and age in normal and obese subjects.

METHOD AND MATERIALS
In 22 normal and 28 obese subjects (age 39±15, 19-64y., 16 male, BMI 34±9, 20-55 kg.m-2 obese is BMI> 30) without known liver disease, the T2 corrected fat fraction (ff) was determined with single volume MR spectroscopy. A set of six breath-hold PRESS acquisitions were obtained from a 2x2x2cm volume in the liver, each averaging two signals at 3s repetition time after one dummy scan. The TE of the sequences was varied from 24 to 144 ms and the T2 was determined within each subject.

RESULTS
The T2 of liver water decreases with fat fraction and also with age. The decrease of T2 with age also correlated significantly in a subgroup of thirty six subjects with fat fractions < 5% (water T2 = 35.5 - 0.063 * age, r2=0.19, p = 0.03), whereas no correlation was found between fat fraction and age.

CONCLUSION
The changes in T2 indicate that the molecular environment of water changes in the ageing liver. The T2 decrease observed in the liver is likely related to an increase in iron content in the liver accumulating over the years. The decrease in the T2 of liver water with increasing fat fraction could also be due to diminishing liver function, or just to a decrease in aqueous space as a result of increases in lipid space.

CLINICAL RELEVANCE/APPLICATION
Age related changes in the hepatic cellular environment are likely related to iron accumulation over the years.

LL-PHS-WE4B • Development of a New Device with an X-ray Phase Contrast Imaging Technology: Preliminary Study on Knee
Development of a New Device with an X-ray Phase Contrast Imaging Technology: Preliminary Study on Knee

LL-PHS-WE4B
Mammography

**RESULTS**

1) Both bivariate analysis of dose and fraction of tumor voxels less than 10 torr (HF10) and Kaplan-Meier analysis of control of tumors by radiation showed significant differences between hypoxic and well oxygenated tumors. 2) BNP3 KO tumors show remarkable hypoxia, and HIF2a partial knock out mice. (Single gene copy knock out).

**CONCLUSION**

This presentation will highlight results in animal models of the ability of pO$_2$ imaging with electron paramagnetic resonance (EPR) O$_2$ imaging to predict therapy outcome.

**METHOD AND MATERIALS**

Examples were drawn from cancer biology and sleep apnea models. 1) EPR O$_2$ images were obtained from two different syngeneic tumor types in C3H mice, FSa fibrosarcomas grown intramuscularly and MCa4 breast carcinomas grown subcutaneously. Mice were then given single radiation doses at or near their 50% control dose (TC50) and followed for 90 and 120 days respectively. 2) BNIP3 promotes mitochondrial autophagy and maintenance of tissue/tumor oxygenation. Tumor BNIP3 knock outs (KO) were imaged in C3H mice and compared with WT tumors. 3) C57 black mice were subjected to alternating atmospheres of 21% and 12% fraction of inhaled oxygen (FIO$_2$) for each cycle phase. It was noted that during the cycle phase with the lower fraction of inhaled oxygen the animals showed a blunted response. We anticipate similar experiments will be obtained from HIF1a and HIF2a partial knock out mice. (Single gene copy knock out).

**CONCLUSION**

Combination of O$_2$ image accuracy, non-invasiveness, rapid image acquisition, whole tumor/animal survey make this technology uniquely useful for a Preclinical Electron Paramagnetic Resonance Oxygen Imager.
important for therapy assessment.
This work is supported by NIH, grants number P41 EB002034 and R01 CA98575 (Chicago).

CLINICAL RELEVANCE/APPLICATION
Local pO₂ determines the effects of disease/therapy in a large fraction of diseases. pO₂ imaging determines early effects of pharmaceutical/therapeutic intervention on disease amelioration.

LL-PHS-WEB7 • Comparison of Organ Dose for Patients with Varied Sizes undergoing Abdomen Pelvis CT Exam Using Patient-Specific Monte Carlo Simulation Coupled with Computational Human Phantoms

Jennifer Siegel MD, MPH (Presenter); Choonsik Lee PhD; Mark P Supanich PhD *

PURPOSE
To compare organ doses specific to real patients with a range of body sizes undergoing abdomen pelvis (AP) computed tomography (CT) examinations by using computational human phantom-based Monte Carlo simulation.

METHOD AND MATERIALS
48 adult patients, meeting defined size and gender criteria, undergoing AP exam using automatic exposure control on any of four units in a community hospital, were randomly selected retrospectively using a commercial dose audit tool, eXposure (Radimetrics Inc., Toronto, ON). Technical parameters (e.g., CTDIvol, kVp, scan range) were abstracted from the CT images and utilized for organ dose calculation. We used an organ library which was pre-calculated by using Monte Carlo transported simulation coupled with a series of hybrid computational human phantoms with different sizes. We compared the organ doses from different sized patients and observed the degree of organ dose difference.

RESULTS
Absorbed dose to a total of 14 organs were calculated for each patient using the abstracted parameters from the CT images. The patient of the highest BMI received up to 6.6 (active marrow), 5.6 (kidney), 5.6 (urinary bladder) times greater dose than the patient with the lowest BMI. Liver dose was least sensitive to the body size where the highest BMI patient received 2.6 times greater dose than the lowest BMI.

CONCLUSION
The study revealed that the high BMI adult patient may receive up to 5-6 times greater organ dose than the low BMI patient in AP CT exams.

CLINICAL RELEVANCE/APPLICATION
Larger patients undergoing AP CT using AEC may receive higher organ doses than smaller patients according to this method of calculation.

LL-PHS-WEB8 • Automated Measurement of Mandibular Cortical Width on Dental Panoramic Radiographs for Early Detection of Osteoporosis: Improvement on Measurement Location

Kazuki Horiba ; Chisako Muramatsu PhD ; Akitoshi Katsumata DDS, PhD (Presenter) ; Tatsumasa Fukui ; Takeshi Hara PhD ; Hiroshi Fujita PhD

PURPOSE
It has been suggested that mandibular cortical width (MCW) on a dental panoramic radiograph (DPR) is significantly correlated with bone mineral density. Automated measurement of MCW on DPRs, which are obtained for dental purposes, may be useful for identifying asymptomatic patients with osteoporosis so that dentists can suggest further examination. In our previous study, one of the reasons for incorrect measurement was due to suboptimal measurement locations. The purpose of this study is to improve our scheme by adjusting measurement locations by variance analysis.

METHOD AND MATERIALS
Our database consists of 100 DPRs obtained from 27 osteoporotic and 73 control patients. First, potential lower mandible edges are detected by modified Canny edge detector. On the basis of the edge information, a most similar contour model is selected from reference data and is fitted to the test case by using an active contour model. In our previous study, the reference mental foramina positions of the model were employed as the right and left MCW measurement locations. By the profile analysis, 21 measurements were made around each location along the contour. However, even when the model is well fitted, the measurement locations on test cases may be shifted from mental foramina. In addition, measurements can sometimes be affected by noise. In this study, measurements are made in a wider range, and most reliable locations are selected on the basis of the variance.

RESULTS
By our previous method, the sensitivity and the specificity were 89% (24/27) and 95% (69/73), respectively. By the proposed method, the sensitivity and the specificity were both improved to 96% (26/27) and 96% (70/73), respectively.

CONCLUSION
The proposed method can be effective in improving MCW measurement by selecting reliable measurement locations. High sensitivity and specificity indicate a potential usefulness of our automated quantification scheme for early detection of osteoporosis.

CLINICAL RELEVANCE/APPLICATION
Detecting a possible risk for osteoporosis on dental panoramic radiograph can be a supplemental screening for osteoporosis with no cost.

LL-PHS-WEB9 • Methodology For Robust MRI Simulations with a Dedicated MRI Scanner In Radiation Oncology

Eric Paulson (Presenter)

ABSTRACT
Purpose/Objective(s): The use of MRI in radiation oncology is expanding rapidly, and more clinics are considering whether to add a dedicated MRI scanner within their department. However, several issues specific to radiation oncology, if not properly addressed, can compromise the utility of MRI for radiation treatment planning. The goal of this work is to report our approach for robust MRI simulations.

Materials/Methods: A dedicated large bore (70cm) Siemens 3T MRI scanner was installed in our department in 2008. Since then, roughly 750 patients with brain, head and neck, breast, lung, pancreas, liver, prostate, cervix, or sarcoma cancers have undergone MRI simulations for radiation treatment planning. MRI simulation immediately followed CT simulation. Patients were setup in treatment position, by radiation therapists, on an MR-optimal G9 fiberglass flat table insert interfaced to the spine array coil. Flexible phased array injections of glucagon before and midway through the MRI simulation exam. Conventional and dynamic contrast abdominal images were acquired using respiratory gating and breath holds, respectively, both performed at end-expiration. Gradient nonlinearity-induced geometric distortion was minimized by positioning the imaging volume isocentrically within the magnet and by applying vendor-provided 3D distortion correction following image reconstruction. A lookup table relating site-specific applications for each MR image contrast was created to guide Radiation Oncologists during contouring.

Results: The combination of a large bore, high field strength, and circumferentially wrapped, flexible phased array receive coils permitted acquisition of thin slice images with high signal-to-noise ratio and image intensity uniformity, while simultaneously accommodating patient setup and immobilization devices. Residual geometric distortion following 3D distortion correction was found to exist for large field of view and/or slice prescriptions. However, the magnitude of the residual distortion was estimated to be less than 2mm.

Conclusions: We have developed and successfully implemented a robust MRI simulation program using a dedicated MRI scanner. The methodology described herein is critical for the acquisition of high fidelity MR images suitable for radiation treatment planning. Our
ABSTRACT
Introduction and Objectives
Total body irradiation (TBI) is used for conditioning of bone marrow transplantation (BMT). Modern equipment and development of new treatment techniques allow to deliver and homogeneous dose and to protect organs at risk of toxicity with low rate of complications. The objective of this study is to assess technical treatment and toxicity in patients treated with TBI for BMT.

Patients and Methods
Between September 2007 and July 2012 thirty five patients (pts) were treated, 13 women and 22 men, mean age 21.9 years (2.8-50.4) diagnosed with acute lymphatic leukemia 28 pts, 5 pts acute myeloid leukemia and non-Hodgkin lymphoma 2 pts. Two linear accelerators were used, Primus (Siemens) and SL15 (Elekta) with 3.5 Gy/hour dose rate and total dose of 12 Gy in 6 applications over 3 days. The dose delivered was confirmed and adjusted with in vivo dosimetry. Pulmonary protection was set at 9 Gy. Two TBI techniques are available: the fist one uses anteroposterior 6MV photons; in this case the patient is positioned in lateral decubitus and 1Gy by each side is delivered. The second modality is lateral irradiation with 10MV photons, for which the patient is placed in dorsal decubitus and 2 Gy are delivered from left side in the morning, and 2 Gy from the right in the afternoon. Acute toxicity related to treatment according international criteria for adverse events (CTCAEV4.0) was evaluated.

Results
Of 35 patients treated, 26 had acute toxicity related to TBI. Of these, 19 patients were Grade 1: nausea 10, vomiting 5, headache 5, asthenia 10, parotitis 2, erythema 1. Toxicity Grade 2 occurred in 8 patients: 5 nausea and 3 vomiting. There was not Grade 3-4 toxicity or treatment interruptions.

Conclusions
Theses fractionation and techniques for TBI are safe, reproducible, with acceptable tolerance in patients who should receive BMT.

Keywords: TBI, BMT

LL-ROS-WEB3B • Whole Body MRI with Diffusion Imaging Compared to FDG-PET-CT in the Post-treatment Setting: The Restaging of Recurrent Lymphoma

Alessandro Stecco MD (Presenter); Mariangela Lombardi; Alberto Santagostino; Francesco Buemi MD; Marco Perchinunno; Gianmauro Sacchetti; Alessandro Carriero MD

PURPOSE
The purpose of this study is to compare whole-body MRI, using diffusion weighted imaging (WB-DWI-MRI), with 18F-FDG-PET/CT in evaluating recurrence in patients previously treated for lymphoma.

METHOD AND MATERIALS
We enrolled 30 patients in follow-up for lymphoma suspected of recurrence. All patients underwent 18F-FDG-PET/CT (PET-CT) and WB-DW-MRI. Histopathology findings or 6-month clinical and radiological follow-up served as the gold standard.

RESULTS
WB-DW-MRI found 19 cases of recurrent disease, while PET-CT found 13. Staging by mean of WB-DW-MRI showed a better agreement with the Standard of Reference than PET-CT. The latter showed, on a "by patient" basis, 100% sensitivity, 62% specificity, 85% diagnostic accuracy, 100% (2.96-0.96, CI 95%) PPV (positive predictive value) and 50% (0.84-0.15, CI 95%) NPV (negative predictive value), while WB-DW-MRI showed 89% sensitivity, 100% specificity, 90% diagnostic accuracy and 94% (1.04-0.83, CI 95%) PPV and 100% (2.96-0.96, CI 95%). There were no statistically significant differences between the two techniques, although with a 'borderline' p-value (p=0.06).

Among discordant sites, on neck nodal sites, WB-DW-MRI showed a better specificity and the same diagnostic accuracy with respect to PET-CT, which displayed superior sensitivity. WB-DW-MRI also showed a better specificity and accuracy at retroperitoneal sites, while showed less sensitivity and better specificity than PET-CT for bone marrow evaluation.

CONCLUSION
WB-DW-MRI has a diagnostic value in restaging follow-up of lymphoma; in some specific anatomic districts outperforms the diagnostic accuracy of PET-CT.

CLINICAL RELEVANCE/APPLICATION
Whole Body MR with Diffusion can be indicated in follow-up after therapy in detecting recurrence of lymphoma's disease

LL-ROS-WE4B • Volumetric Modulated Arc Therapy More Adequately Covers Levels One and Two of the Axilla than Standard Tangential Breast Fields in Early Breast Cancer Patients Following Conservative Surgery with Positive Sentinel Node Biopsy

Raef S Awad, MBBS, FRANZCR (Presenter); April Wong, MBBS; Nicole Dougheney; Lauren Haydu; Gerald Fogarty, MBBS, FRANZCR

PURPOSE
Z0011 study states that women with low volume sentinel lymph node (SLN) positive disease from low risk primaries in the breast do not need axillary lymph node dissection (ALND). It is assumed that all left over axillary disease is treated in tangential whole breast radiotherapy (TWBRT) in conjunction with the planned systemic therapy; however, details about the radiation therapy techniques used were not reported. We hypothesize that breast volumetric modulated arc therapy (VMAT) can provide more adequate axillary coverage with comparable doses to organs at risk than TWBRT.

METHOD AND MATERIALS
Ten consecutive patients with early stage breast cancer treated with TWBRT were selected for this dosimetric analysis. A planning CT was obtained for each patient. CTV breast was defined to be the entire breast as delineated on the CT data set. CTV ipsilateral axillary level one and two were defined with reference to the RTOG breast cancer atlas. No PTVs were generated. Right and left lungs, heart, and surrounding soft tissue were delineated for each patient as organs at risk. For TWBRT, beams-eye-view (BEV) display was used to design the optimal standard tangential beams. VMAT plans to cover breast and ipsilateral axilla were generated using 2 arcs. The and surrounding soft tissue were delineated for each patient as organs at risk. For TWBRT, beams-eye-view (BEV) display was used to

...
design the optimal standard tangential beams. VMAT plans to cover breast and ipsilateral axilla were generated using 2 arcs. The prescription dose for both TWBRT and VMAT plans was 46 Gy/23 fractions prescribed to the isocenter, which was placed near the center of the breast. Isodose distributions and DVHs were compared.

RESULTS
Significant improvement in the doses to ipsilateral axillary level one and two nodes was achieved using VMAT compared with TWBRT. VMAT D95 axilla (dose to 95% volume) was significantly greater than TWBRT D95 axilla, 42 Gy and 1.25 Gy, respectively, (p=0.005). The percentage volume of the ipsilateral lung, total lung, and heart receiving 5 Gy was significantly higher for VMAT compared with TWBRT (p<0.005). However, the percentage volume of the ipsilateral lung, total lung and heart receiving 20 Gy, 20 Gy and 25 Gy, respectively, was not significantly different between both techniques.

CONCLUSION
VMAT provides adequate coverage of breast and axillary level one and two nodes with comparable significant doses to risk organs in patients with early breast cancer with positive SLN with no ALND. Standard TWBRT does not.

CLINICAL RELEVANCE/APPLICATION
Until longer follow up update of Z0011 trial, VMAT is quite feasible and easy radiation technique to ensure adequate coverage of breast and axill.

**LL-ROS-WE5B • Study of Puncture Needle Artifacts Reduction Using Spectral CT Imaging during CT-guided Radioactive Seed 125I Implantation**

Rui Gang Huang; Qinglong Shen (Presenter); Huijun Xiao; Weihua Lin

PURPOSE
To explore the clinical value of puncture needle artifacts reduction using spectral CT Imaging during CT guided radioactive seed 125I implantation in treatment of cancer.

METHOD AND MATERIALS
7 patients referred to CT guided radioactive seed 125I implantation(6 cases of liver and 1 case of lung)underwent GSI examinations using Discovery CT750 HD scanner.During the process of implantation,traditional CT scans were performed for comparision. All data were transferred to Workstation (AW4.5, GE Healthcare) to obtain 11 sets of monochromatic images (40-140keV, interval of 10keV). The CT value and variations were measured in the area with and without the most significant artifact while the background noise was measured in abdominal subcutaneous adipose tissue. The artifact index (AI) of the regions of interest is defined as the square root of the squared noise difference between the region with and without artifact of the same tissue. All the measurements were recorded and statistically compared.

RESULTS

CONCLUSION
Spectral CT showed its potential applications in monitoring disease progressions after 125I radioactive particles implantation.

**LL-ROS-WE6B • Feasibility and Efficacy of Radiotherapy for Patients 80 Years Old or Older with Esophageal Cancer**

Kazuya Inoue; Tetsuro Tamamoto (Presenter); Emiko Katayama MD; Isao Asakawa; Masatoshi Hasegawa

Vascular/Interventional - Wednesday Posters and Exhibits (12:45pm - 1:15pm)

Wednesday, 12:45 PM - 01:15 PM • Lakeside Learning Center

**LL-VIS-WEB • AMA PRA Category 1 Credit™:0.5**

**LL-VIS-WE1B • Multidetector CT or MR Angiography before Endovascular Peripheral Arterial Intervention?**

Vittorio Semeraro MD (Presenter); Alessandro Cina MD; Carmine Di Stasi MD; Riccardo Marano MD; Roberto Iezzi MD; Lorenzo Bonomo MD; Luigi Natale MD

PURPOSE
Multidetector CT angiography (MDCTA) and MR angiography (MRA) are described as accurate techniques for the assessment of significant stenoses and obstructions and for selecting patients with peripheral arterial disease for surgical and endovascular treatment. Until now no studies have compared MDCTA and MRA in the same population regarding the evaluation of peripheral arteries. Aside from known contraindication to MDCTA and MRA no evidence-based indications are available for patients suitable for both techniques. Purpose of this study was to compare MDCTA and MRA in selecting patients for peripheral endovascular intervention

METHOD AND MATERIALS
We compared MDCTA (16 slices scanner) and MRA (1.5 T scanner; 3D gadolinium-enhanced three station bolus chase acquisition plus time resolved acquisition on calves and feet) in 35 patients (Fontaine II-IV) candidates to endovascular treatment to stratify patients according to the TASCII score and to a run-off severity score. We evaluated also the accuracy of techniques to identify the degree of involvement of each arterial segment. Selective angiography performed during the treatment was employed as standard of reference

RESULTS
330 segments and 35 limbs were available for comparative evaluation. MDCTA and MRA resulted both accurate to classify patients according to TASC score in aorto-iliac (accuracy 0.92 for MDCTA and MRA) and femoro-popliteal (MDCTA 0.94 MRA 0.90) districts. MDCTA was founded to be more accurate to stratify infrapopliteal districts according to the runoff severity score (0.96 vs 0.9) and to assess the impairment of runoff arteries (0.94 vs 0.88) at per-segment analysis. MDCTA showed a higher diagnostic reliability than MRA and a lower examination time

CONCLUSION
Our result could suggest MDCTA technique could be the preferred procedure when clinical history or duplex sonographic evaluation are indicative of severe impairment of the infrapopliteal district

CLINICAL RELEVANCE/APPLICATION
Comparison between Angio CT and Angio MR to evaluate lower limbs.

**LL-VIS-WE2B • Clinical Value of Lower Extremity Arterial Imaging Using 80 kVp and Automatic Tube Current Modulation Technique Compared with Traditional 120kVp Scan**

Ying Guo MD (Presenter); Dapeng Shi MD; Ying Hui Ge MD, PhD

PURPOSE
The purpose of this study was to evaluate the image quality and radiation dose of lower extremity arterial imaging using 80kVp with automatic tube current modulation technique compared with traditional 120 kVp scan.
METHOD AND MATERIALS

60 consecutive outpatients with lower extremity occlusive disease performed 64-slices CT scan were randomly divided into 2 groups. The first group (group1, n=30) used standard 120kVp with automatic tube current modulation(NI=10), and the second (group2, n=30) used 80kVp with automatic tube current modulation(NI=10). We selected the observing levels at pelvic, knee, calf and foot levels for noise measurement and image quality assessment with a 3-point scale. Paired analysis was performed on radiation dose, image quality, and image noise using t-test.

RESULTS

CONCLUSION

Using low kvp with automatic tube current modulation for lower extremity arterial scanning can reduce radiation dose by13.42% compared with 120kVp and artery signal intensity can be increased by 53.55% at the foot level.

CLINICAL RELEVANCE/APPLICATION

Radiation dose can be reduced and lower extremity arterial image can be improved by scan with optimized scan protocol of 80kVp.

LL-VIS-WE3B  •  Detailed CTA Study of 60 Superficial Femoral Artery Occlusions: Can Morphological Quantitative Analysis Lead to a New Classification?

Mickael Ohana MD, MSc (Presenter) ; Soraya El Ghannudi-Abdo MD ; Elie Girswowicz ; Nabil Chakfe MD, PhD ; Catherine Roy MD

PURPOSE

TASC II actual classification of superficial femoral artery (SFA) occlusions is limited to length and calcifications analysis on 2D angiograms. State-of-the-art computed tomography angiography (CTA) provides much more information than traditional invasive angiography: detailed quantitative morphological analysis of CTA could be the basis of a refined classification.

METHOD AND MATERIALS

46 patients (65% men, 68yo ± 11,6) totaling 60 SFA occlusions were retrospectively included. Presence of a SFA occlusion was the only inclusion criterion.

For each pathological artery, curved multiplanar reconstructions following the occluded SFA course were used to measure the total length and the mean diameter of the occluded segment. Color-coded map provided an accurate estimation of calcifications’ volume among the occluded segment.

RESULTS

SFA occlusion was complete in 39% of cases. Mean occluded segment length was 219mm ±107 (14-530mm); mean occluded segment diameter was 6.1mm ±1.6 (3.4-10mm); mean calcifications’ volume in the occluded segment was 1265mm ³ ± 1893 (0-8815mm ³), corresponding to a percentage of 17.4% ±20 (0-88.7%).

Defining a cutoff between small or preserved caliber at 5mm and between low or heavily calcified occlusions at 4% allowed the distinction of 4 groups: heavily calcified occlusions of normal caliber (56%), low calcified occlusions of preserved caliber (19%), low calcified occlusions of small caliber (15%) and heavily calcified occlusions of small caliber (10%). Proportions of these 4 groups were roughly the same regardless of TASC II classification.

CONCLUSION

TASC II classification is inadequate for SFA occlusions: quantitative CTA analysis with measurement of mean occluded diameter and percentage of calcifications can refine it. This could be particularly useful in the management of TASC II type D lesions, as new endovascular revascularization techniques are arising, and this CTA-based morphological classification could provide support in choosing between them.

CLINICAL RELEVANCE/APPLICATION

Not all SFA occlusions are the same: this morphological CTA study points out TASC II classification weaknesses and could be the basis of a more precise patient management.

LL-VIS-WE4B  •  Evaluation of Patients after Sclerotherapy for Venous Malformation Using MRI

Sebastien Bommart MD (Presenter) ; Helene Vernhet-Kovacsik MD, PhD ; Valerie Monnin-Bares ; Hamid Zarqane

PURPOSE

To define which MRI data correlate best with the clinical outcome of patients after sclerotherapy for peripheral venous malformations.

METHOD AND MATERIALS

DESIGN: Retrospective analysis of a confined cases. SETTING: Series of cases in a French medical center. SAMPLE: Thirty five patients during 76 sessions were treated with Aetoxysclerol 3% mixed with contrast media and air as a foam with a ratio 60/10/30: from January 2010 to December 2012. All patients had MRI before and one month after completion of the treatment. MRI protocol includes STIR sequences. MAIN OUTCOME MEASURES: Data studied on MRI examination were: size of the malformation on the STIR sequence (3 largest diameters) and % of enhancement on T1 sequences. A correlation was searched for between MRI data and clinical result. MAIN OUTCOME MEASURES: Data studied on each examination were: size of the malformation on the STIR sequence (3 largest diameters) and % of enhancement on T1 sequences. A correlation was searched for between MRI data and clinical result. MAIN OUTCOME MEASURES: Data studied on each examination were: size of the malformation on the STIR sequence (3 largest diameters) and % of enhancement on T1 sequences. A correlation was searched for between MRI data and clinical result.

RESULTS

Clinical results were scored 0 (n=1) 2 (n=2) 3 (n=18) and 4 (n=12). MRI: decrease of the largest diameter was 75% n=11). All patients with a decrease of enhancement >75% had a clinical score at 4 .

CONCLUSION

The percentage of decrease of enhancement on T1 fat sat sequence is reflects the best the clinical outcome after sclerotherapy for venous malformations.

CLINICAL RELEVANCE/APPLICATION

MRI evaluation of venous malformation after sclerotherapy should include T1 weighted sequences with fat saturation before and after injection of gadolinium.

LL-VIS-WE5B  •  Removal of the Grid during Routine Biliary Interventional Procedures Performed in a Flat Panel Interventional Suite: Preliminary Data on Image Quality and Patient Radiation Exposure

Kelvin Cortis MD, MRCS, FRCR (Presenter) ; Roberto Miraglia MD ; Luigi Maruzzelli MD ; Roberta Gerasia ; Corrado Tafaro ; Angelo Luca MD

PURPOSE

To determine whether grid removal during routine biliary interventional procedures performed in a flat panel intervention suite results in adequate image quality and in a significant reduction of the patient radiation exposure.

METHOD AND MATERIALS

Routine biliary interventional procedures were defined as those in which absence of fine image detail during fluoroscopy carries no
Since the discovery of the x-ray almost 120 years ago, musculoskeletal imaging, like all of radiology, has evolved. As new technologies also address the evaluation of articular cartilage.

They will also understand new approaches to image orthopaedic implants using computed tomography and magnetic resonance imaging. They will also appreciate the importance of newer approaches to the evaluation of articular cartilage.

At the end of this presentation, participants should have a better appreciation of challenges facing conventional radiography. They should also understand new approaches to image orthopaedic implants using computed tomography and magnetic resonance imaging. They will also appreciate the importance of newer approaches to the evaluation of articular cartilage.

**LEARNING OBJECTIVES**

- Participants should have a better appreciation of challenges facing conventional radiography.
- They should also understand new approaches to image orthopaedic implants using computed tomography and magnetic resonance imaging.
- They will also appreciate the importance of newer approaches to the evaluation of articular cartilage.

**ABSTRACT**

Since the discovery of the x-ray almost 120 years ago, musculoskeletal imaging, like all of radiology, has evolved. As new technologies were introduced and their roles delineated, most imaging modalities were employed in musculoskeletal imaging, at least temporarily. Many of the currently popular and important technologies are of relatively recent origin, whereas others have been important in musculoskeletal
imaging since the beginning of radiology, and still others have been abandoned. Because of its central importance in musculoskeletal imaging, the role of conventional radiography and some of the challenges it faces will be presented. Recent and ongoing work has focused on the cross-sectional imaging of orthopaedic implants and on decreasing imaging artifacts arising from these implants. Efforts to improve imaging of these implants with both CT and MRI will be discussed. This presentation will also focus on the imaging of articular cartilage and on efforts to apply information about the health of articular cartilage in ongoing research in osteoarthritis.

Case-based Review of US (An Interactive Session)

Wednesday, 01:30 PM - 03:00 PM • S406A

MSCU41A • Contrast-enhanced Ultrasound of the Liver

**Stephanie R Wilson** MD (Presenter) *

**LEARNING OBJECTIVES**

Attendees will recognize the importance of washout and the timing washout on contrast enhanced ultrasound of the liver allowing for the differentiation of malignant and benign liver masses and differentiation of hepatocyte based malignancy from others.

MSCU41B • Transplant Ultrasound of the Liver, Pancreas and Kidney

**Myron A Pozniak** MD (Presenter) *

**LEARNING OBJECTIVES**

1) Several challenging cases of transplant dysfunction will be presented. They will focus on the role of Doppler Ultrasound in making a quick confident diagnosis.

MSCU41C • Peripheral Vascular Ultrasound

**Laurence Needleman** MD (Presenter)

**LEARNING OBJECTIVES**

1) Apply the natural history of abdominal aortic aneurysms to proper reporting of AAA size. 2) Apply the hemodynamics of stenosis to minimizing false positive results. 3) Analyze duplex Doppler of venous disease and apply this knowledge to protocol development, patient management/safety, and cost. 4) Identify the application of pathologic, and physiologic principles to plaque characterization and thrombus aging and clinical significance. 5) Analyze the surgical procedures for common vascular processes to protocol development and interpretation of mapping and post procedural examinations.

**ABSTRACT**

Duplex Doppler of the peripheral vascular system requires an understanding of how the hemodynamics of normal circulations and of abnormal conditions appear. Duplex interpretation requires integration of gray scale sonography, color Doppler and spectral (waveform) analysis. Some examinations requires more or less of one modality (e.g. lower extremity venous exams are mostly gray scale noncompression and compression scans) while some are more equal (e.g. carotid or upper extremity scans). Understanding the hemodynamics of obstruction is necessary when describing and interpreting arterial and venous exams. For arterial stenosis, there are three spectral images that are generally obtained: waveforms before the stenosis, in the stenosis and beyond the stenosis. Pitfalls may occur when all the typical waveform shapes do not occur or when the gray scale, spectral and color images are discordant. Some arterial circulations use absolute velocity to diagnose conditions while others use ratio. Postoperative conditions such as bypass grafts and stents require specific criteria. Venous thrombosis remains a major disease despite more widespread prophylaxis in hospitalized patients. Protocols to determine safe and effective ways to diagnoses DVT use complete (whole leg) compression ultrasound as well as more limited scan. Differentiating acute, residual and recurrent venous thrombosis are necessary as more patients present with history of venous thromboses in the past.

Essentials of Chest Imaging

Wednesday, 01:30 PM - 03:00 PM • S100AB

**MSCU43A • Pitfalls in CT Pulmonary Angiography**

**Andetta R Hunsaker** MD (Presenter)

**LEARNING OBJECTIVES**

1) Identify common pitfalls which cause the indeterminate CT Pulmonary angiogram studies including technical, physiologic and anatomic etiologies. 2) Identify pitfalls due to errors in diagnosis of filling defects in the pulmonary arteries. 3) Avoid the pitfall of satisfaction of search. 4) Identify pitfalls with dual energy CT imaging for acute PE. 5) Understand ways to either solve or get around these pitfalls.

**ABSTRACT**

MSCU43B • Imaging Pulmonary Edema: Elucidate Heart Lung Interaction

**Diana Litmanovich** MD (Presenter)

**LEARNING OBJECTIVES**

1) Identify typical radiological features of pulmonary edema on conventional imaging (chest radiographs and chest CT) in correlation with related pathophysiologic changes cardiac and pulmonary changes. 2) Become familiar with atypical radiologic features of pulmonary edema. 3) Become familiar with cardiac and non-cardiac causes of pulmonary edema identifiable on chest radiographs, chest CT or MRI and their influence on lung parenchyma and airways. 4) Become familiar with etiologies mimicking pulmonary edema and tools available to differentiate between those. 5) Become familiar with post-treatment appearance of pulmonary edema.

MSCU43C • Imaging of Airway Diseases: A Non-Thoracic Radiologist’s Guide

**Sujal R Desai** MBBS (Presenter)

**LEARNING OBJECTIVES**

1) Have a working knowledge of key airway anatomy relevant to radiologists. 2) Understand the principal features of airways disease on HRCT and the pathophysiologic processes underlying these signs. 3) Appreciate the characteristic features of specific disease entities in
ABSTRACT
Diseases of the airways are common in clinical practice and imaging tests have an role in evaluation. Whilst plain chest radiography is the standard investigation, there are significant limitations because of problems including anatomical superimposition and poor contrast resolution. By contrast high-resolution CT (HRCT) has significant advantages. For ease of description the bronchial tree is divided into the large (bronchi) and small (bronchioles) airways; this traditional distinction is based on airway calibre and the possession (or otherwise) of cartilage in the wall: airways greater than 1mm diameter which are reinforced by cartilage, are called bronchi whereas those of greater calibre and without cartilage are termed bronchioles. The pattern of bronchial and bronchiolar branching is ideally suited to serving the two prime functions of the respiratory tract: transport of air and gas exchange. From the radiologist's perspective, the common reason for imaging the large airways is when a diagnosis of bronchiectasis is suspected. As the reader will be aware, the term bronchiectasis refers to an irreversible dilatation of the airways usually associated with inflammation in the bronchial wall. HRCT is now the investigation of choice in patients with bronchiectasis and, for the radiologist, the cardinal feature is airway dilatation with or without of the bronchial wall thickening. Obliteration of the small airways is surprisingly common and occurs in diverse clinical settings. The cross-sectional area of individual peripheral airways is small but because of their number, the effective cross-sectional area is large. The implication is that considerable 'silent' damage will occur before symptoms of functional deficit will manifest. In reality, the two commonest patterns of small airways disease on HRCT are mosaic attenuation and a tree-in-bud pattern. These will discussed in greater detail in the presentation.

ABSTRACT
1) To prepare residents and fellows for the current job market and how to make the most of your first career steps.
LEARNING OBJECTIVES
Aparna Annam
Moderator

Your First Job Isn't Your Last Job
Monique A Meyer MD (Presenter) ; Etta D Pisano MD (Presenter) *

MSRP41A • Future of the Radiology Job Market-Progress or Panic?
Aparna Annam DO (Presenter) ; Edward I Bluth MD (Presenter)

MSRP41B • Negotiating a Tight Job Market-The Do's and Don'ts of Finding a Job
Anthony C Brown MD (Presenter) ; James P Borgstede MD (Presenter)

MSRP41D • Panel Discussion
View learning objectives under main course title.

ABSTRACT
Diseases of the airways are common in clinical practice and imaging tests have an role in evaluation. Whilst plain chest radiography is the standard investigation, there are significant limitations because of problems including anatomical superimposition and poor contrast resolution. By contrast high-resolution CT (HRCT) has significant advantages. For ease of description the bronchial tree is divided into the large (bronchi) and small (bronchioles) airways; this traditional distinction is based on airway calibre and the possession (or otherwise) of cartilage in the wall: airways greater than 1mm diameter which are reinforced by cartilage, are called bronchi whereas those of greater calibre and without cartilage are termed bronchioles. The pattern of bronchial and bronchiolar branching is ideally suited to serving the two prime functions of the respiratory tract: transport of air and gas exchange. From the radiologist's perspective, the common reason for imaging the large airways is when a diagnosis of bronchiectasis is suspected. As the reader will be aware, the term bronchiectasis refers to an irreversible dilatation of the airways usually associated with inflammation in the bronchial wall. HRCT is now the investigation of choice in patients with bronchiectasis and, for the radiologist, the cardinal feature is airway dilatation with or without of the bronchial wall thickening. Obliteration of the small airways is surprisingly common and occurs in diverse clinical settings. The cross-sectional area of individual peripheral airways is small but because of their number, the effective cross-sectional area is large. The implication is that considerable 'silent' damage will occur before symptoms of functional deficit will manifest. In reality, the two commonest patterns of small airways disease on HRCT are mosaic attenuation and a tree-in-bud pattern. These will discussed in greater detail in the presentation.

ABSTRACT
1) To prepare residents and fellows for the current job market and how to make the most of your first career steps.

MSRP41A • Future of the Radiology Job Market-Progress or Panic?
Aparna Annam DO (Presenter) ; Edward I Bluth MD (Presenter)

LEARNING OBJECTIVES
1) Understand the 2012 and 2013 ACR Workforce Survey Results. 2) Understand the types of practices and geographic locations where jobs appear to be potentially available in 2014 and 2016. 3) Understand the number and types of radiology subspecialists and generalists which employers appear to be interested hiring in 2014 and 2016.

MSRP41B • Negotiating a Tight Job Market-The Do's and Don'ts of Finding a Job
Anthony C Brown MD (Presenter) ; James P Borgstede MD (Presenter)

LEARNING OBJECTIVES
1) Assess the current job opportunities. 2) Analyze important metrics and demographics for job satisfaction. 3) Identify key questions which must be answered before signing a contract.

MSRP41D • Panel Discussion
View learning objectives under main course title.

ABSTRACT
Diseases of the airways are common in clinical practice and imaging tests have an role in evaluation. Whilst plain chest radiography is the standard investigation, there are significant limitations because of problems including anatomical superimposition and poor contrast resolution. By contrast high-resolution CT (HRCT) has significant advantages. For ease of description the bronchial tree is divided into the large (bronchi) and small (bronchioles) airways; this traditional distinction is based on airway calibre and the possession (or otherwise) of cartilage in the wall: airways greater than 1mm diameter which are reinforced by cartilage, are called bronchi whereas those of greater calibre and without cartilage are termed bronchioles. The pattern of bronchial and bronchiolar branching is ideally suited to serving the two prime functions of the respiratory tract: transport of air and gas exchange. From the radiologist's perspective, the common reason for imaging the large airways is when a diagnosis of bronchiectasis is suspected. As the reader will be aware, the term bronchiectasis refers to an irreversible dilatation of the airways usually associated with inflammation in the bronchial wall. HRCT is now the investigation of choice in patients with bronchiectasis and, for the radiologist, the cardinal feature is airway dilatation with or without of the bronchial wall thickening. Obliteration of the small airways is surprisingly common and occurs in diverse clinical settings. The cross-sectional area of individual peripheral airways is small but because of their number, the effective cross-sectional area is large. The implication is that considerable 'silent' damage will occur before symptoms of functional deficit will manifest. In reality, the two commonest patterns of small airways disease on HRCT are mosaic attenuation and a tree-in-bud pattern. These will discussed in greater detail in the presentation.

ABSTRACT
Diseases of the airways are common in clinical practice and imaging tests have an role in evaluation. Whilst plain chest radiography is the standard investigation, there are significant limitations because of problems including anatomical superimposition and poor contrast resolution. By contrast high-resolution CT (HRCT) has significant advantages. For ease of description the bronchial tree is divided into the large (bronchi) and small (bronchioles) airways; this traditional distinction is based on airway calibre and the possession (or otherwise) of cartilage in the wall: airways greater than 1mm diameter which are reinforced by cartilage, are called bronchi whereas those of greater calibre and without cartilage are termed bronchioles. The pattern of bronchial and bronchiolar branching is ideally suited to serving the two prime functions of the respiratory tract: transport of air and gas exchange. From the radiologist's perspective, the common reason for imaging the large airways is when a diagnosis of bronchiectasis is suspected. As the reader will be aware, the term bronchiectasis refers to an irreversible dilatation of the airways usually associated with inflammation in the bronchial wall. HRCT is now the investigation of choice in patients with bronchiectasis and, for the radiologist, the cardinal feature is airway dilatation with or without of the bronchial wall thickening. Obliteration of the small airways is surprisingly common and occurs in diverse clinical settings. The cross-sectional area of individual peripheral airways is small but because of their number, the effective cross-sectional area is large. The implication is that considerable 'silent' damage will occur before symptoms of functional deficit will manifest. In reality, the two commonest patterns of small airways disease on HRCT are mosaic attenuation and a tree-in-bud pattern. These will discussed in greater detail in the presentation.
immediate treatment and to learn about key imaging findings in these patients allowing for a fast differential diagnosis. 3) To learn how to adapt CT protocols to CXR findings and to integrate imaging findings with lab findings, patient history and clinical information for making the diagnosis.

ABSTRACT
Pulmonary symptoms such as chest pain, shortness of breath or wheezing are common non-traumatic symptoms prompting ER visits. Because clinical symptoms are very non-specific, imaging plays a major role in differentiating life threatening from less severe diseases and forming a diagnosis. The chest radiograph remains the first imaging despite its limited sensitivity for certain diseases and being prone to inter-observer variability. Comprehensive cardiothoracic CT examinations using most modern CT equipment are well evaluated in their diagnostic accuracy to determine the presence of vascular life threatening events such as aortic dissection, acute coronary disease and pulmonary embolism. Protocols, literature evidence and appropriate examples will be discussed. In addition the course will highlight nonvascular emergencies such as mediastinal diseases (e.g., esophageal perforation, mediastinitis or pericarditis) and pulmonary emergencies (e.g., pneumonia, edema, pneumothorax, exacerbation of diffuse lung diseases) for which a more comprehensive consideration of imaging findings, lab findings, patient history and clinical information is needed for making the diagnosis.

MSSR43C ● Interactive Case Discussion
Stuart E Mirvis MD (Presenter) ; Cornelia M Schaefer-Prokop MD (Presenter)

LEARNING OBJECTIVES

1) Awareness of the current pressures on radiologists. 2) Key constituencies for radiologists of the future. 3) How individual radiologists and their practices need to adapt to the above to provide value in the evolving health care landscape.

LEARNING OBJECTIVES

1) To explain the new emphasis on value over volume in the accountable care era. 2) To examine how radiologists may need to be more involved in coordinating care to achieve appropriate utilization. 3) To discuss how radiologists may share in the savings from value-based
Interventional Oncology Series: Progress, Challenges and Opportunities

Wednesday, 01:30 PM - 06:00 PM • S405AB

LEARNING OBJECTIVES
1) Characterize and appreciate the most important advances of interventional oncology over the last two decades within a well-defined optimization model. 2) Identify key challenges, and greatest opportunities facing the interventional oncology community. 3) Determine under which particular clinical scenarios specific ablation energy sources will have particular benefits over their clinically-available competitors.

ABSTRACT
From a practical perspective, six main basic research areas in which interventional oncology has made substantial progress over the last two decades have been identified including: Ablation devices, Transcatheter therapy, Combination Therapy (including nano-technologies), Understanding local and systemic ablation biology, Procedural Image-guidance, and Post-Ablation Follow-up. Along these lines, for the first half of the session speakers will initially present the 3 - 5 most important advances that have occurred over the last decade for each of these areas. For each topic, this will be followed by a critical assessment of the most pressing current challenges facing and the greatest opportunities presented to advance these key components of current interventional oncologic practice. An additional presentation on ‘Future directions for IO’ and a panel discussion ‘which factors will most drive future progress’ will complement these discussions. The second half of the session will be dedicated to addressing another hotly debated key issue facing the IO community that is becoming ever more relevant with the proliferation of new ablation devices namely: ‘When should I be using that specialized device ?’ Speakers will sequentially present the benefits and limitations of various ablation energy sources for given clinical scenarios including: microwave, cryotherapy, irreversible electroporation, HIFU, and radiofrequency.

VSIO41-01 • Ablation Devices

Christopher L Brace PhD (Presenter) *

LEARNING OBJECTIVES
1) Identify the most common ablation modalities. 2) Compare each modality in terms of energy delivery physics and clinical utility. 3) Analyze common devices for each modality. 4) Evaluate each device’s potential clinical value.

ABSTRACT
Thermal ablation devices continue to evolve at a rapid pace. While more established modalities such as radiofrequency (RF) and cryoablation have seen less technological growth in recent years, much is still to be gained from their respective devices. Microwave ablation and irreversible electroporation (IRE) device are now expanding into the clinical marketplace. Six microwave systems are cleared by the FDA, leading to some confusion about how to differentiate those systems from a clinical perspective. IRE as a treatment modality has been slower to emerge as many users await further scientific evaluation of existing systems. The objective of this presentation will be to provide an overview of the basic underlying physics of each treatment modality, present the systems and devices available for clinical use, and elucidate some of the important features of each system to help physician’s decide which may be right for their practice.

VSIO41-02 • Transcatheter Therapies
LEARNING OBJECTIVES
View learning objectives under main course title.

VSIO41-03 • Novel Navigation Technique for Superselective TACE to Obtain 3D-safety Margin for HCC
Toshihiro Tanaka MD (Presenter); Hideyuki Nishiofuku; Hiroshi Anai MD, PhD; Shinsaku Maeda; Hiroshi Sakaguchi MD; Kimihiko Kichikawa MD

PURPOSE
Our previous report presented at RSNA 2012 demonstrated the importance of the 3-dimmensional embolization margin (3D-safety margin) in superselective transcatheter arterial chemoembolization (TACE), which could significantly prolong disease free survival. We developed novel navigation TACE using hybrid CT/Angio with a workstation to obtain 3D-safety margin, and prospectively evaluated the feasibility of this technique.

METHOD AND MATERIALS
Fifteen patients with small HCC (size: 1.2–2.9cm, mean 1.8cm) and good liver function (Child-Pugh score: 5–7, mean 5.5) were enrolled in this pilot study. Firstly, a maximum intensity projection (MIP) imaging of the hepatic arteriography was created using CT during hepatic arteriography (CTHA) via the common hepatic artery (CHA). Secondly, a cather was superselectively inserted into the tumor feeding artery, and presence or absence of the 3D-safety margin was evaluated by the 3D-fusion images reconstructed using whole liver CTHA via CHA and superselective CTHA via the targeted artery. Thirdly, in the cases without 3D-safety margins, the regions, which lacked safety margins, were marked by a workstation (ZIOSTATION®). These markings automatically appeared on the MIP images, which showed the arterial branches supplying the tumor surrounding areas.

RESULTS
In 13 of 15 patients, 3D-safety margins were absent in the initial fusion images. In all 13 cases, the MIP images of the hepatic arteriography clearly showed the supplying branches into the marginal areas. Superselective TACE using lipiodol (mean volume 2.7ml) mixed with epirubicin (mean volume 23mg) were conducted via both the tumor feeding arteries and the marginal branches. 3D-safety margins were obtained in all 15 patients. No severe complications including liver dysfunction were observed. The mean Child-Pugh score after TACE was 5.5, and no local recurrence was seen during follow-up periods (mean 233 days, range: 171-344 days).

CONCLUSION
Superselective TACE using this navigation technique can achieve 3D-safety margin for HCC patients. Currently, a phase II study using this technique is ongoing to evaluate the local tumor recurrence rate for long term period.

CLINICAL RELEVANCE/APPLICATION
Superselective TACE using this navigation technique can achieve 3D-safety margin, which could prevent local recurrence.

VSIO41-04 • Combination Therapy
Muneeb Ahmed MD (Presenter)

LEARNING OBJECTIVES
1) Demonstrate how understanding tissue responses in and around the ablation zone can be used to develop mechanism-based approaches to combination therapy. 2) Demonstrate how combination strategies for IO using nanoagents offer significant promise for improving minimally-invasive thermal therapy.

ABSTRACT

VSIO41-05 • Comparison of Transarterial Administration of Survivin siRNA Combined with Transarterial Chemoembolization (TACE) and TACE Alone in the Treatment of Rats with Hepatocellular Carcinoma (HCC): Experimental Study
Thomas J Vogl MD, PhD (Presenter); Jun Qian MD; Andreas Tran; Elsie Oppermann; Ulli Imlau; Yousef Hamidavi; Huedayi Korkusuz MD; Wolf-Otto Bechstein

PURPOSE
To evaluate the effects of transarterial administration of survivin siRNA combined with transarterial chemoembolization (TACE) vs. TACE alone for treating hepatocellular carcinoma (HCC) in rats.

METHOD AND MATERIALS
Subcapsular implantation of a solid Morris hepatoma 3924A in the liver was carried out in 20 male ACI rats (day 0). Tumor volume (V1) was measured by MRI (day 12). After laparotomy and retrograde placement of a catheter into the gastroduodenal artery (day 13), the following different agents were injected into the hepatic artery: TACE (0.1mg of mitomycin + 0.1ml of lipiodol + 5.0mg of degradable starch microspheres) + 2.5nmol survivin siRNA (group A, n=10) or TACE alone (group B, n=10). Tumor volume (V2) was assessed by MRI (day 25), tumor growth ratio (V2/V1) was calculated. Western blot analysis was performed to assess the protein expression level of survivin in each treatment. The progressional potential of the tumors was assessed for quantification of positive VEGF tumor cells via immunohistochemical analysis.

RESULTS
Mean tumor growth ratio (V2/V1) was 1.1313 + 0.1381 in group A, and 3.1911 + 0.1393 in group B. Compared with group B, group A showed significant inhibition of tumor growth (p

CONCLUSION
Combined TACE and transarterial administration of survivin siRNA is more effective than TACE alone for inhibiting the growth of HCC in rats.

CLINICAL RELEVANCE/APPLICATION
Combined TACE and transarterial administration of survivin siRNA may be a relevant treatment option in hepatocellular carcinoma.

VSIO41-06 • Understanding Local and Systemic Ablation Biology
Joseph P Erinjeri MD, PhD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

VSIO41-07 • Adoptive Immunotherapy for Hepatocellular Carcinoma with MRI-monitored Transcatheter Delivery of Ferumoxytol Nanocomplexes-labeled Natural Killer Lymphocytes
Kangan LI MD (Presenter); Zhuoli Zhang MD, PhD; Andrew C Gordon BA; Alexander Y Sheu BS; Weiguo Li; Reed A Omary MD *; Gui-Xiang Zhang MD; Andrew C Larson PhD *

PURPOSE
Natural killer (NK)-lymphocytes adoptive immunotherapy (AIT) has advantages over other immunotherapy approaches in being non-MHC-restricted, non-immunogenic and highly cytotoxic for Hepatocellular Carcinoma (HCC). To improve the AIT efficiency, it is essential to visualize and quantify both the biodistribution of NK cells and the AIT responses. The purpose of this study was to test the hypotheses that: a) Magnetic resonance imaging (MRI) will allow quantitative visualization of transcatheter infusion for targeted delivery...
of terumoxytol-heparin-protamine (HPF) nanocomplexes--labeled NK cells to HCC; 2) NK cell AIT responses may be predicted based upon MRI measurements.

METHOD AND MATERIALS
NK-92Mls were labeled with HPF. 24 Sprague Dawley rats were implanted with Mca-RH7777 tumors; 6 rats each comprised intra-arterial (IA) NK, intraportal (IP) NK, IA+IP NK, and IA saline groups. Catheter was placed in hepatic artery or portal vein for IA NK/saline or IP NK infusions. MRI tumor size, T2*, apparent diffusion coefficient (ADC) and volume transfer constant (Ktrans) measurements were compared pre and 12 days post infusion. Tumor size changes, T2*, ADC, and Ktrans were compared; Prussian blue staining was used for histological identification of labeled NK cells; CD56 and CD34 staining qualitatively confirmed NK cells delivery and tumor angiogenesis. ANOVA and Pearson correlation coefficients were used for statistical analyses.

RESULTS
Initial tumor diameters were not different between groups (p=0.23), but final tumor diameters were different between all groups (p < 0.0001) with those estimated from gross pathologic assessment. Infiltration of red blood cells observed by histopathologic examination was greater in the peripheral rim of the ablation zone than in the central zone.

CONCLUSION
In B-mode US, the ablation zone appeared as a hypoechoic area with a peripheral hyperechoic rim 15 minutes after RF ablation; however, the findings were largely obscure for estimating the ablation area. 3D SWE depicted ablation area and volume more clearly. At the largest ablation area, the mean kPa values of the peripheral rim, central zone, and non-ablated zone were 13.1 kPa ± 1.5, 59.1 kPa ± 21.9, and 4.3 kPa ± 0.8, respectively. The ablation volumes obtained by 3D SWE showed the highest correlation (r = 0.9646; p < 0.0001) with those estimated from gross pathologic assessment. Infiltration of red blood cells observed by histopathologic examination was greater in the peripheral rim of the ablation zone than in the central zone.

CLINICAL RELEVANCE/APPLICATION
RFA is applied in many tumors and organs. Our study suggests that potentially harmful tumor stimulatory effects likely need to be characterized in an organ-specific manner.
LEARNING OBJECTIVES
View learning objectives under main course title.

VSIO41-13 • Panel: Which Factors Will Most Drive Future Progress?

LEARNING OBJECTIVES
View learning objectives under main course title.

VSIO41-14 • When Should I Be Using that Specialized Device: MW Systems

Fred T Lee MD (Presenter) *

LEARNING OBJECTIVES
1) Explain basic microwave physics. 2) Demonstrate the differences between radiofrequency and microwave devices. 3) Show illustrative cases where microwave was either useful or contraindicated.

VSIO41-15 • Development of New Materials for Tissue Hydrodissection: An Analysis of Heat Transfer in Liquids and Gels

Alexander Johnson BS (Presenter); Christopher L Brack PhD *

PURPOSE
Hydrodissection is used during image-guided interventions to protect critical tissues from damage collateral to the treatment site. Liquids such as normal saline and 5% dextrose in water (D5W) have been used during thermal ablation, but thermoreversible poloxamer 407 (P407) gels may offer greater stability and robustness. The goal of this study was to evaluate the relative importance of conductive and convective heat dissipation in liquid P407, gel P407, and liquid D5W.

METHOD AND MATERIALS
Radiofrequency (RF) and microwave (MW) ablations were created in ex vivo bovine liver for 10 minutes adjacent to an 11 mm barrier of either gel P407, liquid P407 or liquid D5W. Temperatures were recorded at multiple locations inside the barrier using fiberoptic probes. All experiments were performed in triplicate. Temperature increases at each position within each setup was compared using two-tailed, unpaired Student’s t-tests.

RESULTS
All materials adequately protected the adjacent tissue during RF and MW ablation (mean temperature increase .05). Gel P407 reduced heat flow compared to liquids as indicated by a greater range in mean temperature elevation within the barrier (10.2 ± 0.5°C for gel P407, 1.3 ± 0.8°C and 1.1 ± 0.9°C for liquid P407 and D5W, respectively; P < .05). Both P407 and D5W provided adequate thermal protection during RF and MW ablation. Heat dissipation in gel P407 was conduction dominated, but was convection domination in D5W and liquid P407. Additionally, P407 switches its primary mode of heat dissipation from convection to conduction after gelation. Thus, fluids convectively dissipate heat and may require a large reservoir for adequate protection while gel materials may need a greater thickness but provide more thermal protection due to lower heat dissipation rates. Further in vivo evaluation seems warranted.

CLINICAL RELEVANCE/APPLICATION
The clinical use of novel hydrodissection materials can now be educated by empirical evidence of protective ability and general guidelines for barrier creation.

VSIO41-16 • When Should I Be Using that Specialized Device: Cryo

Peter J Littler MD (Presenter) *

LEARNING OBJECTIVES
1) Understand the different approaches and techniques for thorough cryoablation of nearly any tumor location (e.g., the “1-2 Rule”). 2) Understand unique benefits of cryoablation for soft issue locations of head and neck, bone, intra/retroperitoneal and superficial locations (i.e., chest/abdominal wall), as well as more central locations for chest liver and renal ablations. 3) Understand techniques to minimize morbidity, assessing tumor location and approach. 4) Identify major imaging follow-up criteria for ablation success and any early failures. 5) Describe the overall cost-efficacy trade-offs for cryo vs. heat-based renal ablations vs. stereotactic body radiation therapy, in relation to tumor location, complications and recurrence rates.

ABSTRACT
Cryoablation of tumors in difficult-to-treat locations offers a lower pain alternative than heat-based modalities, especially for multiple soft tissue and central organ locations. Major cryoablation benefits include its excellent visualization of ablation zone extent, low procedure pain and flexible hydrodissection very close to skin surface and adjacent crucial structures. CT-guidance is the cryoablation guidance modality of choice due to circumferential visualization and ready availability. US-guidance can augment cryoablation, especially for smaller superficial masses and/or placement of interstitial metallic markers during biopsy for selected cases requiring better eventual CT localization. MR-guidance has little clinical benefit or cost-efficiency.

For safety, cases will be considered for choosing the most amenable approach for a wide variety of anatomic locations. Imaging outcomes of complications and their avoidance will be shown. For optimal efficacy, tumor size in relation to number and size of cryoprobes emphasize the “1-2 Rule” of at least 1 cryoprobe per cm of tumor diameter and no further than 1 cm from tumor margin, as well as cryoprobe spacing of

VSIO41-17 • When Should I Be Using that Specialized Device: IRE

Stephen B Solomon MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

VSIO41-18 • When Should I Be Using that Specialized Device: HIFU

David C Gianfelice MD (Presenter)

LEARNING OBJECTIVES
1) Introduction to technology of focused ultrasound ablation. 2) Review of thermal monitoring as an aid to treatment. 3) Review of FDA approved treatment protocols to date, uterine fibroids and bone metastases. 4) Update on research protocols in progress. 5) Future applications.

VSIO41-19 • RF Ablation: Still the Preferred Ablation Technology in Practice!

Alison R Gillams MBCHB (Presenter) *

LEARNING OBJECTIVES
1) To learn the relative merits of radiofrequency ablation over other ablation technologies. 2) To understand the limitations of
Agfa Healthcare: Elevating Workflow for Good: Strategic Road Maps for Enterprise Imaging

Wednesday, 02:00 PM - 02:45 PM • South Building Hall A Booth 3314

LEARNING OBJECTIVES

Imagine an information rich clinical record in which access to multi-specialty images is as simple as a click, where referring physicians and families use visual images to better understand clinical conditions. Agfa Healthcare’s ICIS™ (Imaging Clinical Information System) delivers an incrementally scalable, enterprise workflow centric platform, that allows for meaningful acquisition of data, consolidation, and makes medical images readily available to clinicians inside their EHR, portal, or HIE. All with a single goal in mind: enhancing physician collaboration and fostering patient engagement.

ASRT@RSNA 2013: Pediatric CT/CTA: Techniques and Applications

Wednesday, 02:20 PM - 03:20 PM • N230

LEARNING OBJECTIVES

1) Describe the optimal techniques in performing CT/CTA in children. 2) Identify the applications of CT/CTA in children. 3) State the CT/CTA findings of common diseases in children.

ABSTRACT

PURPOSE To review the technique modifications that can optimize the CT images and the common applications in pediatric computed tomography (CT) and CT angiography.

CONTENT ORGANIZATION

1. Basic Imaging techniques and protocols in pediatric populations (chest and abdomen CT and CT angiography). 2. Effective use of oral and intravenous contrast medium. 3. Indications for multiplanar and 3D reformations. 4. Clinical applications of CT and CTA. SUMMARY CT data acquisition using current technology CT systems enables fast volume coverage with less motion artifacts, less sedation and radiation dose reduction. This presentation will review the basic steps and best imaging protocols for performing CT and CTA in children. The indications for post-processing multiplanar and volume rendered reconstructions will be reviewed. The common indications for performing CT and CTA along with examples of clinical cases will be presented. At the conclusion of this presentation, the technologists should have a basic understanding of how to perform CT and CTA in a pediatric population.

ICIA43 • AMA PRA Category 1 Credit ™:1.5

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.

ABSTRACT

The purpose of the RadLex lexicon is to provide a uniform framework for indexing and retrieval of a variety of radiology information sources, including teaching files, research data, and radiology reports. The RadLex lexicon is unifying and supplementing radiology terms from other medical lexicons, such as the ACR Index from the American College of Radiology, the Unified Medical Language System (UMLS) from the National Library of Medicine, SNOMED-CT from the College of American Pathology, and the DICOM Content Mapping Resource. This session will explain the motivations for the creation of the RadLex imaging lexicon and describe new applications being created that leverage its rich knowledge resources, such as structured reporting, radiology information retrieval, image annotation, decision support, and computerized order entry. RadLex technical experts will describe the formats in which RadLex is distributed, and will demonstrate some of the tools available to incorporate RadLex into the development of useful software applications. An update on the recently developed RadLex "playbook" will be provided, with an overview of RadLex methods to describe radiology orderables and procedure steps.

Wednesday, 02:30 PM - 04:00 PM • S401AB

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

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

BOOST: Genitourinary-Case-based Review (An Interactive Session)

Wednesday, 03:00 PM - 04:15 PM • S103CD

LEARNING OBJECTIVES
1) State the modalities, rationale, and indications for imaging local and distant spread of prostate cancer. 2) Describe the evidence-based imaging approaches to prostate cancer. 3) List the emerging modalities for prostate cancer imaging. 4) State the appropriate therapy(s) for low intermediate and high risk prostate cancer treatment.

ABSTRACT
This course will be a case based review of all aspects of the treatment of prostate cancer from early stage disease through metastatic disease. We will focus on radiation aspects of treatment in particular and imaging as appropriate for all stages of disease.

URL’s
http://www.radiology.ucsf.edu/research/meetings/rsna

Breast Imaging (MRI Lesion Characterization)

Wednesday, 03:00 PM - 04:00 PM • Arie Crown Theater

LEARNING OBJECTIVES
To evaluate if changes in background parenchymal enhancement (BPE) on breast MRI predict tumor response to neoadjuvant chemotherapy.

METHOD AND MATERIALS
Retrospective IRB approved review identified 86 patients with biopsy proven breast cancer that underwent bilateral breast MRI both before and after neoadjuvant chemotherapy between September 2008 and August 2012. Patients with synchronous bilateral cancers or a history of contralateral cancer were excluded. Clinicopathologic data were obtained from the electronic medical record. A breast-imaging radiologist blinded to clinical data rated the BPE level using BI-RADS criteria of the unaffected breast on pre- and post-neoadjuvant chemotherapy breast MRIs. Odds ratios (OR) and 95% confidence intervals (CI) were estimated using multinomial logistic regression adjusting for age, menopausal status and family history of breast/ovarian cancer.
RESULTS
Age at cancer diagnosis ranged from 25-72 years (mean: 46). Tumor size ranged from 1.4-17.0 cm (mean: 6.3). 62 (72%) patients were pre/perimenopausal and 24 (28%) postmenopausal. 36 (42%) tumors were unifocal, and 50 (58%) multifocal/multicentric. There were 36 (42%) ER+, 28 (33%) PR+, 36 (42%) HER2+, and 32 (37%) triple negative (TN) tumors. Results suggest that a decrease in BPE between pre- and post-chemotherapy MRI is associated with a complete imaging response in ER+ (OR 9.1, 95% CI 1.1, 78.3, p = 0.04) and PR+ (OR 18.8, CI 1.1,307.7, p=0.04) tumors, though the confidence intervals are wide. BPE reduction was not associated with tumor response with TN or HER 2+ tumors. Changes in BPE were also not associated with clinical stage, MR imaging features, or disease focality.

CONCLUSION
Tumor response to neoadjuvant chemotherapy may be associated with a decrease in BPE in patients with ER+ tumors but not with other subtypes.

CLINICAL RELEVANCE/APPLICATION
Although larger studies are needed to confirm these results, analysis of BPE change in patients with ER+ tumors undergoing neoadjuvant chemotherapy may be useful to predict tumor response.

SSM01-02 • Does Morphologic and Volumetric MR Tumor Response in Locally Advanced Breast Cancers Correlate with Disease Free Survival?

Chiara Iaconci MD (Presenter); Punam Bajaj MD, MBBS; Elizabeth A Morris MD; D. David Dershaw MD

PURPOSE
To analyze a possible correlation between morphology prior to treatment, RECIST response, volumetric reduction, shrinkage pattern and disease free survival (DFS) in locally advanced breast cancers (LABC).

METHOD AND MATERIALS
This is a retrospective analysis of 52 women (mean age 44 years, range: 31-69 years) with LABC who had breast MR before and after neoadjuvant chemotherapy. Dynamic breast MR was acquired using 1.5 or 3 T scanners with dedicated breast coils. 3D-tumor volume measurements were done with automated segmentation of MR images using Sentinelle Aegis 2.0.1. Morphology of tumor at diagnosis (solitary, grouped in same quadrant, separated in different quadrants, total breast replaced by tumor), response to treatment according to RECIST, volumetric response (complete, partial volume reduction: 65-99%, stable: volume reduction < 64%) as well as shrinkage pattern (no residual enhancement, concentric shrinkage, concentric with surrounding lesions, multinodular lesions, diffuse enhancement of the breast) were evaluated and correlated to DFS defined in months after the end of chemotherapy. DFS was evaluated on mammography and PET-CT or total- body CT. Receptor status was also correlated to DFS. Pathological response was defined according to pathology report. Mantel-Cox test was used for the statistical analysis.

RESULTS
Agreement in the evaluation of treatment response between diameter at MR and pathology was observed in 38/52 (73%), overestimated in 4/52 (8%) and underestimated in 10/52 (19%). Tumor morphology at diagnosis did not significantly correlate to DFS (p=0.33). RECIST versus volumetric response in women with complete, partial or stable disease did not significantly affect the DFS (p=0.6, 0.24 and 0.31 respectively). DFS was independent of shrinkage pattern of tumors (p=0.69). No statistical difference in DFS was found between complete and residual pathologic response (p=0.76). The percentage of volume reduction was higher in triple negative cancers compared to others (p=0.003), but DFS was significantly lower (27 months) than the other group (66 months) (p=0.04).

CONCLUSION
DFS in LABC is not related to pre and post treatment breast MR morphology.

CLINICAL RELEVANCE/APPLICATION
DFS in locally advanced breast cancer is better predicted by tumor receptor status than tumor morphology at MR, both prior to and after treatment.

SSM01-03 • Breast Cancer 21-gene Assay Recurrence Score: Correlation between MR Imaging Phenotype and Genotype

Elizabeth J Sutton MD (Presenter); Kirti Magudia PhD; Anne S Reiner MPH; Monica Morrow MD; D. David Dershaw MD; Elizabeth A Morris MD

PURPOSE
Oncotype Dx® breast cancer 21-gene assay recurrence score (RS) is used clinically in early stage estrogen receptor (ER) positive breast cancer to quantify (range 0-100) the likelihood (increased with score) of recurrence and magnitude of chemotherapy benefit. The purpose of this study was to assess ER positive, HER2 negative early breast cancer pre-operative magnetic resonance imaging (MRI) features and their ability to predict the Oncotype Dx® RS.

METHOD AND MATERIALS
This retrospective study received institutional review board approval and need for informed consent waived. Pre-operative MRIs were reviewed of 52 women (mean age 51; range 32-76) with ER positive, HER2 negative early invasive ductal carcinoma (IDC) and an Oncotype Dx® (Genomic Health) RS (mean score 23; range 0-78). MRI features included mass shape, margin, internal enhancement, T2 signal, diameter (mean 1.4 cm, range 0.5-2.8 cm), volume (mean 1.4 cc, range 0.1-8.0 cc) and dynamic time-intensity contrast enhancement kinetics. Clinical and pathologic data was collected. Exclusion criteria included prior history of cancer and BRCA genetic carriers.

RESULTS
All 50 women had stage 1 or 2A ER positive, HER2 negative IDC. Increased Oncotype Dx® recurrence score was significantly associated with increased tumor volume (Spearman correlation=0.35; p=0.01) and an increased percent of the tumor having plateau dynamic kinetics upon segmentation (Spearman correlation=0.32; p=0.03). Increased Oncotype Dx® recurrence score was significantly associated with irregular tumor shape (p=0.03) and increased tumor (hyperintense and heterogeneous) T2 signal (p=0.002).

CONCLUSION
Several IDC MRI features are significantly associated with an increased Oncotype Dx® RS, which has prognostic and predictive significance.

CLINICAL RELEVANCE/APPLICATION
MRI IDC phenotype is significantly associated with their genotype supporting the advent of radiogenomics and possible role in directing targeted therapy.

SSM01-04 • Imaging and Clinicopathologic Factors Associated with Recurrence in Triple-negative Breast Cancers

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

PURPOSE
Triple-negative breast cancer (TNBC) defined as a tumor that is negative for estrogen receptor (ER), progesterone receptor (PR), and HER2 is a biologically aggressive subgroup with poor prognosis. The aim of this study was to identify imaging and clinicopathologic factors associated with breast cancer recurrence in patients with TNBC.

METHOD AND MATERIALS
Of 3237 patients with invasive breast cancer diagnosed between January 2003 and December 2008, 515 patients who underwent breast-conserving surgery or mastectomy were diagnosed with TNBC. 55 patients who had neoadjuvant chemotherapy were excluded. Among 459 patients (median age, 47 years; range, 21-81 years), 69 (15%) had locoregional (n=32) or distant (n=37) recurrence after a median follow-up of 51 months. The imaging and clinicopathologic data were examined. The univariate and multivariate analyses were performed.

RESULTS
Age, family history of breast cancer, histologic type, histologic grade, surgical margin status, and adjuvant therapy showed no significant differences between recurrent group and non-recurrent group (P > .0069). In the multivariate analysis, preoperative breast MRI (P < .0001), mammographic breast density (P = .0034), and LN metastasis (P = .0005) were independent factors associated with recurrence in TNBC patients. The recurrence was more frequent in women without preoperative MRI (n=66) compared to women with preoperative MRI (n=393) (35% vs 12%; adjusted odds ratio [OR], 4.81; 95% confidence interval [CI], 2.51 to 9.20), in women with dense breasts (BIRADS density 3 or 4; n=319) compared to women with non-dense breasts (BIRADS density 1 or 2; n=140) (17% vs 10%; OR, 2.86; 95% CI, 1.14 to 5.78), and in patients with LN metastasis (n=138) compared to patients without LN metastasis (n=321) (24% vs 11%; OR 2.72; 95% CI, 1.55 to 4.81).

CONCLUSION
Risk factors associated with breast cancer recurrence were the lack of preoperative MRI, dense breast tissue on mammography, and LN metastasis. These factors can be predictive of the likelihood of recurrence in TNBC patients.

CLINICAL RELEVANCE/APPLICATION
The use of preoperative breast MRI should be considered for TNBC patients with dense breast tissue.

SSM01-05  Invasive Breast Cancer MRI Phenotype and Receptor Status as Predictors of Clinical Outcome
Kirti M Kulkarni MD (Presenter) ; Kirsten Gaarder MD ; Lingyun Xiong MD ; Hiroyuki Abe MD ; Maryellen L Giger PhD * ; Gillian M Newstead MD * ; Charlene A Sennett MD ; Akiko Shimauchi MD ; David V Schacht MD

PURPOSE
Can aggressive MRI characteristics and receptor profile of invasive breast cancers be used to predict clinical outcome and metastases/recurrence rates?

METHOD AND MATERIALS
54 patients (mean age 56 yo) with biopsy-proven invasive breast cancer and staging MRI (1.5T Phillips) at University of Chicago from 2002-2003 were included in a HIPAA-compliant retrospective study. Patients with prior history of invasive or in-situ breast cancer or distant metastases at time of breast cancer diagnosis were excluded. Imaging and clinical notes were reviewed to identify local recurrence or distant metastases. Average follow up time was 7.8 years. All breast cancers were measured on MRI as maximum diameter in axial dimension. Aggressive MRI morphologic features such as non-mass enhancement (NME), rim or heterogeneous enhancement and multifocality were analyzed in consensus by two board-certified fellowship-trained radiologists. Receptor profiles of all cancers were obtained from pathology reports.

RESULTS
Histology yielded IDC 46/54 (85%) and ILC 8/54 (15%). 9/54 (17%) of the total patients developed distant metastases. Average time to metastases was 2.8 years, range 0.7 to 6.8 yrs. Histology of all metastatic cancers was IDC. 33% of cancers were grade 2 and 37% were grade 3. Grade 3 tumors metastasized in 6/20 (30%) of cases and grade 2 in 1/18 (6%) of cases; tumor grade was not included in the pathology report in 2 cases. Cancers were categorized based on receptor profile as triple negative (9/54; 17%), Her2+ (12/54; 22%), and ER+Her2- (33/54; 61%). ER+ Her2- cancers metastasized in 9/33 (27%) and all were unifocal. Her+ cancers metastasized in 25% (3/12) (1 unifocal, 2 multifocal) and triple negative cancers in 33/3 (1 unifocal, 2 multifocal). Analysis of the MRI morphologic features showed that 25% of rim-enhancing tumors, 22% with NME, 18% of multifocal and 16% of unifocal cancers metastasized.

CONCLUSION
Pilot data shows that grade 3, triple negative, NME and multifocal IDC have higher rates of metastases compared to unifocal, low grade, and ILC. Distant metastases presented as late as 6.8 yrs after diagnosis. We intend to analyze a total of 200 patients in our final study.

CLINICAL RELEVANCE/APPLICATION
To determine the group of patients that can benefit from close follow up and metastatic work up to prevent or detect local recurrence/distant metastases.

SSM01-06  MR Imaging Phenotype of Breast Cancer: Kinetic Assessment for Molecular Subtypes
Eric M Blaschke MD (Presenter) ; Hiroyuki Abe MD

PURPOSE
To evaluate the dynamic contrast enhanced MR kinetic characteristics of newly diagnosed breast cancer in molecular subtypes.

METHOD AND MATERIALS
Breast MRI examinations of 200 patients with newly diagnosed breast cancer at the University of Chicago Medical Center from 2011 through 2012 were reviewed. Cases of newly diagnosed IDC were sorted by molecular subtype (17 triple negative, 7 Her2+, 73 Luminal A/B) and lesion segmentation and kinetic analyses were performed on a dedicated workstation. For kinetic assessment, 50% and 100% thresholds were employed for display of medium and rapid uptake, respectively. Kinetic profiles in terms of percent volume for 6 kinetic types (medium-persistent, medium-plateau, medium-washout, rapid-persistent, rapid-plateau, rapid-washout) relative to the whole volume of the lesion were obtained. Statistical analysis of the kinetic profiles was performed using the student’s T-test.

RESULTS
Percent volume of Her2 positive lesions with greater than 50% uptake at early phase was significantly greater compared with luminal A/B (98.7 +/- 1.14 vs. 91.9 +/- 2.62; P = .0002). There was a nonsignificant trend towards higher >100% uptake at early phase in Her2 positive lesions versus Luminal A/B (87.3 +/- 5.77 vs. 69.3 +/- 6.94; P = .11) and all other subtypes (87.3 +/- 9.77 vs. 71.4 +/- 5.87; P = .199). No significant difference in uptake ratios was noted for Her2 positive vs. triple negative tumors or triple negative tumors vs. all other subtypes. No significant difference was observed in BIRADS assessment of kinetic patterns.

CONCLUSION
Her2 positive breast cancer demonstrates a unique MRI kinetic phenotype with significantly increased rapid uptake ratios compared to other molecular subtypes.

CLINICAL RELEVANCE/APPLICATION
MRI kinetic phenotypes of newly diagnosed breast cancer may provide a means of predicting molecular subtype and thus aid early treatment planning.
SSM02 • Are Suspicious Breast MRI Lesions with an Ultrasound Correlate Higher Histological Grade Tumors?

Punam Bajaj MD, MBBS (Presenter); Junting Zheng; D. David Dershaw MD; Chaya Moskowitz; Elizabeth A Morris MD

PURPOSE
To determine if suspicious breast MRI lesions proven to represent invasive ductal carcinoma with an ultrasound correlate are of different histological grade compared with ultrasound occult lesions.

METHOD AND MATERIALS
Institutional review board approved retrospective study of 310 MRI examinations performed between 2008 and 2011 yielded 350 suspicious lesions for which biopsy was recommended. Subsequent high resolution targeted ultrasound was performed and histopathological grade of carcinomas was recorded as I (low), II (intermediate) or III (high). Statistical analysis was performed applying the Fisher’s exact test, Kruskal-Wallis test and exact Wilcoxon rank sum test.

RESULTS
Targeted ultrasound demonstrated a correlate in 181/350 (52%) suspicious MRI lesions yielding 63/181 (35%) malignant lesions. The remaining 169 (48%) lesions were sonographically occult, yielded 25/169 (15%) malignant lesions. Sonographic correlates were seen for 72% (63/88) of malignant lesions. Of these, 87% (55/63) were invasive carcinomas and 13% (8/63) were ductal carcinomas in situ.

Histological grade was available for 46 invasive ductal carcinomas with ultrasound correlate (36.5% I, 28.3% II, and 35.2% III) and 25 without correlate (50%, 37.5% and 12.5% respectively). There was no statistically significant difference in the size of tumors with or without an ultrasound correlate (p=0.163).

In the group with an ultrasound correlate, no significant difference was observed in tumor size between the recorded histological grades (p=0.052). A grade III tumor was more likely to be present in the group with an ultrasound correlate (p=0.001). In the group without a correlate, 12% (3/25) of tumors were grade II, 48% (12/25) were grade III, and 40% (10/25) were grade I.

CONCLUSION
When a suspicious breast MRI lesion has an ultrasound correlate, it is more likely to represent invasive carcinoma of higher histological grade.

CLINICAL RELEVANCE/APPLICATION
The presence of an ultrasound correlate for a suspicious breast MRI lesion may indicate a more aggressive cancer.


Phillip B Shaffer MD (Presenter)

PURPOSE
Investigate the US appearance of regions with positive MR scans later proven to be cancer.

METHOD AND MATERIALS
In our experience of 373 total MR directed biopsies, 33 patients were found who 1) had suspicious areas discovered on an MR and 2) had a second look US that was negative and 3) subsequently had a malignant diagnosis as a result of MR biopsy. This patient group is interesting because they were examined with prior knowledge of the precise location of a suspicious lesion; nevertheless, the ultrasound was negative.

RESULTS
Of the 33 patients, 13 had a final diagnosis of DCIS, MR imaging size range 0.6 to 5.4 cm. 15 had a final diagnosis of invasive ductal carcinoma (IDC), MR imaging size range 0.7 to 12.0 cm. 4 had a final diagnosis of invasive lobular carcinoma (ILC), MR imaging size range 0.2 to 1.0 cm. These findings were corroborated by 3 experienced radiologists and 3 experienced surgeons. The pattern seen was judged to be not sufficiently suspicious to be certain of correlation with the MR. These were regarded as “negative” US exams. The pattern present on the ultrasound was closely examined in 30 patients (3 sets of images were not available), and divided by appearance into two groups: Group QP which were in retrospect Questionably Positive, and Group B: Benign. In Group QP, two distinct patterns were observed: low echogenicity area (6 patients) and shadow without mass (8 patients). In Group B, three distinct patterns were seen: Normal tissue (7 pts), Heterogeneous without mass (8 pts), and small mass with benign characteristics (5 pts). When segregated by histology, the following was observed: IDC: Group QP: 10 pts Group B: 4 pts. ILC: Group QP: 2 pts Group B: 2 pts. DCIS: Group Q-2 pts Group B-10 pts.

CONCLUSION
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SSM02-04 • Breast MRI as a Problem-solving Tool in the Evaluation of Mammographically and Ultrasonographically Detected Architectural Distortions: Are There Any Predictive Parameters?

Rubina Noemi Cavallin (Presenter) ; Claudio Losio MD ; Marta Maria Panzeri ; Elena Venturini MD ; Giulia Cristel MD ; Alessandro Del Maschio MD

PURPOSE
Despite accounting for only 3% of mammographically detected findings, architectural distortion (AD) may be caused by a wide range of benign and malignant breast lesions, and it is the 3rd most common presentation of non palpable breast cancer. Because of its indefinite mammographic and ultrasonographic features, percutaneous or surgical biopsy is mandatory. In our study we evaluated the potential role of dynamic Breast MRI including diffusion-weighted imaging (DWI) as a problem-solving tool in mammographically and ultrasonographically detected AD

METHOD AND MATERIALS
Out of 232 patients undergoing MRI for problem solving, 34 were examined for a mammographic or ultrasonographic AD. MRI (1.5T) included T2-TSE sequences, dynamic study and DWI (b-values: 0, 900 s/mm²). For each lesion detected we evaluated morphology, dynamic and diffusion patterns and final histopathological result. A cut-off ADC value differentiating benign from malignant breast lesions had been previously established in a large population of women. The difference between the mean Apparent Diffusion Coefficient (ADC) values and the mean T2 signal in malignant and benign findings was evaluated with Mann-Whitney U test. Univariate and multivariate analyses of ADC values, T2 signal and time-enhancement curves (T-Ec) were performed for prediction of malignancy.

RESULTS
MRI confirmed all 38 known findings. At histopathology 25 lesions were benign and 13 malignant. The most represented T-Ec in malignant AD were type 3 (n=7) and 2 (n=3), while no benign lesions showed a washout kinetic. Univariate and multivariate analysis showed that T-Ec were significant predictors of malignancy (p

CONCLUSION
Time-enhancement curves were the most predictive MRI feature to distinguish benign from malignant AD. The contribution of DWI to their differential diagnosis is limited due to ADC borderline values. MRI low negative predictive value, however, suggests to avoid MRI to strengthen the diagnosis after a benign core biopsy.

CLINICAL RELEVANCE/APPLICATION
MRI could not replace breast biopsy to confirm the nature of architectural distortions.

SSM02-05 • Evaluation with Digital Mammography (DM), DM Combined with Digital Breast Tomosynthesis (DBT), Ultrasound (US) and Dynamic Breast MRI of Pathological Response after Neoadjuvant Chemotherapy (NC) Treatment of Breast Carcinoma

Giovanna Mariscotti ; Manuela Durando (Presenter) ; Pier Paolo Campanino ; Maddalena Rigo ; Elisa Regini ; Mattia Robella ; Laura Bergamasco ; Paolo Fioni ; Giovanni Gandini MD

PURPOSE
To evaluate the accuracy of DM, DM combined with DBT, US and MRI in predicting residual tumour size and pathological response after NC for locally advanced breast cancer.

METHOD AND MATERIALS
44 patients (mean age 49.2 years; range 31-71) with locally advanced breast cancer who underwent NC were enrolled in the study. We retrospectively evaluated size and response of tumours to NC by DM, DM combined with DBT, US and MRI before, during and at the end of the treatment. We assumed as gold standard the tumour size measured at pathology. Patients were divided into responders (with pathologic complete (pCR) or partial response (pPR)) and non-responders (NR). Measurements were considered concordant if they were ±10 mm. Tumour size assessments were statistically analyzed with paired t-test, regression line and Pearson’s linear correlation coefficient and Bland-Altman Plots; categorical variables were arranged in contingency tables and analyzed with chi square test or Fisher’s test; 95% Confidence Intervals were estimated for all percentages.

RESULTS
For pCR patients (16/44), size estimates by all modalities showed an exponential decrease during treatment time (r=0.9; p=0.005). The size agreement with pathology was 29 (95%CI 10-55)% for US, 36 (14-62)% for DM, 33 (12-62)% for DM+DBT, 54 (27-79)% for MRI. For pPR patients (18/44), size estimates by imaging showed a linear decrease during treatment (r=0.9; p=0.008). The size agreement was 69 (41-80)% for US, 54 (27-79)% for DM, 70 (38-92)% for DM+DBT, 87 (62-98)% for MRI. For NRs (10/44), US, DM and DM+DBT overestimated tumour size, while MRI measurements agreed with pathology. For the responders, the agreement between pCR predictions at mid-treatment and pathological responses was 71 (10.4-90.5)% for both US and DM, 11 (15.7-65.9)% for DM+DBT, 38.5 (15.7-65.9)% for MRI; pCR prediction was 54.5 (25.9-81)% for US, DM and DM+DBT, 84.6 (57.8-97.3)% for MRI. NR prediction at mid-treatment was 80 (47-99)% for US, 80 (33-98)% for DM, 82 (47-99)% for DM+DBT, 86 (47-99)% for MRI.

CONCLUSION
Predictions of response and residual tumour size made on MRI showed a better agreement with pathology than DM, DM+DBT, US. DBT in addition to DM improved conventional imaging in pPR and NR predictions.

CLINICAL RELEVANCE/APPLICATION
Breast MRI can be considered the most reliable imaging modality for pathological response evaluation after neoadjuvant chemotherapy, but the addition of DBT improves conventional imaging performances.

SSM02-06 • Analysis of the Influence of Surrounding Fat Tissue in the Detection Rate of Ultrasound and Digital Breast Tomosynthesis after Normal Mammography

Pedro Slon MD ; Jon Etxano MD (Presenter) ; Maria Paramo Alfaro MD ; Romina Zalazar MD ; Arlette Elizalde ; Luis Pina MD, PhD ; Fernando Martinez Regueira ; Natalia Rodriguez-Spiteri

PURPOSE
To assess the features of the tissue surrounding the additional detected cancers by US and DBT after normal Mammography.

METHOD AND MATERIALS
We retrospectively analyzed 75 histologically confirmed tumors in 55 patients (13 ductal carcinomas in situ and 62 invasive carcinomas). All the patients underwent Digital Mammography, US and Tomosynthesis. The tumors were classified in four categories according to the amount of peritumoral fat (I = >75%, II = 50-75%, III = 25-75% and IV = Gold Standard) was established with histological study obtained after surgery. The detection rate of additional tumors by US and DBT was compared regarding to the percentage of peritumoral fat using the McNemar test (SPSS, 15.0)

RESULTS
Out of the 75 tumors, DM detected 42 (56%) and 33 (44%) were detected by additional techniques. The number of additional tumors
detected by US was 14 (+18.6%) and by DBT was 17 (+22.6%). Out of these additional tumors, 7 (9.3%) were only detected by US, 4 (5.3%) only detected by DBT and 10 (13.3%) were detected by both. The remaining 9 tumors were diagnosed with second look US after presurgical MRI. All of the additional tumors were invasive carcinomas. We did not find statistical differences between both techniques in Group I (US = 2, DBT = 2; p=1.00), Group II (US = 5, DBT = 8; p=0.375) and Group III (US = 3, DBT = 2; p=1.00). In Group IV (US=7, DBT=2; p=0.06) we found a trend to statistical significance, with 5 tumors detected on US and missed on DBT and no additional tumors diagnosed by DBT not detected by US.

**CONCLUSION**
Both US and DBT present similar results in the detection of additional breast cancers when they are predominantly surrounded by fat (more than 25%). However, we found that in tumors with less than 25% of peritumoral fat, US seems to be more sensitive than DBT.

**CLINICAL RELEVANCE/APPLICATION**
This study supports that US seems to be better than DBT in the detection of tumors with a low quantity of surrounding fat, i.e., in dense breast (ACR density pattern IV).

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**Cardiac (Experimental and Animal)**

**Wednesday, 03:00 PM - 04:00 PM • S502AB**

**SSM03 • AMA PRA Category 1 Credit™: 1 • ARRT Category A+ Credit: 1**

**Moderator**
V. B. Ho, MD, MBA *

**E. Kent Yucel**, MD

**Moderator**
V. B. Ho, MD

**P. K. Woodard**, MD *

**SSM03-01 • Phase-contrast Computed Tomography of Coronary Atherosclerotic Plaque: Characterization of Plaque Components Based on Quantitative Phase-contrast Hounsfield Units**

**Holger Hetterich** MD (Presenter);
**Marian Willner**;
**Christopher Habbel**;
**Julia Herzen**;
**Michael Chabior**;
**Fabian Bamberg** MD, MPH *;
**Franz Pfeiffer**;
**Maximilian F Reiser** MD;
**Tobias Saam** MD *

**PURPOSE**
Atherosclerotic plaque imaging by absorption-contrast computed tomography (ACT) is limited due to poor contrast in low absorbing materials like soft plaque. Phase-contrast CT (PCT) is an experimental technique relying on X-ray phase-shift rather than absorption, yielding a higher contrast in biological soft tissue. Phase-contrast Hounsfield units (HU-P) can be calculated in analogy to absorption-contrast HU (HU-A) using the refraction index. We hypothesized that plaque components including fibrous (Fib), lipid-rich (Lip) and calcified tissue (Cal) can be differentiated based on HU-P.

**METHOD AND MATERIALS**
Ten ex-vivo human coronary arteries were imaged at a laboratory-based set-up using a conventional X-ray tube (35kV) and grating-interferometer to obtain the phase- and absorption-signal simultaneously. Tomographic images were reconstructed with an effective pixel size of 100µm and correlated with histopathology sections. In both ACT- and PCT-data, regions corresponding to Fib, Lip or Cal based on histopathology as well as reference regions in surrounding fat were manually traced. Mean HU-A, HU-P and signal-to-noise ratios (SNR) were calculated for all analyzed regions.

**RESULTS**
A total number of 276 cross-sections with 206 Fib, 113 Lip and 115 Cal containing regions were assessed. Fib, Lip and Cal were associated with significant different mean HU-P (57.5±9.3, 28.9±5.8 and 325.0±113.0; p=0.01) although there was no difference for Cal (p=0.72).

**CONCLUSION**
In an ex-vivo experimental set-up PCT can reliably differentiate important components of atherosclerotic coronary lesions based on quantitative HU-P, indicating its high potential for improved assessment of coronary artery disease.

**CLINICAL RELEVANCE/APPLICATION**
Phase-contrast computed tomography might improve characterization of coronary atherosclerotic plaque morphology compared to conventional absorption CT.

**SSM03-02 • Non Contrast T2-mapping Detects Area at Risk in Acute Myocardial Ischemia Rats**

**Rui Xia** (Presenter);
**Xi Lu**;
**Jichun Liao**;
**Jie Zheng** PhD;
**Fabao Gao** MD, PhD

**PURPOSE**
To compare the area at risk in rats with myocardial infarction and reperfused myocardial ischemia with a T2-mapping method on 7.0T MR.

**METHOD AND MATERIALS**
Two groups (7 each group) of reperfused myocardial ischemia(MI30) and myocardial infarction(MI) rats were investigated. For MI30, the left anterior descending coronary artery was occluded for 30 minutes while MI was induced by permanent ligation of the left anterior descending coronary artery. MRI scans were taken at 24 hours after the occlusion. The T2-mapping was optimized on 7.0T MR(BRUKER BIOSPEC 70/30). Multiple single-slice turbo spin-echo T2-weighted images were acquired on the short axis slices during mid-diastolic phase and end-inspiratory period using both ECG and respiratory gating systems(TR/TE=1500ms/10, 20, 30ms,MTX=192×192,FOV=50×50mm,slice thickness=1.5mm). Then late gadolinium enhancement(LGE) imaging was performed by FISP(TR/TE=5.2ms/1.8ms,FA=25°,MTX=256×256,FOV=50×50mm,slice thickness=1.5mm) after an injection of Gd-DTPA. After MRI scan, rat hearts were cut into transverse slices for TTC staining. The T2-maps were calculated using a custom-made software. Area at risk were defined as the difference between edema areas with high T2 signal and the infarcted area defined by LGE and TTC staining for MI30(17.5±2 vs. 15.2±4, n=3, p>0.05) and MI(22.5±3 vs. 21.2±2, n=3, p>0.05). There was no significant difference between two groups (MI 1.62±0.27, MI30 1.59±0.16, p>0.05) in normalized mean T2 values of myocardial edema areas. The total size of infarction regions in MI(23.2±4.7%) was significantly higher than MI30(16.3±4.2%, p<0.05). No significant difference was found for the edema area defined by LGE and TTC staining for MI30(17.5±2 vs. 15.2±4, n=3, p>0.05) and MI(22.5±3 vs. 21.2±2, n=3, p>0.05).

**CONCLUSION**
After 30 min myocardial ischemia in rats, reperfusion can reduce myocardial infarction, but not area at risk and edema.

**CLINICAL RELEVANCE/APPLICATION**
Area at risk may not always be the target of therapy for patients who undergo reperfusion after acute myocardial infarction.
SSM03-03 • Beam Hardening Correction in Quantitative Myocardial CT Perfusion with Rapid kV Switching Dual Energy CT: A Validation Study with Microspheres

Aaron So PhD (Presenter); Jiang Hsieh PhD *; Yasuhiro Imai MS *; Jean-Baptiste Thibault *; Kelley Branch MD *; Ting-Yim Lee MSc, PhD *; Suresh Narayanan MS *; Sandeep Dutta PhD *

PURPOSE
We validated the usefulness of beam hardening (BH) reduction with a rapid kV switching dual energy CT (DECT) protocol in quantitative myocardial perfusion (MP) imaging against microspheres measurement of MP.

METHOD AND MATERIALS
Normal pigs were scanned using a Discovery 750HD scanner (GE Healthcare (GE)) with a DECT protocol: 140/80 kilovolts (kV) alternating at 0.2 ms intervals, 640 mA and 0.35 s gantry period. In each study, 22 axial scans covering 40 mm of the heart were triggered under normal physiologic conditions every 1-2 heart beat at mid-diastole together with contrast injection contrast at 4 ml/s. Single energy CT (SECT) and DECT monochromatic 70 keV images were reconstructed with 140 kV and both 80 and 140 kV projections respectively. The SECT images were also corrected for BH using an image-based correction algorithm (IBHC). Each image set was analyzed using CT Perfusion (GE) to derive MP functional maps. Fluorescent microspheres were injected into the left atrial appendage of the heart after the CT perfusion studies to measure MP. Mean MP in the lateral, apical and septal segments over 4 to 6 consecutive 5-mm-thick slices measured by microspheres and from the three CT image sets were compared using linear regression and Bland-Altman analysis. A total of 57 segments in 19 slices in four pigs were analyzed in this study.

RESULTS
DECT exhibited the highest correlation with microspheres (R=0.77) compared to SECT with (R=0.56) and without (R=0.49) IBHC. DECT also had the smallest difference in mean MP from microspheres (2.2 ml/min/100g) compared to SECT without IBHC (29.2). Despite a comparable mean difference from microspheres (-2.0), SECT with IBHC showed a wider limits of agreement (-45.0 to 41.0 ml/min/100g) than DECT (-30.7 to 35.2).

CONCLUSION
DECT provided better BH correction and the most accurate and smallest variation of MP measurements compared to microspheres MP gold standard. In SECT MP imaging, IBHC reduced the spatially inconsistent overestimation of MP in myocardial segments but did not outperform DECT.

CLINICAL RELEVANCE/APPLICATION
DECT minimizes beam hardening in contrast-enhanced cardiac images which leads to a more accurate MP measurement with CT Perfusion to facilitate reliable assessment of ischemic heart disease.

SSM03-04 • A Computational Algorithm for the Automated Detection of the Napkin-ring Sign: A High-risk Plaque Feature in Coronary CT Angiography

Christopher L Schlett MD, MPH (Presenter); Nabeel Ali BS; Maros Ferencik MD; Hans-Ulrich Kauczor MD *; Udo Hoffmann MD

PURPOSE
To develop a fully automated computational algorithm which allows highly efficient, accurate and reproducible detection of the "Napkin-Ring Sign" (NRS), which has been validated as a highly specific marker for vulnerable plaque in coronary CT angiography (CTCA). NRS is characterized by a center of lower CT attenuation representing a lipid-rich/necrotic core in histology surrounded by a rim-like area of higher CT attenuation representing fibrous tissue (figure). So far, NRS detection is limited to a manual and time-intensive reading by CTCA experts.

METHOD AND MATERIALS
The algorithm was developed utilizing MATLAB (Mathworks, Natick, MA), which employs computational image-analysis techniques. A database of cross-sectional CTCA images of coronary arteries from ex-vivo human cadaver hearts co-registered with histology was used. Presence of NRS for each CTCA cross-section was evaluated by a manual reading of a CCTA expert. The vulnerable status of the plaques was confirmed based on the co-registered histology images. Images were randomly split into a training and validation sets, each containing 15 NRS-positive and 45 NRS-negative CTCA cross-sections. The algorithm was developed with iterative steps based on the training set and the performance of the algorithm was verified based on the validation sets.

RESULTS
The algorithm analyzes each cross-sectional image by establishing "Line Density Profiles" (LDP) at the lumen centre in fixed intervals of rotation. Based on the training set, the following decision rule was established. A LDP was "positive" if it had a bi-peak curve with its first peak (labeled as X) at a minimum of 0-100 Hounsfield Units (HU) and second peak (labeled as Y) > 0 HU and Y>X regarding HU values. If ≥4 consecutive LPDs were "positive", the algorithm considered the entire CTCA cross-section as NRS positive. Applying this algorithm in the validation set, the accuracy was 72% with 94% sensitivity and 67% specificity to detect NRS fully automated. Adjunct structures such as vessel branches led to a false-positive results.

CONCLUSION
We have developed a novel computational algorithm that automatically detects the presence of the NRS in cross-sectional coronary CTA images with a good accuracy.

CLINICAL RELEVANCE/APPLICATION
If our NRS algorithm is combined with vessel segmentation software, a routine detection of high-risk plaques should be feasible even in larger cohorts and a treatment possible before the event occurs.

SSM03-05 • Cardiac Magnetic Resonance Elastography of the Right Ventricle in Canines with Congenital Pulmonary Valve Stenosis

Juliana S Da Silveira MD (Presenter); Brian A Scansen; Peter Wassenaar MS *; Brian Raterman; Ning Jin *; Richard D White MD; John D Bonagura; Arunark Kolipaka PhD

PURPOSE
To demonstrate the feasibility of quantitatively assessing right ventricular (RV) stiffness using cardiac magnetic resonance elastography (CMRE) and correlate it against RV thickness and mass in dogs with severe congenital pulmonary valve stenosis causing RV hypertrophy (RVH).

METHOD AND MATERIALS
RESULTS
Figure 1 shows a short-axis magnitude image (A), snap shots of wave propagation (B-E) and the corresponding stiffness map (F) with a mean RVFW stiffness value of 6.8kPa from one dog. Figure 2A shows poor inverse correlation between normalized RV mass and RVFW stiffness during ED (R2=0.05) and ES (R2=0.40). Figure 2B shows a poor inverse correlation between RVFW stiffness and thickness during ED (R2=0.19), but a good inverse correlation during ES (R2=0.81).

CONCLUSION
It is known that wall thickness has been used as a surrogate for estimating myocardial stiffness. However, our results do not show an increase in stiffness with an increase in wall thickness or mass; suggesting that thickness or mass do not reflect changes in the intrinsic mechanical property of the RV myocardium.

CLINICAL RELEVANCE/APPLICATION
SSM03-06 • Evaluating Myofibre Architecture of Rhesus Monkey with Myocardial Infarction Using DT-MRI

Yuqing Wang (Presenter) ; Lei Wang ; Rui Xia ; Fabao Gao MD, PhD

PURPOSE
For more accurately deducing and better understanding the microstructural progress of myocardial infarction in human being, we developed a rhesus monkey model of myocardial infarction for studying myocardial fibers on 7.0T MR.

METHOD AND MATERIALS
Infarction had been produced by permanent suture ligation of the left anterior descending coronary artery for 12 weeks. Both infarcted and healthy monkeys were sacrificed under deep surgical anesthesia with pentobarbital for excising heart. The excised heart was immediately perfusion-fixed by and stored in a 4% paraformaldehyde solution. All experiments were performed in accordance with regulations for the humane care of laboratory animals at Sichuan university. The diffusion tensor imaging (DTI) of each excised heart was performed on 7.0T MR (Bruker BioSpec 70/30, Germany). Each DTI dataset consisted of a single non-weighted and 30 diffusion-weighted 3D spin echo scans (TR/TE=12000/32ms, MTX=100×100, FOV=50×50mm, slice thickness=0.8mm) encoded in 30 gradient directions. The scan time for each DTI dataset was the same, approximately 20 hrs. All DTI datasets were analyzed to calculate the diffusion parameters such as fractional anisotropy (FA) and apparent diffusion coefficient (ADC) using Diffusion Toolkit package and the myocardial fiber tractography was performed by using Trackvis software.

RESULTS
The figure 1A and B revealed respectively the myocardial fibers in healthy monkey and in infarcted monkey. In the infarcted heart, the decreased FA (0.2457) and increased ADC (0.00048) in infarcted area (red arrow) than in remote area (FA: 0.817, ADC: 0.00019) indicated damaged completeness of myocardial fibers in infarcted area. In contrast, the healthy heart revealed homogeneous FA and ADC in whole heart. Moreover, the myocardial fibers were intermittent (=2500 track/ml) in infarcted area but holonomic (=4977 track/ml) in remote area.

CONCLUSION
Higher similarity of fibers architecture with the ex-vivo human's heart made us to accurately deduce and interpret the human's myocardial infarction using infarcted monkey's hearts. To the best of our knowledge, this study is a first in monkeys for myocardial fiber imaging using 7.0T MR.

CLINICAL RELEVANCE/APPLICATION
The monkey model enable us to deduce and understand the human's myocardial infarction in more accurate manner.

ISP: Cardiac (Clinical Trials and Population Studies)

Wednesday, 03:00 PM - 04:00 PM • S504AB

CA

SSM04 • AMA PRA Category 1 Credit ™:1 • ARRT Category A+ Credit:1

Moderator
W. Brian Hyslop , MD, PhD

Moderaotor
U. Joseph Schoepf , MD *

SSM04-01 • Cardiac Keynote Speaker: MagnaSafe Registry
Robert J Russo MD, PhD (Presenter)

SSM04-03 • The Diversion of Outpatient Echocardiography from Private Offices to Higher Cost Hospital Facilities: An Unanticipated Effect of Code Bundling

David C Levin MD (Presenter) * ; Vijay M Rao MD ; Laurence Parker PhD ; Ethan J Halpern MD

PURPOSE
In 2009, the add-on codes for spectral Doppler and color flow Doppler echocardiography (echo) were bundled into the primary transthoracic echo (TTE) code. The relative value units for the new single code were substantially lower than the previous sum for the 3 codes that were usually done together. Our purpose was to see what effect this had on Medicare echo utilization rates and on the distribution of outpatient echos between cardiology offices and hospital outpatient departments (HOPDs). This is important because the costs to Medicare of echos done in HOPDs are substantially higher than of those done in offices.

METHOD AND MATERIALS
The nationwide Medicare Part B databases for 2005-2011 were used. All echo CPT codes were selected. Specialty codes were used to identify echos done by cardiologists (who do most echos). Place-of-service codes were used to identify echos done in offices and HOPDs. Procedure volumes and utilization rates per 1000 were determined, and trends were evaluated before and after bundling occurred in 2009.

RESULTS
Cardiologists’ office echo utilization rate rose from 219.5 per 1000 in 2005 to 257.1 in 2008, then dropped to 100.0 in 2009 (-61%). Their HOPD echo rate rose from 72.2 in 2005 to 76.5 in 2008, then dropped to 35.0 in 2009 (-54%). From 2009 to 2011, cardiologists’ office echo rate dropped again from 100.0 to 88.8 (-11%), while their HOPD echo rate increased from 35.0 to 46.1 (+32%). In 2008 (the last year before bundling), 23% of all outpatient echo was done in HOPDs; this increased to 34% by 2011.

CONCLUSION
Echo code bundling produced a sharp drop in outpatient claims from cardiologists. After bundling, office echo rates continued to drop but HOPD echo rates increased. This was likely due to migration of cardiology office practices into hospitals. The technical component national fee for office TTE is $148 vs $393 for HOPD echo. It appears that in this instance, code bundling (which also occurred with cardiac nuclear scans) led to closure of many cardiology offices and a resultant shift of echos from that lower cost setting to the much higher cost HOPD setting. From the perspective of Medicare and other payers, this is a drawback of code bundling.

CLINICAL RELEVANCE/APPLICATION
not applicable

SSM04-04 • Extent and Distribution of Left Atrial Delayed Enhancement at MRI in Patients with and without Atrial Fibrillation

Hubert Cochet MD (Presenter) ; Amaury Mouries ; Delphine Elbes ; Mathilde Merle ; Bruno Quesson ; Jatin Relan ; Maxime Sermesant ; Nicholas Ayache PhD ; Pierre Jais ; Michel Montaudon MD ; Francois H Laurent MD

PURPOSE
Atrial delayed enhancement (aDE) at MRI has mostly been reported in patients with atrial fibrillation (AF). Additionally, the 3-dimensional distribution of aDE has not been thoroughly studied. We aimed to study the extent and distribution of aDE in patients with and without AF.
190 patients referred for cardiac MRI underwent aDE imaging. The population was composed of 60 AF patients (26 persistent), and 130 patients without AF, including 75 with structural heart disease (SHD). Imaging was performed using a 3-dimensional respiratory-navigated inversion-recovery prepared TurboFLASH method with fat saturation (voxel size 1.25x1.25x2.5mm). Acquisition was initiated 15 minutes after contrast media injection. After left atrial segmentation aDE was quantified using an adaptive thresholding algorithm and expressed in % of the left atrial wall. Regression analysis was performed to identify predictors of aDE extent. Areas of aDE were registered to an atrial template to study aDE distribution in sub-populations.

RESULTS

CONCLUSION
In addition to age, AF and its persistence are major determinants of aDE extent. However, aDE is also related to female gender and SHD. The distribution of aDE is highly variable between patients but a stereotyped pattern is found, regardless of the underlying condition. aDE is more frequent in the posterior wall around left inferior pulmonary vein ostium.

CLINICAL RELEVANCE/APPLICATION
The determinants of atrial delayed enhancement at MRI are consistent with atrial remodeling. Age, atrial fibrillation and structural heart disease are associated with a higher extent of enhancement.

Standard Weight-based Gadolinium Dosing over Corrects for Body Size in Obese Individuals when Evaluating the Myocardium: The Multi-Ethnic Study of Atherosclerosis (MESA)

Songtao Liu MD (Presenter); Chia-Ying Liu; Jing Han; Evrim B Turkbey MD; Bharath Venkatesh; Diane Bild; Andrew E Arai MD; Robyn Mcclelland; William Hundley; Antoinette S Gomes MD *; Russell Tracy; Richard Kronmal; Joao A Lima MD *; David A Bluemke MD, PhD *

PURPOSE
Gadolinium-based contrast agents (GBCAs) are administered in direct proportion to body weight according to FDA approval. However, body fat deposits more than either visceral organs or muscle and has a lower contribution to the extravascular fluid space. The purpose of this study was to evaluate the impact of body weight based GBCA dosing on myocardial T1 time in a large multi-center study.

METHOD AND MATERIALS
1231 study participants (mean age 67±9 years) free of clinical cardiovascular disease at enrollment (2000) in the Multi-Ethnic Study of Atherosclerosis (MESA) underwent gadolinium enhanced CMR. GBCA (Magnevist,0.15mmol/kg) was administrated and T1 mapping was performed at the mid-ventricular level before and after GBCA using a MOLLI sequence. Study participants with focal late gadolinium enhancement were excluded. The associations of myocardial T1 time with body weight and body mass index (BMI) were evaluated by a linear model adjusting for age, ethnicity, traditional risk factors and creatinine.

RESULTS
The mean BMI was 28.4±5.6 for women and 27.9±4.2 for men. The mean post-contrast myocardial T1 times were 440±39 ms (@12min), and 504±38 ms (@25min) for women. For men, the corresponding values were slightly higher, 469±31 ms @12min, and 532±33 ms (@25min). Pre-gadolinium T1 times were not associated with either body weight or BMI. Post-gadolinium T1 times were significantly related to both weight and BMI (women, weight, r:-0.43; BMI, r:-0.41; men, weight, r:-0.25; BMI, r:-0.23; all p=0.001). For an individual with BMI of 35 kg/m², weight-based GBCA administration resulted in a 38 msec lower T1 time for women, and a 20 msec lower T1 time for men relative to an individual with a BMI of 20 kg/m². Similar results were obtained when considering waist circumference as a measure of obesity.

CONCLUSION
For myocardial T1 evaluation, standard body weight based administration of GBCA “overdoses” individuals with elevated BMI, this effect is slightly greater for women compared to men.

CLINICAL RELEVANCE/APPLICATION
Standard weight based dosing of a GBCA may result in overcorrection in obese subjects, lowering myocardial T1 time, potentially confounding interpretation of T1 results.

Ethnic Differences in Aortic Stiffening across the Adult Life Span: Results from MRI Aortic Pulse Wave Velocity Measurements in the Dallas Heart Study

Akshay Goel BS (Presenter); Ronald M Peshock MD; Christopher Maroules MD; Colby Ayers MS; Roderick McColl PhD; Kevin S King MD

PURPOSE
Aortic pulse wave velocity (APWV) is a non-invasive measure of aortic stiffness, independently associated with end organ damage and mortality. The purpose of this study was to assess ethnic differences in aortic stiffness across the adult life span using MRI measured APWV in a large population based study.

METHOD AND MATERIALS
The study consisted of 1197 participants from the Dallas Heart Study-1 (DHS-1), a multiethnic, population-based study of cardiovascular health. APWV was measured across the thoracic aortic arch using phase contrast (PC) cardiac gated MRI, expressed as velocity in m/s. APWV measurements were log transformed to normalize the distribution. Linear regression was used to model the age-related increase in APWV stratified by Black ethnicity and Non-Black ethnicity.

RESULTS

CONCLUSION
In the DHS-1 Blacks demonstrated increased age related aortic stiffening across the adult life span relative to Non-Blacks.

CLINICAL RELEVANCE/APPLICATION
Ethnic differences in aortic stiffness across the adult life span can be demonstrated by MRI measures of APWV, and may account for ethnic differences in cardiovascular events.
Characteristics and Prognostic Implications- Work in Progress

In advanced stage (IIIB and IV) lung adenocarcinoma, the presence of lymphangitic metastasis or its extent does not have any impact on patient prognosis. Compared with those without the condition, and the extent of lymphangitic metastasis also does not affect on patient overall survival.

Stage IIIB or IV lung adenocarcinoma patients with lymphangitic metastasis at the initial CT does not show significantly different survival. The subject group (n = 54) consisted of four stage IIIB (7.4%) and 50 stage IV (93.6%) lung adenocarcinoma patients. After restaging with CT and PET/CT results by the new 7th TNM classification, CT and clinico-demographic data were investigated for the patients with non-adenocarcinoma pathology or with surgery or irradiation history.

RESULTS Quality of fat suppression was better for DWIBS in comparison with DWI both for the ungated (image quality score 3.9±0.33 vs 1.5±1.2, p = .001) and for the gated sequences (3.9±0.33 vs 1.5±1.2, p = .001). For each of the four sequences, a qualitative analysis, defined by fat-sat homogeneity and presence of motion artefacts, rated from 0 to 4, was independently performed by two radiologists. The signal to background (SB) of mediastinal lymph nodes was also calculated as the signal of the lymph node divided by the mean signal of the thoracic muscles. Kruskal Wallis and ANOVA tests were performed to compare respectively the qualitative and the quantitative data of DWI and DWIBS images with adapted post-hoc tests.

CONCLUSION DWIBS sequence improves the fat-sat homogeneity, reduce motion artefacts and increase the STB of mediastinal lymph node in comparison with DWI. Respiratory gating doesn’t improve significantly DWIBS image quality.

Lung Adenocarcinomas Presenting with Concurrent Lymphangitic Metastasis at the Initial CT: Clinical Characteristics and Prognostic Implications- Work in Progress

PURPOSE To evaluate the clinical characteristics and prognostic implications of patients with lung adenocarcinoma presenting with concurrent lymphangitic metastasis at CT

METHOD AND MATERIALS We retrospectively reviewed the clinical data base of patients who were newly diagnosed to have non-small cell lung cancer (NSCLC) from 2007 through 2010. We searched for the cases in which radiologic report text harbored the term “lymphangitic metastasis” and clinically ensured that the findings are suggestive of lymphangitic metastasis by excluding those who were proven to have pulmonary edema on follow-up study. The extent of lymphangitic metastasis was classified into having involved the same lobe, the ipsilateral lung but the different lobe, and the different lung. Two chest radiologists reviewed CT scans and decisions were reached by consensus. We excluded the patients with non-adenocarcinoma pathology or with surgery or irradiation history.

RESULTS The subject group (n = 54) consisted of four stage IIIB (7.4%) and 50 stage IV (93.6%) lung adenocarcinoma patients (34 men, 20 women; mean age 59 ± 10 years). Of these patients, lymphangitic metastasis was depicted in the same lobe in 10, in the ipsilateral lung but different lobe in 32 and in the different lung in 12 patients. Forty two patients received chemotherapy and 12 patients did not. There was no significant difference in overall survival between lung adenocarcinoma patients with and without lymphangitic metastasis (p = .758). The extent of lymphangitic metastasis also showed no significant correlation with patient prognosis (p = .121).

CONCLUSION Stage IIIB or IV lung adenocarcinoma patients with lymphangitic metastasis at the initial CT does not show significantly different prognosis compared with those without the condition, and the extent of lymphangitic metastasis also does not affect on patient overall survival.

Lung Adenocarcinomas Presenting with Concurrent Lymphangitic Metastasis at the Initial CT: Prognostic Value of Metabolic Tumor Volume in Patients with Esophageal Carcinoma

PURPOSE To compare DWIBS sequence with DWI both with and without respiratory gating in mediastinal lymph node analysis at 3T.

METHOD AND MATERIALS 26 patients (27-79 years-old) scheduled for surgical lymph node analysis, prospectively undergone a whole thoracic exploration with DWIBS (TR/TE 6674/44; FatSat STIR with IR=260ms; Slice Thickness=5mm) and DWI sequences (TR/TE 1291/59; Spectral FatSat; Slice Thickness=5mm) with and without (free breathing) respiratory gating with 0, 400 and 800 b-values at 3T. For each of the four sequences, a qualitative analysis, defined by fat-sat homogeneity and presence of motion artefacts, rated from 0 to 4 were independently performed by two radiologists. The signal to background (SB) of mediastinal lymph nodes was also calculated as the signal of the lymph node divided by the mean signal of the thoracic muscles. Kruskal Wallis and ANOVA tests were performed to compare respectively the qualitative and the quantitative data of DWI and DWIBS images with adapted post-hoc tests.

RESULTS Quality of fat suppression was better for DWIBS in comparison with DWI both for the ungated (image quality score 3.9±0.33 vs 1.5±1.2, p = .001) and for the gated sequences (3.9±0.33 vs 1.5±1.2, p = .001). For each of the four sequences, a qualitative analysis, defined by fat-sat homogeneity and presence of motion artefacts, rated from 0 to 4 were independently performed by two radiologists. The signal to background (SB) of mediastinal lymph nodes was also calculated as the signal of the lymph node divided by the mean signal of the thoracic muscles. Kruskal Wallis and ANOVA tests were performed to compare respectively the qualitative and the quantitative data of DWI and DWIBS images with adapted post-hoc tests.

CONCLUSION DWIBS sequence improves the fat-sat homogeneity, reduce motion artefacts and increase the STB of mediastinal lymph node in comparison with DWI. Respiratory gating doesn’t improve significantly DWIBS image quality.

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CONCLUSION DWIBS sequence improves the fat-sat homogeneity, reduce motion artefacts and increase the STB of mediastinal lymph node in comparison with DWI. Respiratory gating doesn’t improve significantly DWIBS image quality.
### SS05-05 • Dual-energy CT in Differentiating Thymic Epithelial Tumors: An Initial Experience

**Suyon Chang** MD (Presenter); **Jin Hur** MD; **Young Jin Kim** MD; **Hyе-Jеong Lee** MD; **Yoo Jin Hong** MD; **Byoung Wook Choi** MD

**PURPOSE**
The WHO histological classification reflects both the clinical and functional features of thymic epithelial tumors and thus contributes to the clinical assessment and treatment of patients with these tumors. The purpose of this study was to evaluate the diagnostic value of dual-energy computed tomography (DECT) in differentiating thymic epithelial tumors.

**METHOD AND MATERIALS**
We prospectively enrolled 14 patients (3 males; mean age: 53.3 years) who were pathologically confirmed as thymic epithelial tumors. All patients underwent dual-energy CT using gemstone spectral imaging (GSI) mode (GE HD750). For quantitative analysis, two investigators measured the following parameters; CT attenuation density (HU values), iodine-related HU (IHU), and iodine concentration (mg/ml). Pathological results were used as a final diagnosis. Statistical analysis included calculation of means and standard deviations, and the t-test.

**RESULTS**
There were a total of 8 low-risk thymomas (6 type AB and 2 type B1) and 6 high-risk thymomas (4 type B2 and 2 type C). The mean HU values of tumors were significantly different between the low-risk and high-risk thymoma groups (90.73 ± 17.04 vs 43.09 ± 20.08 HU; p = 0.0069). The mean iodine concentration and IHU values were significantly different between the two groups (2.18 ± 0.61 vs 0.64 ± 0.32; p = 0.0001 and 42.62 ± 14.36 vs 9.31 ± 5.39 HU; p = 0.0002, respectively).

**CONCLUSION**
Dual-energy CT using a quantitative analytic methodology can be useful in the differentiation between low-risk thymomas and high-risk thymomas.

**CLINICAL RELEVANCE/APPLICATION**
Dual-energy CT with quantitative measurements could be a helpful complementary tool to differentiate low-risk thymomas and high-risk thymomas in cases in which conventional CT is inconclusive.

### SS05-06 • Volume Perfusion Computer Tomography Monitors the AntiVascular Normalization Effect of Antivascular Therapy in Preclinical A549 Lung Adenocarcinoma Model

**Zeng Xiong** (Presenter); **Jin-Kang Liu**; **Hui Zhou**

**PURPOSE**
Numerous recent studies have shown that anti-angiogenic therapy can improve oxygenation and blood flow of aberrant tumors, thereby enhancing the efficacy of subsequent radiation and chemotherapy. This is referred to as "normalization" of aberrant tumor vasculature. Application of immunohistochemical techniques in quantitative evaluation of "vascular normalization" effect has always been limited by difficulties in generating reproducible data. This study demonstrates that volume perfusion computer tomography (VPCT) parameters may indicate vascular abnormality in a lung tumor model and reflect the "Vascular Normalization" effect after Bevacizumab treatment.

**METHOD AND MATERIALS**
In treated mice, BF was increased at day2 (p=0.035) and significantly increased at day4 (p=0.000) as compared to the baseline. In control mice, BF gradually decreased during treatment with significant difference on the baseline (p=0.05). Microvessel pericyte coverage index (MPI) was significantly increased and hypoxia was significantly reduced in tumors at day4-6 after Bevacizumab treatment compared to those treated with saline (p=0.000). This study clearly demonstrates the "vascular normalization" effect and it is perfectly correlated with VPCT parameters.

**CONCLUSION**
VPCT is a novel method for investigating lung tumor vascular architecture, and this might be considered as an innovative complementary tool for precise quantification of "vascular normalization" effect.

**CLINICAL RELEVANCE/APPLICATION**
VPCT might be considered as an additional complementary tool for precise quantification of Vascular Normalization effects, assessment of antitumor treatment effects.
**SSM06-02 • Abdominal Contrast-enhanced Computed Tomography Using Weight-specific Dosages and Fixed Injection Time: Contrast Medium Concentration Selection and Contrast Effects**

**Daiji Uchiyama** MD (Presenter) ; **Katsumi Nakamura** MD ; **Junpei Tanaka** ; **Akiyoshi Yamamoto** RT ; **Seigo Yoshida** MD

**PURPOSE**
To examine the methods for determining the contrast medium concentration and dosage in accordance with body weight, patients were divided into six groups according to their body weight, and the contrast effects of each contrast medium concentration were investigated and compared between these groups.

**METHOD AND MATERIALS**
The subjects comprised 1144 cases with an estimated glomerular filtration rate of no less than 60 ml/min/1.73 m2, who underwent imaging between October 2011 and February 2013. To stabilize the contrast effects of abdominal contrast-enhanced CT and to make reproducible testing possible in our hospital, abdominal contrast CT was conducted with a fixed injection time (30 s), a weight-specific dosage (600 mgI/kg), an adjustable injection speed, saline flushing, and bolus tracking. CT values of the aorta (celiac artery level), portal vein trunk, liver parenchyma, and hepatic vein were measured among the subjects in each body weight group (=39 kg, 40–49 kg, 50–55 kg, 56–62 kg, and > 63 kg (63-75kg, >76kg), and >63kg (63-79kg, 80kg)]. In addition, the contrast effects according to the contrast medium concentration (240, 300, 350, or 370 mgI syringes) were compared within each group. The upper limit for the contrast medium dosage was set at 350 ml/155 mL.

**RESULTS**
No significant differences in the contrast effects were noted within each group because of differing contrast medium concentrations in the aorta, portal vein, liver parenchyma, and hepatic vein. In addition, no clear differences were observed in the contrast effects groups. In the very high weight groups (96 kg or heavier in particular), the total contrast medium dosage restrictions resulted in lower iodine volumes (less than 499 mgI/kg), and the contrast effects were somewhat inferior to the other body weight groups.

**CONCLUSION**
When conducting abdominal dynamic CT with weight-specific dosages, fixed injection times, bolus tracking, and saline flushing, and selection of different contrast medium volumes and concentrations for each group makes it possible to maintain necessary iodine volumes and reduce waste of contrast medium. In addition, it makes it possible to inhibit excessively fast injection speeds.

**CLINICAL RELEVANCE/APPLICATION**
Abdominal Contrast-enhanced Computed Tomography using Weight-specific Dosages and Fixed Injection Time is recommended.

**SSM06-03 • Comparison of Four ContrastInjection Protocols with a Combination of Fixed Injection Duration and Patientsâ€™ Body-weight-Tailored Dose of Contrast Material for Multiphasic Hepatic CT: A Prospective Randomized Study**

**Masakatsu Tsurusaki** MD, PhD (Presenter) ; **Keitaro Sofue** ; **Tomoko Hyodo** MD ; **Yukinobu Yagyu** MD ; **Mitsuru Matsuki** MD ; **Takamichi Murakami** MD, PhD * ; **Masahiro Okada** MD

**PURPOSE**
We performed a prospective randomized study using 4 protocols for multiphasic hepatic CT applying a combination of fixed injection duration in patients' body-weight-tailored dose of contrast material, and to compare the quantitative and qualitative analyses among 4 protocols.

**METHOD AND MATERIALS**
The contrast enhancements of the aorta during the arterial phase were Group A/B/C/D=228.8/189.9/236.5/244.4 (HU), and there was no significant difference among Groups A, C, and D; furthermore, there was no difference in visual evaluation. The contrast enhancements of hepatic parenchyma during the portal and equilibrium phase were A/B/C/D = 36.7/34.3/44.9/42.4 (HU), respectively. There were significant differences between Group A and B, as well between as Group C and D, and also there is significant difference of visual evaluation of portal vein and hepatic parenchyma between C and other protocols.

**CONCLUSION**
Contrast enhancement of the aorta was dependent on fractional dose, while that of hepatic parenchyma was dependent on iodine dose. Good contrast enhancement of both the aorta and hepatic parenchyma could be achieved by using Group C, which indicated the potential usefulness of this method.

**CLINICAL RELEVANCE/APPLICATION**
A new protocol using longer injection duration of 38sec and middle concentration of contrast material may yield satisfactory enhancement.

**SSM06-04 • A Study of Reducing Contrast Agent Dose in Abdominal CTA**

**Weibing Wang** MMed (Presenter) ; **Jinbai Huang** MA ; **Jie Peng** MMed ; **Jing Luo** MMed

**PURPOSE**
To evaluate the image quality and the diagnostic value of using Low contrast dose, low contrast concentration and low flow rate for abdominal CTA on spectral CT imaging.
METHOD AND MATERIALS
120 patients prescribed to take abdominal CTA (Discovery CT750 HD, GE Healthcare) were enrolled and divided randomly and averagely into 2 groups. This study was approved by our institutional ethics committee. Use SmartPrep software to start every CTA scan at the threshold of 100 HU. Use GSI viewer software to get optimal keV images with optimal contrast noise ratio (CNR). Two CTA protocols (group A: n=60, fast 80 kVp/140 kVp switching, 60 ml, 300 mgI/ml, 3 ml/s; group B: n=60, 120 kV, 70 ml, 350 mgI/ml, 5 ml/s) were compared. The image quality parameters [mean CT value and CNR for abdominal aorta] and the weighted dose index (CTDIw) were evaluated, and the display ratio of right gastroepiploic artery were observed in VR images.

RESULTS
The image quality in both groups met the diagnostic need. The optimal keV for abdominal CTA in spectral CT imaging was 50.98±0.85 keV. There was no statistical difference for CNR and the display ratio of right gastroepiploic artery between optimal keV images and conventional CT images (P = 0.0526; CI -12.8 -0.07). Total contrast dose for CT scans was 60 ml in group A and 70 ml in group B. Total contrast concentration was 300 mgI/ml in group A and 14% less than the 300 mgI/ml in group B. The injection speed was 3 ml/s in group A, 40% less than 5 ml/s in group B. There was no statistical difference in CTDIw between 2 groups (16.87 mGy vs 14.98±8.12 mGy) (P>0.05).

CONCLUSION
The use of low contrast dose, low contrast concentration and low flow rate combined with spectral CT imaging provided contrast dose, contrast concentration and injection speed reduction with similar or better image quality in comparison with the conventional CTA protocol.

CLINICAL RELEVANCE/APPLICATION
The study makes it possible to undergo abdominal CTA scan with lower contrast agent dose, concentration and flow rate.

SSM06-05 • Reduction of Total Iodine Dose by Using Low Tube Voltage and High Tube Current Technique in Combination with Adaptive Statistical Iterative Reconstruction for Dynamic CT of the Pancreas
Yoshifumi Noda MD (Presenter); Satoshi Goshima MD, PhD; Hiroshi Kawada MD; Haruo Watanabe MD; Hiroshi Kondo MD; Masayuki Kanematsu MD; Nobuyuki Kawai MD; Yukichi Tanahashi MD; Kytongae T Bae MD, PhD*

PURPOSE
To prospectively compare a low tube voltage (80-kVp) with a conventional (120-kVp) CT protocol for contrast enhancement degree of vascular and pancreatic parenchyma, image quality, and detectability of pancreatic cancer.

METHOD AND MATERIALS
Institutional review board approval and written informed consent was obtained. During a 6 months period, 136 patients (66 men, 70 women, age range 21-86 years, mean age 65.9 ± 11.0 years) with suspicious having pancreatic disease were randomized into three groups according to the following iodine-dose per body-weight protocols: 600 mgI/kg (600 mg of iodine per kilogram) at 120-peak kilovoltage (kVp) (Group 1), 500 mgI/kg at 80-kVp (Group 2), and 400 mgI/kg at 80-kVp (Group 3). One way analysis of variance were conducted to evaluate differences in CT number, background noise, signal-to-noise ratio (SNR), DLP, effective dose (ED), and liver (P<.001) and portal vein (P<.001) in portal venous phase, respectively. There was no significant difference in FOM, the image quality, and radiation exposure between the three groups. Sensitivity, specificity, and AUC for detection of pancreatic cancer were comparable among three groups.

RESULTS
47 patients (20 men, 27 women, mean 62.2 years, age range 42-85 years) with 53 pancreatic cancers (mean size, 30.2 mm; range, 6.0-89.0 mm) were identified. Compared with group 1 and 3, group 2 demonstrated significantly higher contrast enhancement and SNR of the aorta (P<.001) and pancreas (P<.001), and CNR (P=.004) in pancreatic parenchymal phase (PPP), and portal vein (P<.001) and liver (P<.001) in portal venous phase, respectively. There was no significant difference in FOM, the image quality, and radiation exposure between the three groups. Sensitivity, specificity, and AUC for detection of pancreatic cancer were comparable among three groups.

CONCLUSION
Use of 400 mgI/kg at 80-kVp tube voltage demonstrated comparable image quality and detectability of pancreatic cancer to conventional protocol of 600 mgI/kg at 120-kVp, while the use of 500 mgI/kg at 80-kVp showed better enhancement degree and CNR.

CLINICAL RELEVANCE/APPLICATION
Our study demonstrated the possibility of the iodine-dose reduction in 80-kVp CT imaging of the pancreas. This information is useful for designing clinical protocols for pancreatic CT imaging.

SSM06-06 • High Concentration (400 mgI/mL) versus Low Concentration (320 mgI/mL) Iodinated Contrast Media in Multi Detector Computed Tomography of the Liver: Comparison between 100 kV and 120 kV Acquisition Protocol
Fabrizio Vecchietti MD (Presenter); Marco Rengo MD; Davide Bellini MD; Damiano Caruso MD; Domenico De Santis MD; Andrea Laghi MD *

PURPOSE
To compare two contrast media with different iodine concentration (Iodixanol 320 mgI/mL and Iomeprol 400 mgI/mL) in terms of liver parenchymal enhancement in multidetector computed tomography at 100 kV and 120 kV.

METHOD AND MATERIALS
110 patients were prospectively randomized into three groups. In Group A patients received 637.5 mg of Iodixanol per kg of Lean Body Weight (LBW) and images were acquired at 120 kV. In Group B patients received 637.5 mg of Iomeprol per kg of Lean Body Weight of Iodixanol 320 and images were acquired at 100 kV. In Group C patients received 750 mg of Iodixanol per kg of Lean Body Weight of Iodixanol 400 and images were acquired at 120 kV. Attenuation values were measured on pre contrast and portal venous phase. Contrast Enhancement Indexes (CEI) were calculated subtracting basal densities from post contrast acquisitions. Means were compared with Paired T-test. Image quality was evaluated by a blinded independent reader.

RESULTS
Mean CEIs for groups A, B and C were respectively 49.37 HU (±7.2), 58.04 HU (±11.3), 54.55 HU (±9.9). Liver enhancement achieved injecting Iodixanol 320 was significantly higher at 100 kV if compare with imaging at 120 kV (P = 0.0369; CI 0.67-18.2). Liver enhancement achieved injecting Iodixanol 320 at 100 kV was not significantly different from that achieved injecting Iomeprol 400 at 120 kV (P = 0.4183; CI -5.581 -12.56). Liver enhancement achieved injecting Iodixanol 320 at 120 kV was not significantly different from that achieved injecting Iomeprol 400 at 120 kV (P = 0.0526; CI -12 -0.07). No significant differences were observed in terms of image quality among the three groups.

CONCLUSION
Similar liver enhancement values were observed injecting a lower amount of Iodixanol 320 compared to the ones achieved injecting Iomeprol 400. Values were even more similar when images obtained at 100 kV with Iodixanol 320 were compared to the ones obtained at 120 kV with Iomeprol 400 with no significant differences in terms of image quality.

CLINICAL RELEVANCE/APPLICATION
Liver imaging with Iodixanol 320 can be performed with a lower iodine dose and low kV protocol.

Gastrointestinal (Esophagus)
SSM07-01 • Esophageal Carcinoma: Evaluation with Diffusion-tensor MR Imaging and Tractography Ex Vivo

Ichiro Yamada MD (Presenter); Keigo Hikishima PhD, MS; Naoyuki Miyasaka MD; Yutaka Tokairin MD; Tatsuyuki Kawano MD; Eisaku Ito MD; Daisuke Kobayashi MD; Yoshinobu Eishi MD; Hideyuki Okano MD, PhD; Hitoshi Shibuya MD

PURPOSE
To determine the usefulness of diffusion-tensor MR imaging and tractography for evaluating the depth of mural invasion by esophageal carcinomas.

METHOD AND MATERIALS
Twenty esophageal specimens containing 20 carcinomas were studied using a 7.0-T MR system with a four-channel phased-array surface coil. Diffusion-tensor MR imaging was performed by using a diffusion-weighted spin-echo pulse sequence based on a Stejskal-Tanner diffusion preparation. The imaging parameters were: repetition time, 3000 msec; echo time, 25 msec; field of view, 50-60 x 25-30 mm; matrix, 256 x 128; section thickness, 1 mm without intersection gaps; voxel size, 0.195-0.234 x 0.195-0.234 x 1 mm (0.038-0.055 mm3); number of excitations, two; b value, 0 sec/mm2 or 1000 sec/mm2; and motion-probing gradient, in seven noncollinear directions. Diffusion-tensor tractographic images were computed with TrackVis software. MR images were compared with the histopathologic findings as the gold standard.

RESULTS

CONCLUSION
Diffusion-tensor MR imaging and tractography are capable of clearly depicting the individual tissue layers of the normal esophageal wall, and they have excellent diagnostic accuracy for evaluating the mural invasion of esophageal carcinomas. Thus, they may make it possible to noninvasively diagnose the depth of mural invasion by esophageal carcinomas.

CLINICAL RELEVANCE/APPLICATION
Diffusion-tensor MR imaging and tractography may provide a new tool to noninvasively diagnose the depth of mural invasion by esophageal carcinomas.

SSM07-02 • Is PET-CT a Better Tool than EUS for Preoperative Staging of Esophageal Carcinoma? A Comparative Study

Seyed Mahdi Abtahi MD (Presenter); Azadeh Elmi MD; Yingbing Wang MD; Yuen Chi Ho; Sandeep S Hedge MD; Mukesh G Harisinghani MD

PURPOSE
Currently, there is no single ideal staging modality for preoperative staging of esophageal cancer. The aim of this study was to assess the role of PET-CT in the pretreatment staging of esophageal cancer. We also compared the diagnostic accuracy of PET-CT with endoscopic ultrasound (EUS) in distinguishing low-stage disease (T1 and T2) from advanced T-stage disease.

METHOD AND MATERIALS

RESULTS
The overall accuracy of PET-CT in predicting the correct stage was significantly higher than EUS (p=0.002). However, there was no significant difference in comparison made for T-staging between the two modalities (p-value= 0.247). Correct T-staging was performed by PET-CT in 72.2% and by EUS in 55.58% of the patients. Overstaging was more observed by EUS (p=0.008). The sensitivity of the modalities was similar for distinguishing advanced T-stage from low-stage disease; however, the specificity was significantly higher for PET-CT (93.8% vs. 62.5%, p=0.006). The performance of PET-CT for evaluating nodal involvement was significantly higher than EUS (accuracy of 91.4% and 73.6%, respectively, p=0.002). The sensitivity and specificity for distant metastasis were 82.5% and 93.7% for PET-CT and 75% and 81% for EUS.

CONCLUSION
Combination of PET-CT has a superior overall staging ability over EUS in our study group especially for nodal and distant disease staging. The tests showed similar performance in tumoral staging while PET-CT demonstrated improved specificity in distinguishing advanced T-stage disease.

CLINICAL RELEVANCE/APPLICATION
Integration of PET-CT into the staging work-up of esophageal cancer may improve the accuracy compared with EUS alone. PET-CT may contribute to better treatment planning for advanced T-stage disease.

SSM07-03 • Chemotherapy Response in Gastroesophageal Tumours with Magnetic Resonance and 18F-FDG-PET/CT: Correlation of Apparent Diffusion Coefficient (ADC) and Partial Volume Corrected Standardized Uptake Value (PVC-SUV) with Tumour Regression Grade (TRG)

Francesco Giganti MD (Presenter); Francesco A De Cobelli MD; Carla Canevari MD; Francesca Gallivanone; Carlo Staudacher MD; Alessandro Del Maschio MD

PURPOSE
Patients with locally advanced gastroesophageal tumours (GT) or adenopathies are treated with neoadjuvant chemotherapy (NC) to make radical resection possible. TRG is a histological objective indicator of treatment response which scores residual tumour in 5 grades, after resection. Aim of our study was to compare ADC and PVC-SUV changes during NC with TRG to evaluate if molecular imaging biomarkers from Diffusion Weighted Imaging (DWI) Magnetic Resonance (MR) and 18F-FDG-PET/CT may help to differentiate between Responders (R) and Non Responders (NR) to NC.

METHOD AND MATERIALS
31 patients affected by GT (7 esophageal, 3 gastro-esophageal junction, 21 stomach) were evaluated on a 1.5-T MR system including DWI performed using b value of 0 and 600 s/mm2, before and 3 weeks after the end of NC and ADC were calculated. Patients also underwent a baseline and a follow up 18F-FDG-PET/CT scan, before and after NC, and PVC-SUV were obtained, as quantitative PET biomarkers.

RESULTS

CONCLUSION
DWI-MR, which can be performed in a relatively short examination time compared to 18-FDG-PET/CT, may become an important imaging technique in evaluating CT response in patients with GT. Our study suggests that DWI-MR is potentially capable of offering more accurate information for treatment response than 18-FDG-PET/CT in these patients. Patients and modifications of ADC may represent a reproducible tool to assess tumor response to NC.
SSM07-04 • Diagnosing Leak after Esophagectomy for Esophageal Cancer by CT-esophageal Protocol (CTEP) and Standard Esophagram (SE): Is the Old School Still the Best School?

Diana M Palacio MD (Presenter) ; Wayne L Hofstetter ; Arlene M Correa PhD ; Sonia L Betancourt Cuellar MD ; Edith M Marom MD

PURPOSE
This retrospective study compares CTEP and SE, alone or in combination, to the clinical diagnosis of leak established by endoscopy, operation and/or clinical course.

METHOD AND MATERIALS
We reviewed the charts of patients who underwent esophagectomy for esophageal cancer between 1/2005 to 1/2009. A final diagnosis of leak was made based on a combination of clinical course, endoscopic and/or surgical evaluation: Type 0= No leak. Type 1= Subclinical leak, imaging diagnosis only. Type 2= Clinical suspicion for leak +/- positive imaging, conservative management. Type 3= Clinical suspicion for a leak, +/- positive imaging, requiring an intervention. Type 4= Conduit necrosis diagnosed at re-operation, +/- positive imaging. Reports of all diagnostic CT-EP and SE performed < 31 days post-op were reviewed and the diagnosis of leak classified as either small/contained vs. large/uncontained. A cross match between the clinical leak diagnosis and the imaging results was made.

RESULTS
382 patients underwent esophagectomy. 23 patients did not have any imaging and were excluded. Of the remainder 359, 274 had SE only, 19 CTEP only, and 66 CTEP+SE. SE was done 4-31 d post-op (mean=13), and CTEP done 1-31 d post-op (mean=9). If CT+SE, both were performed

CONCLUSION
SE alone has higher S, S, PPV, and NPV than CTEP alone for identification of leak. Although SE+CTEP slightly improves sensitivity, the specificity only improves compared to CTEP alone. CTEP had greater false+ and false- than SE. SE may continue to be the imaging method of choice to evaluate anastomotic leak.

CLINICAL RELEVANCE/APPLICATION
Despite the increased availability and usage of Chest CT-EP, when an esophageal leak is suspected after esophagectomy, an esophagram is recommended due to its greater accuracy as compared to CT.

SSM07-05 • The Sensitivity and Specificity of Diagnosing Eosinophilic Esophagitis in Adults on Barium Swallow Examination with Histology as the Gold Standard

Dhiraj Joshi MD, MRCS (Presenter) ; Jonathan C Rodrigues MBChb, MRCP ; James P Virjee MBChb, FRCR

PURPOSE
Eosinophilic esophagitis (EE) is a chronic inflammatory condition of the esophagus that presents with symptoms of dysphagia and food bolus impaction. The patients are referred for barium swallow examination (BSE) either from the community or following inconclusive endoscopy. The aim of this study was to determine the sensitivity and specificity of BSE for diagnosing EO by using histology as the gold standard. Established radiological features from previous studies were used.

METHOD AND MATERIALS
The number of radiologically diagnosed cases of EE from all outpatient BSE performed over a 2-year period was determined from the radiology database. The total number of histologically proven cases of EE was determined from the histopathology database. This data was cross-referenced and used to calculate sensitivity and specificity of BSE for diagnosing EE.

RESULTS
A total of 824 outpatient BSE were performed for a variety of oesophageal symptoms. Sixteen patients were diagnosed as EE of which 14 patients were confirmed to have EE on subsequent histology. Fifteen patients were diagnosed with EE on histology, which also included the 14 patients that were diagnosed by BSE. One patient was diagnosed on a random endoscopic biopsy but had not undergone BSE. The most common symptom was intermittent dysphagia (14 patients) followed by food bolus obstruction (10 patients). The most common radiological feature was presence of ring deformity (16 patients), followed by a fixed stricture (5 patients). The true positives were 87.5%; false positives, 12.5%; true negatives, 100%; false negatives, 0%. This sensitivity of diagnosing EE on BSE was 100% and specificity was 99.7%.

CONCLUSION
In an appropriate clinical setting, BSE can be used as a reliable investigation for the diagnosis and management of EE.

CLINICAL RELEVANCE/APPLICATION
EE is often erroneously treated for reflux esophagitis. BSE can help in appropriate diagnosis and management of difficult cases.

SSM07-06 • Oral Effervescent Powder Administration for Multidetector CT Evaluation of the Esophagus - A Validation Study

Kristina I Ringe MD (Presenter) ; Simone Meyer ; Frank K Wacker MD * ; Hans-Juergen Raatschen MD

PURPOSE
To quantitatively and qualitatively assess the value of oral effervescent powder administration for CT evaluation of the esophagus in patients without underlying esophageal disease.

METHOD AND MATERIALS
This prospective study was IRB approved. 42 patients (27 males/15 females, mean age 57y) who referred for thoraco-abdominal staging CT were included. Contrast-enhanced CT was performed on a 64-slice scanner after oral administration of 3g effervescent powder immediately before image acquisition. Distension of the esophagus was assessed at three levels (proximal/middle/distal) by volumetry of the inner (ID) and outer diameter (OD), using a thin client software. In addition, esophageal distension in the corresponding segments was evaluated qualitatively separately by two blinded readers on a three-point scale. Further, at an interval of two weeks, both readers in consensus decided on the number of diagnostic esophageal segments in each patient in terms of the possibility to decide upon a potentially underlying pathology. Findings were compared with results from an age and sex matched control group (42 patients; 30 males, 12 females; mean age 62 y). Quantitative and qualitative results of both groups were compared (T-Test, Mann-Whitney-U-Test).

RESULTS
ID and OD in all esophageal segments were significantly larger after effervescent powder administration as compared to the control group (p<0.0001). Inter-observer variability was calculated (weighted-Cohen’-?).

CONCLUSION
Correctly timed oral administration of effervescent powder results in good distension of the esophagus, allowing readily assessment of the wall at contrast enhanced CT as compared to studies without effervescent powder.

CLINICAL RELEVANCE/APPLICATION
Oral administration of effervescent powder is a feasible technique resulting in good distension of the esophagus, allowing readily assessment of the wall at contrast enhanced CT.
SSM08-01  •  The Activity Grade of Hepatitis Affects Liver Stiffness Measured Using MR Elastography

Tomohiro Takamura (Presenter); Shintaro Ichikawa MD; Utaro Motosugi MD; Katsuhiro Sano MD; Hiroyuki Morisaka MD; Tomoaki Ichikawa MD, PhD *

PURPOSE
To elucidate the relationship between activity grade of hepatitis and liver stiffness measured using MR elastography (MRE).

METHOD AND MATERIALS
This study included 123 patients who underwent liver biopsy or surgery less than 2 months after MRE. The histological fibrosis scores and activity grades were as follows: F1, n = 19 (A1 = 12, A2 = 7, and A3 = 0); F2, n = 40 (A1 = 19, A2 = 20, and A3 = 1); F3, n = 32 (A1 = 9, A2 = 16, and A3 = 7); and F4, n = 32 (A1 = 6, A2 = 17, and A3 = 9). MRE was performed using 1.5T or 3T (Signa EXCITE HD or Discovery 750; GE Healthcare) scanners to measure liver stiffness in kilopascals (kPa). Stepwise multiple linear regression modeling was performed using the following variables as potential indicators: age, gender, body mass index (BMI), international normalized ratio of prothrombin time (PT-INR), platelet count, and METAVIR F score. Multiple linear regressions included variables maximizing the adjusted R2 in each stepwise regression to identify significant independent explanatory factors for liver stiffness and to delineate any inflammatory effects on liver stiffness after adjusting for nothing (model 1), alanine aminotransferase/upper limit of normal (ALTmeas/31 IU/L) categories (model 2), and METAVIR A grades (model 3).

RESULTS
After adjusting for activity grade or ALT/ULN, the platelet count and METAVIR F score were found to be strongly associated with liver stiffness. The R2 value of model 3 (0.7390) was higher than those of model 1 (0.6821) and 2 (0.6852), indicating that activity grade correlates with liver stiffness.

CONCLUSION
While staging liver fibrosis using MRE, it is important to remember that the activity grade of hepatitis can affect liver stiffness measurement independent of the degree of fibrosis.

CLINICAL RELEVANCE/APPLICATION
Although liver stiffness measurement using MRE is useful for staging liver fibrosis, we should be aware that the activity grade of hepatitis can be a confounding factor in stiffness measurement.

SSM08-02  •  Usefulness of Shear Wave Elastography (SWE) to Differentiate in Diffuse Hepatic Diseases

Min Yeong Kim MD (Presenter); Yong-Soo Kim MD, PhD; Woo Kyounge Jeong MD; Soon-Young Song; Byung-Hee Koh MD; On-Koo Cho MD, PhD

PURPOSE
To evaluate the values of liver stiffness (LS) measured by Supersonic shear wave elastography (SWE) in diffuse hepatic parenchymal abnormalities and to find the difference according to severity and kinds of liver diseases.

METHOD AND MATERIALS
Of 663 patients who underwent ultrasonography coupled with SWE, normal group (n=24) was defined as the person without any clinical evidence of underlying cause and normal laboratory and ultrasonographic features. Diffuse liver disease groups consisted of as follows: 1)fatty liver disease (n=136), 2)acute hepatitis (n=9), 3)chronic hepatitis (n=240), 4)cirrhosis (n=254) and cause of diseases are classified as 1)viral infection (n=362), 2)alcohol (n=176), 3)others (n=125) by clinicopathologic settings. We compared mean values and standard deviation (SD) provided by SWE and calculated median values.

RESULTS
Mean values of LS as follows: normal, 6.19±1.83kPa; fatty liver disease, 7.88±5.96kPa; acute hepatitis, 12.66±6.31kPa; chronic hepatitis, 8.47±5.75kPa; cirrhosis, 19.54±13.70kPa. There is significant difference of mean values and SD between cirrhosis and each other liver disease (p<0.05). According to causes of diffuse hepatic diseases, mean values of LS were significantly different: chronic hepatitis by virus, 8.04±4.01kPa; by alcohol, 12.60±11.56kPa (p<0.05).

CONCLUSION
LS values by SWE is significantly higher in cirrhosis than in other hepatic diseases and also affected by causes of chronic hepatic diseases. Degree of alcoholic liver disease cannot be possible by SWE.

CLINICAL RELEVANCE/APPLICATION
SWE could help to distinguish cirrhosis from diffuse liver diseases. In chronic hepatic diseases, the measured values by SWE have to be adjusted according to causes such as virus and alcohol.

SSM08-03  •  Visual Assessment of Diffusion MRI of the Liver: Do We Need Conventional Sequences and Contrast Enhanced Images in Every Case?

Veyssel Akgun MD (Presenter); Murat Kocaoglu MD; Bilal Battal; Yalcin Bozkurt; Mustafa Tasar MD

PURPOSE
The aim of this study is to assess the value of visual assessment of DWIs and ADC maps in determining hemangiomas and simple cysts without additional sequences and contrast medium administration and its capability in exclusion of malignancy.

METHOD AND MATERIALS
283 focal liver lesions (FLL) (69 malign, 214 benign) in 130 patients (74 men, 56 women, mean age 50.7, age range 15 to 80 years) that were detected in ultrasonography or computed tomography underwent MR and diffusion weighted imaging with non breath-hold single-shot echo-planar spin echo sequences. Most of the benign FLLs were cysts (n=89, 38.7%) and hemangiomas (n=96, 41.7%). The lesions that were hyperintense in all sequences and the lesions that were hyperintense on diffusion weighted images (DWI) with low b value and ADC maps and hypointense on DWIs with high b value were noted as hemangiomas and simple cysts, respectively. The signal intensities of the FLLs on DWIs with low and high b values and ADC maps were noted by two radiologists blinded to the pathological and radiological diagnoses in consensus. All FLLs were classified according to pathological diagnoses or radiological follow-up. Then we formed a cross table to determine sensitivity, specificity, positive and negative predictive values for characterization of the simple cysts and hemangiomas and for exclusion of malignancy.

RESULTS
The sensitivity and specificity were 98.6% and 99.5%, respectively. The positive predictive value was 98.6% and negative predictive value was 98.6% for the visual assessment of the DWIs and ADC maps for the characterization of the hemangiomas and simple cysts and in...
CONCLUSION
Visual assessment of DWIs and ADC maps can be useful in characterization of the hemangiomas and simple cysts, and in exclusion of malignancy without additional sequences and contrast medium administration. As a consequence, this technique can decrease study time and cost.

CLINICAL RELEVANCE/APPLICATION
By using DWIs and ADC maps we can characterize most of the hemangiomas and simple cysts and exclude malignancy without additional sequences and contrast medium administration.

SSM08-04 • Clinical Significance of Signal Heterogeneity in the Hepatobiliary Phase of Gadoxetic Acid-enhanced MR Imaging in Hepatocellular Carcinoma

Nobuhiro Fujita MD, PhD (Presenter); Akihiro Nishie MD; Yoshiki Asayama MD; Yasuhiro Ushijima MD; Yukihisa Takayama MD*; Hiroshi Honda MD; Dai Shimamoto; Ken Shirabe; Yuichiro Kubo MD

PURPOSE
To clarify the relationship between biological behavior of hepatocellular carcinomas (HCCs) and signal intensity in the hepatobiliary phase of gadoxetic acid-enhanced MR imaging with a special focus on its heterogeneity.

METHOD AND MATERIALS
A total of 68 patients with 70 pathologically proved HCCs who underwent gadoxetic acid-enhanced MR imaging prior to surgery were enrolled. Based on the signal intensity in the hepatobiliary phase, lesions were classified as homogeneously hypointense (n = 44), heterogeneously hyperintense (n = 20) and homogeneously hyperintense (n = 6) groups, by comparing with the signal intensity of the background liver. The clinicopathological findings were compared among these three groups by Fisher’s exact test, Kruskal-Wallis test and Mann-Whitney U test where appropriate. The patient disease-free survival analysis was performed by the Kaplan-Meier method with the log-rank test and Cox proportional hazard model.

RESULTS
The tumor size and serum level of PIVKA-II were significantly higher in heterogeneously hyperintense group than homogeneously hypointense (P = .0155 and P = .0215) and hyperintense (P = .0330 and P = .0220) groups. In univariate analysis, heterogeneously hyperintense group showed lower disease-free survival rates than homogeneously hypointense group (P = .0125). In multivariate analysis, heterogeneous hyperintensity in the hepatobiliary phase of gadoxetic acid-enhanced MR imaging was an independent prognostic factor for disease-free survival (P = .0308).

CONCLUSION
Heterogeneously hyperintense HCCs in the hepatobiliary phase of gadoxetic acid-enhanced MR imaging have more malignant potential than other HCCs.

CLINICAL RELEVANCE/APPLICATION
Our study suggests that heterogenous hyperintensity in the hepatobiliary phase of gadoxetic acid-enhanced MR imaging is a new imaging biomarker to indicate malignant potential of HCCs.

SSM08-05 • Intrahepatic Mass Forming Cholangiocarcinomas (IMCC): Utility of Feature Analysis for Differentiation from Other Intrahepatic Mass Lesions

Laura Heacock MS, MD (Presenter); Andrew B Rosenkrantz MD; Sooah Kim MD; Nicole M Hindman MD

PURPOSE
To evaluate the imaging features of intrahepatic mass-forming cholangiocarcinomas (IMCC) at contrast-enhanced dynamic CT and MRI, which allow for differentiation from other common intrahepatic tumors.

METHOD AND MATERIALS
Study was IRB approved with waiver of informed consent. 41 patients with 41 pathologically confirmed IMCCs underwent dynamic contrast-enhanced CT or MRI. Size-matched lesions of pathological proven hepatocellular carcinoma (HCC, n=36), isolated hepatic metastases (n=43), liver abscesses (n=39) and imaging proven (stability over >2 years) hemangiomas (n=42) were evaluated. Two blinded readers (R1, R2) retrospectively assessed all lesions for morphologic and enhancement features and assigned a diagnosis from the tumor types included. Features analyzed were: heterogeneous rod-like internal enhancement, a peripheral complete rim of enhancement, progressive delayed central enhancement, presence of capsular retraction, portal vein thrombosis, or biliary dilatation proximal to the mass. Imaging feature frequencies were compared between lesion types.

RESULTS
Readers correctly identified 51.2% of IMCCs, 86.9% of hemangiomas, 87.5% HCCs, 77.4% metastases and 83.4% of abscesses. The most frequently seen imaging features in IMCC were biliary dilatation proximal to the mass (R1: 53.7%; R2: 61%) and portal vein thrombus (R1: 46.3%; R2 46.3%); these features were present significantly more frequently in IMCCs than other lesions (p<.05). Differences of IMCC from other liver masses is best determined by the presence of portal venous thrombosis and proximal biliary dilatation. Heterogeneous rod-like internal enhancement helps distinguish IMCC from HCC and may be particularly useful in cirrhotic patients, for whom other focal hepatic lesions are less likely.

CONCLUSION
Heterogeneous internal rod-like enhancement are important imaging features for distinguishing IMCC from other hepatic lesions.

SSM08-06 • Liver Remnant Regeneration in Donors after Living Donor Liver Transplantation: Long-term Follow-up Using CT and MR Imaging

Andreas Koops MD (Presenter); Philipp Simon MD; Harald Ittrich MD; Lutz Fischer; Thorsten Klink MD; Gerhard B Adam MD

PURPOSE
To assess liver remnant volume regeneration and maintenance, and complications in long-time follow-up of donors after living donor liver transplantation using CT and MRI.

METHOD AND MATERIALS
47 patients with a mean age of 33.5 years who donated liver tissue for transplantation and were available for follow-up imaging were included in this retrospective study. Contrast-enhanced CT and MR images were acquired according to standardized protocols of the upper abdomen. Two observers evaluated pre- and postoperative images, analyzed liver volume regeneration, and documented postoperative complications.

RESULTS
47 preoperative and 89 follow-up studies covered a mean period of 22.4 months (range, 1-84). Right liver lobe (segments V-VIII) was donated in 18 cases, left liver donation of segment II and III was performed in 24 cases, and of segments II-IV in 5 cases. Liver remnants regenerated rapidly within the first 6 months. After 36 months, the remnant volume was not significantly reduced compared to the preoperative liver volume (p=0.2155), and was maintained at a minimum of 80% in most patients. Minor postoperative complications were found early in 4 patients. No severe or late complications or mortality occurred.
Genitourinary (Evaluation of Hematuria)

Wednesday, 03:00 PM - 04:00 PM • E351

**SSM09-01 • 640-slice CT Perfusion Imaging in Tumor of Urinary Bladder: An Initial Study**

Sun Bo, MENG, BMBS (Presenter); Hao Xiaoru; Lai Tingmei; Sun Chang Hua; Wang Chuntao; Lin Li; Xu Guang Chao; Liu Yuyan

**PURPOSE**
To explore the clinical value of 640-slice CT perfusion imaging (CTP) in diagnosis and differential diagnosis for tumor of urinary bladder.

**METHODOLOGY AND MATERIALS**
One hundred and five patients with urinary bladder tumor were qualified for this research. All patients underwent routine CT scanning and dynamic volume scanning with TOSHIBA Aquilion ONE 640-slice CT scanner. The patients were divided into Group A (benign bladder diseases) and B (bladder carcinoma) according to the malignancy. Time-density curve (TDC) of the patients was depicted. Perfusion parameters of AF, BV and clearance were obtained automatically. All parameters were statistically analyzed between groups. All patients achieved 640-slice CT enhancement perfusion imaging, thirty one of them were enrolled in the benign group, in which ten were divided into subgroups of urothelial papilloma and twenty one were divided into subgroups of adeno-cystitis. Seventy four patients enrolled in the malignant group and they were all urothelial carcinoma, and twenty eight were divided into subgroups of low grade of papillary urothelial carcinoma and forty six were divided into subgroups of high grade of papillary urothelial carcinoma.

**RESULTS**
TDC speeds up fast and sustains then descends slowly in malignant groups, whereas benign groups show low and flat in TDC. Moreover AF, BV, Clearance of malignant groups are respectively 163.924±35.733/ml/100g/min, 42.194±10.464 ml/100ml, 10.185±1.144 ml/min/100ml; AF and BV of benign groups are respectively 48.890±9.238 ml/100g/min and 3.622±0.482 ml/100ml. But the clearance of benign group can not be measured. The difference in AF and BV is statistically significant between two groups (P < 0.001).

**CONCLUSION**
640-slice CTP might have the potential capability for exactly demonstrating the blood flow features of bladder, and it shows great reference value for differential diagnosis between benign bladder disease and bladder carcinoma.

**CLINICAL RELEVANCE/APPLICATION**
640-slice CTP will be conducive to differential diagnosis between benign bladder disease and bladder carcinoma.

**SSM09-02 • Diffusion-weighted MRI in Bladder Carcinoma: The Differentiation between Tumor Recurrence and Benign Changes after Resection**

Huanjun Wang (Presenter); Yan Guo, MD

**PURPOSE**
To investigate the efficacy of diffusion weighted MRI on differentiating recurrent tumor from chronic inflammation and fibrosis after cystectomy or transurethral resection of bladder cancer.

**METHODOLOGY AND MATERIALS**
11 consecutive patients suspected of bladder tumor recurrence at 3 months to 2 years after single TURBT (6), 3 months to 3 years after repeated TURBT (4), 1 year after partial cystectomy (1), or 2 years after unilateral nephroureterectomy and partial cystectomy (1) were performed pelvic MRI scanning using a 3-T MR system and phased-array pelvic coil which including high spatial resolution T2-weighted imaging, DWI in axial and sagittal planes and DCE MRI using three-dimensional volumetric spoiled gradient-echo sequence before and after GD-DTPA injection. The DWI and DCE MR images were independently interpreted by two uroradiologists (Y.G. and D.Y.) blinded to the results of TURBT and cystoscopy. The apparent diffusion coefficients (ADC) of lesions and gluteus muscles were manually measured in solid portions of the lesions and muscles on ADC maps for three times by one uroradiologist (H.J.W.) and normalized average ADC of lesions were obtained as ratios of ADClesion and ADCgluteus.. Diagnosis was histologically confirmed in all patients by transurethral or repeated TURBT (4), 1 year after partial cystectomy (1), or 2 years after unilateral nephroureterectomy and partial cystectomy (1) were performed pelvic MRI scanning using a 3-T MR system and phased-array pelvic coil which including high spatial resolution T2-weighted imaging, DWI in axial and sagittal planes and DCE MRI using three-dimensional volumetric spoiled gradient-echo sequence before and after GD-DTPA injection. The DWI and DCE MR images were independently interpreted by two uroradiologists (Y.G. and D.Y.) blinded to the results of TURBT and cystoscopy. The apparent diffusion coefficients (ADC) of lesions and gluteus muscles were manually measured in solid portions of the lesions and muscles on ADC maps for three times by one uroradiologist (H.J.W.) and normalized average ADC of lesions were obtained as ratios of ADClesion and ADCgluteus.. Diagnosis was histologically confirmed in all patients by transurethral or cystoscopic resection of 27 lesions within two weeks of MR examinations.

**RESULTS**
CONCLUSION
DWI is superior to DCE MRI for differentiating recurrent bladder tumors from benign changes after resection. DWI can be included in the follow-up MRI protocol after bladder cancer surgery.

**CLINICAL RELEVANCE/APPLICATION**
Be much valuable in the following-up for patients with bladder carcinoma after tumor resection.

**SSM09-03 • Low Dose CT Urography: Does Longer Delay Time or Tri-phasic Acquisition for Excretory Phase Achieve Complete Opacification of Urinary System?**

Hirosi Juri, MD (Presenter); Takahiro Tsuboyama, MD; Seishi Kumano, MD; Yuki Inada, MD; Kazuhiro Yamamoto, MD; Yoshifumi Narumi, MD; Mitsuhito Koyama, MD; Hiroyuki Akagi, MD; Masako Yuki, MD; Haruhito Azuma, MD

**PURPOSE**
To evaluate if longer delay time or multi-phasic acquisition for the excretory phase (EP) in CT urography (CTU) can achieve complete opacification of urinary systems.

**METHODOLOGY AND MATERIALS**
Thirty-two patients underwent CTU including ultra-low dose tri-phasic EPs acquired on 5, 10, and 15 minutes after administration of contrast media using adaptive iterative dose reduction 3D. For qualitative analysis, opacification scores for four segments of upper urinary tracts (renal collecting systems, upper, middle, lower ureters) and urinary bladders were recorded and were compared among the three phases. Patients were recorded if all upper urinary segments were delineated completely on single-, bi-, and tri-phasic EPs. For tracts (renal collecting systems, upper, middle, lower ureters) and urinary bladders were recorded and were compared among the three phases. For qualitative analysis, opacification scores for four segments of upper urinary tracts (renal collecting systems, upper, middle, lower ureters) and urinary bladders were recorded and were compared among the three phases. For qualitative analysis, opacification scores for four segments of upper urinary tracts (renal collecting systems, upper, middle, lower ureters) and urinary bladders were recorded and were compared among the three phases. For qualitative analysis, opacification scores for four segments of upper urinary tracts (renal collecting systems, upper, middle, lower ureters) and urinary bladders were recorded and were compared among the three phases. For qualitative analysis, opacification scores for four segments of upper urinary tracts (renal collecting systems, upper, middle, lower ureters) and urinary bladders were recorded and were compared among the three phases. For qualitative analysis, opacification scores for four segments of upper urinary tracts (renal collecting systems, upper, middle, lower ureters) and urinary bladders were recorded and were compared among the three phases.
phases. Patients were recorded if all upper urinary segments were delineated completely on single-, bi-, and tri-phasic EPs. For quantitative analysis, the ratio of the CT values of anterior and posterior portion of the urinary bladders was compared among the three phases. For statistical analysis, we used Friedman test for opacification scores, and Cochran’s Q test if all upper urinary segments were delineated among single-phase EPs.

RESULTS
Opacification scores for the upper urinary tracts were not statistically different in all segments among the three phases, while those for the urinary bladders were significantly higher in EP with longer delay time (5 vs 10 minutes, P

CONCLUSION
Longer delay time for EP statistically improves opacification of bladders but not that of the upper urinary tracts. Multi-phasic EPs may improve opacification of the upper urinary tracts, however complete opacification is difficult even with tri-phasic acquisition.

CLINICAL RELEVANCE/APPLICATION
The optimal delay time may be 15 minutes for the urinary bladder in the excretory phase (EP), but upper urinary tracts are not enough delineated even in multi-phasic EP.

SSM09-04 Evaluation of the Usefulness of DWI in Orthogonal Planes for T Staging of Urinary Bladder Cancer at 3T MRI
Kazuma Terauchi (Presenter) ; Takayuki Masui MD ; Motoyuki Katayama MD ; Kimihiko Sato MD ; Kei Tsukamoto ; Kenichi Mizuki MD

PURPOSE
Diffusion-weighted imaging (DWI) at 3T using 32 channel body array multicoil can visualize anatomical structures well and are useful tool for T staging of urinary bladder cancer. The purpose was to evaluate values of DWI in orthogonal planes for T staging of urinary bladder cancer at 3T MRI.

METHOD AND MATERIALS
This study was approved by the IRB in our hospital. 50 consecutive patients were included in the study, who underwent MRI for evaluation of the urinary bladder cancer at 3T MRI (Discovery MR750 GEHC, 32 channel body array coil) bed. From October 2010 and January 2012. There were 41 men and nine women (mean age 71.3 years) and written informed consent was obtained from each patient. Of the total 66 lesions, 65 lesions were resected with TUR, and the one patient with one lesion underwent cystectomy after TUR. Pathologic tumor staging for T1 or lower, T2, T3, and T4 were 54, 5, 2, and 2. DWI in a transverse plane (b value = 1500, TR / TE = 5000/58.3 msec, slice thickness 3 mm) and additional either coronal or sagittal plane were obtained. T stage criteria of DWI for urinary bladder cancer were as follows: T1 or lower; flat tumor or tumor with submucosal stalk, T2; tumor without submucosal stalk or tumor bulging with smooth surface, T3; tumor with irregular margin, T4; tumor extending to adjacent organ. It was referred to as T1, if stalk was visualized in any one plane when evaluated with DWI in two planes. Two radiologists evaluated the depth of invasion in the case of transverse DWI and DWI in two planes. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) regarding the presence or absence of muscle invasion were also calculated.

RESULTS
63 lesions (95.5%) could be detected by both transverse DWI, and DWI in two planes. The number of preoperative tumor stage for T1 or lower, T2, T3, and T4 were 45, 14, 2, and 2 for transverse DWI; 49, 11, 1, and 2 for DWI in two planes, respectively. The sensitivity, specificity, PPV, and NPV for tumor stage between T1 or lower and T2 or higher were 90.9%, 84.6%, 55.6%, and 97.8% for transverse DWI; 90.9%, 92.3%, 71.4%, and 98.0% for DWI in two planes respectively.

CONCLUSION
DWI in two planes can accurately evaluate the presence or absence of muscle invasion and improves tumor staging for urinary bladder cancer.

CLINICAL RELEVANCE/APPLICATION
Preoperative T staging is important. for management of urinary bladder cancer.

SSM09-05 CT Urography - Optimized Urothelial and Excretory Phases for Improved Detection of Bladder Tumors
Anton Jansson ; Aart J Van Der Molen MD ; Monica Segelsjo * ; Par E Dahlman MD (Presenter)

PURPOSE
To optimize CT Urography (CTU) of the lower urinary tract by combining a distended urine-filled bladder in the urothelial phase with a distended, homogeneously contrast-opacified bladder in the excretory phase.

METHOD AND MATERIALS
The study included 115 patients referred for CTU. All patients drank 1 liter water in 2 hours prior to the examination and were instructed not to void. Patients were randomised into five equal groups: A) standard single-bolus 3-phase CTU with unenhanced, urothelial (UroP) and 5 min delay excretory (EP) phases; B) standard 3-phase CTU with 5 mg IV furosemide; C) Voiding after the UroP and 15 – 30 min delay EP without IV furosemide; D) Voiding after the UroP and 30 min delay prone EP without IV furosemide; E) Voiding after the UroP and 30 min delay EP with IV furosemide. Two observers evaluated bladder volume and the percentage of contrast opacification.

RESULTS
Median EP bladder contrast opacification was 20% in group A, 50% in group B, and 100% in groups C-E. The mean EP bladder volume and mean percentage of bladder volume in EP compared to the UroP in group A was 350 ml and +20%; group B 438 ml and +48%; group C 162 ml and -29%; group D 281 ml and -17%, group E 469 ml and +106%. A trend curve of groups C-D, estimating the time to achieve EP bladder volume similar to UroP pre-voiding is 43 minutes Use of furosemide will allow complete bladder refilling in less than 30 minutes.

CONCLUSION
Voiding following the UroP and performing a long-delay EP will create optimal conditions for diagnosis of bladder cancer. Use of furosemide will keep scan delay times for EP practical.

CLINICAL RELEVANCE/APPLICATION
Using furosemide and voiding after the UroP and performing a 30-min delayed EP scan a practical combination of optimal UroP and EP for bladder cancer detection in CTU protocols can be achieved.

SSM09-06 Isotropic Volume Diffusion-weighted Imaging of Bladder Cancer: Feasibility and Preliminary Evaluation of Staging Accuracy
Mitsuru Takeuchi MD, PhD (Presenter) ; Kiyotaka Mori ; Hirohito Kan ; Nobuyuki Arai MS ; Tatsuya Kawai MD ; Yuta Shibamoto MD, PhD ; Takatsune Kawaguchi MD ; Yuki Kamishima ; Masaki Hara MD, PhD

PURPOSE
To investigate the feasibility of obtaining isotropic volume diffusion-weighted imaging (VDWI) of bladder cancer and its staging accuracy.

METHOD AND MATERIALS
Between May 2012 and April 2013, 25 patients (15 men and 10 women; mean age, 72 years) with bladder cancer underwent 3-T MRI. Axial and sagittal conventional DWI (CDWI) (b value, 1,000 s/mm²; repetition time/echo time, 5,900/61 msec; matrix, 128 x 128; thickness/gap, 4/0.4 mm; field of view, 320 x 260 mm) and axial VDWI (b value, 1,000 s/mm²; repetition time/echo time, 14,000/72 msec; matrix, 320 x 140; thickness/gap, 2.2/0 mm; field of view, 280 x 240 mm) were obtained. Sagittal and oblique planes were reconstructed from axial VDWI. The contrast-to-noise-ratio (CNR) of the lesion and bladder muscle on CDWI and VDWI were measured.
The subjective image quality of the axial and sagittal CDWI, axial VDWI and reconstructed sagittal and oblique plane DWI were visually scored with a 5-point scale for bladder muscle layer and bladder cancer. For the evaluation of the CNRs and subjective image qualities, Wilcoxon match-pairs test was used to compare CDWI and VDWI. The 25 bladder cancers were staged using CDWI and VDWI based on the following findings; bladder cancer, tumor stalk and muscle layer show high, low and intermediate signal intensity, respectively. The staging accuracy of the CDWI and VDWI was evaluated with pathological stage and compared with McNemar test.

RESULTS
The CNR of the bladder cancers on CDWI and VDWI were 81.6 and 79.9, respectively, with no significant difference. The mean subjective image quality scores of bladder muscle layer and bladder cancer were respectively 4.6 and 4.9 on both axial CDWI and sagittal CDWI, 4.3 and 5.0 on axial VDWI, and 4.2 and 5.0 on reconstructed sagittal and oblique plane DWI. There were no significant differences between subjective image quality of CDWI and VDWI. Overall staging accuracy, sensitivity and specificity of bladder muscle invasion on VDWI were 84%, 86% and 94%, respectively, and were the same as those of CDWI.

CONCLUSION
Obtaining VDWI is feasible with good image quality and staging accuracy similar to those of CDWI. It is an advantage of VDWI that optimal arbitrary planes for each tumor staging can be obtained from one volume data.

CLINICAL RELEVANCE/APPLICATION
VDWI could be applied for patients with bladder cancer, in particular in which axial or sagittal planes are not perpendicular to the tumor base.

**ISP: Health Service, Policy and Research (Medicolegal and Ethics)**
Wednesday, 03:00 PM - 04:00 PM • S102D

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**SSM10 • AMA PRA Category 1 Credit™:**

**Moderator**
James V Rawson, MD
Annette J Johnson, MD, MS

**SSM10-01 • Health Service, Policy and Research Keynote Speaker: Medicolegal and Ethics**
James V Rawson MD (Presenter)

**SSM10-02 • The Medical Malpractice Environment for Radiology at a Large Integrated Health System: A 5-Year Survey**

**H. B Harvey MD, JD (Presenter); Sam T Boland; Deborah LaValley RN; Garry Choy MD, MS**

**PURPOSE**
Medical malpractice liability is a pervasive concern among radiologists and shapes the way radiology is practiced. Working with a professional liability insurer, we studied the radiology malpractice liability environment at a large integrated health system over a five-year period.

**METHOD AND MATERIALS**
All medical malpractice claims asserted against the health system from 1/1/2008 to 12/31/2012 were collected and analyzed. Claims were evaluated based on the medical specialties involved, total liability costs incurred, and the disposition of closed cases. Claims involving radiology were further evaluated to determine severity of the injury asserted, health care setting involved, primary allegation asserted, and, for missed diagnosis cases, the primary diagnosis missed. When possible, comparison was made to the Comparative Benchmarking System (CBS), a large national HIPAA-compliant, medical malpractice claims database.

**RESULTS**
Over the five-year period, 1,126 malpractice claims were asserted against the health system resulting in $623M of total incurred liability. Claims involving radiology made up 8% of the cases, representing the 5th most commonly involved medical specialty, compared to 7th nationwide. Of the radiology claims, 57% were dropped or dismissed, 39% settled, 2% resulted in a defense verdict, and 2% resulted in a plaintiff verdict. The nature of the claims involving radiology was also assessed. Of those claims, 52% involved a high level of injury severity (defined as injury resulting in death or permanent significant deficit). The majority of the claims involving radiology involved the ambulatory setting (80%), followed by the inpatient setting (13%) and emergency department (7%). The most commonly asserted allegation against radiology involved diagnosis-related negligence (65%), followed by treatment-related (39%) and medication-related (3%) negligence. Cancer was the most commonly missed diagnosis representing 65% of missed diagnosis cases. There was little difference in the nature of the radiology claims compared to nationwide data.

**CONCLUSION**
Radiology is a significant contributor to malpractice liability with claims commonly originating in the ambulatory setting, involving allegations of diagnostic failure, and resulting in high severity injuries.

**CLINICAL RELEVANCE/APPLICATION**
Medical malpractice claims data can offer valuable insight into the current liability environment and can direct strategies for reducing liability exposure.

**SSM10-03 • SECURE Study: Observational Post-marketing Study on the Safety of Gadoterate Meglumine - Interim Analysis**

**Harsh Mahajan MD, MBBS ( Presenter)**

**PURPOSE**
To prospectively assess the safety profile of gadoterate meglumine and the overall incidence of nephrogenic systemic fibrosis (NSF).

**METHOD AND MATERIALS**
An ongoing worldwide multicentre post-marketing study (PMS) is conducted to collect safety data in 40,000 patients (adults and children) with or without renal insufficiency, scheduled to undergo a routine contrast-enhanced magnetic resonance (MR) examination using gadoterate meglumine (Dotarem®). Risk factors at inclusion, indications for MR imaging, conditions of the contrast material administration, occurrence of adverse events are recorded. For any patient identified as renally impaired at the time of inclusion (i.e., estimated creatinine clearance or estimated glomerular filtration rate

**RESULTS**
As of October 23, 2012, the cut-off date for the interim safety analysis, this ongoing PMS included data on 29689 patients (mean age: 50 years; range: 0-98 years; female, 53.4%). MR examinations were mainly performed to image the central nervous system (55.1%). The main risk factors were renal insufficiency (12.7%) and hypertension (11.8%). Moderate to severe impaired renal function was reported in 552 patients (1.9%). Among them, 391 (70.8%) were reported without suspicion of NSF during the 3-month follow-up. For the remaining patients (29.2%), the follow-up evaluation was not yet reported at the time of data analysis. Twenty-eight patients (1.9%)

**CONCLUSION**
This interim safety analysis already confirms the very good safety profile of gadoterate meglumine.

**CLINICAL RELEVANCE/APPLICATION**
SSM10-04 • Patient-centered Care: Lessons Learned from Brief Radiologist-patient Interviews Prior to Musculoskeletal Magnetic Resonance Imaging

Derek L Davis MD (Presenter); Michael E Mulligan MD; Arie Moszkowicz MD; Charles S Resnik MD

PURPOSE
To determine if brief radiologist-patient interviews before musculoskeletal magnetic resonance imaging (MRI) improve the quality of clinical information available during image interpretation.

METHOD AND MATERIALS
The institutional review board approved this retrospective study and waived informed consent. A total of 186 screening questionnaires completed by outpatients prior to musculoskeletal MRI at a single institution between August and November 2011 were separated into two cohorts: (1) outpatient imaging center (IC) forms with no radiologist-patient interaction; (2) hospital (H) forms with radiologist-patient interviews before MRI. Two musculoskeletal (MSK) radiologists and one MSK fellow independently reviewed each form while blind to the patient demographics, imaging site, clinician referral information, and MR images. The reviewers rated the forms for quality on a 5-point scale: 5(outstanding) to 1(poor). A third MSK radiologist performed a separate analysis to determine if each question received an answer, and also to quantify the response to the open-ended symptoms question. The unpaired t test, Fischer exact test, and χ² test were used to compare the two cohorts.

RESULTS
The mean score of the H-cohort among reviewers was higher than the IC-cohort: 3.79 (±0.98) versus 3.04 (±1.00), P < 0.001. Direct radiologist-patient interaction prior to musculoskeletal MRI improves the quality of clinical information available during image interpretation.

CONCLUSION
The interpretation of imaging studies with inadequate clinical information is not uncommon. Direct radiologist-patient communication before imaging may remedy this problem.

SSM10-05 • The ABR’s Practice Analysis Survey: Comparison of 2010 and 2013

June C Yang PhD, RN (Presenter); Anthony Gerdeeman PhD; Kay H Vydareny MD; Gary J Becker MD; Jennifer Bosma PhD

PURPOSE
To present the findings of the 2013 ABR Practice Analysis survey, performed to determine the critically important and frequently performed activities in clinical practice, and to note changes in practice patterns since the prior survey in 2010.

METHOD AND MATERIALS
The survey instrument was distributed electronically to 17,721 members of American College of Radiology with a unique identification code for each individual in 2010 and to 16,369 individuals in 2013. A five-point scale was established for both frequency and importance variables. Rating scales were identical both in 2010 and 2013. Currently, the data are being collected and data collection will be closed on April 12, 2013.

RESULTS
In 2010, 2909 (19.32%) diagnostic radiologists answered the survey, while in 2013, there were 1964 (13.00%) respondents as of April 2, 2013. 2233 (76.8%) of the respondents indicated that they spent at least 50% of their time in clinical practice in 2010 whereas 1368 (69.65%) diagnostic radiologists who participated reported practicing 50% or more in clinical practice thus far in 2013. The test of statistical significance will be tested in the clinical practice settings and in other demographic data between the two surveys, 2010 and 2013. Changes in top three activities/indications in importance and frequency between the two surveys will be compared.

CONCLUSION
The 2013 practice analysis survey may show changes in practice patterns between 2010 and 2013. These changes will be incorporated into the exam development processes of the ABR.

CLINICAL RELEVANCE/APPLICATION
Changes observed from a practice analysis survey in 2013 will be discussed. Knowledge of these changes is important so that examinations which reflect current practice patterns can be constructed.

SSM10-06 • Making Imaging around the World Better: Global Survey of Radiologists in 10 Countries

Bhavva Rehani MD (Presenter); Pamela W Schaefer MD; Ramon G Gonzalez MD; Vinil Shah; Javier M Romero MD; Otto Rapalino MD; David A Rosman MD *; Vinil Shah MD; Garry Choy MD, MS

PURPOSE
There are substantial unmet imaging needs for vulnerable and crisis affected populations. Our aim was to survey radiologists across developing countries in Asia, Europe and South America to assess their imaging needs and find out what in their opinion are the most effective ways to improve imaging in their respective countries.

METHOD AND MATERIALS
A standardized questionnaire containing 11 questions was sent to radiologists in 18 developing countries across the world. Radiologists from 10 countries responded (response rate=55%). These include Sri Lanka, Thailand, Costa Rica, Belarus, Serbia, Macedonia, Singapore, the Czech Republic, Lithuania and Slovenia. Some questions addressed the overall status of radiology in their countries and focused on potential shortages of radiologists, residency positions and medical physicists, while others focused on effective solutions to problems they face everyday.

RESULTS
Survey results indicated that most of the countries (90%), need to establish more radiology residency training positions. For improving knowledge in radiology, 100% thought online teaching modules would be most effective, and 30% believed that they need additional training workshops to help. 60% of radiologists (95% CI being 47.6 to 72.4%) believed that humanitarian "second opinion" teleradiology would be valuable in more than 50% of their cases, while 40% (95% CI being 27.6 to 52.4%) believed that a second opinion would be needed in less than 50% of their cases. 100% believed that the subspecialty in which they feel most deficient is neuroradiology with musculoskeletal imaging and pediatric imaging being the second and third most highly ranked choices. Only 60% (95% CI being 47.6 to 72.4%) had access to a medical physicist and most believed that they need education in radiation safety and dose reduction. Other practical questions focused on image transfer, organizational development and informatics.

CONCLUSION
This survey helps radiologists around the world communicate the imaging needs in their respective countries and how they can be met. This survey can help radiologists who want to reach out in their humanitarian efforts to improve imaging around the world.

CLINICAL RELEVANCE/APPLICATION
Global outreach programs can use this survey to determine more effective ways of improving radiology in developing countries.
INTEGRATION OF GLOBUS ONLINE WITH RSNA CLINICAL TRIAL PROCESSOR (CTP) FOR HIGH-THROUGHPUT IMAGE DATA TRANSFER

Stephen J Granite, MD, MBA; Dinanath Sulakhe, MS (Presenter); Ravi Madduri; Ian T Foster, PhD; Rai Winslow, PhD

CONCLUSION
RSNA's CTP suite already improves data transfer rates for imaging data. Adding Globus to CTP improves the transfer rate even more, allowing more time for physicians to analyze data and improve patient care.

Background
The clinical imaging trials involving images coded according to Digital Imaging and Communications in Medicine (DICOM) standard produce large volumes of data and require sophisticated tools to ensure de-identification, transfer, management and distribution. While RSNA's Clinical Trial Processor (CTP) software suite addresses many of the challenges in handling the imaging data, we present here the development and integration of Globus Online (Globus)-based ExportService within CTP, for a secure, high-throughput data transfer between CTP nodes.

Evaluation
CTP is a tool developed by RSNA that processes and handles data objects in clinical trials in the form of pipelines. The imaging data goes through various stages (i.e., Import Service, Processors, Storage Services and Export Services). In multi-center clinical image collection projects, CTP's Export Services transfers the DICOM images from the facility producing the images, and CTP's Import Services receives the data at another center. Currently, CTP supports various export services, implemented using HTTP, DICOM-SCP and FTP protocols. We implemented a GlobusExportService (Fig. 1) within CTP that initiates data transfers of DICOM images between two globus online
Strategies for Foreign Study Ingestion by a PACS Interfaced to a XDS Affinity Domain

Alain Gauvin MSc (Presenter) ; Suzanne Laframboise RT ; Greg Ruthman BSC *

PURPOSE
Ingestion by a local PACS of foreign images is a challenge when importing studies. This work is based on the implantation of a XDS-1.b proxy to allow a PACS to receive pre-fetch priors from other hospitals in a same XDS affinity domain. The coercion of DICOM tags of foreign studies in the context of their ingestion by the PACS needed to be carefully defined. Given that the model was to be used for different PACS technologies, a single automatic ingestion methodology was devised to satisfy all PACS requirements.

METHODOLOGY
The implementation of the XDS-1.b proxy took place in a center producing about 250 000 studies/year. The XDS registry used in the affinity domain initially allowed the proxy to access studies from 3 different sites. The proxy was able to determine the required pre-fetch set from the HL7 activity of the RIS. Given the modality type and body part of the incoming study, the required priors were determined by the proxy from a set of predefined rules, pulled from their locations, and sent to PACS after the coercion of multiple DICOM tags. The list of coerced tags includes MRN, accession number, institution name, study description and the alphanumerical code of the study. The coercion of the 2 last values of that list was more complex, and was accomplished using logic based on the modality, anatomical code, and keyword detection in the study description of the ingested study. These combined criteria allowed to achieve a granular normalized

SSM11-04 • Leveraging 3D Immersive and Collaborative Environments (3D-ICE) to Enhance Interactive Collaboration in the Radiology Workflow

Rohini Pangrikar BEng, MS (Presenter) ; Sarita S Akolkar

CONCLUSION
3D-ICE facilitates interactive collaboration in Radiology workflow. It can seamlessly integrate at hospital sites while ensuring secure access and confidentiality of data.

Background
In the Radiology workflow, referring physicians need to interact directly with radiologists to review medical images or critical results. PACS systems facilitate sharing of patient data but do not support interactive collaboration. When interacting remotely, collaborators juggle with image viewing applications, communication equipment and patient reports. This collaboration is error prone and affects quality of patient care. Productive collaboration entails a single environment enabling real-time interactions and easy access to patient data while adhering to healthcare standards.

Evaluation
3D-ICE is increasingly used as a virtual, one stop, cost-effective remote collaboration solution. In 3D-ICE users are represented as human-like 3D Avatars capable of inter-personal interactions inside customizable Virtual Workspace (VW). VWs simulate real workspaces aiding interactions with minimal training. 3D-ICE:
• Enables real-time, one-stop collaboration using integrated tools
• Ensures secure access to patient data
• Restricts access to VW preserving data confidentiality
• Supports viewing of 3D-reconstructions
• Is also supported on mobile devices

These features can enhance physicians and radiologists’ collaboration while retaining integrity of patient data.

Discussion
3D-ICE can utilize existing infrastructure and integrate into radiology workflow while adhering to healthcare standards:
• Users login to 3D-ICE clients over secure connections( to a secure 3D-ICE server) to enter VW
• Connect to an IHE compliant facility via shared web-browser in VW ensuring access to patient data across enterprises (XDS-I.b) and auditing (ATNA)
• Integrate file sharing systems with VW or drag-drop files in VW for consolidated view of patient data
• Co-view images, reports or share monitor screen using integrated shared applications
• Use 3D cues to point ROI in images for precise reference
• Restrict access to VW or export of data outside VW in compliance with local policies
• Auto-delete VW contents after predefined time ensuring data safety

SSM11-05 • Always on Virtualization: A Dramatic Improvement for PACS/RIS Applications and Desktops

Craig Dunwoody (Presenter) *

CONCLUSION
Virtual desktop infrastructure (VDI) solutions have been available for many years, but recent technological improvements have now made VDI truly compelling to radiology organizations.

Background
Radiology professionals are facing significant challenges integrating an increasingly complex environment of different devices, operating systems, and applications. Radiology professionals use multiple devices through their day, resulting in an inconsistent desktop experience. Users must contend with multiple logins, varying hardware configurations, and limited tablet access options. The cost of managing and securing the desktop environment is soaring. Maintaining uptime is critical, but is difficult to achieve, especially in large organizations, when hardware or software refreshes are taking place.

Evaluation
In this paper, I will evaluate these challenges and present a strategy that addresses them. A number of virtualization strategies can support the needs of end users, while making it easier for IT staff to manage and secure applications and desktop environments. I will evaluate some of the most prominent PACS and RIS applications and the workflows associated with using these tools in the radiology environment. I will then describe use cases for deploying these strategies to workstations and discuss the benefits that are provided to different target users.

Discussion
Managing and securing the high-end workstations with Graphics Processing Units (GPUs) that support diagnostic medical imaging is becoming increasingly challenging, as application and operating system changes are increasingly difficult to implement for IT staff and end-users. The rise of Bring-Your-Own-Device (BYOD) means that multiples devices with different operating systems must be integrated, and the growth of healthcare organizations means that institutions often must share information and images across multiple sites. There are a number of virtualization strategies that can facilitate diagnostic processing time and quality, by helping radiologists reduce downtimes for their workstations, improving the consistency of the user experience, improving remote access, and empowering the use of multiple devices including tablets.
Molecular Imaging (Imaging Probes)

Wednesday, 03:00 PM - 04:00 PM • SS04CD

SSM12-01 • Building Nanoparticles from Small Molecules in S itu in Dying Tumor Tissue to Track Chemotherapy Response by MRI

Adam J Shuhendler PhD (Presenter); Deju Ye PhD; Prachi Pandit PhD; Kimberly D Brewer PhD; Brian K Rutt PhD; Jianghong Rao PhD

PURPOSE
Apoptosis is a major cellular pathway for chemotherapy-induced tumor death, the early monitoring of which could lead to evidence-based and personalized therapy planning. We report a novel small molecule for chemotherapeutic response monitoring by MRI based on the caspase-3-triggered formation of nanoparticles in dying tumor tissue.

METHOD AND MATERIALS
Our modular probe design comprises a biocompatible intramolecular condensation reaction, a two-step activation requiring both active caspase-3 and disulfide reduction, and an exchangeable reporter moiety. For MRI, this reporter moiety is a gadolinium chelate, resulting in a caspase-sensitive nano-aggregation MRI (C-SNAM) probe. C-SNAM was tested in female nude mice bearing subcutaneous HeLa tumors receiving i.v. doxorubicin (DOX) chemotherapy. MR imaging was performed following C-SNAM administration prior to treatment and following three rounds of therapy on a Bruker Icon 1T desktop scanner. Additionally, the mechanism of probe activation was demonstrated using a fluorescent version of the probe (C-SNAF), which was used with both super-resolution microscopy and whole animal imaging.

RESULTS
Apoptosis requires the activation of caspase-3, which cleaves the L-DEVD peptide capping group of C-SNAM. Coupled to the reducing environment of the tumor, this two-step activation results in the formation of a hydrophobic macrocycle. This macrocycle self-assembles in situ into ~80 nm nanoparticles, providing enhanced imaging contrast in regions of apoptotic tumor through high local reporter moiety concentrations and prolonged retention in tumor tissue. Additionally, nanoparticle formation resulted in a ~223% increase in r1 relaxivity at 1T (C-SNAM, r1 = 12.57 mM⁻¹s⁻¹; nanoparticle r1 = 28.02 mM⁻¹s⁻¹). In vivo studies showed that both probe accumulation and retention were significantly greater post-treatment, demonstrating the utility of C-SNAM for therapeutic response monitoring.

CONCLUSION
Our novel, biocompatible and bioorthogonal self-assembling contrast agent chemistry results in in situ probe nano-aggregation and contrast enhancement that allows for the successful tracking of chemotherapeutic response with MRI.

CLINICAL RELEVANCE/APPLICATION
In vivo self-assembly is a new strategy for smart molecular imaging, where this first-of-kind demonstration of in situ nanoparticle formation pushes the frontier of probe and tracer design.

SSM12-02 • High r1 Relaxivity Sub-5 nm Suprasmall Iron Oxide Nanoparticles (sSIOs) as Contrast Agent for MRI Angiography

Hui Mao PhD (Presenter); Jing Huang; Liya Wang MD

PURPOSE
A new class of high r1 relaxivity, sub-5 nm, super small iron oxide nanoparticles with oligosaccharide coating as T1-weighted MRI contrast agents while providing reverse T2 contrast was used in MRI angiography.

METHOD AND MATERIALS
The sSIO nanoparticles were obtained from the encapsulation of iron oxide core in a thin oligosaccharide shell through in situ polymerization. SIO solutions with different concentrations were examined by a 3T MRI scanner using T1- and T2-weighted fast spin echo sequences, inversion recovery turbo spin echo sequence and multi-echo T2-weighted spin echo sequence. R1 and R2 relaxivities were calculated by fitting signal changes in multi-IR T1 and multi-TE T2 images using simple exponential equations. SIO with different sizes and Gd-BOP TA were intravenously administrated into mice. Fat suppressed T1-weighted spin echo images were obtained to investigate the contrast changes in liver, kidney and iliac artery at the different time points.

RESULTS
The prepared sSIO has an r1 value of 4.2 mM⁻¹s⁻¹ and a high r1/r2 ratio (0.28), which is competitive with commercial Gd-based contrast agent. Significant T1 contrast enhancement in the kidney and iliac artery were evidenced in vivo MRI after intravenously administration of sSIO in mice, similar to that observed in Gd-BOP TA enhanced MRI. The positive contrast enhancement is attributed to the small size and the reduced susceptibility of the nanoparticles, as well as the excellent colloidal stability in physiological environment. Such T1 contrast enhancement is not obvious when using a larger size SIO-10 or 20. Interestingly, uptake of SIO-3 in liver led to strong T2 effect or signal drop in liver further improves the image quality for visualizing liver tissue and hepatic vasculature in T1 weighted MRI. Furthermore, SIO-3 has a much longer blood retention time than small molecule Gd for prolonged imaging time for organs of interest, providing a potential long half time T1 weighted imaging agents for imaging of vasculature of disease tissues.

CONCLUSION
sSIO-3 has a much longer blood retention time than small molecule Gd for prolonged imaging time for organs of interest, providing a potential long half time T1 weighted MR imaging agents for MRI Angiography.

CLINICAL RELEVANCE/APPLICATION
The suprasmall SIOs exhibit excellent T1 contrast in vivo MRI studies, especially for kidney and iliac artery, providing a potential long half
Monocyte Specific Single Photon Emission Computed Tomography (SPECT) Imaging Reveals Local Inflammation

Shadi A Esfahani MD, MPH (Presenter) ; Fanny Chapelin MS ; Graham Beck ; Jessica Donig BA ; Solomon Messing ; Heike E Daldrup-Link MD

PURPOSE
To develop an immediately clinically applicable approach for labeling of bone marrow derived mesenchymal stem cells (MSC), which would not require ex vivo manipulations of harvested MSC.

METHOD AND MATERIALS
Sprague Dawley rats were injected with IV ferumoxytol (0.5mmol/kg). 48 hours later, MSC were extracted from long bones (femur & tibia) as per established protocols. The labeling efficiency of these in vivo labeled cells was compared with traditional ex vivo labeling procedures using fluorescence, confocal and electron microscopies. These in vivo labeled stem cells were cultured for 7 days before imaging them on 7T GE MR scanner (T-2 ME/SE; TE-15, 30, 45, 60 TR-4000; NEX: 1) along with unlabeled controls to calculate T2 relaxation times and generate T2 maps. Day-7 labeled in vivo cells were subsequently transplanted in osteochondral defects of 12 knees of 6 nude Sprague Dawley rats and followed up for 4 weeks using MR imaging. Quantitative T2 relaxation times were compared for significant differences between labeled cells and controls using t-tests. MR imaging data were correlated with histopathology of cell samples and implants.

RESULTS
Fluorescent & confocal microscopy confirmed presence of iron oxides in in vivo labeled cells, with 3.2 times higher intracellular quantities than standard ex vivo labeled cells. Electron microscopy localized iron oxide nanoparticles in secondary lysosomes. In-vivo labeled cells demonstrated significant T2 shortening effects both in vitro & in vivo when compared to unlabeled controls (T2 times in vitro: 8.2 vs 33.6 ms, in vivo: 15.4 vs 24.4ms; p

CONCLUSION
To the best of our knowledge, this is the first report of in vivo stem cell labeling with an immediately clinically applicable iron supplement. This method eliminates risks of ex vivo contamination and alterations of stem cell due to manipulations between harvest and transplantation and thus could be rapidly translated to the clinic via off label use of the FDA-approved Ferumoxytol.

CLINICAL RELEVANCE/APPLICATION
In vivo labeling could be widely used for tracking of MSC in various target tissues as it involves no additional cell manipulation between harvest & transplantation & provides strong MR signal in vivo.

SSM12-06 • Monocyte Specific Single Photon Emission Computed Tomography (SPECT) Imaging Reveals Local Inflammation

Shadi A Esfahani MD, MPH (Presenter) ; Pedram Heidari MD ; Umar Mahmood MD, PhD

PURPOSE
Despite significant advancements in diagnosis and treatment, colorectal cancer (CRC) is still the fourth most common cause of cancer death with a global incidence rate of greater than 1 million people per year. Although the colonoscopy is a routine method for CRC screening, it has limited sensitivity for detection of lesions in the early stages. We assessed the ability of a novel probeate activable probe (Lumicell-33) selective for Cathepsin B (CTSB) with improved kinetics in the early detection of CRC tumors.

METHOD AND MATERIALS
An orthotopic CRC model was developed with crossing APCCKO, KrasLSL-G12D and p53BloxBlox mouse to generate APCCKO/KrasLSL-G12Dp53BloxBlox (AKP) mice (n=8). Cre expressing adenovirus (AdCre) was administered focally in descending colon of the mice to cause recombination; mice were followed by colonoscopy for tumor development. Also in a human CRC model HT-29 cells expressing R26R-LoxP-STOP-LoxP-tdTomato (L2-cre;p120ctnLoxP/LoxP); the model demonstrates a trend of increasing periostin concentration in serum, and its enhanced expression genetically engineered mouse model (GEMM) of ESCC by conditionally deleting the cell adhesion molecule p120ctn (L2-cre;p120ctnLoxP/LoxP); the model demonstrates a trend of increasing periostin concentration in serum, and its enhanced expression genetically engineered mouse model (GEMM) of ESCC by conditionally deleting the cell adhesion molecule p120ctn (L2-cre;p120ctnLoxP/LoxP); the model demonstrates a trend of increasing periostin concentration in serum, and its enhanced expression genetically engineered mouse model (GEMM) of ESCC by conditionally deleting the cell adhesion molecule p120ctn

RESULTS
Fluorescent & confocal microscopy confirmed presence of iron oxides in in vivo labeled cells, with 3.2 times higher intracellular quantities than standard ex vivo labeled cells. Electron microscopy localized iron oxide nanoparticles in secondary lysosomes. In-vivo labeled cells demonstrated significant T2 shortening effects both in vitro & in vivo when compared to unlabeled controls (T2 times in vitro: 8.2 vs 33.6 ms, in vivo: 15.4 vs 24.4ms; p

CONCLUSION
To the best of our knowledge, this is the first report of in vivo stem cell labeling with an immediately clinically applicable iron supplement. This method eliminates risks of ex vivo contamination and alterations of stem cell due to manipulations between harvest and transplantation and thus could be rapidly translated to the clinic via off label use of the FDA-approved Ferumoxytol.

CLINICAL RELEVANCE/APPLICATION
In vivo labeling could be widely used for tracking of MSC in various target tissues as it involves no additional cell manipulation between harvest & transplantation & provides strong MR signal in vivo.

SSM12-05 • PET Imaging of Periostin, a Novel Extracellular Matrix Protein Target in the Tumor Microenvironment

Shadi A Esfahani MD, MPH (Presenter) ; Pedram Heidari MD ; Nazife S Turker ; Peiman Habibollahi MD ; Timothy C Wang ; Anil Rustgi ; Umar Mahmood MD, PhD

PURPOSE
Periostin, a secreted extracellular matrix protein, plays a key role in cell adhesion and motility within the tumor microenvironment, and is correlated with metastases. Periostin is highly upregulated in esophageal squamous cell carcinoma (ESCC), one of the two major subtypes of esophageal cancer worldwide. We developed a novel PET tracer that specifically targets periostin, and tested it in murine models of ESCC.

METHOD AND MATERIALS
Human ESCC cell lines were subcutaneously implanted in nu/nu mice (n = 10). TE-11 cells with high expression and TT cells with minimal expression of periostin were used to generate the positive and control tumor models. We additionally tested the probe in a genetically engineered mouse model (GEMM) of ESCC by conditionally deleting the cell adhesion molecule p120ctn in osteoblasts (L2-cre;p120ctnLoxP/LoxP); the model demonstrates a trend of increasing periostin concentration in serum, and its enhanced expression in distal esophagus and forestomach with progression of ESCC. An anti-periostin-F(ab)2 was generated from a monoclonal antibody by enzymatic digestion and conjugated with p-SCN-Bn-DOTA. The conjugate was labeled with 64Cu. PET/CT scanning and quantitative background ratio (TBR) were calculated. AKP mice were sacrificed 6 hours after injection of the probe. Ex vivo imaging of the colon was performed using NIRF imaging system. IHC evaluation of CTSB expression in both human and murine CRCs was performed.

RESULTS
Fluorescent & confocal microscopy confirmed presence of iron oxides in in vivo labeled cells, with 3.2 times higher intracellular quantities than standard ex vivo labeled cells. Electron microscopy localized iron oxide nanoparticles in secondary lysosomes. In-vivo labeled cells demonstrated significant T2 shortening effects both in vitro & in vivo when compared to unlabeled controls (T2 times in vitro: 8.2 vs 33.6 ms, in vivo: 15.4 vs 24.4 ms; p

CONCLUSION
To the best of our knowledge, this is the first report of in vivo stem cell labeling with an immediately clinically applicable iron supplement. This method eliminates risks of ex vivo contamination and alterations of stem cell due to manipulations between harvest and transplantation and thus could be rapidly translated to the clinic via off label use of the FDA-approved Ferumoxytol.

CLINICAL RELEVANCE/APPLICATION
In vivo labeling could be widely used for tracking of MSC in various target tissues as it involves no additional cell manipulation between harvest & transplantation & provides strong MR signal in vivo.

SSM12-04 • Optical Imaging with a Novel Cathepsin-B Activated Probe for Enhanced Detection of Colorectal Cancer

Shadi A Esfahani MD, MPH (Presenter) ; Pedram Heidari MD ; Umar Mahmood MD, PhD

PURPOSE
Despite significant advancements in diagnosis and treatment, colorectal cancer (CRC) is still the fourth most common cause of cancer death with a global incidence rate of greater than 1 million people per year. Although the colonoscopy is a routine method for CRC screening, it has limited sensitivity for detection of lesions in the early stages. We assessed the ability of a novel protease activable probe (Lumicell-33) selective for Cathepsin B (CTSB) with improved kinetics in the early detection of CRC tumors.

METHOD AND MATERIALS
An orthotopic CRC model was developed with crossing APCCKO, KrasLSL-G12D and p53BloxBlox mouse to generate APCCKO/KrasLSL-G12Dp53BloxBlox (AKP) mice (n=8). Cre expressing adenovirus (AdCre) was administered focally in descending colon of the mice to cause recombination; mice were followed by colonoscopy for tumor development. Also in a human CRC model HT-29 cells expressing R26R-LoxP-STOP-LoxP-tdTomato (L2-cre;p120ctnLoxP/LoxP); the model demonstrates a trend of increasing periostin concentration in serum, and its enhanced expression genetically engineered mouse model (GEMM) of ESCC by conditionally deleting the cell adhesion molecule p120ctn

RESULTS
Fluorescent & confocal microscopy confirmed presence of iron oxides in in vivo labeled cells, with 3.2 times higher intracellular quantities than standard ex vivo labeled cells. Electron microscopy localized iron oxide nanoparticles in secondary lysosomes. In-vivo labeled cells demonstrated significant T2 shortening effects both in vitro & in vivo when compared to unlabeled controls (T2 times in vitro: 8.2 vs 33.6 ms, in vivo: 15.4 vs 24.4ms; p

CONCLUSION
To the best of our knowledge, this is the first report of in vivo stem cell labeling with an immediately clinically applicable iron supplement. This method eliminates risks of ex vivo contamination and alterations of stem cell due to manipulations between harvest and transplantation and thus could be rapidly translated to the clinic via off label use of the FDA-approved Ferumoxytol.

CLINICAL RELEVANCE/APPLICATION
In vivo labeling could be widely used for tracking of MSC in various target tissues as it involves no additional cell manipulation between harvest & transplantation & provides strong MR signal in vivo.
SSM13 • AMA PRA Category 1 Credit™: 1 • ARRT Category A+ Credit: 1

**Moderator**
Corrie M Yablon, MD

**Moderator**
Donald J Flemming, MD *

**SSM13-01 • Musculoskeletal Keynote Speaker: New Developments in Foot and Ankle Imaging**
Corrie M Yablon MD (Presenter)

**SSM13-02 • Do Conventional MRI, Ultrasound, Ultrashort-TE MRI, and Compressive Elastography Overestimate Achilles Tendinosis? A Cadaver Study with Histologic Correlation**

Aubrey J Slaughter MD (Presenter); Michael L Loftus MD, MBA; Theodore T Miller MD; Matthew F Koff PhD *; Giorgio Perino MD; Parina Shah

**METHOD AND MATERIALS**

A pilot study utilizing five fresh-frozen human cadaveric legs was performed (mean age 71.4 years, range 65-76 years). Each specimen underwent conventional 3T MRI, UTE 3T MRI, conventional US, and CE at five standardized levels along the Achilles tendons. Conventional MR images were graded according to Lohman et al: grade 0 (normal signal), grade 1 (punctate hyperintensities), and grade 2 (larger hyperintensities), and T2* values from 2D UTE imaging were calculated from a multi-echo acquisition. Conventional US images were graded according to Archambault et al: grade 1 (normal tendon with parallel margins and homogenous echotexture), grade 2 (enlarged tendon), and grade 3 (hypoechoic area with or without tendon enlargement). CE images were evaluated per an experimentally proven color grading system (hardest tissues are blue to green and softest tissues are red), and by measuring peak strain ratios. The Achilles tendons were harvested and underwent both gross and histologic examination.

**RESULTS**

All five Achilles tendon specimens demonstrated normal imaging and quantitative characteristics at all five levels on conventional MRI, UTE MRI, conventional US, and CE without abnormal results from either UTE or CE. Sonoeleastrography strain ratios demonstrated an average mean strain ratio of 0.14 (range 0.13-0.18), and a mean T2* value of 7ms (range 5.98ms). No evidence of tendinosis was identified at gross pathologic or histologic examination.

**CONCLUSION**

Conventional MRI, UTE MRI, conventional US and CE did not overestimate disease in this sample of specimens without pathology.

**CLINICAL RELEVANCE/APPLICATION**

This pilot study established a baseline of normative data to support the next study phase in which we will evaluate UTE and CE in Achilles tendons with chemically-induced collagen disruption.

**SSM13-03 • 3D Printing in the Pre-operative Assessment of Subtalar Coalitions Compared to 2-D and 3D CT Datasets**

Zbigniew Starosolski PhD (Presenter); J. H Kan MD; Scott B Rosenfeld MD; Ananth Annapragada PhD *

**PURPOSE**

3D printing is an emerging technology that can be used to generate physical models of 3D images. It has promise for treatment planning as well as patient education. The purpose of this paper is to explore its use in the preoperative phase for subtalar coalitions. In patients with subtalar coalitions, a 50% area threshold is used to decide between surgical arthrodesis and coalition resection. We tested if 3D prints based on a CT dataset correctly displays the CT dataset and the degree of subtalar coalition joint involvement.

**METHOD AND MATERIALS**

Local inflammation was induced at the right ears of female Balb/c mice by application of 2% croton oil (n=10). A S100A9-antibody (aS100A9) was conjugated to DTPA and labelled with In111. The labelling efficacy and purity of the compound was assessed using HPLC. Mice received the labelled tracer iv in doses, corresponding to about 10 MBq activity 24 h after induction of inflammation. An equivalently labelled IgG of irrelevant specificity in mice was used to control for unspecific tracer distribution. SPECT was performed immediately after tracer injection and repeatedly up to 48 h later. Tracer biodistribution was assessed after in-vivo imaging. For correlation of imaging findings, S100A9 serum levels were determined at the imaging time points and immunohistochemistry for S100A9 was performed.

**RESULTS**

SPECT imaging immediately after tracer injection did not reveal a specific tracer uptake in the region of inflammation but already allowed for estimation of perfusion properties. 24 h later however, the diseased area showed a significant uptake of aS100A9 with excellent contrast to the healthy control side and other tissues, as confirmed by ex-vivo biodistribution measurements (%ID/g – right ear: 51.9; left ear: 3.1; liver: 2.5; spleen: 8.5). Control experiments and histology supported the in-vivo imaging results.

**CONCLUSION**

In a first approach using a well established and controllable model, S100A9-mediated imaging of monocytes activity appeared to be a promising tool for specific visualisation of inflammation.

**CLINICAL RELEVANCE/APPLICATION**

Inflammation is widely accepted as the driving pathomechanism behind multiple diseases. Understanding and specific monitoring of the underlying cellular processes is therefore of utmost importance.
RESULTS

CONCLUSION

3D printing based on a CT dataset correctly quantifies the degree of subtalar joint involvement compared with 2-D and 3-D CT datasets.

CLINICAL RELEVANCE/APPLICATION

3D printing may play a supplementary role in diagnosis, treatment planning, and patient education in children with subtalar coalitions.

SSM13-04 • Lateral Ligament Injury of the Ankle: Value of Additional Oblique MR Image Plane with Arthroscopic Correlation

Ji Eun Lee (Presenter); Jang Gyu Cha MD; Hyun Joo Kim MD; Young Koo Lee; Jai Soung Park; Eun Hye Lee MD; Heon Lee

PURPOSE

To determine whether the additional oblique coronal and axial MR imaging planes play a valuable role in assessing the anterior tibiofibular (ATFL) and anterior talofibular (ATFL) ligament injuries.

METHOD AND MATERIALS

Data was collected retrospectively for 25 patients (M: F = 13: 12) with lateral ankle injury who underwent 3T MR imaging for diagnosis of ATFL and ATFL injuries. MR was performed in both standard three orthogonal planes and in additional coronal and axial oblique planes with 1mm thickness. Features of ligament injuries were each subdivided into two groups (ATFL: normal/abnormal, ATFL: partial tear/complete tear). Ligaments were first reviewed with routine MR imaging planes only, and then with additional oblique MR imaging planes. Arthroscopic result was considered as the standard of reference. Two musculoskeletal radiologists independently reviewed the MR images. Descriptive statistics were performed and receiver-operating characteristic (ROC) curve analysis was used to compare the improvement of diagnostic performance in using additional oblique MR imaging planes.

RESULTS

When imaging diagnosis of ATFL injury was based on routine MR images only, the diagnosis was made with a sensitivity of 40%, and a specificity of 60-67%. With additional oblique MR imaging planes, the sensitivity and specificity increased up to 90% and 60-80%, respectively. Area under the curve (AUC) values showed significant difference (p<0.05). The interobserver agreement (κ) regarding injury of the ATFL and ATFL were good to excellent in both the routine and additional oblique imaging planes (κ 0.66–0.88) except in evaluation of ATFL in routine MR images. (κ 0.43)

CONCLUSION

Using additional oblique MR imaging planes in patients with lateral ligament injury of the ankle can significantly improve the sensitivity and specificity in diagnosing ATFL injury.

CLINICAL RELEVANCE/APPLICATION

Using additional oblique MR imaging planes provides better diagnostic performance, leading to optimal management for ankle injuries.

SSM13-05 • Magnetic Resonance Microscopy of the Tendons, Pulleys, and Plantar Plates of the Toes at 11.7T

Paul A DiCamillo MD, PhD (Presenter); Sheronda Statum; Christine B Chung MD; Graeme M Bydder MBChB *

PURPOSE

MR studies of the anatomy of the tendons, pulleys and plantar plates of the toes have been performed with clinical systems at field strengths up to 3T. In this study we used a high performance small bore 11.7T system to study the anatomy of the toes in detail.

METHOD AND MATERIALS

Following institutional policy human cadaveric great and lesser toes were collected and imaged with a 11.7T Bruker BioSpec 117/16USR system (Bruker BioSpin, Billerica, MA) fitted with resonators (60 and 72mm internal diameter) with and without receive-only four element semi-circular surface array coils. Both spin echo (80x80x400um resolution, TE 7-14ms, TR 5000ms, 2 echoes, fat sat, NEX 5-15, 4-6 hour scans) and gradient echo (90-150um isotropic resolution, TE 6ms, TR 25ms, fat sat, NEX 9-25, 4-6 hour scans) images were acquired.

RESULTS

Unprecedented spatial resolution and contrast was achieved, with well over 20 times greater spatial resolution than previous reported in anatomic studies using clinical systems. Our acquisitions parameters reversed the typical contrast pattern of previous non-fat saturated studies. Tendons, pulleys, and plates had a high signal relative to the saturated fat. Flexor tendons, extensor apparatus, annular and cruciate pulleys as well as the fiber structure within the plates were well seen.

CONCLUSION

Use of a high performance 11.7T system allow detailed anatomic imaging of the tendons, pulleys and plates of the toes at a level that has not previously been described. These results are likely to help in the recognition of injury and disease of the tendons, pulleys and plates of the toes as stronger field strengths become clinically available.

CLINICAL RELEVANCE/APPLICATION

High resolution 11.7T anatomic images of the tendons, pulleys and plates of the toes were acquired. These results may indicate what will be achievable on higher field clinical systems.

SSM13-06 • Early Detection of Tendinopathy and Chondropathy in Patients with Diabetes Mellitus Type I by Means of Quantitative Sodium Imaging at 7 Tesla MRI

Wolfgang Marik MD (Presenter); Veronika Schopf; Stefan Zbyn; Manuela Karner; Bernhard Ludvik MD; Siegfried Trattnig MD

PURPOSE

The purpose of this study was to investigate possible biochemical alterations of tendons and cartilage caused by diabetes mellitus (DM) Type 1 using quantitative in vivo sodium imaging at 7 Tesla.

METHOD AND MATERIALS

Eight patients (4f/4m, mean age 43a, SD 16,9a) with established diagnosis of DM Type 1 and no history of knee trauma were examined on a 7 Tesla whole body MR with a dedicated knee coil and compared with nine healthy volunteers. Controls were age and weight matched (3f/6m, mean age 40a, SD 17,2a). In all patients and volunteers axial, sagittal and coronal proton-density sequences were obtained for morphological diagnosis and localization of anatomical sites for Region of interest (ROI) analysis. For sodium imaging a optimized GRE sequence with variable TE was used and sodium-signal intensity was measured. Region of interest (ROI) analysis was performed manually for the femoral condyle cartilage layers and the patella tendon. Mean sodium intensity values were compared between both groups using the analysis of variance.

RESULTS
CONCLUSION
The preliminary data suggest that, although cartilage and tendons in patients with DM Type 1 appear morphologically intact, changes in the glycosaminoglycan content have already occurred. Thus, sodium imaging seems to be a promising noninvasive approach for early detection of tendinopathy and chondropathy in patients suffering from Diabetes mellitus Type 1.

CLINICAL RELEVANCE/APPLICATION
Quantitative sodium imaging due to its higher sensitivity compared to morphological imaging may improve early detection of tendinopathy and chondropathy in patients with Diabetes mellitus Type 1.

SSM14-03 • Functional Imaging Using 3D High-sampling-Efficiency Technique (SPACE) versus Conventional CSF Flow Techniques in Patient with Hydrocephalus at 3 Tesla

Murat Ucar (Presenter) ; Melike Guryildirim ; Ali Yusuf Oner MD ; Nil Tokgoz ; Alp Borcek ; Koray Kilic ; Koray Akkan ; Turgut E Talli MD *

PURPOSE
To evaluate the diagnostic accuracy of high spatial resolution three-dimensional magnetic resonance cerebrospinal fluid (CSF) flow with a high-sampling-efficiency technique (sampling perfection with application optimized contrasts using different flip angle evolutions [SPACE]) versus TSE T2 (2 mm section thickness without flow compensation) over detection of aqueductal patency (AP) in patient with hydrocephalus, using three-dimensional (3D) constructive interference in the steady state (CISS) and cine phase contrast (Cine PC) sequences as reference standard at 3 tesla.

Neuroradiology (Hydrocephalus and Intracranial Hypotension)

Wednesday, 03:00 PM - 04:00 PM • N226

SSM14 • AMA PRA Category 1 Credit ™:1 • ARRT Category A+ Credit:1

Moderator
William G Bradley , MD, PhD

SSM14-01 • Whole Brain Volume as a Risk Factor for Post Lumbar Puncture Headache Requiring Blood Patch

Phillip J Hsu (Presenter) ; Tammie S Benzinger MD, PhD * ; Shengmei Ma MS ; Chengjie Xiong PhD, MS ; John Morris * ; Marcus E Raichle MD ; Anne Fagan PhD ; Russell Hornbeck MSC ; Virginia Buckles PhD

PURPOSE
Post lumbar puncture headache (PLPH) is a common complication of lumbar puncture (LP) and is characterized by orthostatic headache that worsens when a patient moves from a supine to upright position. Blood patch, the injection of autologous blood near the puncture site, is the standard treatment of lasting PLPH. Though the exact cause of PLPH is uncertain, hypothesized causes include downward pull on pain-sensitive structures in the brain due to cerebrospinal fluid (CSF) leakage through the post-puncture opening. This study investigates whether whole brain volume affects risk of positional PLPH requiring blood patch (BPHA).

METHOD AND MATERIALS
Community-dwelling volunteers enrolled in prospective studies of memory and aging (n = 661) aged 43 to 91 years received LPs, 373 of which also received MRI scans for brain volume. Whole brain volume was calculating using FreeSurfer and normalized to intracranial volume (ICV). Logistic regression was used to determine effects of risk factors age, gender, and whole brain volume on risk of severe headache.

RESULTS
Of the 661 unique participants (285 male), 28 (5 male) experienced BPHA. As shown in previous studies, young age (p

CONCLUSION
Our finding that greater whole brain volume is correlated with BPHA risk is in accordance with the theory that PLPH is caused by the downward pull on pain-sensitive structures in the brain. Those people with larger brain volume are potentially more likely to have the brain to come into contact with the skull following lumbar puncture.

CLINICAL RELEVANCE/APPLICATION
Larger brain volumes are associated with risk of post-LP headache requiring blood patch; consideration should be given to recommending extra precautions for LP patients with large brain volumes.

SSM14-02 • Minimizing Iatrogenic Meningitis and Spinal Headache: Current Practice Patterns of Neuroradiologists in the Academic Setting

Yi C Zhang MD (Presenter) ; Alexander Chandler MD ; Nolan J Kagetsu MD *

PURPOSE
Iatrogenic bacterial meningitis and dural leak resulting in spinal headache are serious sequelae of lumbar punctures and myelograms. Although the CDC and American Academy of Neurology have issued standardized techniques for dural puncture including use of facemasks and atraumatic spinal needles, there is a wide range of practice patterns. We undertook a survey of neuroradiologists with academic affiliations to evaluate the degree of technical compliance towards mitigating iatrogenic meningitis and dural leak.

METHOD AND MATERIALS
In February 2013 we surveyed neuroradiology fellows and attendings in the email directory of the Association of Program Directors in Radiology. We queried use of facemasks, use of atraumatic needles, and dural puncture practices. We sent a repeat questionnaire five weeks later. All data were collected anonymously.

RESULTS
A total of 96 survey responses were received. Only 48% always wear a facemask during lumbar punctures, and only 51% during myelograms. A majority of respondents (91%) use the Quincke cutting needle by default, compared to only 26% who have ever used atraumatic needles. Only 16% of respondents prescribe immediate post-procedure mobilization, which has been shown to reduce spinal headache. There are no statistically significant differences between attending neuroradiologists and fellows for these results.

CONCLUSION
Many neuroradiologists only partially conform to standard guidelines designed to prevent iatrogenic meningitis and spinal headache. Approximately half of the respondents do not wear facemasks during dural puncture, placing patients at risk for iatrogenic meningitis. Only 26% of neuroradiologists use atraumatic needles which have been shown to reduce dural leak. Only 16% of neuroradiologists prescribe immediate post-procedure mobilization which has been shown to decrease the incidence of spinal headaches and the length of required post-procedure monitoring.

CLINICAL RELEVANCE/APPLICATION
Use of facemasks and atraumatic needles in conjunction with immediate post-procedure mobilization reduce the risk of iatrogenic bacterial meningitis and spinal headache.

SSM14-04 • Functional Imaging Using 3D High-sampling-Efficiency Technique (SPACE) versus Conventional CSF Flow Techniques in Patient with Hydrocephalus at 3 Tesla

Murat Ucar (Presenter) ; Melike Guryildirim ; Ali Yusuf Oner MD ; Nil Tokgoz ; Alp Borcek ; Koray Kilic ; Koray Akkan ; Turgut E Talli MD *

PURPOSE
To evaluate the diagnostic accuracy of high spatial resolution three-dimensional magnetic resonance cerebrospinal fluid (CSF) flow with a high-sampling-efficiency technique (sampling perfection with application optimized contrasts using different flip angle evolutions [SPACE]) versus TSE T2 (2 mm section thickness without flow compensation) over detection of aqueductal patency (AP) in patient with hydrocephalus, using three-dimensional (3D) constructive interference in the steady state (CISS) and cine phase contrast (Cine PC) sequences as reference standard at 3 tesla.
METHOD AND MATERIALS
68 patients with hydrocephalus who were suspected aqueductal stenosis and had 3.0T CSF flow MR imaging were included. In addition to routine sequences which consisted of sagittal TSE T2, 3D-CISS, and axial-sagittal cine PC, sagittal 3D-T2 SPACE was obtained to evaluate the cerebral aqueduct by two radiologists, independently. AP and visibility of flow void were scored on the TSE T2 and 3D-T2 SPACE on a relative 4-point scale and compared with cine PC as a reference standard of patency and 3D-CISS as a reference standard of image quality in terms of wall conspicuity, contrast, continuity, sharpness, and background homogeneity. The McNemar test was used to compare for statistical analysis. Inter-observer agreement was calculated using kappa statistics.

RESULTS
AP by 3D-T2 SPACE and TSE T2 were in agreement with cine PC findings in 100%(65/65) and 85% (58/68), respectively and the sensitivity of 3D-T2 SPACE was equal to cine PC. Visibility of flow void in aqueduct and periaqueduct was significantly better with 3D-T2SPACE than TSE T2 (P = 0.05). Inter-observer agreement was almost perfect for TSE T2 and 3D-T2SPACE (kappa > 0.81).

CONCLUSION
3D-T2SPACE should be the method of choice as a stand-alone sequence for the evaluation of AP in hydrocephalus. Due to the high accuracy for physiologic information and the short -acquisition time with high resolution should be preferred to conventional TSE T2.

CLINICAL RELEVANCE/APPLICATION
Due to the high accuracy for physiologic information and the short -acquisition time with high resolution, 3D-T2SPACE should be preferred to conventional TSE T2 for aqueductal patency in hydrocephalus.
METHOD AND MATERIALS
In this retrospective study, axial T2WI from MR imaging of 25 patients with ophthalmologically proven papilledema and 66 controls were presented to two neuroradiologists, who interpreted these for presence of papilledema in each eye. All studies included conventional axial 2D T2WI (slice thickness 3-5 mm) and high-resolution axial 3D T2WI (slice thickness 0.7-1 mm), which were presented to the readers in a blinded and random fashion. Sensitivity, specificity, positive likelihood ratio, and negative likelihood ratio were calculated for each reader and for each technique. Assessment was done for all the eyes combined as well as for each side individually. The positive likelihood ratios for 2D and 3D techniques were compared using homogeneity of Odds-Ratio test. Interobserver variability was studied by calculating kappa, and using McNemar test.

RESULTS
For all eyes, the sensitivity, specificity, positive likelihood ratio, and the negative likelihood ratio for first reader were 56.3%, 85.8%, 3.97, and 0.51 for 2D T2WI, with the corresponding values of 83.3%, 93.3%, 12.4, and 0.18 respectively for 3D T2WI. The second reader achieved a sensitivity, specificity, positive likelihood ratio of 54.2%, 94.0%, 9.07, and 0.49 respectively with 2D T2WI, and 87.5%, 91.0%, 9.77, and 0.14 respectively with 3D T2WI. The differences in positive likelihood ratio were statistically significant for first reader (p=0.009), but not for the second (p=0.0793). A similar pattern was observed when results were analyzed for each eye individually.

Substantial interobserver agreement (kappa 0.617) with 2D T2WI improved to an almost perfect interobserver agreement with 3D T2WI (kappa 0.824). McNemar test for paired proportions showed a significant difference of 6.59% in the positive and negative interpretations of two readers using 2D T2WI (p=0.0227), while the corresponding difference of 2.75% difference for 3D T2WI was not significant (p=0.2668).

CONCLUSION
Higher spatial resolution offered by 3D T2WI translates into improved diagnostic efficacy and a higher interobserver agreement for detection of papilledema, when compared to 2D T2WI.

CLINICAL RELEVANCE/APPLICATION
High resolution 3D T2WI can improve the diagnostic efficacy of MR imaging for detection of papilledema.
RESULTS
rADC voxels showed an increase of 21.9+26.3 % above 0.25 in patients with real progression and in 55.7 + 28.3% in patients with pseudoprogression. ROC analysis revealed a very good diagnostic performance (AUC = 0.82).

CONCLUSION
The introduced parametric response map for rADC maps provides a potential tool for the differentiation between pseudoprogression and real progression. Generally an ADC increase is supposed to be correlated with a decrease of cellularity and hence with therapy response. Therefore our findings of an increased number of voxels with increased ADC values in patients with pseudoprogression are in line with these basic pathophysiological considerations.

CLINICAL RELEVANCE/APPLICATION
The reliable differentiation of real progression and pseudoprogression is crucial not only for the therapeutic decision but also for the correct radiological assessment within clinical studies.

SSM15-03 • Prognostic Value of ADC in Glioblastoma Multiforme and Its Correlation with Histopathologic Biomarkers

Romina Zalazar MD; Miguel D Hernandez Arguello MD; Pablo D Dominguez MD; Maria Paramo Alfaro MD; Pedro Slon MD (Presenter); Jon Etxano MD; Ricardo Diez-Valle MD, PhD; Miguel Idote; Jose Luis Zubiesta; Maria De Los Reyes Garcia De Eulate

PURPOSE
To analyse whether apparent diffusion coefficient (ADC) values derived from diffusion-weighted imaging (DWI) MRI correlate with overall survival (OS), progression-free survival (PFS) and with molecular status on glioblastoma multiforme (GBM)

METHOD AND MATERIALS
Retrospective study in 60 patients with untreated GBM that underwent DWI study before surgery (mean time 6 days). Patients included were followed-up for at least 12 months or until death. Circular 5 mm2 ROI were drawn on ADC map. First on the solid enhancing tumor with the highest restriction value, without evidence of bleeding on SWI.Then on peritumoral area with hyperintensity on T2 FLAIR. Finally on the normal-appearing contralateral white matter (NCWM). Minimum, maximum, and mean ADC (ADCmin, ADCmax, ADCmean) were evaluated as well as ADCindex defined as a ratio between tumoral ADCmin and NCWM ADCmean. The methylguanine-DNA-methyltransferase (MGMT) promoter methylation, epidermal growth factor receptor (EGFR) amplification and EGFRvIII status, tumoral volume, residual volume, OS and PSF were evaluated. ROC curves, Student’s t-test, Kaplan-Meier curves and Cox regression model were performed.

RESULTS
30 males and 30 females (median age 60.5, range 28-78) were evaluated. 48 patients had complete resection (80%). Presurgical tumoral volume (mean=41.02 cm3, range 2.2-111.8) and post-surgical volume (mean=0.55, range 0.2-13) had no association with PFS and OS. MGMT promoter status (n=54) was not methylated in 26. EGFR amplification (n=51) was present in 6. MGMT promoter methylation, EGFR amplification and EGFR overexpression status did not have correlation with ADC.MGMT status correlated with PFS. ADCindex value is a new parameter that could predict the prognosis in GBM.

SSM15-04 • Variability of rCBV Measurements of Glioblastoma between Three FDA-approved Software Packages

Zachary S Kelm BS (Presenter); Leland S Hu MD; Panagiotis Korfiatis PhD; Ravi Lingineni MPH; Rickey Carter PhD; John Daniels RT; Bradley J Erickson MD, PhD *

PURPOSE
We measured the variability between three FDA-approved perfusion software packages with respect to their relative cerebral blood volume (rCBV) output for dynamic-susceptibility contrast MRI of glioblastomas. The hypothesis is that they should produce the same rCBV values when obtaining measurements of the same image locations.

METHOD AND MATERIALS
We retrospectively identified 45 glioblastoma cases where within 6 months post-radiation therapy, an MRI was interpreted to contain a worrisome increase in hyperintensity on the T1w post-gad and/or T2w images. Using IB Neuro, GE Functool, and nordicICE, we generated rCBV images for each case, repeating the processing with three different operators for Functool and nordicICE, but just one operator for IB Neuro since it did not require manual input. For each of the 7 operator-software combinations, we calculated a representative rCBV value for each brain, using measurements of the exact same regions. The tumor regions were semi-automatically defined using only enhancement information in the post-gad volume that we had mapped to the same space as the rCBV volumes. We normalized the tumor rCBV values by the mean of a normal-appearing white matter region in the contralateral hemisphere. In addition to the mean normalized rCBV value for the tumor, we calculated the 95% rCBV value to robustly represent a tumor ‘hot-spot’ analysis.

RESULTS
For the mean and 95% normalized rCBV values for the tumors, the intra-class correlation coefficients (ICCs) (with 95% confidence interval in parentheses) for the 7 operator-software combinations were 0.835 (0.766, 0.893) and 0.727 (0.630, 0.817) respectively. For inter-operator analysis, the ICCs for GE Functool were 0.880 (0.813, 0.928) for the mean rCBV, and 0.910 (0.858, 0.946) for the 95% rCBV. For nordicICE, they were 0.971 (0.953, 0.983) and 0.959 (0.933, 0.976) respectively. The higher ICCs for nordicICE were expected since it requires less manual input in the rCBV processing than GE Functool.

CONCLUSION
Due to the variability in rCBV determination, we recommend that the software package be considered and potentially adjusted for when using results and thresholds published in the literature.

CLINICAL RELEVANCE/APPLICATION
Glioblastomas are often imaged using perfusion-weighted acquisitions, but the determination of rCBV is not standardized. This results in different rCBV measurements depending on the software used.

SSM15-05 • Fast Whole-brain Magnetic Resonance Spectroscopy (MRS) for Patients with Brain Tumors

Yi Zhang (Presenter); Jinyuan Zhou PhD; Paul A Bottomley PhD

PURPOSE
The clinical application of multi-voxel MRS is often limited by long scan times. It is shown here that a recently proposed method, spectroscopy with linear algebraic model (SLAM), combined with parallel imaging or ‘SENSE’, offers dramatically faster MRS acquisitions than conventional chemical shift imaging (CSI).

METHOD AND MATERIALS
The SLAM method reconstructs spectra from multiple compartments using a small subset of CSI phase-encodes from central image k-space. Compartments are segmented from co-registered MRI, and compartment-average spectra are reconstructed using linear algebra. 8 patients with brain tumors were scanned with a 32-channel head coil in a 3T Philips MR system. A ~6 min three-slice conventional proton MRS SENSE CSI sequence and a five-slice pro-active SENSE SLAM sequence providing whole-brain coverage
Effect of 3T Contrast-enhanced 3D Fast Spin-echo Imaging on the Detection of Small Brain Metastases in a Prospective Multicenter Trial

Minako Azuma (Presenter) ; Toshinori Hirai MD ; Masayuki Maeda MD ; Yoshiyuki Watanabe MD, PhD ; Mika Kitajima MD ; Yasuuky Yamashita MD * ; Yoshikazu Uchiyama ; Junji Shiraiishi *

PURPOSE
To evaluate the effect of contrast-enhanced three-dimensional (3D) T1-volume isotropic turbo spin-echo acquisition (T1-VISTA) imaging at 3T on the performance of readers in detecting small brain metastases in a prospective multicenter clinical trial.

METHOD AND MATERIALS
We enrolled 200 consecutive patients with suspected brain metastases who underwent contrast-enhanced brain MRI on 3T units at 3 sites in Japan. We used 3D T1-VISTA and 3D turbo field echo (TFE) sequences. Conventional gadolinium doses were delivered and the order of the two 3D MR sequences was randomized. When the size of the lesion was decreased after therapy or increased on follow-up MRI it was regarded as metastatic. Our observer performance study included 24 metastatic lesions less than 5 mm in diameter in 10 patients and 6 patients with no metastases. The number of metastatic lesions ranged from 1 to 8, (mean, 3). Six radiologists (3 neuroradiologists, 3 radiology residents) interpreted the 3D TFE images first without- and then with 3D T1-VISTA images and their performance without and with these images was evaluated using the jack-knife free-response receiver operating characteristic method (JAFROC 4.1).

RESULTS
For all 6 observers, the figure of merit (FOM) values for the detection of brain metastases was increased significantly (from 0.757 to 0.897, P = 0.002) when they used the 3D T1-VISTA images. The FOM values for the residents and neuroradiologists increased from 0.704 to 0.871 (P = 0.008) and from 0.811 to 0.923 (P = 0.008), respectively. In terms of the FOM value, the performance improvement was much greater for the residents than the neuroradiologists and the performance of residents using 3D T1-VISTA (FOM = 0.871) was slightly better than of neuroradiologists without 3D T1-VISTA (FOM = 0.811).

CONCLUSION
3T contrast-enhanced 3D T1-VISTA images improved the performance of neuroradiologists and radiology residents for the detection of small brain metastases. The addition of the 3D T1-VISTA sequence holds promise for the better assessment of brain metastases.

CLINICAL RELEVANCE/APPLICATION
The contrast-enhanced 3D fast spin-echo sequence is useful for evaluating small brain metastases and adds information to the contrast-enhanced 3D gradient-echo sequence.

SSM16-06 • Altered Spontaneous Brain Activity in Type2 Diabetes: A Resting-state Functional MRI Study

Ying Cui (Presenter) ; Yun Jiao PhD ; Yu-Chen Chen ; Gao-Jun Teng MD

PURPOSE
Type 2 diabetes mellitus (T2DM) has been associated with increased risk of cognitive impairment. Population with impaired cognition showed decreased spontaneous brain activity. In this study, we aimed to investigate this pattern in T2DM patients using resting-state functional magnetic resonance imaging (rs-fMRI).

METHOD AND MATERIALS
RESULTS
Compared with healthy controls, patients with T2DM showed diffuse decreased ALFF mainly in prefrontal regions, visual cortex and postcentral gyrus. Instructively, decreased ReHo showed quite a similar pattern. Meanwhile, increased ALFF were found in anterior cingulate and posterior lobe of cerebellum (PLC) while increased ReHo were found in precuneus (PCu) and PLC. Additionally, cognitive performance of patients were inversely correlated with the spontaneous brain activity, especially in the left cuneus.

CONCLUSION
Widespread abnormalities in intrinsic brain activity reflected by ALFF and ReHo were found in T2DM patients, which may provide insights into the neurological pathophysiology underlying diabetes-associated cognitive decline.

CLINICAL RELEVANCE/APPLICATION
Resting-state functional MR imaging is a powerful tool to evaluate regional interactions that occur when a subject is not performing any task, which is only for research purpose.

SSM16-02 • Aging-related Altered Functional Connectivity in Putamen at Resting State

Tianyu Tang MS (Presenter) ; Yun Jiao PhD ; Xunheng Wang ; Hui Wang ; Ming Yang MD ; Zuhong Lu PhD

RESULTS
The validation analysis revealed differences between SENSE SLAM and SENSE CSI (percentage mean ± standard deviation) of: Cho, -4.2 ±4.5%; CR, -3.1 ±4.7%; NAA, 1 ±10%, which are considered negligible. Applied pro-actively, SENSE SLAM could achieve whole-brain coverage in just 1.5 min, which was not feasible for SENSE CSI due to the limited time available for spectroscopy in the current study protocol.

CONCLUSION
SLAM combined with SENSE can produce quantitatively the same results as the standard CSI method much faster (5-fold demonstrated). This speed advantage enables inclusion of brain MRS in studies that may otherwise be precluded by scan-time limitations. SENSE SLAM could potentially supplant CSI for clinical studies in which lesion-averaged MRS measures can suffice.

CLINICAL RELEVANCE/APPLICATION
With SLAM, whole-brain proton MRS studies of brain tumor patients can be conducted within 1-2 min, greatly increasing its potential clinical utility.
PURPOSE
Motor functions decline with the progress of aging and act differently in male and female brains. By investigating voxel based functional
cnectivities (FCs) between putamen subdivisions and the whole brain, we aimed to study the effects of gender-related aging progress in
putamen subdivisions.

METHOD AND MATERIALS
In this study, 176 healthy subjects including 120 young adults (male 62, female 58) and 56 elder (male 28, female 28) adults were
performed EPI functional MRI scanning. Firstly, after preprocessing of raw EPI data using FSL, an ICA based identification of subdivisions of
putamen was applied and bilateral putamen were automatically parcelled. Secondly, time courses (TCs) of each subdivision of every
subject were extracted. Thirdly, voxel-based FCs between TCs and whole brain were generated. Finally, FCs were compared between
groups using two-sample t tests with a threshold at p = 64.

RESULTS
Based on temporal correlation parcel approach, putamen was automatically divided into six subdivisions: Left and Right Ventral Rostral
Putamen (LVRP and RVRP); Left and Right Dorsal Rostral Putamen (LDRP and RDRP); Left and Right Dorsal Caudal Putamen (LDCP and
RDCP); With two-sample t tests, we found significant age-related increase of FCs between LVRP and Supplementary Motor Area (SMA) in
male groups. In addition, an age-related decrease of FCs in male groups between LDCP and right insular was also detected. In females, we
found significant age-related decrease of FCs between middle cingulum and RVRP.

CONCLUSION
Different patterns of age-related FCs changes in male and female groups were detected. The decrease of FCs between SMA and LVRP in
elder male group may reflect the gender specific age-related motor function decline and provided evidence to explain the higher
susceptibility of Parkinson’s disease in males. The age-related changes of FCs between putamen and whole brain could provide neural
evidence for the aging brain.

CLINICAL RELEVANCE/APPLICATION
Our study provided evidences for gender specific brain degeneration in putamen and related brain functions.

SSM16-03 • Disrupted Functional Connectivity in the Human Brain Network during Short-term Hyperthermia Exposure
Shaowen Qian (Presenter); Kai Liu; Gang Sun; Min Li

PURPOSE
Passive hyperthermia is a potential risk factor to human in many extreme work environments, such as a product manufacturing plant,
c coal mine, military operation, firefighting and outdoor sports. Previous studies have shed light on the significant effects of passive
hyperthermia on human cognitive performance and behavior. However, the potential principles of human cognition and behavior
deteriorations were still not clearly known. Therefore, the aim was to examine the influences of passive hyperthermia on brain functional
connectivity patterns and their relationships with behavioral performance.

METHOD AND MATERIALS
RESULTS
We identified decreased correlations of a set of regions with the PCC/Pcu, including the medial orbitofrontal cortex (mOFC) and bilateral
medial temporal cortex, and increased correlations with the partial orbitofrontal cortex particularly in the bilateral orbital superior frontal
gyrus (Figure a). The decreased correlations mainly involved with the mOFC, temporal lobe and occipital lobe, while increased

correlations were mainly located within the limbic system (Figure b). More importantly, the number of significantly altered connectivities
was positively correlated with an increase in executive control reaction time (Figure c).

CONCLUSION
The changes in the functional connectivity network might be a possible explanation for the cognitive and behavior alteration.

CLINICAL RELEVANCE/APPLICATION
The clear recognition for the potential mechanisms of the effects of passive hyperthermia may provide new evidence for protections of
heat exposure in many extremely hot work environments.

SSM16-04 • Functional Connectivity of Resting State Networks in Spinocerebellar Ataxia Type 6 Correlates with Fractional
Anisotropy of Cerebellar White Matter
Licia P Pereira MD (Presenter); Haris I Sair MD; Raag D Airan MD, PhD; Sarah H Ying

PURPOSE
To determine brain regions that have abnormal white matter and resting-state functional MRI (rs-fMRI) internetwork connectivity (IC) in
patients with spinocerebellar ataxia type 6 (SCA6) and whether these measures correlated.

METHOD AND MATERIALS
RESULTS
In this study, 176 healthy subjects including 120 young adults (male 62, female 58) and 56 elder (male 28, female 28) adults were

subject were extracted. Thirdly, voxel-based FCs between TCs and whole brain were generated. Finally, FCs were compared between
groups using two-sample t tests with a threshold at p = 64.

FA values were decreased in SCA6 compared to controls for both cerebellar hemispheres (p

CONCLUSION
Cerebellar fractional anisotropy alterations in patients with SCA6 are correlated with specific rs-fMRI IC modules, while supratentorial DTI
measures are not. Motor, cingulate, and attention networks are particularly involved and correlate with clinical dysfunction. This pilot
study supports the use of network analysis in SCA6 and may help elucidate the pathophysiology of these complex degenerative diseases.

CLINICAL RELEVANCE/APPLICATION
Some specific rs-fMRI networks are correlated with DTI measures in posterior fossa and with clinical dysfunction in SCA6 patients. This
may help elucidate the pathophysiology of these complex diseases.

SSM16-05 • Resting State Neural Network in Monolateral and Central Tinnitus
Chang-Woo Ryu MD (Presenter); Hye Soo Koo MD; Seong Jong Yun; Moon Suh Park; Geon-Ho Jahng PhD

PURPOSE
The neural activity in tinnitus was investigated with a task-based fMRI paradigm by using auditory or somatic modulation. However,

few studies have investigated the resting-state neuronal activity in tinnitus. The objective of this study is to identify the difference of
resting-state networks among patients with monolateral and central tinnitus, and matching healthy control by using resting-state fMRI.

METHOD AND MATERIALS
Total 53 patients (18 left-sided, 16 right-sided, and 19 central tinnitus) and age-matched 20 healthy controls underwent resting-state
fMRI scan. We computed the connectivity in default mode and auditory networks using the group independent component analysis, and
the networks were compared among groups.
RESULTS
In the default mode network, the connectivity in the bilateral inferior frontal, prefrontal, and motorsensory areas were increased in tinnitus groups. Connectivity in the central tinnitus had increased at the bilateral angular gyri compared with the monolateral tinnitus and the healthy control. In the auditory network, the reduced functional connectivity of auditory network and increased functioning were found, included in the prefrontal, and middle temporal regions.

CONCLUSION
These results suggested that the chronic tinnitus may be related to aberrant functioning of the default mode network. Alteration of the default mode and auditory networks between monolateral and central tinnitus imply that the two tinnitus may have different mechanism.

CLINICAL RELEVANCE/APPLICATION
Our research suggested that resting-state fMRI would be useful to lateralize tinnitus and analyze the mechanism of tinnitus without a task-based paradigm.

SSM17-06 • Mapping Functional Reorganization of the Motor Network Connectivity after Training with a Novel MR-compatible Hand Induced Robotic Device

Asimina Lazaridou MD ; Phaethon Philbrook (Presenter) ; Loukas Astrakas ; Dionyssios Mintzopoulos PhD ; Aneesh B Singhal MD ; A. Aria Tzika PhD ; Azadeh Khanicheh MS, PhD * ; Michael Moskowitz MD ; Bruce R Rosen MD, PhD *

PURPOSE
After stroke, the connectivity in the primary motor cortex (M1), supplementary motor area (SMA) and the cerebellum (Ce) are affected. This has been observed as a decrease in intrinsic neural coupling between M1 and Ce. Using fMRI and dynamic causal modeling (DCM) with a novel MR-compatible hand-induced robotic device (MR_CHIROD), this functional reorganization of the motor systems in the brain was further examined in chronic stroke patients.

METHOD AND MATERIALS
Healthy volunteers (n=12) and chronic stroke patients (n=5; = 6 months poststroke) were studied. fMRI was performed on a 3T Siemens using a block paradigm at baseline, during, and after 8 weeks of training, which consisted of squeezing a gel ball with the paretic hand at approximately 75% of maximum strength for 1 hour/day, 3 days/week. Patients squeezed and released the MR_CHIROD during the action period at increments of 45%, 60%, and 75% of their maximum grip force. DCM of fMRI data was used to model the task-dependent influences that one area exerts over another to infer connectivity strengths. Connectivity region stimulation and posterior probability was calculated using the DCM SPM5 utility.

RESULTS
Results indicated that in healthy volunteers performing a simple motor resulted in a minimum effective connectivity for the Ce to M1 pathway. However, in patients, M1 to SMA increased 98%, SMA to M1 increased 616% (p < 0.05). Regional lymph node involvement was correctly determined in 30/40 cases as N-positive for (T1W, T2W-STIR), Diffusion-Weighted Imaging With Background Suppression (DWIBS) and contrast-enhanced T1w 3D sequences.

CONCLUSION
WB-MRI is a fast and feasible method for staging colon cancer patients but up-to-date does not reach the accuracy of 18F-FDG-PET/CT. The mean follow-up time was 22 months. Regional lymph node involvement was correctly determined in 30/40 cases as N-positive for WB-MRI (75%, p < 0.05). WB-MRI is a fast and feasible method for staging colon cancer patients but up-to-date does not reach the accuracy of 18F-FDG-PET/CT.

CLINICAL RELEVANCE/APPLICATION
The present study demonstrated expected advantages of PET/CT over WB-MRI in staging colon cancer patients.

SSM17-02 • Comparison of Diffusion Weighted MR Imaging with 18-FDG PET-CT for Lymph Node Assessment in Known Cases of Malignancy

Salli Bhargava DMRD (Presenter) ; Chalapathi R M. V. MD * ; Pupshpalatha Sudhakar MD

PURPOSE
To perform a node-by-node correlation of the maximum standard uptake value (SUVmax) and the minimal apparent diffusion coefficient (ADCmin abs) for each lymph node that shows radiotracer uptake on 18-FDG PET-CT. Develop a visual grading of diffusion restriction and
To assess its correlation with radiotracer uptake. Calculate the sensitivity and specificity of diffusion weighted imaging (DWI) for the assessment of lymph nodes while using 18-FDG PET-CT as the gold standard.

METHOD AND MATERIALS
The study included 40 patients with histologically confirmed diagnosis of malignancy who were found to have significant lymph node involvement on 18-FDG PET-CT examination. These patients were subsequently imaged on a 1.5 T MR scanner using a Torso-PA coil where DWI was performed using b values of 0, 100 and 1000 without respiratory gating. Binned reading of the PET-CT and DW images was performed and SUV_{max}, ADC_{min} abs and visual grade of diffusion restriction were recorded for each lymph node. Pearson’s correlation was performed over the entire data set and after segregating it into various subgroups.

RESULTS
Evaluation of 241 lymph nodes revealed a statistically significant inverse correlation (r = -0.190, p < 0.05) and SUV_{max}. The mean values of ADC_{min} abs for PET-CT negative and PET-CT positive lymph nodes were 1.197 ± 0.392 x 10^{-3} mm/s and 0.907 ± 0.356 x 10^{-3} mm/s with their difference being statistically significant (p < 0.05).

CONCLUSION
Increasing visual grade of lymph nodes on DWI consistently correlates with increase in radiotracer uptake and low ADC values. DWI has a sensitivity and specificity of 89.9 and 90.3% when compared to PET-CT. However, it is inaccurate in the evaluation of mediatinal lymph nodes suggesting the need for respiratory gating.

CLINICAL RELEVANCE/APPLICATION
DWI is a cheaper, radiation free imaging alternative that allows for qualitative and quantitative evaluation of lymph nodes, with findings closely paralleling those of 18-FDG PET-CT.

SSM17-03 ▪ Misregression of Intra-abdominal and Intrapelvic Organs: Comparison between PET-CT and PET-MR

Pinakpani Roy (MD (Presenter)) ; Joseph K Lee MD ; Arif Sheikh MD ; Meagan Shepherd ; Stacy Hengsterman ; Yueh Z Lee MD, PhD * ; Wei Li PhD

PURPOSE
To quantify and compare organ misregistration between PET-CT data and PET-MR data obtained on a hybrid whole body PET-MR system.

METHOD AND MATERIALS
Biograph mMR consists of a 3.0T whole-body magnet with body coils optimized for minimal 511-keV photo attenuation. The PET detectors are made of lutetium oxyorthosilicate crystals in combination with MR-compatible avalanche photodiodes.

PET-CT data were acquired using a Siemens Biograph mCT system. Approximately 1 hour after 18-FDG injection, the CT data was acquired, followed sequentially by PET acquisition. IRB approval and informed consent were obtained.

After fasting for at least 4 hours, 9 normal PET-MR volunteers (5 men and 4 women, age range 26-50 years, BMI range 20-30) were imaged approximately 1 hour after 18-FDG injection. Breath-hold T2 HASTE, T2 STIR and T1 VIBE sequences were obtained simultaneously or sequentially (following PET acquisition).

10 clinical PET-CT studies performed during the same time frame were chosen, with the same BMI matched and BMI range matching those of the PET-MR volunteers. Registration of MR-PET data in selected organs (liver, spleen, kidneys, colon, small bowel, bladder, uterus) was compared to that of PET-CT data with respect to organ type, MR sequence and mode of acquisition.

Statistical analysis was performed using student T-test and Analysis of Variance (ANOVA).

RESULTS
With respect to misregistration, there was no significant difference between simultaneously obtained PET-MR data (mean 0.50 cm) and PET-CT (0.48 cm), but sequential acquired data (1.25 cm) showed significantly higher misregistration than PET-CT data (p=0.03). With respect to sequences, mean misregistration with T1 VIBE (mean 1.24 cm) was significantly (p=0.03) higher than with PET-CT (0.48 cm).

Although statistically significant misregistration with T2 STIR (0.27 cm) was lower than both PET-CT and PET-MR with breath hold T2 HASTE (0.82 cm) was significantly lighter than PET-CT, the results were not statistically significant.

CONCLUSION
Comparing BMI matched subjects, sequentially obtained PET-MR data has significantly higher misregistration than PET-CT data. Simultaneously obtained PET-MR data is non-inferior to PET-CT in that regard.

Misregistration with T1 VIBE is significantly lighter than with PET-CT.

CLINICAL RELEVANCE/APPLICATION
Simultaneously acquired PET-MR using T2 STIR sequence is comparable to PET-CT in terms of misregistration, which has diagnostic implications.

SSM17-04 ▪ Preliminary Investigation of Composite Biomarkers in Simultaneous PET/MR: Relationship between SUV and ADC in Oncology Patients

Rajan Rakheja ; Hersh Chandarana MD * ; Linda Demello ; Kimberly Jackson ; Christopher Glielmi PhD * ; Kent P Friedman MD (Presenter)

PURPOSE
To assess the correlation between SUV and ADC of neoplastic lesions using a simultaneous PET/MR and to investigate the value of a composite biomarker, SUV_{max}/ADC_{min}.

METHOD AND MATERIALS
Twenty-four patients with known primary malignancies underwent FDG-PET/CT followed by PET/MR (Biograph mMR). Diffusion weighted imaging was acquired using a single shot spin echo EPI sequence with b-values of 0, 350 and 750 s/mm². ROIs were manually drawn on PET/MR along the contours of neoplastic lesions larger than 1 cm. SUV_{max}, SUV_{mean}, ADC_{min} and ADC_{mean} were recorded for each FDG-avid tumor with a maximum of 3 lesions per patient. Relationships between SUV_{max} and ADC_{min} and ADC_{mean}, and SUV_{max}/liver mean versus ADC_{min} were assessed using Pearson’s correlation coefficient. A sub-analysis of patients with progressive disease (PD) and partial treatment response (PR) by RECIST 1.1 was performed using a ratio of SUV_{max}/ADC_{min} for the most metabolically active lesion.

RESULTS
Simultaneous PET/MR is a promising technology for detection of neoplastic disease. There is an inverse correlation between SUV_{max} and ADC_{min} and between SUV_{max}/liver ratio and ADC_{min}. Given that the correlation between both biomarkers is relatively weak, the authors hypothesize that SUV and ADC values may offer complimentary information to aid in determination of prognosis and treatment response. Preliminary results suggest that SUV_{max}/ADC_{min} may increase more rapidly than SUV_{max} in progressive disease, thus warranting further study of this ratio as a composite biomarker.

CLINICAL RELEVANCE/APPLICATION
There is a need to develop better imaging biomarkers for assessment of treatment response; our study investigates SUV_{max}/ADC_{min} measured by PET/CT as marker of cancer therapy response.

SSM17-05 ▪ The Correlation between SUV_{max} of 18F-FDG PET/CT and Apparent Diffusion Coefficients (ADC) in Pancreas Cancer and Biliary Cancer?

Shigeki Nagamachi MD, PhD (Presenter) ; Ryuichi Nishii MD, PhD ; Youichi Mizutani ; Shogo Kiyohara ; Eiji Furukoji MD, PhD ; Tatetumi Sakae MD ; Shozo Tamura MD, PhD ; Hideyuki Wakamatsu MD ; Seigo Fujita MD ; Shigemi Futami ; Keiichi
Apparent diffusion coefficient (ADC) is a quantitative parameter providing information regarding tumor cellularity. Several studies demonstrated that ADC and SUVmax of FDG-PET had negative correlations in various cancers. The aim of this study was to investigate and to compare the correlations between ADC and SUV in pancreatic cancer or biliary cancer.

RESULTS
In pancreas cancer, both ADC mean and ADC min was negatively correlated with SUVmax of early image ($r = -0.350$ and $r=-0.346$) and of delayed image ($r = -0.329$ and $r=-0.334$). In biliary cancer, both ADC mean and ADC min also negatively correlated with SUVmax of early image ($r = -0.602$ and $r=-0.414$) and of delayed image ($r = -0.599$ and $r=-0.381$).

CONCLUSION
The present study demonstrated negative correlations between ADC and SUVmax in both pancreas cancer and biliary cancer. However, the correlation coefficients of biliary cancer were higher than those in pancreatic cancer. The correlation between cell density and glucose metabolism seems to be different considerably according to disease respectively.

CLINICAL RELEVANCE/APPLICATION
Because it is difficult to estimate SUVmax from a value of the ADC in pancreas tumor, both indices had better be evaluated together for understanding biological characteristics.

SSM17-06 • Growth and Utilization Trends in Outpatient PET by Place-of-Service and Specialty

David C Levin MD (Presenter) *; Vijay M Rao MD; Laurence Parker PhD; Charles M Intenzo MD; Andrea J Frangos MPH

PURPOSE
PET is the most rapidly growing segment of nuclear medicine. Our purpose was to study recent PET growth trends in private offices and hospitals, also to determine who owned the PET facilities in offices and who interpreted the PET scans in hospitals.

METHOD AND MATERIALS
The nationwide Medicare Physician/Supplier Procedure Summary Master Files for 2001-2011 were studied. All CPT codes for PET were selected and procedure volumes were determined for each year. Medicare location codes identified the settings where the scans were performed, and specialty codes identified the specialties of the facility owners (in offices) and interpreting physicians (in hospitals). Ownership in offices was established by tabulating global and technical component claims, while interpreting physician specialty in hospitals was determined by tabulating global and professional component claims.

RESULTS
In offices, Medicare PET volume grew from 31,422 in 2001 to 342,397 in 2011. In 2011, radiologists owned the office unit in 141,289 (41.3 % share). Independent diagnostic testing facilities (IDTFs) had the next largest ownership share, 19.2%. IDTFs are listed as a "specialty" by Medicare, although the actual specialty of the physician provider cannot be determined. Cardiologists had a 13.4 % share, and all other internal medicine specialties as a group had an 18.8 % share. In hospitals, PET volume grew from 65,099 in 2001 to 340,870 in 2011. 95.6% of volume in the latter year was in outpatients. In 2011 in hospitals, radiologists interpreted 325,664 (95.5% share), while cardiologists interpreted 10,178 (3.0% share). Examination of the growth curves showed that in hospitals, PET volume underwent continued rapid growth during the entire period. Private office PET volume grew even more rapidly from 2002 to 2008, but then slowed from 2008-2011.

CONCLUSION
Outpatient PET is evenly split between private offices and hospitals. Rapid growth occurred from 2001-2011 in both locations, but the trend line began to flatten in offices in more recent years. Radiologists strongly predominated in hospital-based PET (96% share) in 2011. 95.6% of volume in the latter year was in outpatients. In 2011 in hospitals, radiologists interpreted 325,664 (95.5% share), while cardiologists interpreted 10,178 (3.0% share). Examination of the growth curves showed that in hospitals, PET volume underwent continued rapid growth during the entire period. Private office PET volume grew even more rapidly from 2002 to 2008, but then slowed from 2008-2011.

CLINICAL RELEVANCE/APPLICATION
Not applicable

SSM18 • AMA PRA Category 1 Credit ™:1 • ARRT Category A+ Credit:1

SSM18-01 • Structural Abnormalities of the Lung in Children Born Extremely Preterm during the Surfactant Era

Karla M Logie BSc (Presenter); Conor Murray; Graham L Hall PhD; J. J Pillow MD; Andrew C Wilson MD

PURPOSE
The long-term structural consequences of preterm birth upon the lungs remain unclear due to improved clinical management, survival rates and survival from younger gestations. Secondary to preterm birth, many infants develop bronchopulmonary dysplasia (BPD) the lung disease attributed to impaired morbidly and lung function. The purpose of this study was to assess lung structure in a contemporary cohort of children born at $=32$ weeks gestation. We hypothesised that structural abnormalities would be present in preterm children regardless of BPD status, with increased frequency and severity in the BPD cohort.

METHOD AND MATERIALS
Images of 1mm thickness were collected from a 64-slice CT machine (Philips Brilliance 64; Philips Medical Systems, Eindhoven, Netherlands). Inspiratory images were obtained at 10mm intervals from the lung apex to the diaphragm. Three expiratory images were collected at the level of the carina and the mid-points between the carina and the lung apex, and the carina and the diaphragm, respectively. Consensus scoring using a previously published, preterm specific protocol was performed by a paediatric thoracic radiologist and paediatric respiratory physician.

RESULTS
Structural lung abnormalities were present in 94 of the 100 preterm children. The most common abnormalities were the presence of...
To determine the best imaging tool in assessing longitudinal progression of Cystic Fibrosis (CF) lung disease.

**PURPOSE**

Evan J Zucker
Robert H Cleveland

Recognition of determined radiological patterns is important to lead invasive diagnosis of VAP in intubated neonates in the NICU.

**METHOD AND MATERIALS**

A Markov model was used to project the outcomes of 100,000 hypothetical patients undergoing screening for PPB. Estimates of PPB risk given a DICER1 mutation, risk of progression from type I to type II/III PPB, and PPB subtype mortality were estimated from the International PPB Registry data. Scenarios included patients aged 0-3 years with annual, biannual and quarterly CXR or CT exams. Additional scenarios with only 1 or 2 CT exams during the entire 3 year period were also tested. Radiation doses were based on dosimetry estimates. Lifetime radiation-attributable risks of cancer incidence and mortality were derived from the BEIR VII report. Additional scenarios with only 1 or 2 CT exams during the entire 3 year period were also tested. Radiation doses were based on dosimetry estimates. Lifetime radiation-attributable risks of cancer incidence and mortality were derived from the BEIR VII report.

**RESULTS**

Out of 398 newborn infants a total of 202 neonates were on mechanical ventilation (MV) more than 48h, of whom 16 were diagnosed of VAP (prevalence 8.1%). The mean age at diagnosis was 29±15 days and a mean of 21±16 days on MV had elapsed at onset of VAP. Patients screened with CT incur higher lifetime detriment due to radiation-induced cancer than those screened with CXR. However, CT identified virtually all cystic PPB at the first screen while CXR required multiple screening cycles. The model predicts that even for multiple (>2) CT examinations, the average loss of life expectancy is on the order of days. This is orders of magnitude lower than for undetected PPB, which results in an average loss in life expectancy of >10 years. Sensitivity analysis showed that model uncertainty was dominated by the exam radiation dose.

**CONCLUSION**

The model suggests that the benefits of chest CT for cystic PPB detection greatly exceed the potential risks attributable to radiation exposure.

**CLINICAL RELEVANCE/APPLICATION**

Markov modeling can be used to compare projected radiation-induced cancer and disease-related risks and guide optimization of imaging-based disease surveillance strategies.

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**SSM18-02 • Markov Model Optimization of the Imaging Screening Strategy for Cystic Pleuropulmonary Blastoma in Children with DICER1 Mutations**

Divya Sabapathy (Presenter); R. Paul Guillian MD; Jack Priest MD; Robert Orth MD, PhD *; Eugene Kim MD; William Foukes MD; Ananth Annapragada PhD *

**PURPOSE**

Pleuropulmonary Blastoma (PPB), the most common primary pediatric pulmonary neoplasm, is strongly associated with DICER1 gene mutations. Unresected type I (cystic) PPB may progress into more aggressive type II/III during early childhood. X-ray based screening for the disease bears the risk of radiation induced malignancies. We therefore compared the utility of chest radiography (CXR) and computed tomography (CT) screening strategies for cystic PPB in children with DICER1 mutations.

**METHOD AND MATERIALS**

A Markov model was used to project the outcomes of 100,000 hypothetical patients undergoing screening for PPB. Estimates of PPB risk given a DICER1 mutation, risk of progression from type I to type II/III PPB, and PPB subtype mortality were estimated from the International PPB Registry data. Scenarios included patients aged 0-3 years with annual, biannual and quarterly CXR or CT exams. Additional scenarios with only 1 or 2 CT exams during the entire 3 year period were also tested. Radiation doses were based on dosimetry estimates. Lifetime radiation-attributable risks of cancer incidence and mortality were derived from the BEIR VII report. Mortality and life expectancy loss were calculated using a life table method to evaluate lifetime detriment.

**RESULTS**

Patients screened with CT incur higher lifetime detriment due to radiation-induced cancer than those screened with CXR. However, CT identified virtually all cystic PPB at the first screen while CXR required multiple screening cycles. The model predicts that even for multiple (>2) CT examinations, the average loss of life expectancy is on the order of days. This is orders of magnitude lower than for undetected PPB, which results in an average loss in life expectancy of >10 years. Sensitivity analysis showed that model uncertainty was dominated by the exam radiation dose.

**CONCLUSION**

The model suggests that the benefits of chest CT for cystic PPB detection greatly exceed the potential risks attributable to radiation exposure.

**CLINICAL RELEVANCE/APPLICATION**

Markov modeling can be used to compare projected radiation-induced cancer and disease-related risks and guide optimization of imaging-based disease surveillance strategies.

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**SSM18-03 • Radiological Evaluation of Neonatal Ventilator - Associated Pneumonia**

Roberto Llorens Salvador (Presenter); Maria Cernada Badia MD; Amparo Moreno Flores MD; Marta Aguar MD

**PURPOSE**

1. To illustrate the radiological patterns depicted in chest radiographies in those intubated neonates diagnosed of ventilator-associated pneumonia (VAP).
2. To discuss the impact of chest imaging in neonatal VAP diagnosis.

**METHOD AND MATERIALS**

Following the CDC/National Nosocomial Infection Surveillance criteria, persistent radiological infiltrates or consolidation in two sequential radiographs after initiation of mechanical ventilation, in the proper clinical and microbiological scenario, are necessary to diagnose VAP. After a prospective observational cohort study conducted in our tertiary-care regional referral center for a 2-yr period, two experienced pediatric radiologists, blinded to the clinical suspicion in the moment of imaging interpretation, reviewed the radiological patterns detected in the X-rays of 202 neonates included in the study. Both radiologists, separately, evaluated retrospectively the chest radiographs and registered in an electronic data sheet (Excel 2010, Microsoft) the radiological findings according to their individual interpretation following the criteria mentioned before. Detailed causative microbiological agents were investigated using invasive bronchoalveolar lavage (BAL).

**RESULTS**

Out of 398 newborn infants a total of 202 neonates were on mechanical ventilation (MV) more than 48h, of whom 16 were diagnosed of VAP (prevalence 8.1%). The mean age at diagnosis was 29±15 days and a mean of 21±16 days on MV had elapsed at onset of VAP. Clinical suspicion of VAP required a radiological confirmation and the most frequent radiological features associated with VAP were persistent atelectasis or consolidation on chest radiograph (88.9% of episodes). Radiological infiltrate was described in 55.6% of cases.

**CONCLUSION**

There are typical radiological patterns that radiologists should be able to recognise in chest radiographies of intubated neonates in the NICU. Under clinical suspicion, radiological information is a key feature to let neonatologists perform invasive techniques as BAL to confirm VAP diagnosis.

**CLINICAL RELEVANCE/APPLICATION**

Recognition of determined radiological patterns is important to lead invasive diagnosis of VAP in intubated neonates in the NICU.

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**SSM18-04 • Imaging for Assessing Progression in Cystic Fibrosis Lung Disease: What Is the Best Approach?**

Robert H Cleveland MD (Presenter) *; Catherine Stamoulis PhD; Gregory Sawicki MD; Emma L Kelliher MMBC, MRCP; Evan J Zucker MD; Christopher Wood BA; David Zurakowski PhD; Edward Y Lee MD, MPH

**PURPOSE**

To determine the best imaging tool in assessing longitudinal progression of Cystic Fibrosis (CF) lung disease.

**METHOD AND MATERIALS**

Four radiologists independently scored 211 serial chest x-rays (CXR) from 30 CF patients twice using the Brasfield and twice using the
Comparison of Low Dose Chest CT with CR Chest Images in the Management of Pediatric Pulmonary Tuberculosis Infection

Elisabete Kadakovska (Presenter) ; Gabriel Bartal MD ; Ausma Ozolina MD ; Eivja Livcane MD, PhD ; Iveta Ozere MD, PhD ; Elina Valtere MD

PURPOSE
Currently diagnosis of Pulmonary Tuberculosis (Tb) is based on medical history, physical examination, specific tests for Tb infection and chest computerized radiography (CR). Vast number of infected children remains undiagnosed, thus creating a reservoir for future adult disease. Diagnosis of Lung Tb in children is complex can be easily missed and chest CR does not exclude all cases of active Tb. Our purpose was to compare low dose Chest CT and chest CR in children following a course of medical treatment.

RESULTS
Between January 2008 and December 2012, 61/295 children in the State Tuberculosis hospital of Latvia with clinical and laboratory signs of Tb underwent low dose chest CT (80 kV, 90 mAs, CTDIvol (mGy) 0.68, DLP (mGy-cm) 23.12) and CR following a course of specific Anti Tuberculosis treatment. The inclusion criteria for the study were laboratory and clinical improvement. Two certified chest radiologists (EK and AO) retrospectively, independently and blindly compared chest CR and CT findings.

CONCLUSION
Low dose CT can improve management of pulmonary Tb thus avoiding unnecessary and possibly harmful antibiotic treatment in pediatric population.

CLINICAL RELEVANCE/APPLICATION
Low dose chest CT is valuable tool in diagnosis and management of Tb in children.
Images: A Feasibility Study

SSM19-03 • Multisite Quantitative Evaluation of the Accuracy and Precision of a Novel Test Bolus-based CT Angiography Contrast-enhancement Prediction Algorithm

Johannes G Korporaal PhD (Presenter) *; Andreas H Mahnken MD *; Jiri Ferda MD; Jorg Hausleiter; Bernhard Schmidt PhD *; Thomas G Flohr PhD *

PURPOSE
To quantify the accuracy and precision of a novel test bolus-based CT angiography (CTA) contrast-enhancement prediction (CEP) algorithm by comparing the amplitude, timing and curve shape of the predicted and true enhancement in the descending aorta (DAo).

METHOD AND MATERIALS
After routine clinical scanning according to local scan and injection protocols, from three hospitals a total of 72 (3x24) anonymized cardiac CTA exams were collected for retrospective analysis. Patients (30f/42m) had a median age and body weight of respectively 74y (range 31-81) and 79kg (range 61-125).

Since existing data were retrospectively analyzed, injection protocols, image acquisitions and reconstructions differed substantially between hospitals.

Test bolus (TB) scans were performed at the level of the pulmonary artery, after which the TB signal in the DAo was processed by the CEP-algorithm. This novel algorithm takes the injection protocols and kV settings of the TB and CTA scan into account, and uses population-averaged information to predict the CTA enhancement. The true enhancement was extracted from the CTA scan with a 6mm ROI along the DAo-centerline.

For each patient, the relative errors in the accuracy and precision were calculated. Deviations in the amplitude were quantified with Bland-Altman analysis and shape differences with the mean absolute error (MAE) of the normalized curves. The predicted curve was shifted along the true enhancement to find the timing error, which is the time shift for which the MAE is minimal.

RESULTS
Although differences in injection and acquisition protocols existed, no significant differences in the precision and accuracy were found between the hospitals. For the entire patient group, the predicted enhancement has an average deviation of 1.0±1.8s in the timing, and 5.5±2.4% in the curve shape.

CONCLUSION
No clinically relevant offsets in the timing and amplitude of the predicted enhancement exist, and the curve shape corresponds well with the true enhancement. With its excellent accuracy and good precision, this algorithm has high potential for CTA scan timing and injection protocol optimization.

CLINICAL RELEVANCE/APPLICATION
Most efficient usage of contrast agent, and thus maximum CNR in CTA images, can potentially be achieved by using this algorithm for scan timing and injection protocol optimization.

SSM19-01 • Automated Pulmonary Nodule Elastometry as a Potential Diagnostic Tool

Mohammadreza Negahdar (Presenter); Billy W Loo MD, PhD *; Maximilian Diehn MD, PhD *; Dominik Fleischmann MD *; Lu Tian; Peter G Maxim PhD

SSM19-02 • Detecting Enhancing Lesions in Multiple Sclerosis Patients Using Visual Texture Analysis on Brain T2-weighted MR Images: A Feasibility Study

Nicolas Michoux (Presenter); Alain Guillet; Denis J Rommel MD; Thierry P Duprez MD

BACKGROUND
MRI is the most sensitive technique for detecting multiple sclerosis (MS) lesions. While DCE-MRI is routinely used for evaluating the inflammatory activity, diffusion MRI is controversial (1). Texture analysis has been used with success to investigate pathological brain tissues (2). This study assesses the feasibility of texture analysis on T2-weighted MRI to detect changes within white matter in MS patients.

EVALUATION

PATIENTS
This retrospective study was approved by our institutional ethical committee. From post-Gd T1-weighted imaging, 44 enhancing lesions (EL), 37 non-enhancing lesions (non-EL) and contra-lateral regions in normal appearing white matter (NAWM) were identified in 21 patients diagnosed with MS.

MRI
Examinations were performed using a 3.0T whole body imaging system and a SENSE head 32 receiving coil. FSE T2, FSE FLAIR, EPI diffusion and 3D post-Gd GRE T1 sequences were acquired.

COMPUTING
A 21-components vector (20 Textons + ADC) was derived for each region from grey level co-occurrence and run length matrices (3, 4).

RESULTS
Differences between EL/non-EL and NAWM were statistically significant (p < 0.05) except for one Texton. Differences between EL and non-EL were significant except for one Texton and ADC. ROC analysis showed a performance of Textons and ADC ranging from moderate (AUC 

ADCh = 0.58) to good (AUC Texton = 0.84). A good predictive model of EL (Se = 88 %, Sp = 81 %) was achieved based on a partial least squares classifier and a set of 6 Textons.

DISCUSSION
Textons values result from the structural characteristics of the tissues and thus are affected by pathologic changes. Applying texture analysis to T2-weighted MRI is feasible and may help differentiating EL from non-EL in MS.

SSM19-04 • Comparison Study of Spectral Imaging Associated with Iso-Osmolar Contrast Media on Vascular Evaluation in Rabbits

Pan Liang (Presenter); Jianbo Gao MD

PURPOSE
To compare the vascular enhancement between spectral imaging associated with iso-osmolar contrast media and traditional 120kVp scans with high-osmolar contrast media on vessel.

METHOD AND MATERIALS
6 adult New Zealand rabbits of similar age and size were enrolled in this study. Each rabbit underwent two epigastric CT protocols and interval time among every protocol is 24 hours. Protocol A: traditional CT gastric angiography (CTA) with Iopromide 350 (2ml/kg, 1.5ml/s). Protocol B: spectral CT enhanced sequence with iodixanol 270 (2ml/kg, 0.5ml/s). Images of spectral CT series will be...
reconstructed at 55 keV. Signal intensity, image noise, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) measured within the parallel groups in aortoventralis and left gastric artery were calculated and compared. Overall diagnostic quality of images were evaluated using a five-point scale. Comparison of percentages of diagnostic images (score ≥3) were performed.

RESULTS

Compared with the traditional CTGA scans, 55 keV images demonstrated significantly higher signal intensity (p=0.000) in aortoventralis and left gastric artery, and inferior noise (p=0.029) only in left gastric arteries. The SNR and CNR of the 55 keV images had no significant differences from that of the traditional CTGA images (23.33±5.54 vs. 24.45±1.65, P=0.646; 18.19±4.28 vs. 17.74±1.03, P=0.806). Also, spectral CT images provide better overall image quality scores (p>0.05), the proportion of diagnostic images was higher (p=0.000).

CONCLUSION

Spectral imaging associated with iso-osmolar contrast media of Iodixanol 270 can provide excellent gastric vascular images at 55 keV at equivalent radiation of traditional CTGA scans. In the meanwhile, contrast media dose can be greatly reduced.

CLINICAL RELEVANCE/APPLICATION

The association of iso-osmolar contrast media with spectral imaging can greatly reduce the amount of iodine while maintaining high quality of vascular images.

SSM19-05 • Assessment of a New Image-based Method of Monoenergetic Imaging

Katharine Grant PhD (Presenter) * ; Bernhard Krauss PhD * ; Martin U Sedlmair MS * ; Thomas G Flohr PhD * ; Christian Eusemann PhD * ; Bernhard Schmidt PhD *

PURPOSE

Following the trend of low dose imaging, concerns regarding the detectability of low contrast lesions have been growing. The goal of this research is to evaluate if a new image-based algorithm (mono+) for monoenergetic imaging can improve the contrast-to-noise ratio and conspicuity of these low contrast objects.

METHOD AND MATERIALS

Three different anthropomorphic dual energy phantoms of different size representing a small medium and large phantoms containing 3 different iodine inserts (known values of 20, 50 and 100HU @120kV) were scanned at 3 different dose levels (full, half and quarter dose). Images were reconstructed at 40keV and 70keV using both a standard image-based monoenergetic algorithm and mono+ at all three dose levels, resulting in 12 different images sets per phantom size. Hounsfield units and standard deviation (noise) measurements were recorded from ROIs placed within the three inserts and one background for each image set. To calculate monoenergetic images, similar to raw data approaches a two material decomposition into base materials is performed. Based on tabulated data, from the two material images, monoenergetic (keV) images can be calculated. Since by theory, any decomposition leads to an increase in noise, keV images of very low or high energy (e.g. 40 keV or 190 keV) show a substantial noise increase. Our newly developed method to calculate keV images suppresses this increase by applying a regional analysis-dependent frequency-based recombination of the high signal at lower energies and the superior noise properties at medium energies.

RESULTS

The mono+ algorithm resulted in a greatly improved image quality for both the 40 keV (Fig 1.) and 70 keV. Both keV level displayed lower image artifacts and a significant reduction in image noise. CNR improved for all inserts using mono+ compared to the standard algorithm. For example for the small phantom CNR could be improved for the 40 keV by about 50%.

CONCLUSION

Mono+ improves CNR and low contrast lesion conspicuity in particular for low dose imaging, independent of phantom size.

CLINICAL RELEVANCE/APPLICATION

Mono+ provides significantly increased CNR, resulting in increased lesion conspicuity. These improvements should allow for added diagnostic confidence, higher throughput and reduced reader fatigue.

SSM19-06 • Automated and Optimized Imaging Simulation Platform for Virtual Clinical Trials of Breast Cancer Screening

Predrag R Bakic PhD (Presenter) * ; Andrew D Maidment PhD * ; Joseph H Chui MSc * ; Ali N Avanaki PhD * ; Cedric Marchesoux * ; David D Pokrajac PhD ; Kathryn S Espig MSc * ; Tom Kimpe PhD * ; Albert Xthona * ; Miguel A Lago ; Varsha Shankla

PURPOSE

We have developed an automated pipeline for the simulation and analysis of x-ray breast images. The simulation has been used to conduct Virtual Clinical Trials (VCTS) of digital mammography and digital breast tomosynthesis imaging.

METHOD AND MATERIALS

An automated pipeline has been developed (in C++ and OpenCL) that includes simulation of the normal breast anatomy and lesions (e.g., microcalcification clusters), breast deformation, image acquisition, image processing, display modeling, and image analysis using model observers. The breast anatomy is simulated using an octree-based recursive partitioning method, which allows for fast simulation of a large number of phantoms with very small voxel size. Clusters of microcalcifications (derived from stereomammographic clinical images) are added after identifying potential locations of cluster insertion based upon the convolution of simulated dense tissue regions with the minimal bounding box surrounding the cluster. The phantom deformation resulting from mammographic compression is simulated using a finite element model. Images of the deformed breast are then synthesized using a fast ray tracing method. Image processing is applied to create “For Presentation” DICOM images and display modeling takes into account medical monitors effects including temporal effects and an accurate browsing speed simulation. Detection of microcalcifications is estimated using 2D, 2D+t, and 3D channelized Hotelling observers equipped with the spatio-temporal contrast sensitivity function of the human visual system in response to the simulated display of images.

RESULTS

The developed pipeline supports the simulation of 2D and 3D breast imaging. The GPU implementation has resulting in significant acceleration, with the simulation duration at each pipeline stage now being on the order of seconds. For example, compressed versions of 450ml breasts with voxel size of 200 microns are generated at a rate of more than 30 per minute. Extensive pipeline testing has demonstrated that detection results follow the same trends as human observers in terms of contrast and browsing speed.

CONCLUSION

We have developed an automated and accelerated pipeline for performing VCTS of breast imaging.

CLINICAL RELEVANCE/APPLICATION

VCTS have role as a preclinical optimization and validation tool prior to clinical trials of new imaging equipment.
SSM20-01 • Quantitative Image Quality in CT: Detectability = f (Dose, Reconstruction, Contrast, Size)

Brendan Eck (Presenter) ; Rachid Fahmi PhD ; Kevin M Brown MS * ; Nilgoun Raihani ; David L Wilson PhD *

CONCLUSION
Detectability studies suggest that image quality can be preserved at reduced dose with IMR as compared to higher doses with FBP. The success of CHO over a range of independent variables encourages us to perform automated assessments of reconstruction parameters, greatly reducing the need for human detection studies.

Background
In CT, an important goal is to reduce dose but maintain image quality using advanced reconstruction techniques. There are numerous image reconstruction approaches, each with parameters to optimize. One good way to evaluate methods is with quantitative detectability studies. However, human observer trials are labor intensive and costly. In this study, we performed observer studies as a function of dose, reconstruction, contrast, and target size, and tested computational observers over this wide range of applicability.

Evaluation
4-alternative forced choice experiments were used for human experiments. Images of 69x69 pixels were obtained from a simulated phantom of same size as a Catphan, with added low contrast pins. 200 images contained a low contrast target and 600 images contained no target. Over 200 4-AFC trials, a probability correct, PC, was computed. Channelized Hotelling with different internal noise models (CHO) was the model observer. Observers were students blind to hypotheses. The experiment was conducted in a dark room on a perceptually linear display.

We compared a knowledge-based iterative reconstruction algorithm (IMR) and filtered back projection (FBP) over dose, contrast, and target size. Results are shown in Figure 1. Humans gave increased PC with increasing signal size, contrast, and dose. The CHO with internal noise gave similar trends across this wide range of variables.

Discussion
Compared to FBP, IMR substantially improved detection over all average data in the figure as well as for each subject. The improvement in detectability index was at least a factor of 2.7 in all cases. At 20% dose, IMR even gave better results than FBP at the highest dose. CHO with a single set of internal noise parameters reasonably fit experiments, even though image noise characteristics of FBP and IMR were quite different.

SSM20-02 • Measuring the Contrast-dependent Spatial Resolution of CT Iterative Reconstruction Methods at Very Low Contrast Values

Lifeng Yu PhD (Presenter) ; Thomas J Vrieze RT ; Shuai Leng PhD ; Joel G Fletcher MD * ; Cynthia H McCollough PhD *

PURPOSE
To measure the spatial resolution of iterative reconstruction (IR) methods at very low contrast values (METHOD AND MATERIALS
The spatial resolution of IR is contrast- and noise-dependent because of the non-linear regularization term in IR. Studies exist that measure the spatial resolution at medium-contrast levels using the polyethylene (-90 HU) and acrylic (120 HU) test objects in the ACR phantom. However, because of the severe noise contamination of low-contrast edges, it is extremely challenging to perform precise spatial-resolution measurements at very low-contrast levels (RESULTS
The spatial resolution of IR images was highly dependent on contrast level. At high contrast, IR_1 and IR_2 had an almost identical MTF as FBP. The degradation of the MTF by IR relative to FBP became more severe as the contrast level decreased. The differences in spatial frequencies at the 50%, 10%, 2% MTF values between IR_1 and FBP were (21 HU: -0.02, 0.02, 0.02 cm^-1; 14 HU: -0.04, -0.04, -0.02 cm^-1; 7 HU: -0.02, -0.06, -0.08 cm^-1). IR_2 degraded the MTF even more than IR_1 due to a stronger regularization setting.

CONCLUSION
A novel methodology was used to measure the spatial resolution of IR at very low contrast levels (CLINICAL RELEVANCE/APPLICATION
Quantifying contrast-dependent resolution is important for clinical use of IR. This is the first experimental study to demonstrate the degradation of resolution for IR at very low contrast (METHOD AND MATERIALS
First, a pseudo-sinogram whose values equal unity is back-projected according to the scan geometry. Voxel values within the irradiation volume represent the number of times the voxel is irradiated by X-ray flux, normalized by the number of views. If the voxel is irradiated at each view for once and only once, then its normalized value is unity. Then, the percentage of the useful radiation administered to the VOI relative to the entire irradiation volume is computed, denoted as a useful-irradiation rate. Next, an irradiation uniformity index is calculated by computing the mean absolute difference between the values within an ideal, uniformly-irradiated VOI and those of the actually irradiation distribution within the VOI, and then subtracting this value from unity. Finally, we obtain the GiRE as the product of data or equal the maximum) versus their corresponding mean integrated X-ray tube power.

RESULTS
We evaluate the GiRE of 4 CT system architectures for cardiovascular imaging including single source CT (half scan), dual (transaxial) source CT (half scan), triple (transaxial) source CT (full scan), and dual twin-Z source CT (half scan). Using the proposed evaluation criteria, their GiREs are 0.88 for the first three architectures, and 0.64 for the last one. Triple source CT is identified as the best based on irradiation uniformity versus. X-ray tube power.

CONCLUSION
An approach for evaluation of GiRE is proposed and applied to the architecture analysis of the cardiac CT-specific scanner of the future.

CLINICAL RELEVANCE/APPLICATION
Our method is beneficial in identifying CT system with the best noise uniformity and dose utilization. It provides an easy way to better understand and illustrate the relative irradiation efficiency.

SSM20-03 • Evaluation of Geometric Irradiation Efficiency for CT System Architecture

Hewei Gao PhD (Presenter) * ; Paul Fitzgerald * ; Yannan Jin * ; Jiao Wang * ; Peter Edic * ; Bruno De Man PhD *

PURPOSE
Geometric irradiation efficiency (GiRE) of a CT system, a function of the percentage of applied X-ray radiation useful for reconstructing a volume of interest (VOI) and the uniformity of the radiation within the VOI, is an important factor when considering noise uniformity and dose optimization. In this study, we propose a fast evaluation approach for relative comparison of different CT system architectures.

METHOD AND MATERIALS
First, a pseudo-sinogram whose values equal unity is back-projected according to the scan geometry. Voxel values within the irradiation volume represent the number of times the voxel is irradiated by X-ray flux, normalized by the number of views. If the voxel is irradiated at each view for once and only once, then its normalized value is unity. Then, the percentage of the useful radiation administered to the VOI relative to the entire irradiation volume is computed, denoted as a useful-irradiation rate. Next, an irradiation uniformity index is calculated by computing the mean absolute difference between the values within an ideal, uniformly-irradiated VOI and those of the actually irradiation distribution within the VOI, and then subtracting this value from unity. Finally, we obtain the GiRE as the product of data or equal the maximum) versus their corresponding mean integrated X-ray tube power.

RESULTS
We evaluate the GiRE of 4 CT system architectures for cardiovascular imaging including single source CT (half scan), dual (transaxial) source CT (half scan), triple (transaxial) source CT (full scan), and dual twin-Z source CT (half scan). Using the proposed evaluation criteria, their GiREs are 0.88 for the first three architectures, and 0.64 for the last one. Triple source CT is identified as the best based on irradiation uniformity versus. X-ray tube power.

CONCLUSION
An approach for evaluation of GiRE is proposed and applied to the architecture analysis of the cardiac CT-specific scanner of the future.

CLINICAL RELEVANCE/APPLICATION
Our method is beneficial in identifying CT system with the best noise uniformity and dose utilization. It provides an easy way to better understand and illustrate the relative irradiation efficiency.

SSM20-04 • Effect of Scan and Reconstruction Parameters on Grand Glass Opacity Visibility in Low-dose Lung Computed Tomography

Katsuhiko Ichikawa PhD (Presenter) ; Takeshi Kobayashi ; Motoyasu Sagawa MD

PURPOSE

METHOD AND MATERIALS

Eighteen screening centers participated. Phantoms for physical measurements and an anthropomorphic chest phantom that included simulated GGOs with CT numbers of -630 Hounsfield units (HU) (LGGOs) and -800 HU (HGGOs) were employed. The phantoms were scanned using parameters used for screening in each center. In the total of 21 image sets, the slice thickness and CT dose index (CTDIvol) ranged from 1.0 to 5.0 mm and 0.85 to 3.50 mGy, respectively, and a wide variety of reconstruction kernels was used. One thoracic surgeon and five radiologists evaluated nodule visibility in each chest phantom image set using a five-point scoring system. For quantitative analysis, we used the nodule detectability index based on a signal-to-noise ratio (SNR) theorem, which could be calculated from resolution, noise property, and the spatial frequency property of the simulated nodule image.

RESULTS

Strong correlations between CTDIvol and the visual score were observed for 10-mm LGGOs ($R^2 = 0.843, p_2 = 0.725, p_2 = 0.761, p_2 = 0.709$, p 80%) for 6-mm HGGOs and 10-mm LGGOs were 2.0 and 3.0 mGy, respectively.

CONCLUSION

It has been experimentally known that the low contrast visibility in CT primarily depends on the dose, while the slice thickness and reconstruction kernels affect image sharpness. This fact was demonstrated through our results of visual and SNR evaluations corresponding to DLCT. The dose level of 2.0 and 3.0 mGy were thought to be appropriate for HGGOs and LGGOs (subtle GGOs) respectively.

CLINICAL RELEVANCE/APPLICATION

The primary dependency on the radiation dose for GGO visibility, demonstrated in this study, would be contributed to easy settings of optimal scan condition for lung CT screening.

SSM20-05 • Patient Size Dependent Low Contrast Detectability in Abdominal CT

Yifang Zhou PhD (Presenter) ; Alexander W Scott PhD

PURPOSE

We chose to use the statistically defined minimum detectable contrast (MDC) as a gauge for image quality. We attempted to study MDC's relationship to patient size, dose and lesion size in typical abdomen CT scans.

METHOD AND MATERIALS

Seven abdomen phantoms (CIRS TE series) simulating patients from an infant to a large adult were used. Helical scans were conducted using a Siemens Sensation 64 (mCT) with 120 kVp and mAs ranged 35-595 (kernel B30s, pitch 1.4 and width 5 mm). For each phantom, the uniform sections of the contiguous slices were subtracted and the resulted regions were divided by grids of cells sized from 1.37 mm-6.84 mm. Standard deviations (sd) were computed from the means of all cells and scaled down by square root of 2. The MDC, quantified by the signal to background difference equal to 3.29sd, was fitted to dose D (phantom specific CTDIvol) and cell sizes (d). MDC versus patient size relationship was established by extracting the fitting parameter's dependency.

RESULTS

MDC versus D and d was fitted to a power law ($R^2$ larger than 0.94), with power indices close to -0.5 and -1, respectively. The proportional constant versus patient size follows an exponential relationship with an index of 0.18 1/cm, close to the linear attenuation coefficient of the phantom.

CONCLUSION

The relationships of MDC versus patient size, dose and lesion size, were established. They can be used for task specific dose optimization.

CLINICAL RELEVANCE/APPLICATION

The MDC's relationship to patient size, dose and lesion size, were established. They can be used for task specific dose optimization.
**SSM21-01 • Introduction and Benefits of an Anti-scatter Grid in Digital Breast Tomosynthesis**

Colin Auclair Dipl Eng, MSc (Presenter) *; Jeffrey Shaw PhD, MS *; Mathias Cisaruk DIPLENG *; Remy Klausz DiplEng *; Henri Souchay PhD *

**PURPOSE**
Conventional grids for mammography (MG) with septa perpendicular to the chest wall are not suitable for digital breast tomosynthesis (DBT) because the trajectory of the x-ray tube relative to the grid moves the source out of the grid focus line. The performance of a new 3D-grid, compatible with DBT and MG, was evaluated and its benefits compared with a conventional grid for MG, and with no grid at equal dose for DBT.

**METHOD AND MATERIALS**
The septa of the 3D-grid are designed to be parallel to the tube sweep trajectory. To eliminate grid line visibility, the septa interspace is matched to the detector pixel pitch. During image acquisition, the 3D-grid moves with sub-mm amplitude, preserving tissue visibility at chest wall side. Grid performance was determined using methods derived from IEC 60627 standards, which allows to estimate the theoretical image quality improvement at same dose for average breasts. Evaluation of the image quality performance in 2D used a CDMM phantom sandwiched between 2cm PMMA plates. For DBT, image quality performance was compared from the detectability of inserts in an ACR phantom imaged directly and on top of 2.5cm PMMA. All images were acquired on a Senographe Essential (GE Healthcare) using the same technique factors for each comparison.

**RESULTS**
For 5cm PMMA and at 28kV MoMo, primary transmission of the 3D-grid was 70.1%±0.5%, indicating that the grid contribution to SDNR² for average breast patient was 0.9±0.03. For MG, automatic CDMM scoring (CDMM Analysyer, Artinis) provided similar IQF scores for the 3D-grid (122) and conventional grid (127) when using the same acquisition parameters. For DBT, at the central plane of the inserts, ACR phantom scores were similar with (13.3 ± 0.5) and without (13.2 ± 0.5) grid. When adding 2.5 cm PMMA, ACR phantom scores were higher with (10.3 ± 0.5) than without (8.3 ± 0.5) grid. In addition, the 3D-grid significantly improved signal uniformity throughout the phantom.

**CONCLUSION**
The 3D-grid demonstrated a potential of improving detectability of features for breasts above the average thickness, while preserving the dose in DBT.

**CLINICAL RELEVANCE/APPLICATION**
For breasts above the average thickness, most difficult to image in mammography, the 3D-grid offers scatter rejection benefits comparable to MG grids, yet capable of operating both in MG and in DBT.

**SSM21-02 • X-ray Differential Phase Contrast Tomosynthesis Imaging based on a Clinical Digital Breast Tomosynthesis System**

Ke Li MS (Presenter) ; John W Garrett MS *; Yongshuai Ge ; Guang-Hong Chen PhD *

**PURPOSE**
To systematically investigate the feasibility and clinical relevance of grain-based x-ray differential phase contrast (DPC) tomosynthesis imaging constructed based on the hardware setup of a clinical digital breast tomosynthesis (DBT) system.

**METHOD AND MATERIALS**
The feasibility of DPC tomosynthesis imaging was first demonstrated using a benchtop system (40 kVp, 80 micron pixel size), from which tomosynthetic images of three different contrasts (refraction angle, phase shift, and absorption) of physical phantoms were acquired. Next, the feasibility of DPC tomosynthesis imaging using the hardware setup of a clinical digital breast tomosynthesis system with a rotary x-ray source and static detector (Hologic Selenia Dimensions) was studied using a framework that quantitatively relates the detection performance of DPC tomosynthesis with the associated absorption DBT. X-ray spectrum, noise power spectrum, and MTF of the absorption DBT involved in the framework was physically measured and the imaging task was created based on the materials' phase and absorption properties provided by NIST.

**RESULTS**
Reconstructions of physical phantoms show improved signal difference to noise ratio (SDNR) compared with absorption images acquired under the same exposure (SDNR_PMMa = 5.9 and 0.6 for DPC and absorption, respectively). Equivalent spatial resolution for the two contrast mechanisms was observed. Design parameters of the DPC tomosynthesis system are compatible with the current clinical DBT system. The accuracy of the framework that predicts detectability in DPC-DBT was validated experimentally, and it suggests that the DPC mechanism will result in improved detectability of both small objects (e.g. calcification) and irregular-shaped objects (e.g. spiculated lesions).

**CONCLUSION**
It is feasible to build a DPC tomosynthesis system using the hardware setup of an existing clinical DBT system. The system shows promise in improving lesion and calcification detectability, and therefore merits further investigation.

**CLINICAL RELEVANCE/APPLICATION**
This study demonstrates potential improvement in lesion/calcification detection performance by combining the DPC mechanism with the tomosynthesis imaging method.

**SSM21-03 • Dynamic Four-dimensional Contrast-enhanced Tomosynthesis**

Brian C Lee (Presenter) ; Susan Ng *; Johnny Kuo PhD *; Peter A Ringer BS *; Andrew D Maidment PhD *

**PURPOSE**
To explore the feasibility of performing four-dimensional dynamic contrast-enhanced tomosynthesis (4D DCE-DT).

**METHOD AND MATERIALS**
A custom bench-top tomosynthesis system was designed and built to perform 4D DCE-DT. The system consists of a stationary x-ray source and selenium x-ray detector, and a computer-controlled filter wheel with a variety of filter materials and thicknesses; phantoms are mounted on a rotary stage set atop of an x-y linear translation stage. A computer system coordinates all components, including a contrast injector. Images are acquired using a slow-scanning method in which each projection image is acquired after a fixed delay. Between each acquisition the phantom orientation is changed; it is also possible to change the x-ray energy and filter type, as well as perform injections. Both temporal and dual-energy subtraction are supported. Real-time reconstructions are performed by backprojection filtering using a customized commercial software package. A dynamic flow phantom was constructed and imaged to test the feasibility of 4D DCE-DT. One projection was acquired per energy per angle per timepoint and reconstructions were performed on subsets of these images; e.g., if projections 1 through N are used in the reconstruction for one timepoint, projections 2 through N+1 are used for the next timepoint.

**RESULTS**
Real-time reconstruction is possible to allow viewing of arbitrary tomographic planes and timepoints. Measured data from reconstructed waveforms of iodine concentration over time observed in the dynamic flow phantom matched the expected iodine concentration over time after convolution with a square wave with width equal to the number of projections per reconstruction. Experiments involving binary pulses of iodine (simulating the movement of a bolus of iodine through a vessel) confirmed the linearity and shift-invariance of the
CONCLUSION

4D dynamic contrast-enhanced tomosynthesis can be performed in a dose-efficient fashion.

CLINICAL RELEVANCE/APPLICATION

4D dynamic contrast-enhanced tomosynthesis should allow for measurement of both spatial and temporal characteristics of blood flow and lesion perfusion.

SSM21-04 • Characterization of the Dependence of the Modulation Transfer Function in Tomosynthesis on Acquisition Geometry and Reconstruction Parameters

Brian C Lee (Presenter) ; Raymond Acclavatti ; Andrew D Maidment PhD *

PURPOSE

To characterize the spatial dependence of the in-plane modulation transfer function (MTF) in tomosynthesis and investigate the influence of the acquisition geometry.

METHOD AND MATERIALS

The in-plane MTF was calculated from measured edge spread functions using a custom test tool consisting of a 0.250 mm thick lead sheet affixed to a 5.88 mm acrylic sheet. Images were obtained using a non-clinical benchtop tomosynthesis system; reconstructions were performed using customized commercial software (Briona, RTT Inc., Villanova PA). The dependence of the MTF was measured with respect to the following factors: 1) the offset of the reconstruction plane from the plane containing the edge; 2) the obliquity of the reconstruction plane with respect to the detector; 3) the number of projections per reconstruction; and 4) the acquisition's angular range. Findings were validated by developing an analytical model of the MTF (accounting for blurring due to focal spot size, magnification, detector element size, out-of-focus plane, and reconstruction filter) and by replicating the experiment on a clinical tomosynthesis system.

RESULTS

The MTF is degrading when the edge is located between two reconstruction planes. The degree of degradation of the MTF increases as the distance between the edge and the reconstruction plane increases and as the angular range of acquisition increases. Degradation increases very slightly as the obliquity of the reconstruction plane with respect to the detector increases over the range 0º to 32º. The number of projections per reconstruction does not affect the degradation. The simulated MTFs generated by the analytical model were concordant with findings on the MTF degradation factors, and the validation experiment on the clinical tomosynthesis system provided independent confirmation that the MTF degrades with increasing distance between the edge and the reconstruction plane.

CONCLUSION

The MTF of tomosynthesis systems is anisotropic and varies with sub-slice spacing. Reconstruction of oblique planes results in minimal degradation of the MTF and thus may be clinically acceptable.

CLINICAL RELEVANCE/APPLICATION

Sub-slice misalignment of objects with the reconstructed DBT slices may adversely affect the conspicuity of small clinical features such as calcifications.

SSM21-05 • Comparative Performance Evaluation of Contrast-detail in Full Field Digital Mammography Systems Using Hotelling Observer Signal to Noise Ratio versus Automated CDMAM Image Analysis

Ioannis Delakis PhD, MSc (Presenter) ; Robert Wise ; Eugenia Kulama MSc ; Donald McRobbie

CONCLUSION

We compared the Hotelling observer SNR against the CDMAM technique. to evaluate the performance of FFDM detectors. Results showed that the Hotelling observer SNR methodology is more consistent and can be more representative of the system's performance characteristics.

Background

Image quality evaluation plays an important role in ensuring and enhancing the diagnostic value of mammography studies. According to EUREF (www.euref.org), image quality in mammography is assessed using images acquired with the Contrast Detail mammography (CDMAM) phantom (Arthin medical systems, Netherlands). However, CDMAM analysis can suffer from intra-observer variations, limited statistics and structural differences between CDMAM phantoms. The purpose of this work was to evaluate detector performance for a range of full field digital mammography systems using Hotelling observer SNR analysis and ascertain whether it can be an alternative to CDMAM evaluation.

Evaluation

FFDM units used in West of London Breast Screening were evaluated. Detector performance was first analysed using CDMAM phantom methodology. As part of Hotelling observer SNR analysis, the generalised normalised noise power spectrum (GNNPS) was measured by collecting flat field images of a 5cm PMMA phantom. The generalised modulation transfer function (GMTF) was measured by placing a 0.2mm Tungsten edge in the middle of the PMMA phantom. This setup allowed for scatter and focal spot unsharpness to be incorporated in the measurements. The Hotelling observer SNR was calculated for input signal originating from gold discs of varying thicknesses and diameters.

Discussion

The Hotelling SNR values were used to estimate the threshold gold thicknesses for each diameter as per CDMAM analysis. The Hotelling SNR technique was more consistent than CDMAM results. There were small differences between the two techniques, especially in small diameter details, which can be attributed to structural characteristics of the CDMAM, as confirmed by previous comparative work from our group. Overall, the Hotelling SNR technique showed variations in the performance of FFDM detectors, demonstrating the use of this metric as a differentiator.

SSM21-06 • Improving Image Quality for Digital Breast Tomosynthesis: Automatic Detection and Inpainting Method for Metal Artifact Reduction

Yao Lu PhD (Presenter) ; Heang-Ping Chan PhD ; Jun Wei PhD ; Lubomir M Hadjiiski PhD ; Ravi K Samala PhD

PURPOSE

Image quality is an important factor that will affect breast cancer detection in digital breast tomosynthesis (DBT). The high-attenuation metal clips embedded in the breast marking a previous biopsy site cause errors in the estimation of attenuation along the ray paths intersecting the clips during reconstruction, which result in interplane and inplane metal artifacts (MAs). Because of the small number of projection views (PVs) acquired in a limited angular range, the voxel value errors in the artifact region cannot be compensated for. This causes stronger MAs for DBT than those for CT reconstruction. We developed a new MA reduction (MAR) method to improve image quality.

METHOD AND MATERIALS

Our MAR method uses iterative detection and segmentation to automatically generate a clip location map for each PV. Correlation among different PVs is used to reduce false positive detections. Iterative diffusion-based inpainting is designed to replace the labeled clip pixels with estimated tissue intensity from the neighboring regions in each PV. The inpainted PVs are then used for DBT reconstruction. A voting technique is used to determine the location and shape of the clips and label them in the reconstructed volume. The MAR method does not depend on specific reconstruction techniques. With IRB approval and informed consent, DBT of human subjects was acquired with a GE prototype system (60º arc, 21 PVs, 3º increments), 20 DBT views from 10 breasts of various densities with clips were reconstructed.
with and without MAR. Five breasts had multiple large clips from lumpectomy, two of which and five other breasts had microclips from core biopsy. The improvement in MAs was visually assessed.

**RESULTS**
The clip detection rate in the PVs was 100% with no false positives. The interplane and inplane MAs were reduced to a level that was not visually apparent in the reconstructed slices regardless of the size and number of clips in the breast. The visibility of microcalcifications and breast tissues along the ray paths of the clips was improved.

**CONCLUSION**
The inpainting-based MAR method reduced the MAs while preserving the structured background and microcalcifications. The visibility of breast lesions obscured by the MAs was improved.

**CLINICAL RELEVANCE/APPLICATION**
DBT has strong potential to improve breast cancer detection. Reducing the MAs in DBT can improve detection and assessment of subtle breast lesions, especially recurrence near the biopsy site.

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**Radiation Oncology and Radiobiology (Breast)**

**Wednesday, 03:00 PM - 04:00 PM • S104A**

**SSM22-01 • Statistical Analysis Using a Quality Reports Program to Retrospectively Review Patients with Early Stage Left-sided Breast Cancer: A Pilot Project**

*Houman Vaghefi*, MD, PhD; *Fang Liu* PhD; *Adams W Moore* MD *; *Benjamin E Neims* PhD, MS *; *Greg Robinson* *; *James A Wheeler* MD, PhD (Presenter); *Ingrid Bowser* RN

**ABSTRACT**

Purpose/Objective(s): The evaluation of the radiation oncology treatment plan for patients with early stage left-sided breast cancer requires a balance between coverage of the target tissues and avoidance of the heart and lungs. Quality Reports is a software system developed to allow the user to design dose volume constraints which can then be saved into statistical libraries for subsequent comparison with other patients who were already treated or for whom treatment planning is in progress.

Materials/Methods: This is a pilot study of 20 patients with early stage breast cancer who were treated by a single physician to the whole left breast using tangent fields. These treatment plans were then retrospectively reviewed. Two different scoring systems were evaluated. The first system gave a single point for each dose constraint satisfied. The second scoring system gave a weighted value for each dose constraint satisfied. The results of the two scoring systems were then compared.

Results: Both scoring systems followed a normal distribution. There was good agreement between the two systems; the concordance correlation coefficient (95% CI) was 0.79 (0.62, 0.89). The weighted system (as a percent possible) was 2.75% higher on average than the unweighted scores (p-value = 0.002). The patients who developed skin desquamation tended to have lower quality scores on both systems compared to the rest (by 1.1% and 1.7%, for the unweighted and weighted systems, respectively), but given the small sample size and the relatively large variability in the difference of the scores, this was not statistically significant.

Conclusions: It is possible with this methodology to compare the quality of breast treatment plans, but a much larger patient database including information on treatment outcomes is necessary to establish the optimal scoring system.

**SSM22-02 • Influence of Registration Based on the Different Reference Markets on the Displacement of the Geometry Consisted of All Clips in the Cavity for External-beam Partial Breast Irradiation at Moderate Deep Inspiration Breath Holding**

*Jianbin Li* (Presenter)

**SSM22-03 • Intra-operative Radiotherapy in Early Breast Cancer-First Experience in the Middle East**

*Yasir Bahadur* (Presenter)

**ABSTRACT**

Purpose: We report our early experience using the Intrabeam low-kv X-ray generator for intra-operative radiotherapy (IORT) in early breast cancer.

Methods: This phase 2 prospective study was performed between December 2010 and November 2012. All female patients eligible for breast-conserving surgery, with biopsy proven invasive ductal carcinoma, clinical mass 3 cm, lymphovascular invasion, multifocal lesion with area of >3 cm, extensive DCIS (>25%, or >3 cm), or lymph node metastasis. Patients received 46 Gy in 23 fractions over 4.5 weeks, using 2 whole-breast tangential fields and photons in the range of 6-15 MV. Early and late toxicity features were recorded using RTOG toxicity criteria.

Results: 45 female patients were included, with a median age 54 years (range, 27-79 years); the majority was more than 45 years (37 cases, 73.3%). Most of patients (36 cases, 80%) had tumor size of 2 cm or less. The tumor was located in the lower outer quadrant in 25 cases (55.5%) and in the upper outer quadrant in 18 cases (39.5%). The median tumor size was 1.8 cm (range, 0.5-5.0 cm). The median number of clips per breast was 17 (range, 4-56). Most of patients were treated in 1 (26 cases, 57.7%) or 2 (16 cases, 35.6%) sessions. Most of patients (33 cases, 73.3%) had tumor positive lymph nodes. The median margin was 0.8 cm (range, 0.2-2.0 cm). The median volume of the PTV was 12.8 cm^3 (range, 1.8-63.4 cm^3). The median dose delivered was 11 Gy (range, 9.0-14.3 Gy). The median toxicity score was 0 (range, 0-3).

Conclusions: IORT for early stage breast cancer patients using the Intrabeam delivery system was easily implemented in our center, with an acceptable toxicity profile.

**SSM22-04 • Comprehensive Chest Wall Irradiation: A Dosimetric Description of Tomotherapy and Linac-based IMRT**

*Christopher D Abraham* MD (Presenter)

**ABSTRACT**

Purpose/Objectives(s): Intensity modulated radiation (IMRT) for whole breast irradiation has been found to improve homogeneity while decreasing dose to critical structures including the heart and lung. However, there exists a paucity of data examining the role of IMRT in comprehensive chest wall and regional nodal irradiation. Therefore, the objective of this study is to generate dosimetric descriptions of two common inverse-planned IMRT delivery methods: Tomotherapy and linac-based IMRT (LB-IMRT).

Materials/Methods: Women with locally advanced left sided breast cancer who underwent radiation to a PTV encompassing any residual breast tissue, chest wall, all levels of the axilla, interpectoral lymph nodes, infraclavicular lymph nodes, and the supraclavicular lymph nodes between April 2004 and March 2011 were retrospectively identified. A sample of 45 women were analyzed including 25 treated using Tomotherapy and 20 treated using LB-IMRT. The PTV and organs at risk were contoured at the time of initial treatment planning by the treating radiation oncologist. The dose to the PTV ranged from 50 Gy to 50.4 Gy. Mean dosimetric parameters were analyzed for the PTV, ipsilateral and contralateral lung.
A New Angiographic Imaging Technology Enables Substantial Dose Reduction without Compromise to Image Quality

Marco J Van Strijen MD (Presenter) ; Thijs Grunhagen MSc, DPhil * ; Jan Albert Vos ; Marc Van Leersum MD ; Daniel A Van Den Heuvel MD

PURPOSE
Increasing use of radiation for medical imaging is a growing concern. Recently a new angiographic imaging platform has become available that can result in a considerable reduction in radiation dose without compromising image quality. The potential of this novel technique for increasing use of radiation for medical imaging is a growing concern. Recently a new angiographic imaging platform has become available.

RESULTS
The mean PTV V45Gy was 99% and 97% for Tomotherapy and LB-IMRT, respectively. The mean ipsilateral lung V5Gy was 79% for Tomotherapy and 75% for LB-IMRT. The ipsilateral lung meanV20Gy was 22% and 27% while mean ipsilateral lung dose was 15Gy and 17Gy for Tomotherapy and LB-IMRT, respectively. Contra lateral lung mean V5Gy was 52% for Tomotherapy and 45% for LB-IMRT while V20Gy was 5.3% and 4.7%.

CONCLUSIONS:
Comprehensive chest wall irradiation using inverse-planned IMRT techniques remains to be adequately described in the literature. We retrospectively analyzed cases to better characterize the dosimetry of this treatment method. Further studies are required to validate these findings and to determine anatomic characteristics to optimize the benefits of both delivery methods for women undergoing comprehensive treatment.

SSM22-05 • Does Morbid Obesity Disadvantage Breast-conserved Treated Patients with Pre-inverse or Early Stage Breast Cancers?

Federico L Ampil MD (Presenter) ; Gloria Caltito PhD ; Benjamin Li MD ; Gary Burton MD ; Roger H Kim MD ; Quyen Chu MD

PURPOSE
The literature supports the association between obesity and poor prognosis of breast cancer (BCa) in both pre- and post-menopausal women. It is unclear whether these patients may benefit from standard of care interventions. This study compares the outcomes between morbidly obese (MO) and non-morbidly obese (NMO) breast-conserved treated (BCT) patients with pre-inverse or early stage breast cancers.

METHOD AND MATERIALS
We performed a retrospective cohort study of 100 patients who had undergone BCT (with negative surgical margins including postoperative whole breast 50 Gy irradiation) for minimally invasive BCas during the period from 1992 to 2005. Each patient's body mass index (BMI) was calculated and the subjects were classified into the NMO group (BMI score < 17Gy for Tomotherapy and 75% for LB-IMRT. The ipsilateral lung V5Gy was 79% for Tomotherapy and 75% for LB-IMRT. The ipsilateral lung meanV20Gy was 22% and 27% while mean ipsilateral lung dose was 15Gy and 17Gy for Tomotherapy and LB-IMRT, respectively. Contra lateral lung mean V5Gy was 52% for Tomotherapy and 45% for LB-IMRT while V20Gy was 5.3% and 4.7%.

CONCLUSION
In this single institution’s experience, morbid obesity did not adversely affect long-term patient outcomes after BCT for minimally invasive breast cancers. It is suggested that the treatment options for select women with BCa should not be lessened on account of an excessively large body habitus.

CLINICAL RELEVANCE/APPLICATION
Morbid obesity should not ordinarily disqualify breast cancer patients from receiving breast conserving therapy.

SSM22-06 • Clinical Outcomes with a Radiation Therapy System: Results of a Prospective Trial

Tamer Refaat Abdelrahman MD, PhD (Presenter) ; William Small MD ; Jonathan B Strauss MD ; Kevin Bethke MD ; Judith A Wolfman MD * ; Krystyna D Kiel MD ; Ellen B Mendelson MD *

PURPOSE
To report the treatment induced adverse events (AEs), and treatment outcomes of accelerated partial breast irradiation (APBI) delivered with the MammoSite Radiation Therapy System (RTS) in breast cancer patients undergoing breast conservative treatment.

METHOD AND MATERIALS
This is a prospective clinical trial that was approved by the IRB. The study included female breast cancer patients undergoing breast conservative treatment in the form of surgery and APBI delivered with the MammoSite Radiation Therapy System (RTS) in breast cancer patients undergoing breast conservative treatment.

RESULTS
The study included 36 eligible patients treated consecutively in Northwestern Memorial Hospital between November 2003 and August 2009. The age range was 45 – 83 years. A total of 29 patients had invasive disease (median size 1.1cm), while 7 patients had in situ disease only (median size 0.8cm). The skin distance in most of the patients (91.7%) was =1cm; only 3 patients (8.3%) had skin distance >1cm. The median balloon diameter was 5 cm (range 4 – 6 cm). At a median follow-up of 42 months (range 4 – 65 months), LC, PFS and OS were 91% and 89% respectively, p=0.66. There were no differences between the MO and NMO patients in age, tumor estrogen/progesterone/HER-2 neu receptors and grade and the presence of co-morbid illness.

CONCLUSION
In this single institution's experience, morbid obesity did not adversely affect long-term patient outcomes after BCT for minimally invasive breast cancers. It is suggested that the treatment options for select women with BCa should not be lessened on account of an excessively large body habitus.

CLINICAL RELEVANCE/APPLICATION
Morbid obesity should not ordinarily disqualify breast cancer patients from receiving breast conserving therapy.
that can result in a considerable reduction in radiation dose without compromising image quality. The potential of this novel technique for reducing patient radiation exposure was studied in relation to the clinical image quality in digital subtraction angiography (DSA). The objective of this study was to establish the degree of patient dose reduction, while preserving equivalent image quality.

METHOD AND MATERIALS
In 50 prospective patients scheduled for iliac intervention two angiographic runs were performed at the start of the procedure. One run was acquired using the conventional imaging platform (Allura Xper, Philips Healthcare); the other run was acquired using the new imaging platform (AlluraClarity, Philips Healthcare) at lower X-ray dose. The conventional-dose and low-dose acquisitions were performed in random order. Air Kerma and Dose Area Product values were recorded in all acquisitions and at the end of the procedure. In the second part of the study, qualitative image quality assessment of both runs was performed by five experienced interventional radiologists. The readers were blinded to the imaging parameters and imaging platform.

RESULTS
50 patients were prospectively included. Evaluation of the radiation dose in all procedures showed a mean reduction of radiation dose in iliac DSA of 83%. In all patients the new imaging technology was used in the remainder of the procedure, as image quality was considered sufficient for performing the intervention. Likewise, the qualitative image quality assessment revealed equivalence in image quality between the two paired runs.

CONCLUSION
With the new imaging technology, a reduction in radiation dose of 83% is possible without a compromise in image quality.

CLINICAL RELEVANCE/APPLICATION
Revolutionary and substantial dose reduction in interventional radiology without compromise of image quality.


Kelvin Cortis MD, MRCS, FRCR (Presenter) ; Roberto Miraglia MD ; Luigi Maruzzelli MD ; Roberta Gerasia ; Corrado Tafaro ; Angelo Luca MD

PURPOSE
To determine whether grid removal during routine biliary interventional procedures performed in a flat panel interventional suite results in adequate image quality and in a significant reduction of the patient radiation exposure.

METHOD AND MATERIALS
Routine biliary interventional procedures were defined as those in which absence of fine image detail during fluoroscopy carries no procedural impact including change of internal-external biliary drains (BCC) or balloon dilatation of biliary anastomosis (bilioplasty). 10 consecutive patients were enrolled, 8 had a BCC and 2 bilioplasty. The study population consisted of 8 adults with an average Body Surface Area (BSA) of 1.64, and 2 children with an average BSA of 0.49. All patients had a previous procedure in which the grid was used. Constant object-to-detector and source-to-image distance were maintained in each patient during the grid/no-grid procedures. The same fluoro protocol was used for all examinations. Dose area product (DAP given in cGy cm2) and procedure fluoroscopy time (given in seconds) were recorded for each procedure. DAP was normalized per unit of fluoroscopy time (nDAP, cGy.cm2/s). In order to quantify the change in nDAP, the nDAP of the procedure done without the grill was divided by that done with the grill for each patient, and the change in dose expressed as a percentage.

RESULTS
In all procedures image quality was considered adequate by two different interventional radiologists and all procedures were successfully completed without significant changes in fluoroscopy time between the two groups (p=0.37). In every procedure without the grid nDAP was inferior as compared to the nDAP in procedures performed using the grid. The mean reduction in dose was 32.3±21.1% (p=0.01).

CONCLUSION
Our preliminary data shows that removal of the grid in routine biliary procedures is feasible and results in a significant reduction of patient radiation exposure. Larger studies with more procedures are warranted to confirm this data.

CLINICAL RELEVANCE/APPLICATION
Most routine biliary procedures can be performed without a grid with reduction in radiation exposure. This seems of particular relevance since most of these patients require frequent re-intervention.

SSM23-03 • Comparison of Radiation Exposure and Image Quality of 14 and 16 Bit Angiographic C-Arm CT and MDCT

Bernhard C Meyer (Presenter) ; Thomas Werncke MD, Dipl Phys ; Oliver A Meissner MD * ; Frank K Wacker MD * ; Christian Von Falck MD *

PURPOSE
To compare image quality and radiation exposure of a 64-row CT (MDCT) and angiographic C-Arm CT (CACT) using 14 bit and 16 bit flat detector angiographic systems for abdominal imaging.

METHOD AND MATERIALS
An anthropomorphic phantom (AP) representing a 70kg male was used for this study. To assess contrast resolution, one high contrast phantom insert with five line pair objects (LPO; 6, 8, 10, 11 and 12lp/cm) and four low contrast phantom inserts mimicking 32 spherical objects (SPO; 8 diameters, range 2 – 10 mm) and 24 tubular objects (TUO; 6 diameters, range 1.2 – 7 mm) with four different densities (10, 20, 40 and 60%HU) were inserted into the AP. MDCT imaging was conducted on a 64-row MDCT (Somatom Definition®, Siemens Healthcare) using the standard abdominal acquisition protocol (120kV, Iexposure = 210mA; SL 0.6mm). CACT imaging was acquired on 14 and 16 bit flat detector angiographic systems (CACT1: Artis zee®, CACT2: Artis zee Q®, Siemens Healthcare) using standard abdominal CACT presets (both systems) and a reduced dose preset (CACT2). For each imaging protocol, effective dose (ED) was measured. The detectability of low and high contrast objects was assessed in 3mm transversal slabs. Objects were classified as visible when they were independently rated as clearly delineable by 3 readers.

RESULTS
The highest low contrast detectability was obtained by MDCT (SPO:14/32, TUO:10/24, ED 4.6mSv) followed by standard abdominal CACT using CACT2 (SPO:14/32, TUO:9/24, ED 6.1mSv) and CACT1 (SPO:12, TUO:8, ED 6.1mSv). The use of a reduced dose protocol (-38%ED) on CACT2 showed only a minor reduction of low contrast resolution (SPO: 11/32, TUO 9/24, ED 3.8mSv). Best high contrast resolution (LPO:2/5) was observed for CACT2 (LPO:2/5, both protocols) followed by MDCT and CACT1 (LPO:1/5).

CONCLUSION
16 bit CACT imaging provides improved low and high contrast resolution compared to 14 bit CACT. In comparison to MDCT, CACT is still slightly inferior for low contrast but superior with regard to high contrast resolution. Using significantly reduced dose protocols, a similar image quality compared to 14 bit CACT was observed.

CLINICAL RELEVANCE/APPLICATION
The outstanding low and high contrast resolution of 16 bit CACT provides excellent guidance during interventional procedures in unenhanced and contrast-enhanced images.

SSM23-04 • Retrospective Analysis of the Effectiveness of Real Time Dosimetry Combined with Increased Emphasis on Radiation Safety in Reducing Healthcare Worker Exposure to Radiation

Oleg Mironov MD (Presenter); Thomas Lostracco MD; David L Waldman PhD; Frederic Mis PhD
The University of Rochester Medical Center (URMC) recently evaluated healthcare worker radiation exposure in high radiation areas. In 2011 there were multiple incidents of physician exposure in excess of 4 rem and approaching the 5 rem legal limit. Simultaneously, the University hired a new radiation safety officer who began a major radiation dose-lowering strategy which included education and real time exposure awareness. The purpose of this study was to measure the effect.

METHOD AND MATERIALS
Retrospective analysis was undertaken looking at historical radiation exposure to workers from 2010 to 2012. The radiation safety records of 253 physicians and staff were included in the study (49 faculty, 39 residents and 165 support staff). An aggressive radiation safety education program was initiated. A real time dosimetry (DoseAware, Philips Medical, Andover MA in conjunction with Unfors Instruments AB, Goteborg Sweden) for healthcare workers in high exposure radiation areas (Cath labs, Interventional Radiology labs, hybrid OR and Interventional CT scanner) was installed in March 2012.

RESULTS
Physician and staff collective exposure in 2010 and 2011 was 127 person-rem and 124 person-rem respectively. In 2011 there was quarterly average of 18 Level 1 and 6 level 2 ALARA radiation safety letters indicating excessive dose. In 2012 the exposure dropped by more than 50% to a collective exposure of 60 person-rem. ALARA letters declined by 50% in 2012 as compared to the 2 previous calendar years. Total staff dose continues to decline. In the most recent quarter there were zero employee ALARA notification letters.

CONCLUSION
The dose lowering initiative successfully achieved a 50% reduction in radiation exposure for health care providers working in high radiation areas. It remains uncertain if this accomplishment was the result of an aggressive education program or due to real time feedback from instantaneous dose monitoring. Regardless of the cause, the decrease in radiation exposure is significant and a pleasant surprise.

CLINICAL RELEVANCE/APPLICATION
Significant reductions in staff exposure to radiation can be achieved with the combination of increased emphasis on radiation safety and real time dosimetry thus creating a safer working environment.

SSM23-05  Effectiveness of Using a Novel Lead Curtain Applied to the Image Detector to Protect Operator and Staff in the Angiography Suite

Zubin Irani MD (Presenter) ; Bailin Alexander BA ; Da Zhang PhD ; Bob Liu PhD ; Rahmi Oklu MD, PhD

PURPOSE
Recent research suggest that long-term low-dose radiation exposure in the interventional (angiographic) suite may lead to greater stochastic effects than previously believed. Sufficient shielding from scatter radiation during fluoroscopy still remains a formidable challenge. We designed and tested the utility of a disposable, sterile lead curtain applied to the image detector to reduce scatter radiation to the operator and staff during IR procedures.

METHOD AND MATERIALS
To simulate standard patient positioning on the angiography table, an anthropological phantom was used. Using a computer aided design software, a grid was overlaid on the procedure room. Using a high sensitivity radiation survey meter, measurements of scatter radiation from the phantom were made throughout the grid. Sequential measurements were made before and after the application of the curtain using a full field of view, a coned field of view and with maximal kVp. Results are presented as standard error of the mean. Statistical significance was measured using a student’s t-test.

RESULTS
Scatter radiation was attenuated throughout the grid (room). The highest level of scatter radiation was detected immediately adjacent to the phantom at 2 feet distance. In this location, which would approximate the position of the operator, attenuation by the curtain was also maximal averaging at 60% less dose to the operator. The use of the curtain did not result in increase scatter radiation detection to the operator (patient).

CONCLUSION
The use of this lead curtain significantly reduces scatter radiation in the procedure room. Specifically, the curtain leads to reduction in radiation exposure to the operator at levels averaging 60%.

CLINICAL RELEVANCE/APPLICATION
Radiation exposure is known to have detrimental sequelae. This curtain reduces radiation exposure to the operator and staff in the angiography room and may have significant impact on radiation safety.

SSM23-06  Efficacy of Radiation Safety Glasses in Interventional Radiology

Bart Van Rooijen (Presenter) ; Michiel W De Haan MD, PhD ; Marco Das MD * ; Carsten Arnoldussen MD ; Rick De Graaf MD, PhD ; Wim Van Zwam MD ; Walter H Backes PhD ; Cecile R Jeukens PhD

PURPOSE
Recent evidence suggests that radiation-induced cataract to the eye occurs at a lower dose than previously thought. We have assessed how the design of radiation protection glasses and positioning of the operator influence the reduction of the eye lens dose.

METHOD AND MATERIALS
The scatter free attenuation and the dose reduction with the glasses were determined for several different spectacle designs on an anthropomorphical head phantom. The phantom head was positioned at different locations relative to the radiation source to assess the effects of geometry and head rotation on the dose reduction. The eye dose reduction achieved in clinical practice was measured using TLD dosimetry during 9 procedures with protective glasses and 13 procedures without.

RESULTS
The scatter-free attenuation of the glasses was approximately a factor of 100. For frontal irradiation of the phantom head, the dose reduction factor was in the range of 7.9 to 10.0. With the head phantom at a location typical for radiological interventions, the dose reduction factor was in the range of 3.4 to 8.3 (left eye) and 1.5 to 2.3 for the right eye. When the phantom head was rotated 45 degrees away from the tube in the axial plane, there was no significant dose reduction for the right eye and the dose reduction for the left eye was 1.1 to 2.5.

In clinical practice wearing leaded glasses resulted in a dose reduction of 2.1 (left eye) and 0.8 (right eye).

CONCLUSION
The dose reduction of radiation protection glasses reduces when incoming radiation faces the head laterally of inferiorly. Physicians performing x-ray guided interventions should be aware of these effects to optimize their posture and choose the appropriate model of glasses.

CLINICAL RELEVANCE/APPLICATION
- Protective eyewear should shield radiation entering from the side and below.
- The radiologist’s posture and the room layout should be adjusted to prevent radiation entering from the side or below.
RESULTS

Time-to-peak (TTP) and mean tissue transit time (TTT) were significantly prolonged and derived intensity peak (dIP) was significantly lower in the ischemic foot than the healthy contralateral (TTP 48.76±9.38 s vs. 32.12±6.8 s, p=0.011, A/Tt 6.81±4.52 s vs. 3.25±3.27 s, p=0.02 and dIP 4.8±2.3 db vs. 8.6±3.1 ). A significantly good correlation between transcutaneous parameters and CEUS parameters was observed.

CONCLUSION

Peripheral microcirculation may be evaluated with CEUS. TTP, TTT and dIP may be an alternative to percutaneous oximetry parameters to evaluate peripheral microcirculation in critical limb ischemia.

CLINICAL RELEVANCE/APPLICATION

Percutaneous oximetry may fail to evaluate peripheral microcirculation. CEUS may be an useful alternative; in order to assess the degree of critical limb ischemia before endovascular revascularization.

SSM24-02 • Measurement of Peripheral Muscle Microperfusion (PMP) and Macroperfusion in an Animal Peripheral Artery Disease (PAD) Model Using Contrast-Enhanced Ultrasound (CEUS) and Doppler Flow (DF) Measurement

Claas P Naehle MD (Presenter) * ; Verena A Steinberg ; Gottfried Mommertz ; Dominik Krause ; Hans H Schild MD

PURPOSE

Non-invasive assessment of PMP could improve management of PAD patients and allow for evaluation of new therapies. However, currently only very limited data using outdated/discontinued CEUS technology for assessment of PMP exists.

METHOD AND MATERIALS

In a porcine animal model, PMP of the lower extremity was quantified using CEUS replenishment kinetics (mean transit time (mTT) and wash-in rate (WiR)) of the biceps femoris during i.v. steady-state infusion of an ultrasound contrast agent (INN-sulphur hexafluoride). In addition, macroperfusion was measured at the common femoral artery using a DF probe. PMP and DF measurements were performed bilaterally at rest and under vasodilatation by infusion rate 70 μg/kg body weight/min.) after unilateral creation of a moderate external iliac artery stenosis (mean gradient 14.4± 5.4 mmHg).

RESULTS

In all 10 pigs all measurements could be performed. During adenosine stress and after stenosis creation, PMP decreased significantly compared to baseline measurements (rest vs. adenosine stress: mTT: 7.8± 3.3 s vs. 21.2± 18.4 s; p < 0.05 - WiR: 58.4± 38.1 arbitrary units (AU) vs. 26.2± 15.7 AU; p < 0.05 - DF: 122.3± 31.4 ml/s vs. 83.6± 28.1 ml/s; p < 0.05 | no stenosis vs. stenosis: mTT: 8.1± 3.1 s vs. 29.2± 18.0 s; p < 0.05 - WiR: 53.0± 22.7 AU vs. 13.6± 8.5 AU; p < 0.05 - DF: 120.3± 19.5 ml/s vs. 65.9± 40.0 ml/s; p < 0.05). After stenosis creation, adenosine stress lead to a further decrease of PMP, but had no effect on macroperfusion (stenosis rest vs. stenosis adenosine stress: mTT: 29.2± 18.0 s vs. 56.3± 38.7 s; p < 0.05 - WiR: 13.6± 8.5 AU vs. 6.0± 4.1 AU; p < 0.05 - DF: 65.9± 40.0 vs. 62.2± 33.2; p < 0.05).

CONCLUSION

In a porcine PAD model, CEUS for assessment of PMP is feasible. In addition, using mTT and WiR for quantification of PMP appears to be more sensitive compared to DF measurements.

CLINICAL RELEVANCE/APPLICATION

Measurement of PMP using CEUS may prove to be a useful tool in diagnosis of PAD and for evaluation of new therapies.

SSM24-03 • Non-invasive Prediction of Hepatic Transplant Portal Vein Stenosis - Experience at a Single High Volume Transplant Center

Marie A Vasher MD (Presenter) ; Danny R Lababidi MD ; Kamal Massis MD ; Bruce R Zwiebel MD ; Dana M Poletto MD ; Haydi Rojas RN ; Yougui Wu PhD

PURPOSE

We sought to compare Doppler ultrasound findings to transhepatic catheter portal veinogram findings of hepatic transplant main portal vein stenoses, and to determine which Doppler ultrasound criteria are often the best non-invasive measures for diagnosing portal vein stenosis.

METHOD AND MATERIALS

32 post-hepatic transplant transhepatic catheter portal venograms following initial Doppler ultrasound were performed at our institution on 30 patients from November 1, 2004 to May 31, 2012 due to clinical, biochemical, Doppler ultrasound, CT and/or MRI abnormalities. Doppler ultrasound and catheter portal venograms were retrospectively reviewed. Doppler ultrasound criteria of main portal vein peak velocity, velocity step-up ratio, and change in velocity across the anastomosis were correlated with catheter portal venogram. Narrowing of the main portal vein of at least 50% on portal venogram was considered stenotic. 54 randomly chosen patients without suspicion of hepatic transplant portal anastomotic stenoses were assigned to our control group. Patients who underwent catheter portal venogram without findings of portal vein stenosis were also assigned to our control group.

RESULTS

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Stenotic</th>
<th>No Stenosis</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Velocity</td>
<td>0.05 - DF</td>
<td>65.9± 40.0 vs. 83.6± 28.1</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Step-up Ratio</td>
<td>WiR</td>
<td>53.0± 22.7 vs. 13.6± 8.5</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Change in Velocity</td>
<td>DF</td>
<td>120.3± 19.5 vs. 65.9± 40.0</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

CONCLUSION

Doppler ultrasound criteria of main portal vein peak velocity, velocity step-up ratio, and change in velocity across the anastomosis were significantly different between stenotic and non-stenotic cases.

CLINICAL RELEVANCE/APPLICATION

Doppler ultrasound criteria of main portal vein peak velocity, velocity step-up ratio, and change in velocity across the anastomosis are useful for non-invasive prediction of hepatic transplant portal vein stenosis.
RESULTS

CLINICAL RELEVANCE/APPLICATION

Applying the Doppler ultrasound criteria yielded in our study will result in selecting the most appropriate hepatic transplant patients with main portal vein stenosis for catheter portal venogram.

SSM24-04 • Stenosis Index Is a Specific Secondary Screening Test for Patients with Suspected Transplant Hepatic Arterial Stenosis

Sherwin S Chan MD, PhD (Presenter) *; Thomas X Le MD; Michael F McNeely MD; Manjiri K Dighe MD; Theodore J Dubinsky MD

PURPOSE

Stenosis Index (SI) is a novel angle-independent quantitative measure that is computed using Fourier analysis of the spectral Doppler waveform. We evaluate the utility of stenosis index (SI) as a secondary measure after resistive index (RI) to increase the accuracy of diagnosing transplant hepatic artery stenosis using Doppler ultrasound (US).

METHOD AND MATERIALS

An institutional anonymized retrospective case-control study was performed. Patients who underwent US for suspected post-transplant hepatic artery stenosis and abdominal angiography within 30 days at a large academic center in 2006-2010 were included. Patients who had no imaging of the transplanted artery on their angiography and patients who did not have complete ultrasound evaluation of their hepatic arteries were excluded. These Spectral Doppler images were imported into MATLAB and SI was calculated for each artery in each patient by obtaining a ratio of the power in high frequency bands to fundamental frequency. Student t-test and receiver operator characteristic (ROC) analyses were used to characterize the performance of SI, with ROC analysis providing the optimal SI threshold for detecting clinically relevant stenoses.

RESULTS

63 patients (20 with clinically relevant stenoses) met the inclusion and exclusion criteria. The mean + standard deviation SI of the right and left hepatic arteries for stenotic arteries was 1.04 ± 0.22 and normal transplant arteries was 1.18 ± 0.19. The mean SI of these two groups were significantly different (p<0.01). In these patients, area under the ROC curve (AUC) was 0.71 for SI and a cutoff value of SI < 0.85 gave a specificity of 95% and sensitivity of 40%. In comparison, RI AUC = 0.6 and RI < 0.6 had a specificity of 20% and sensitivity of 93% for significant transplant hepatic artery stenosis.

CONCLUSION

In a subset of patients whom appeared suspicious enough on ultrasound to warrant angiography, SI is an excellent screening test for transplant hepatic artery stenosis.

SSM24-05 • Should Ultrasound Be Used as Prophylactic Screening for Venous Thromboembolism in High Risk Patients with Malignancy?

Katherine A Kaproth-Joslin MD, PhD (Presenter); Charles Francis MD; Susan K Hobbs MD, PhD; Alok Khorana; Deborah J Rubens MD

PURPOSE

Using the previously described clinical risk score for venous thromboembolism (VTE) (Khorana et a, Blood 2008) to identify high risk patients, this study evaluates the utility of screening for thrombosis in a prospective cohort of initially asymptomatic cancer patients initiating outpatient chemotherapy.

METHOD AND MATERIALS

Asymptomatic cancer patients initiating a new chemotherapy regimen and found to be high-risk for VTE based on a predictive risk model (score ≥3) were enrolled on an ongoing prospective cohort study with informed consent. Patients were evaluated with a baseline and an every 4 (± 1) week serial US study for up to 16 weeks. Additionally, CT scans obtained for restaging purposes were also evaluated for VTE.

RESULTS

Of the 35 high-risk patients enrolled, 8 (23%) were found to have VTE, 5 patients w/ DVT alone (14%), 1 w/ PE alone (3%) and 2 (6%) w/ both. 32 patients underwent a baseline US and 3 asymptomatic DVTs were identified (9%), w/ 1 patient also having an asymptomatic PE detected on staging CT. Subsequent US were performed in 23 patients at week 4 (0DVT), 21 patients at week 8 (0DVT) and 18 patients at week 12 (1 DVT, 6%). An additional 2 patients developed symptomatic DVT between screens. Restaging CT scans identified an asymptomatic PE in a patient at week 6 and an asymptomatic PE in a patient at week 9. Of the patients w/ isolated DVT, 2 had isolated unilateral calf clot, 2 had unilateral calf and thigh clot, and 1 had unilateral upper extremity clot.

CONCLUSION

In this prospective observational study, 23% of cancer outpatients deemed high-risk for VTE developed clot at a rate much higher than found in both normal and acutely ill hospitalized populations (0.5 and 6% respectively). This study confirms the validity of the previously described risk score developed by Khorana et al and makes this model highly predictive of identifying patients at risk for VTE. In addition, these findings suggest that screening US for asymptomatic clot should be considered in high-risk patients based on this risk score. This study highlights the importance of VTE screening in the calf, w/ 50% of patients w/ VTE having calf clot and 25% having isolated unilateral calf clot, indicating that this region should be included in the assessment of DVT.

CLINICAL RELEVANCE/APPLICATION

Screening ultrasonography for asymptomatic thrombosis should be considered in high-risk patients based on this risk score with the goal of reducing the morbidity and mortality associated with VTE.

SSM24-06 • A Comparison between Contrast-enhanced Ultrasound (CEUS) and Multi-slice Computer-tomography (MS-CT) in Detecting and Classifying Endoankles in the Follow-up after EVAR

Dirk-Andre Clevert MD (Presenter) *; Verena Guertler; Wieland H Sommer MD; Georgios Meimarakis; Maximilian F Reiser MD

PURPOSE

To compare Contrast-Enhanced-Ultrasound (CEUS) and Multislice-Computed-Tomography (MS-CT) angiography in detecting and classifying endoankles in the follow-up of patients following Endovascular-Aortic-Aneurysm-Repair (EVAR).

METHOD AND MATERIALS

In this prospective study a cohort of 171 patients with both CEUS and MS-CT follow-up examinations after EVAR were included. In total 489 CEUS and 421 MS-CT examinations were assessed during the follow-up. B-scan, color Doppler and CEUS were performed in all patients. MS-CT was performed with a 16- up to 128-slice-scanner.

RESULTS

Regarding our inclusion and exclusion criteria we obtained 200 contemporary examination pairs out of the 132 patients of our cohort.
CONCLUSION

CEUS appears to be as good as MS-CT in the detection of endoleaks in the follow-up after EVAR, with the added advantages of no radiation dose and nephrotoxicity of the contrast agents. A switch of the preferred examination from MS-CT to CEUS should be considered.

CLINICAL RELEVANCE/APPLICATION

CEUS appears to be as good as MS-CT in the detection of endoleaks in the follow-up after EVAR, with the added advantages of no radiation dose and no nephrotoxicity of the contrast agents.
may contain cystic spaces and amorphous calcification. Lymphoma of the thyroid is rare and may be aggressive or indolent (MALT lymphoma). It is typically heterogeneous and can invade surrounding tissues. Thyroiditis can be acute, subacute, and chronic. Subacute thyroiditis is a post viral disorder. At ultrasound, focal hypoechoic area(s) may be seen that are ill defined and have little if any vascularity. Hashimoto thyroiditis is an autoimmune disorder causing gland enlargement with characteristic hypoechoic micronodules and echogenic septae. Vascularity may be increased, normal, or decreased. Grave’s disease is also an autoimmune disease. Ultrasound shows a heterogeneously enlarged gland and diffuse increased vascularity and increased PSV in the thyroidal arteries.

Essentials of Breast Imaging

Wednesday, 03:30 PM - 05:00 PM • S100AB

MSES44A • How to Get the Most Out of Breast Ultrasound

Paula B Gordon MD ( Presenter) *

LEARNING OBJECTIVES

This course will cover the technical aspects of performing breast ultrasound. The quality of the examination depends on the choice of the optimal transducer for the task at hand, adjusting scan parameters such as gain and focal zones, and the proper use of compound imaging and harmonics. The addition of Doppler, extended field of view, 3D, elastography and automated breast ultrasound will be discussed.

MSES44B • How to Find Breast Cancer When It Is Still Small

Laszlo Tabar MD ( Presenter) *

LEARNING OBJECTIVES

1) Learn the skills necessary for reading the mammograms of asymptomatic women. 2) Be familiar with the varying appearances of a normal mammogram. 3) Increase confidence in reading large numbers of full field digital mammograms at lower call-back rates. 4) Minimize call-back rates without missing cancers. 5) Improve skills in detecting early phase breast cancer at digital mammography screening. 6) Be able to guide the diagnostic workup using mammography, ultrasound and interventional methods.

MSES44C • Probably Benign - Rules of the Game

Jay A Baker MD ( Presenter) *

LEARNING OBJECTIVES

1) Review features of mammographic, sonographic, and MRI lesions that can be closely followed rather biopsied. 2) Review protocol and timing for imaging at follow-up. 3) Review findings that should not be labeled Probably Benign.

ABSTRACT

Population-based mammography screening has brought about a paradigm shift in our approach to the diagnosis and treatment of breast cancer, since the spectrum of the disease has shifted from primarily palpable, advanced cancer to mainly impalpable tumors that have exceedingly good prognosis. Early detection of breast cancer with high quality mammography screening and treatment at an early stage has succeeded in lowering the death rate from breast cancer by nearly 50% among women who have attended screening regularly. The challenge of successful screening should be met with a commitment to master the complexities of image production, the variations in normal breast anatomy, the heterogeneity of breast diseases, and the progressive nature of breast cancer. Comparison of the imaging findings with large section and subgross histologic images facilitates understanding of the underlying pathophysiologic processes leading to the findings. These comparisons will enable the radiologist to better differentiate normal from pathologic, improving both the sensitivity and specificity of mammographic interpretation. The predominance of early-stage disease has created a revolutionary new era for those involved in the diagnosis and treatment of breast cancer patients. Early detection of breast cancer challenges current standards of care.

RSNA/ESR Emergency Symposium: Abdominal Emergencies (An Interactive Session)

Wednesday, 03:30 PM - 05:00 PM • S402AB

MSSR44A • Abdominal Injuries

Andras Palko MD, PhD ( Presenter) *

LEARNING OBJECTIVES

1) To explain the significance of injury mechanism and its role in the formation of consequent abdominal lesions and their complications. 2) To outline the role of proper imaging technique and diagnostic algorithm in the sufficiently fast diagnosis of abdominal injuries. 3) To learn more about the typical and unusual findings of various abdominal traumatic conditions.

ABSTRACT

Abdominal injuries require a timely and reliable diagnosis in order to prevent the potentially lethal outcome. The armory of clinical tools (physical examination, lab tests) does not fulfill these criteria, since they are either too fast, or not reliable. Imaging diagnostic modalities help the clinician to acquire the necessary amount of information to initiate focused and effective treatment. However, the selection of the appropriate imaging algorithm, modality and technique, as well as the precise detection and interpretation of essential imaging findings are frequently challenging, especially because the circumstances, under which these examinations are performed (open wounds, bandages, non-removable life-supporting equipment, lack of patient cooperation, etc.), are frequently less than optimal. Knowledge of critical imaging signs, symptoms and the role they play in the evaluation of the patient’s condition, but also fast decision-making and ability to closely cooperate with the clinicians are skills of key importance for radiologist members of the trauma team.

MSSR44B • The Enemy Within, Non-Traumatic Abdominal Emergencies

Ronald J Zagoria MD ( Presenter) *

LEARNING OBJECTIVES

1) Attendees will be able to better analyze CT scans for non-traumatic causes of abdominal pain. 2) Attendees will learn the CT signs and
ABSTRACT
This segment of the course will go over the optimal imaging approach for patients presenting with acute abdominal pain. CT findings will be emphasized. Key imaging findings of nontraumatic causes of acute abdominal pain including gastrointestinal tract and urinary tract pathology will be explained. A systematic approach for the imaging evaluation of patients with abdominal emergencies will be illustrated and explained including proper scan protocols and analysis of imaging findings. Imaging diagnosis of urinary tract obstruction, infection, bowel obstruction, and ischemia will be emphasized.

MSR44C ● Interactive Case Discussion
Andras Palko MD, PhD (Presenter) *; Ronald J Zagoria MD (Presenter)

LEARNING OBJECTIVES
1) Attendees will be able to better analyze CT scans for traumatic and non-traumatic causes of abdominal pain. 2) Attendees will learn the CT findings of common causes of a traumatic and non-traumatic 'acute' abdomen. 4) Attendees will learn the imaging findings of acute, traumatic and nontraumatic urinary tract and GI tract emergencies.

ABSTRACT
Using cases and an audience response system, this segment of the course will go over the optimal imaging approach for patients presenting with acute abdominal pain and abdominal wall injuries. CT findings will be emphasized. Key imaging findings of traumatic and nontraumatic causes of acute abdominal pain including gastrointestinal tract and urinary tract pathology will be explained. A systematic approach for the imaging evaluation of patients with abdominal emergencies will be illustrated and explained including proper scan protocols and analysis of imaging findings. Imaging diagnosis of blunt an penetrating abdominal injuries, urinary tract obstruction, infection, bowel obstruction, and ischemia will be emphasized.

ASRT@RSNA 2013: The Role of the Radiologic Technologist in Patient Safety (HCIAC)
Wednesday, 03:40 PM - 04:40 PM ● N230

LEARNING OBJECTIVES
1) Comprehend the need for a workplace culture that improves the process of reporting errors and near misses. 4) Embraces a personal skills assessment and opportunities for continuous learning. 5) Recognize the value of collaborative applications training environment. 6) Develop processes from the recommendations and actions of the white paper.

ABSTRACT
Radiologic technologists are at the forefront of patient safety and quality. The tremendous growth in medical imaging has improved patient care in the United States and around the world. However, some risks and drawbacks have accompanied that growth. As researchers and regulatory, advocacy and clinical organizations continue to explore the issue of safety in medical imaging, they consider the delicate balance of effective diagnosis and treatment of disease with the required exposure to radiation or other potential hazards. Among strategies to improve radiation safety are justification, education and optimization of images and technique. The American Society of Radiologic Technologists and its partners recognize the critical role of the radiologic technologist in all aspects of medical imaging patient safety. This presentation will provide an overview of recommendations from the ASRT Foundation’s Health Care Industry Advisory Council’s Subcommittee on Patient Safety and Quality Medical Imaging with the primary focus on quality and safety in CT, computed radiography/digital radiography, along with all medical imaging specialties. Specific topics addressed will include the current state of medical imaging as well as challenges associated with providing consistently high-quality care and education on equipment and new and emerging technologies. The panel will also discuss the desired state for radiologic technologist workplaces to ensure consistent quality in patient care and to maximize education and understanding of equipment and new technology.

RSNA Resident and Fellow Symposium 2013: Career 102: Survival Skills for Your Job (An Interactive Session)
Wednesday, 04:00 PM - 05:45 PM ● E451B

LEARNING OBJECTIVES
1) To help recently graduated physicians make positive decisions to extend the scope and longevity of their individual careers as well as their professional communities.

ABSTRACT
Using cases and an audience response system, this segment of the course will go over the optimal imaging approach for patients presenting with acute abdominal pain and abdominal wall injuries. CT findings will be emphasized. Key imaging findings of traumatic and nontraumatic causes of acute abdominal pain including gastrointestinal tract and urinary tract pathology will be explained. A systematic approach for the imaging evaluation of patients with abdominal emergencies will be illustrated and explained including proper scan protocols and analysis of imaging findings. Imaging diagnosis of blunt an penetrating abdominal injuries, urinary tract obstruction, infection, bowel obstruction, and ischemia will be emphasized.

MSRP42 ● Fight for Your Right-The Importance of Advocacy
Aparna Annam DO (Presenter) *; James H Thrall MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

MSRP42B ● Stayin' Alive-Making Yourself Indispensable to Your Job
Richard E Sharpe MD, MBA (Presenter) *; Norman J Beauchamp MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

MSRP42C ● How To Dictate A Radiology Report-Is It What You Say or Don't Say?
Christina M Cinelli MD (Presenter) *; George B Bisset MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.
Rapid Application Development with XIP™ - the eXtensible Imaging Platform

Wednesday, 04:30 PM - 06:00 PM • S401CD

LEARNING OBJECTIVES
- View learning objectives under main course title.

ABSTRACT
The eXtensible Imaging Platform (XIP™) is an open source framework supporting rapid development of imaging and visualization applications. In this ‘hands on’ tutorial participants will dissect a fully functional XIP™ application to see firsthand how developers utilize XIP's visual ‘drag-and-drop’ programming tool (the XIP Builder™) and associated libraries (the XIP Libraries™) in creating applications. In addition to functions from the popular ITK and VTK libraries, the XIP Libraries include modules tailored for medical imaging, many of which are hardware accelerated via GPU programming (e.g., OpenGL® GLSL or OpenCL or CUDA C). Applications created with XIP can either run standalone, or as DICOM Hosted Applications. Through the DICOM Application Hosting interfaces (DICOM WG-23), a Hosting System, such as the XIP Host™, relieves the application developer from the need to re-implement infrastructure common to all applications (e.g. DICOM network connectivity, database, etc.). We will demonstrate how users execute Hosted Applications, such as those created with the XIP Libraries, via the XIP Host.

URL’s
http://www.OpenXIP.org

IHE Workflow Efficiency from Acquisition to the Report Attendees

Wednesday, 04:30 PM - 06:00 PM • S501ABC

LEARNING OBJECTIVES
1) Understand how report templates can improve productivity. 2) Examine how IHE profiles facilitate system interoperability. 3) Learn about the features of the new IHE profile for management of radiology report templates. 4) Review proposed new features for radiology reporting systems.

ABSTRACT
The purpose of this session is to demonstrate how existing and planned IHE profiles can help improve the workflow in a medical imaging department, and help those responsible for its operation, monitor what is happening. Prior IHE profiles focused heavily on traditional RIS and PACS. Newer projects are focused on exchange of images and reports between medical facilities. We will also describe future possible profiles for utilizing RadLex to improve radiologist efficiency. We will also describe workflow terminology in RadLex and describe how that can help manage and improve departmental workflow.

National Library of Medicine PubMed: Free Online Databases: Images and More

Wednesday, 04:30 PM - 06:00 PM • S401AB

LEARNING OBJECTIVES
1) Identify freely available online image databases and data archives and know their contents and value. 2) Identify freely available online case studies and educational materials. 3) Become familiar with online drug, contrast agents, and other substance databases. 4) Understand basic searching skills across a variety of databases.

ABSTRACT
The National Library of Medicine (NLM) is only one of many agencies which support freely available online databases and data archives. In this hands-on workshop, explore the richness of the online resources for radiographic images and data, imaging tools, drugs and contrast agents, and education (e.g. case studies). Databases covered include PubMed/MEDLINE, the National Cancer Institute’s Cancer Imaging Archive, MedlinePlus.gov and RadiologyInfo for patients and families, plus search engines and portals offering a radiology option. Learn which databases may be the best starting point for your research.
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.

Controversy Session: Lung Cancer Screening: Conflict of 'Dollars and Sense?'
Wednesday, 04:30 PM - 06:00 PM • E450A
MODERATOR
Ned Patz, MD
Caroline Chiles, MD

LEARNING OBJECTIVES
1) Understand the primary objectives of the NLST. 2) Describe the results of the NLST and assess their potential applications to clinical practice. 3) Assess advantages and limitations of LDCT screening. 4) Consider financial implications of widespread screening.

ABSTRACT
http://www.radiology.ucsf.edu/research/labs/radiology-outcomes-research

Controversy Session: CT Radiation and Risk: How Certain Are We of the Uncertainties?
Wednesday, 04:30 PM - 06:00 PM • N228

LEARNING OBJECTIVES
1) To understand the source of data that have been used to assess the association between medical radiation exposure and cancer risk. 2) To understand the work that has been done to quantify risk and the uncertainty in those estimates.

URL
http://www.radiology.ucsf.edu/research/labs/radiology-outcomes-research

Controversy Session: Controversies in Radiology: Stroke Penumbral Imaging (An Interactive Session)
Wednesday, 04:30 PM - 06:00 PM • E353B

LEARNING OBJECTIVES
1) Assess the evidence for and against penumbral imaging in acute ischemic stroke. 2) Create multi-modal stroke imaging algorithms based on intended treatment options.

SPSC43A • Stroke Penumbral Imaging: Pro
Steven Warach, MD, PhD (Presenter)
LEARNING OBJECTIVES
View learning objectives under main course title.

SPSC43B • Stroke Penumbral Imaging: Con
Albert J Yoo, MD (Presenter)
LEARNING OBJECTIVES
View learning objectives under main course title.

Controversy Session: The Evolving Role of Image-guided Pulmonary, Hepatic, and Renal Mass Biopsy: Current Indications and Controversies
Wednesday, 04:30 PM - 06:00 PM • S404AB

LEARNING OBJECTIVES
1) To describe the current role of receptor studies in lung biopsy specimens. 2) To report what imaging and biochemical studies are diagnostic of hepatocellular carcinoma obviating the need for biopsy. 3) To describe the current and future indications for renal mass biopsy
and why many, if not all small solid masses may need to undergo biopsy.

ABSTRACT

SPSC44A ● Pulmonary Biopsy
Elizabeth H Moore MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSC44B ● Liver Biopsy
Fred T Lee MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSC44C ● Renal Mass Biopsy
Stuart G Silverman MD (Presenter) *

LEARNING OBJECTIVES
View learning objectives under main course title.

Controversy Session: The Heart of the Matter: Nuclear Stress Test vs CTA for Low to Intermediate Risk Cardiac Patients with Chest Pain

Wednesday, 04:30 PM - 06:00 PM ● S404CD

LEARNING OBJECTIVES
1) To review the current literature on cardiac CT in the setting of chest pain with low to intermediate risk. 2) To review the current literature on radionuclide myocardial perfusion imaging in the setting of chest pain with low to intermediate risk. 3) To understand the strengths and weaknesses of radionuclide imaging and MDCT in this particular situation.

ABSTRACT

URL
http://www.mgh-cardiovascimages.org/

Controversy Session: Controversies in Imaging Strategies for HCC in Cirrhosis

Wednesday, 04:30 PM - 06:00 PM ● N227

LEARNING OBJECTIVES
1) To understand optimal strategies for using CT and MRI to detect and stage hepatocellular carcinoma. 2) To understand the pharmacokinetic and imaging properties of various MR contrast agents and how to use them to optimize the detection and staging of hepatocellular carcinoma. 3) To learn how to implement the LiRads classification system into routine interpretation of hepatocellular carcinoma on CT and MRI.

ABSTRACT

SPSC46A ● CT vs MR
Rendon C Nelson MD (Presenter) *; Mustafa R Bashir MD (Presenter) *

LEARNING OBJECTIVES
1) To understand the optimal CT and MRI techniques for detecting and staging hepatocellular carcinoma. 2) To learn when CT is a more suitable choice or MRI is a more suitable choice for detecting and staging hepatocellular carcinoma.

ABSTRACT

SPSC46B ● MR Contrast Agents (Hepatobiliary vs Purely Extracellular Agents)
Claude B Sirlin MD (Presenter) *; John R Leyendecker MD (Presenter)

LEARNING OBJECTIVES
View learning objectives under main course title.

SPSC46C ● LI-RADS
Reena C Jha MD (Presenter) *

LEARNING OBJECTIVES
1) To review the LI-RADS classification system. 2) By means of case study, discuss LI-RADS categories, and show both representative and challenging cases and strategies for classification.

ABSTRACT

URL

BOOST: Genitourinary Hands-on Contouring (In Cooperation with ASTRO)

Wednesday, 04:45 PM - 06:00 PM ● S104B
LEARNING OBJECTIVES
1) To use MRI in contouring local prostate cancer as well as pelvic lymph nodes.

Disclosure Index

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Page 236 of 262
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