Controversy Session: Predicting Outcome with Cardiac CT - Which Is Best?

**Special Courses**

**AMA PRA Category 1 Credits ™:** 1.00

**ARRT Category A+ Credit:** 1.00

**Thu, Dec 4 7:15 AM - 8:15 AM   Location: E451A**

**Sub-Events**

**SPSC50A  Calcium Scoring**

John Jeffrey Carr MD, MS (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To describe the pathologic basis for calcified coronary plaque as part of advanced atheromatous plaque in the coronary arteries. 2) Review the evidence on how the CT coronary artery calcium score is an independent and powerful predictor of cardiovascular deaths and myocardial infarction in men, women and minority groups. 3) Discuss how the CT coronary artery calcium score can be integrated into the 2014 prevention guidelines as a tool to reduce deaths from heart disease.

**SPSC50B  Coronary CT Angiography (CCTA)**

Stephan Achenbach MD (Presenter): Research Grant, Siemens AG Research Grant, Bayer AG Research Grant, Abbott Laboratories Speaker, Guerbet SA Speaker, Siemens AG Speaker, Bayer AG Speaker, AstraZeneca PLC Speaker, Berlin-Chemie AG Speaker, Abbott Laboratories Speaker, Edwards Lifesciences Corporation

**LEARNING OBJECTIVES**

1) To be familiar with the typical data acquisition modes for CCTA. 2) To identify clinical situations in which CCTA is useful. 3) To understand the prognostic value of CCTA.

**SPSC50C  Myocardial Perfusion**


**LEARNING OBJECTIVES**

1) To review the available evidence supporting the use of Stress CT perfusion. 2) To understand the importance of combining anatomy and physiology in the non-invasive evaluation of chest pain patients. 3) To describe the limitations and understand the future directions of Stress CTP.

**ABSTRACT**

A major limitation of coronary CTA is that the physiological significance of stenotic lesions identified is often unknown. Stress myocardial computed tomography perfusion (CTP) is a novel examination that provides both anatomic and physiological information. Multiple single-center studies have established the feasibility of stress myocardial CTP. Furthermore, it has been illustrated that a combined CTA/CTP protocol improves the diagnostic accuracy to detect hemodynamic significant stenosis as compared with CTA alone; this combined protocol can also be accomplished at a radiation dose comparable to nuclear myocardial perfusion imaging exams. Stress CTP is a modality with significant potential, particularly in the evaluation of chest pain patients, given the advantages of short exam time and comprehensive data acquisition. This lecture will summarize the current literature, indications, limitations and discuss future directions of Stress CTP.

**URL**

www.rasf.net [http://www.rasf.net/handler.cfm?event=practice,templateandcpid=51323](http://www.rasf.net/handler.cfm?event=practice,templateandcpid=51323)

**SPSC50D  Fractional Flow Reserve (FFR) CT**

Jonathon Avrom Leipsic MD (Presenter): Speakers Bureau, General Electric Company Speakers Bureau, Edwards Lifesciences Corporation Consultant, Heartflow, Inc Consultant, Circle Cardiovascular Imaging Inc

**LEARNING OBJECTIVES**

1) To define the role of lesion specific ischemia as defined by invasively measured FFR to guide coronary revascularization. 2) To review the background and science behind derivation of a computational FFR (FFRCT) from a resting coronary CT angiogram. 3) To review the current diagnostic performance and cost effectiveness data for FFRCT
SPSH50

Hot Topic Session: Advances in Prostate Cancer Imaging

**Special Courses**

| OI | NM | MR | GU | OI | NM | MR | GU |

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

Thu, Dec 4 7:15 AM - 8:15 AM Location: E351

**Participants**

Moderator
David M. Schuster MD: Research funded, Nihon Medi-Physics Co, Ltd Expert Advisory Committee, AIM Specialty Health

**LEARNING OBJECTIVES**

1) New developments in molecular imaging for the detection, staging, and restaging of prostate cancer. 2) The potential role of PET imaging with acetate for prostate cancer. 3) The potential role of amino acid imaging including FACBC PET in prostate cancer. 4) The contribution that PET-MR can make to the evaluation and understanding of prostate cancer. 5) New developments in PSMA imaging beyond ProstaScint. 6) The role of choline based PET in the evaluation of prostate cancer including details of FDA approval.

**Sub-Events**

**SPSH50A Choline PET**

Val John Lowe MD (Presenter): Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Eli Lilly and Company Advisory Board, Bayer AG

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**SPSH50B Amino Acid PET Imaging with FACBC**

David M. Schuster MD (Presenter): Research funded, Nihon Medi-Physics Co, Ltd Expert Advisory Committee, AIM Specialty Health

**LEARNING OBJECTIVES**

1) The molecular basis of acetate imaging of prostate cancer. 2) The diagnostic performance and potential role of acetate PET in prostate cancer. 3) The molecular basis of amino acid based imaging and FACBC PET in prostate cancer. 4) The diagnostic performance and potential role of FACBC PET for prostate cancer. 5) Current status of clinical trials for acetate and FACBC PET.

**SPSH50C Prostate-specific Membrane Antigen and PET/MR**

Matthias Johannes Eiber MD (Presenter): Speaker, Siemens AG Speaker, Astellas Group Speaker, Johnson & Johnson

**LEARNING OBJECTIVES**

1) The molecular basis of prostate cancer imaging targeting the prostate-specific-membran antigen (PSMA), review of the various PSMA-tracers. 2) The diagnostic performance and potential role of PSMA PET/SPECT for primary and recurrent prostate cancer (including the comparison to other tracers). 3) Discuss non-routine applications (e.g. biopsy targeting, radioguided surgery).

**Centennial Showcase**

**Miscellaneous**

Sat, Nov 29 12:00 PM - 5:00 PM Location: Centennial Pavilion, Learning Center

**ABSTRACT**

Explore an onsite experience to see, hear, and discover the advancements that shaped radiology. The Showcase will feature a historical timeline and a special welcome from a virtual Wilhelm Roentgen. Visitors can explore the Centennial Gallery featuring the stories behind RSNA, and the Cases of the Century, which gives attendees a chance to try their hand at diagnosis using only "vintage" images. Attendees will also have an opportunity to view striking images in the Art and Science gallery and contribute their favorite RSNA memories or celebratory messages in the Memory Book. The Centennial Showcase will be open: November 29, 12:00pm-5:00pm November 30 - December 4, 7:30am-6:00pm December 5, 7:30am-12:30pm

**MSRT51**

**ASRT@RSNA 2014: Contrast Media - Adverse Reactions and Management**

**Multisession Courses**

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

Thu, Dec 4 8:00 AM - 9:00 AM Location: N230AB

**Participants**

Gauravi Kaur Sabharwal MD (Presenter): Nothing to Disclose
LEARNING OBJECTIVES

1) Know incidence of reactions to contrast media. 2) Understand risk factors that may increase incidence of an adverse reaction to contrast media. 3) Understand pathogenesis of the reactions to contrast media. 4) Know classification of the different contrast reactions. 5) Review management of the different types of contrast reactions. 6) Known about premedications for prevention of contrast reactions.

ABSTRACT

Contrast media is the most commonly used pharmacological agent in Radiology. It is associated with multiple adverse reactions. While these reactions are relatively uncommon, some of them can be severe and even fatal. This makes it important to be able to recognize these reactions and appropriately manage them. Patients with known prior reactions to contrast media and with other risk factors should be premedicated prior to the administration of this agent.

MSCN51
Case-based Review of Neuroradiology (An Interactive Session)

Multisession Courses

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AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 8:30 AM - 10:00 AM  Location: S100AB

Participants

Director
Pina Christine Sanelli MD Nothing to Disclose

Sub-Events

MSCN51A  Adult Brain
Pamela Whitney Schaefer MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize the key neuroimaging characteristics of various adult cerebral disease entities. 2) Use pertinent imaging features and key clinical factors to formulate a pertinent differential diagnosis for various adult cerebral pathologies. 3) Discuss the utility of various imaging techniques for evaluating various adult cerebral disorders. 4) Review pertinent anatomy as it pertains to common adult cerebral pathologies.

MSCN51B  Adult Spine
Gordon K. Sze MD (Presenter): Investigator, Remedy Pharmaceuticals, Inc

LEARNING OBJECTIVES

1) To analyze findings on imaging examinations of the spine. 2) To characterize unusual findings and provide a differential diagnosis.

MSCN51C  Adult Head and Neck
Hugh D. Curtin MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To use imaging findings to differentiate head and neck lesions that can occur in similar locations. 2) To identify and evaluate imaging landmarks that determine changes in treatment.

MSCP51
Case-based Review of Pediatric Radiology (An Interactive Session)

Multisession Courses

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AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 8:30 AM - 10:00 AM  Location: S406A

Participants

Director
Sudha Ayyala Anupindi MD Nothing to Disclose

LEARNING OBJECTIVES

1) Access the results of new research and assess their potential applications to clinical practice. 2) Improve basic knowledge and skills relevant to clinical practice. 3) Practice new techniques. 4) Assess the potential of technological innovations and advances to enhance clinical practice and problem-solving. 5) Apply principles of critical thinking to ideas from experts and peers in the radiologic sciences.
**Sub-Events**

**MSCP51A**  
**Abdominal Masses in Children**  
Sudha Ayyala Anupindi MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the common types of abdominal tumors in children and the practical pathway of imaging. 2) Analyze the common features of these abdominal tumors in a case based format. 3) Discuss the differential diagnosis and therapeutic options for each case.

**ABSTRACT**

During this session we will be presenting cases of common pediatric abdominal tumors. The following are the learning objectives: At the end of the session the participant will be able to: 1) Identify the common types of abdominal tumors in children and the practical pathway of imaging 2) Analyze the common features of these abdominal tumors in a case based format 3) Discuss the differential diagnosis and therapeutic options for each case

**MSCP51B**  
**Interventional Procedures in Infants and Children**  
Ricardo Restrepo MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**MSCP51C**  
**Pediatric Bone Marrow Imaging**  
Kirsten Ecklund MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Apply conventional and advanced MR techniques to design adequate protocols for assessment of pediatric bone marrow disorders. 2) Recognize normal age related variations in bone marrow signal intensity throughout the skeleton. 3) Identify primary and secondary marrow abnormalities that accompany focal and systemic disorders of the musculoskeleton.

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**MSES51**

**Essentials of Genitourinary Imaging**

**Multisession Courses**

**MSCP51A**

**URINARY STONE DISEASE**

Parvati Ramchandani MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Familiarize attendee with the radiologic features of the spectrum of urinary stone disease. 2) Familiarize attendees with the role of imaging in the management of patients with stone disease. 3) Familiarize attendees with the role of the different imaging modalities in diagnosis of urinary stone disease.

**ABSTRACT**

Imaging is crucial in the diagnosis and management of urinary stone disease. Abdominal radiography, ultrasound and CT all continue to be important modalities in detecting urinary stone disease, determining stone composition, determining the best management strategy, and in detecting complications due to stone disease. In this presentation, the role, advantages and pitfalls of the different imaging modalities available to evaluate stone disease will be discussed.

**MSCP51B**

**ENDOMETRIOSIS IMAGING**

Andrea Grace Rockall MRCP, FRCP (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To be familiar with the typical clinical presentations of endometriosis. 2) To know the imaging features of endometriosis on ultrasound. 3) To know the imaging features of endometriosis on MRI. 4) To be aware of the potential serious complications of endometriosis and the accompanying imaging findings.

**MSCP51C**

**ECTOPIC PREGNANCY: CHALLENGES AND PITFALLS**

Genevieve Louise Bennett MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

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1) Understand the role of imaging in evaluation and management of the patient with suspected ectopic pregnancy, including unusual sites of pregnancy implantation. 3) Avoid common pitfalls in diagnosis of ectopic pregnancy.

**ABSTRACT**

Ectopic pregnancy is the leading cause of first trimester maternal morbidity and mortality, and the diagnosis may often be challenging. In this course, the role of imaging in evaluation and management of patients with suspected ectopic pregnancy will be reviewed. Both common and uncommon manifestations of ectopic pregnancy will be discussed, including unusual sites of pregnancy implantation. Diagnosis of C-section scar implantation and early detection of placental implantation disorders will be reviewed. Throughout the course, common diagnostic pitfalls and strategies to avoid these pitfalls will be emphasized.

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**RC601**

**Chest Imaging: How Radiologic-Pathologic Correlation Informs Interpretation**

*Refresher/Informatics*

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

**Thu, Dec 4 8:30 AM - 10:00 AM**  
**Location: E353C**

**Participants**

Moderator  
Jeffrey R. Galvin MD : Nothing to Disclose

**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.

**Sub-Events**

**RC601A**  
**Interstitial Lung Disease**  
Jeffrey R. Galvin MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC601B**  
**Diseases of the Small Airways**  
Phillip M. Boiselle MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To understand the normal anatomy of the small airways and their relationship to the secondary pulmonary lobule. 2) To identify characteristic HRCT patterns of small airways diseases along with their clinical and pathological correlates.

**RC601C**  
**Vascular Disease**  
Aletta Ann Frazier MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC601D**  
**Lymphoid Diseases**  
Tomas C. Franquet MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To illustrate the imaging findings of some pulmonary lymphoid diseases. 2) To correlate these findings with histopathologic features. 3) To present a differential diagnosis based on pathologic-radiologic correlation.

**RC601E**  
**Lung Nodules**  
Seth Jay Kligerman MD (Presenter): Author, Reed Elsevier

**LEARNING OBJECTIVES**

1) Learn the revised terminology for adenocarcinoma of the lung. 2) Recognize imaging findings that will help differentiate lung adenocarcinoma from other lung nodules. 3) Understand the pathologic findings...
and how it correlates to imaging

**RC602**

**Business Education in Academic Radiology: New Imperatives for the New World of Healthcare**

*Refresher/Informatics*

AMA PRA Category 1 Credits ™: 1.50  
ARRT Category A+ Credits: 1.50  
Thu, Dec 4 8:30 AM - 10:00 AM  Location: S403A

**Participants**

Moderator  
Richard Duszak MD  Nothing to Disclose

**LEARNING OBJECTIVES**

1) To develop programs to cultivate trainee and staff radiologist non-clinical interests in practice management, economics, and health policy, and apply newly acquired knowledge and insights into current and future practice.  
2) To help radiologists at all levels in academic medical centers understand the complex environment in which health care services are delivered and the roles and relationships of various stakeholders including professional societies, private and academic practices, hospitals and health systems, payers, governmental bodies and private sector industry.  
3) To guide radiology residency programs in fulfilling new formal residency training requirements in non-interpretative skills as they pertain to healthcare economics and practice management.

**ABSTRACT**

As healthcare delivery systems undergo rapid and dramatic changes, the need for dynamic physician leadership in both academic and private practice settings has increased. Traditional graduate medical education curricula have often left young radiologists ill-equipped to address complex issues related to practice management, health policy and economics. Given the many leadership opportunities available for practicing radiologists, additional education and training in these areas should enhance their effectiveness as clinical and non-clinical leaders to positively impact healthcare systems through appropriate use and integration of medical imaging. This course is intended to introduce such educational opportunities at the resident, fellow, and attending radiologist level and share the early experience of several academic medical centers in these pursuits.

**Sub-Events**

**RC602A**

**Business Education in Academic Radiology: Radiology Residents**

Falgun Harish Chokshi MD (Presenter):  Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC602B**

**Business Education in Academic Radiology: Radiology Fellows**

Raymond Wang Sze MD (Presenter):  Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC602C**

**Business Education in Academic Radiology: Practicing Radiologists**

Frank J. Lexa MD (Presenter):  Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC603**

**Cardiac PET/CT and PET/MR**

*Refresher/Informatics*

AMA PRA Category 1 Credits ™: 1.50  
ARRT Category A+ Credits: 1.50  
Thu, Dec 4 8:30 AM - 10:00 AM  Location: E353B

**Sub-Events**

**RC603A**

**Cardiac PET Imaging: Perfusion and Viability**

Sharmila Dorbala MBBS (Presenter):  Research Grant, Astellas Group Speaker, General Electric Company

**LEARNING OBJECTIVES**
1) Identify the current clinical applications of cardiac PET. 2) Compare advantages and disadvantages of myocardial perfusion PET versus SPECT. 3) Recognize image artifacts associated with cardiac PET/CT. 4) Demonstrate understanding of myocardial viability interpretation and its use in clinical practice.

Clinical Indications, Methods and Interpretation of Cardiac Magnetic Resonance Imaging

Albert De Roos MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To learn appropriate indications for the use of cardiac magnetic resonance imaging. 2) To appreciate the strengths and weaknesses of cardiac MRI in relation to other cardiovascular imaging modalities. 3) To define the relative and absolute contraindications in selecting patients for cardiac MRI. 4) To know the spectrum of clinical information available from cardiac MRI. 5) To learn the basic pulse sequences and MRI protocols most commonly used in cardiac MRI.

ABSTRACT

Cardiac magnetic resonance imaging (CMR) is a noninvasive imaging modality most commonly available in tertiary referral centers. In general, it is a secondary, rather than primary test. However, in many appropriately referred patients, echocardiography, computed tomography, nuclear scintigraphy and/or invasive angiography are insufficient for definitive diagnosis. Additionally, in certain clinical situations primary referral for CMR is preferable due to unique capabilities or institutional preferences and/or expertise. The evaluation of cardiomyopathies is a frequent use of CMR, in particular to differentiate ischemic, infiltrative, restrictive, inflammatory, hypertrophic and idiopathic myopathies. This is due to its unique capacity for tissue characterization using first pass and delayed contrast enhancement and T1 and T2 sensitive pulse sequences. Another use is in pre- and post-operative evaluation of congenital heart disease, in which the ability to provide anatomic, functional and vascular information from the entire thorax is unique, and particularly advantageous in young, radiation sensitive patients. Another frequent indication is analysis of suspected intracardiac or pericardial masses, which also benefits from the anatomic flexibility and tissue characterization capabilities of this modality.

Cardiac PET/MRI: Clinical Applications

Pamela K. Woodard MD (Presenter): Research support, Siemens AG Research support, Astellas Group Consultant, BIOTRONIK GmbH & Co KG

LEARNING OBJECTIVES

1) Participants in this course will learn clinical applications of cardiac PET/MRI. 2) Participants in this course will learn potential workflows for the performance of a cardiac PET/MRI myocardial perfusion examination and in assessment of myocardial viability.

Glands of the Head and Neck

Ilona Maria Schmalfuss MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand advantages and disadvantages of salivary gland imaging. 2) Discuss application of diffusion weighted imaging in work-up of salivary gland abnormalities. 3) Generate differential diagnostic considerations based on acuity of symptom onset, distribution of lesion(s) and imaging appearance. 4) Outline potential difficulties in the work-up of salivary gland abnormalities.

Thyroid Imaging

Ashley Hawk Aiken MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the incidence, significance and natural history of incidental thyroid nodules and differentiated thyroid cancer respectively. 2) Know the current literature and best practice recommendations for further imaging evaluation (US) and FNA of the incidental thyroid nodule. 3) Recognize the indications for cross-sectional imaging in the pre-operative evaluation of thyroid cancer.

ABSTRACT

The evaluation of thyroid nodules and masses is a broad, complex and controversial topic. This presentation aims to look at the current evidence for three of the most common clinical scenarios: 1. Incidental thyroid nodule on CT or MRI: When to recommend ultrasound or biopsy? 2. Palpable thyroid mass: What is the best test? 3. Preoperative evaluation of a thyroid mass with cancer diagnosis: What is the best test? Thyroid nodules are extremely common, with approximately 50% at autopsy. Most of these nodules are less than a centimeter. Thyroid cancer is also common, but not nearly as common as thyroid nodules, with approximately 2-5% at autopsy. Thyroid cancer incidence is on the rise without a significant
change in mortality rate. There is some evidence that a rising incidence of subcentimeter papillary thyroid cancer results from increased detection on CT. There are no current guidelines for the management of these extremely common incidental thyroid nodules. This presentation will review the current literature and suggest some practical guidelines to help radiologists decide how to report these nodules. The combination of size criteria and clinical risk factors such as age is the best approach to date. The common practice of using a 10 mm size threshold alone to recommend US is arbitrary and results in excessive work-up of these incidental nodules, cost, and patient anxiety. Current evidence suggests that a stratification approach, incorporating aggressive imaging findings, age younger than 35-40 years, and a 15-mm cutoff for triaging work-up, may reduce this excess work-up of benign ITNs while capturing the same proportion of thyroid malignancies. Ultrasound is the study of choice for the evaluation of an intrathyroidal mass or nodule. CT has no signs that help to differentiate malignant from benign thyroid nodules and is therefore not the study of choice. The Society of Radiologists in Ultrasound (SRU) has developed ultrasound criteria to determine high-risk nodules and prompt fine needle aspiration (FNA) for diagnosis. The SRU recommends FNA for the following US characteristics: 1. 1 cm & microcalcification. 2. > 1.5 cm solid or coarse calcifications. 3. > 2 cm mixed solid & cystic components. 4. Nodule w/ substantial growth. 5. Nodule w/ abnormal cervical lymph nodes. The American Thyroid association (ATA) guidelines also currently recommend ultrasound as the preoperative study of choice for evaluation of uncomplicated thyroid cancer. However, cross-sectional imaging should be recommended for cases with: 1. Aggressive pathology. 2. Clinical signs of extra-thyroidal extension: vocal cord palsy, fixed mass, dysphagia, respiratory symptoms, etc. 3. Lateral compartment lymphadenopathy by palpation or ultrasound. Many thyroid cancer experts would also consider cross-sectional imaging for ultrasound or palpable central compartment lymphadenopathy.

active handout

RC606C
Parathyroid Imaging
C. Douglas Phillips MD (Presenter): Stockholder, MedSolutions, Inc Consultant, Guerbet SA

LEARNING OBJECTIVES
1) Discuss the history of parathyroid imaging. 2) Understand current imaging modalities and their strengths and weaknesses. 3) Know the current surgical approach to parathyroid disease. 4) Understand the contribution of physiologic imaging of parathyroid disease.

ABSTRACT
Parathyroid imaging for patients with primary hyperparathyroidism (PHPT) has gone through a series of changes that have been brought about because of the necessity of very precise localization of the abnormal parathyroid gland or glands. In the current surgical paradigm, minimally invasive parathyroid surgery (MIPS) is the sought after technique, demanded by patients and offering the lowest cost and most efficacious method to address an abnormal gland. Radiologists offer much to this patient group. Cross-sectional imaging is very often offered to this patient group and precise localization of parathyroid tissue is the goal. Surgeons do not want to operate on normal glands, and they do not want to explore ectopic parathyroid tissue, the classic localizing techniques may fail, and a gland that is not evident on the necks. They must be directed to tissue that is parathyroid tissue, and not lymph nodes, and not other potential visceral space masses. Ectopic parathyroid tissue is also a vexing problem. In the setting of ectopic parathyroid tissue, the classic localizing techniques may fail, and a gland that is not evident on the cross-sectional imaging exams. The classic localizing techniques in the past have been bone scans, scintigraphy, and sestamibi scans. These are very useful but not always available and are not always accurate. There is a great need for imaging of the parathyroid glands.

RC607
Bladder, the Forgotten Organ: Role of CT, MRI, and PET in Diagnosis, Staging, and Surveillance of Cancer

Participants
Andrew B. Rosenkrantz MD (Presenter): Nothing to Disclose
Homer Aquino Macapinlac MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Learn the latest developments on the role of CT, MRI, and PET/CT in the detection, diagnosis, staging, and surveillance of patients with bladder cancer. 2) Learn currently recommended CT, MRI, and PET/CT techniques and protocols and how to implement them in clinical practice. 3) Learn how to interpret CT, MRI, and PET/CT scans of the bladder with an emphasis on case review and diagnostic pitfalls.

ABSTRACT
The urinary bladder is the most common site of malignancy of the urinary tract and is imaged by radiologists on many abdominal imaging exams. However, historically the bladder has been a 'forgotten' organ and thought to be largely the purview of the urologist due to the central role that cystoscopy has played in both the diagnosis and local staging of bladder cancer. Recent advances in CT, MRI, and PET have emerged that now allow radiologists to play an important role in the detection, diagnosis, staging, and surveillance of patients with or suspected of having bladder cancer. This course will detail these advances and explain when, and why radiologists should be using these three modalities in clinical practice today. Using illustrative case examples, advances in knowledge such as how CT urography can be used to detect bladder cancer, how MR urography can be used to distinguish muscle-invasive from superficial tumors and evaluate the upper tracts, and how PET/CT (and the newly introduced PET/MRI) can be used to stage and follow patients. With additional advances in low dose CT, emerging MRI techniques, and novel PET agents, radiology will play an increasingly vital role in the care of patients with bladder cancer in the future.

RC609
Gastrointestinal: CT Colonography Update (An Interactive Session)
**Sub-Events**

**RC609A**

Current Approaches and Controversies in Patient Preparation  
Kevin J. Chang MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) List various options for bowel catharsis and their relative advantages and disadvantages. 2) List various options and the timing of fecal and fluid tagging agents. 3) Evaluate potential indications for noncathartic or minimal cathartic preparations and their disadvantages.

**RC609B**

Interpretation Principles and the Difficult Lesion  
David H. Kim MD (Presenter): Consultant, Viatronix, Inc Co-founder, VirtuoCTC, LLC Medical Advisory Board, Digital ArtForms, Inc

**LEARNING OBJECTIVES**

1) List the two tasks undertaken during CTC interpretation. 2) Identify the reasons underlying the difficulty in flat polyp detection and characterization. 3) State the importance of serrated polyps related to cancer development.

**RC609C**

Pitfalls at CT Colonography  
Seong Ho Park MD (Presenter): Research Grant, DONGOOK Pharmaceutical Co, Ltd Research Grant, General Electric Company

**LEARNING OBJECTIVES**

1) To understand the pitfalls related to CT colonography techniques and how to avoid them. 2) To understand the pitfalls in interpreting CT colonography and how to avoid them.

**RC609D**

Current Status of CT Colonography and Reimbursement  
Judy Yee MD (Presenter): Research Grant, EchoPixel, Inc

**LEARNING OBJECTIVES**

1) To learn some of the latest advances in performance of CTC. 2) To understand the current challenges to national reimbursement for screening CTC. 3) To review methods for local dissemination of CTC.

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**RC610**

**Thyroid and Neck Ultrasound**

Refresher/Informatics

**ABSTRACT**

As an overview, this presentation will review the epidemiology of thyroid nodules and correlate the sonographic findings with the risk of malignancy or the likelihood that the appearance represents a benign hyperplastic thyroid nodule rather than a true neoplasm. Additionally, the rationale for current guidelines for recommending thyroid fine needle aspiration will be discussed. The prevalence of palpable thyroid nodules is estimated to be 6.4% in women and 1.5% in men between 30 to 60 years of age, living in iodine-sufficient regions. However, high resolution sonography of the neck has been shown to be a much more sensitive technique than palpation, detecting nodules in 19 to 67% of randomly selected adults, with detection rates greater in women and increasing with age for both genders. Fortunately the vast majority of sonographically detected thyroid nodules are benign, hyperplastic regions of the thyroid. Fine-needle aspiration biopsy (FNA) is still considered the most reliable diagnostic test to determine if a thyroid nodule is malignant. Malignant nodules account for approximately 5% of all nodules that undergo palpation-guided FNA and approximately 10 to 15% of nodules that undergo sonography-guided FNA procedures. Analysis of the sonographic features of thyroid nodules has become the preeminent...
non-invasive tool for analyzing the risk of malignancy of thyroid nodules and aids in selecting which nodules should undergo fine needle aspiration (FNA). A number of recently published guidelines and consensus statements emphasize that the sonographic appearance of a nodule is a superior predictor of malignancy compared with nodule size or palpability and that when sonographic features of malignancy are noted, the nodule should undergo FNA. A number of sonographic features have shown a high specificity for the diagnosis of thyroid cancer and include marked hypoechoigenicity, the presence of microcalcifications, infiltrating or micro-lobulated borders, and a taller-

**RC610B**

**Post-Thyroidectomy Neck**  
Carl C. Reading MD (Presenter):  Nothing to Disclose  

**LEARNING OBJECTIVES**  
1) Recognize the sonographic appearance of recurrent and metastatic disease, and other abnormalities, in the post-operative neck.

**ABSTRACT**  
In the post-thyroidectomy neck, ultrasound surveillance is a highly effective method to evaluate for residual and recurrent disease. Recurrence can occur anywhere within the neck, but typically is located in the mid and low internal jugular chains and thyroid bed region. Abnormal cervical lymph nodes can be recognized with a high degree of accuracy due to abnormal size, shape, internal architecture, and color Doppler appearance. In patients with suspected metastatic papillary cancer, the presence of internal fluid or calcifications is highly predictive of malignancy. Abnormal nodal color Doppler flow including peripheral (non-hilar), increased, and irregular flow is highly predictive of malignancy. Within the post-operative thyroid bed, itself, residual thyroid tissue, tumor recurrence, and suture granulomas can occur. FNA for cytologic analysis of suspected abnormalities can be performed, and the addition of thyroglobulin and calcitonin assay of the specimen, for papillary and medullary cancer, respectively, adds a high degree of accuracy to this procedure.

**RC610C**

**Parathyroid and Other Neck Masses**  
Mary Catherine Frates MD (Presenter):  Nothing to Disclose  

**LEARNING OBJECTIVES**  
1) Understand the best method to detect abnormalities of the parathyroid gland. 2) Gain understanding of the wide variety of lesions that can be found in the neck outside of the thyroid gland. 3) How to differentiate between these lesions based on their sonographic characteristics.

**RC611**

**Update on Radionuclide Therapies**  
*Refresh/Informatics*

**AMA PRA Category 1 Credits ™: 1.50**  
ARRT Category A+ Credits: 1.50  
Thu, Dec 4 8:30 AM - 10:00 AM  Location: SS05A

**Sub-Events**

**RC611A**

**New Guidelines for I-131 Therapy of Thyroid Cancer**  
Don C. Yoo MD (Presenter):  Consultant for Endocyte  

**LEARNING OBJECTIVES**  
1) Describe why thyroid cancer is increasing. 2) Review guidelines for the use of I-131 in the treatment of thyroid cancer. 3) Review the controversies in thyroid cancer treatment.

**ABSTRACT**  
The purpose of this educational activity is to review the reasons why the incidence of thyroid cancer has risen so rapidly over the last 40 years and discuss the role of radioiodine ablation in patients with thyroid cancer. Issues that will be discussed include controversies in the extent of thyroid surgery and the appropriate use of radioiodine ablation in patients with thyroid cancer which is controversial in low risk and intermediate risk patients. The incidence of thyroid cancer in the United States has almost tripled since the early 1970s with unchanged mortality principally due to overdiagnosis. The extent of surgery performed for thyroid cancer is controversial especially in small cancers but only patients with complete thyroidectomy are candidates for radioiodine ablation. Recently lower doses of I-131 have been shown to be effective for radioiodine ablation of remnant thyroid tissue after thyroidectomy. High risk patients will benefit from radioiodine ablation with decreased recurrence and improved mortality. Radioiodine ablation in low risk patients is very controversial and has not been shown to improve mortality.

**RC611B**

**Ra-223 Therapy for Bone Metastases**  
Eric Michael Rohren MD, PhD (Presenter):  Nothing to Disclose  

**LEARNING OBJECTIVES**  
1) Review the chemistry and mechanism of action of Ra-223. 2) Understand the approved indication for Ra-223. 3) Illustrate the techniques and procedures for radium administration using a case-based approach.
ABSTRACT
Radium-223 is an alpha-emitting radiopharmaceutical approved for use in men with castration-resistant prostate carcinoma. The use of radium in a clinical setting will be discussed, including the rationale, patient eligibility, administration, and follow-up, as well as radiation safety precautions and handling. Illustrative cases will be presented.

RC611C
Hepatic Artery Infusion Therapy with Y90 Microspheres
Charles Yoon Kim MD (Presenter): Consultant, CareFusion Corporation Research Grant, Galil Medical Ltd Consultant, Kimberly-Clark Corporation Consultant, Cryolife, Inc

LEARNING OBJECTIVES
1) Review range of malignancies treated with Y90 microsphere infusion. 2) Discuss the types of Y90 therapy and dosimetric considerations. 3) Describe the procedures and technical steps involved in Y90 therapy. 4) Recognize pertinent scintigraphic findings associated with Y90 therapy.

ABSTRACT
Intra-arterial Yttrium-90 (Y90) therapy is an important treatment modality for a variety of hepatic tumors. While numerous types of embolotherapies are employed by interventional radiologists for treatment of cancer, Y90 therapy is unique in its multimodality and multi-procedural nature. Not only does this treatment effect rely on deposited ionizing radiation therapy, but scintigraphic imaging is also an integral component of treatment. Two types of Y90 therapies are available, made by two different manufacturers. The differences between the two types are subtle, but there are differences in administration and manufacturer-recommended dosimetric calculation. These various differences will be highlighted. Y90 therapy is comprised of several steps and is frequently subclassified into a “planning” phase and “treatment” phase. In the planning phase, detailed angiographic imaging is performed to delineate arterial anatomy, determine tumor distributions, and redistribute vascular flow if indicated. Scintigraphic imaging is an integral component of this planning phase, in order to help identify angiographically occult arterial anomalies, confirm appropriate infusion site, and to quantify the hepatopulmonary shunt fraction. From this information, as well as other factors, the appropriate treatment doses can be determined. In the treatment phase(s), the Y90 dose is administered to the appropriate portions of the liver with subsequent scintigraphic imaging for confirmation.

RC613
Interactive Game: Pediatric: Oncology
Refresher/Informatics

LEARNING OBJECTIVES
This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

Sub-Events
RC613A
Bone Mineral Density Changes in Survivors of Childhood Cancer
Sue Creviston Kaste DO (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Participants will learn risk factors for bone mineral density deficits in patients having been treated for childhood malignancies.

RC613B
Pediatric Hybrid Imaging (PET/CT, PET/MR) and the Role of the Radiologist
Stephan Dieter Voss MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To review the role of hybrid imaging in Pediatric Radiology, with a focus on Oncology. 2) To review strategies for integrating PET/CT, PET/MR and SPECT/CT into both Radiology and Nuclear Medicine workflows. 3) To develop an understanding of hybrid imaging techniques and their role in dose reduction and elimination of unnecessary duplicate scanning.

RC613C
Secondary Malignancies and Surveillance Imaging
Kieran McHugh (Presenter): Consultant, F. Hoffmann-La Roche Ltd

LEARNING OBJECTIVES
1) To create an awareness of the radiation burden from radiological examinations in young children with cancer. 2) To identify the risks to children of repeated CT examinations. 3) To question the value of repeated surveillance imaging after treatment completion in children with cancer, as there is little evidence to support it.
**RC615**

**Breast US**

*Refresher/Informatics*

ARRA PRA Category 1 Credits ™: 1.50  
ARRT Category A+ Credits: 1.50  
Thu, Dec 4 8:30 AM - 10:00 AM  
Location: E450A

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**Sub-Events**

**RC615A**  
**High-quality Breast US**  
Janice S. Sung MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

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

**RC615B**  
**Challenging Cases**  
Bruno D. Fornage MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To review common and less common causes of artifacts, diagnostic errors, and pitfalls, and ways to identify them.  
2) To describe tips and tricks to optimize the acquisition and interpretation of sonograms of the breasts and nodal basins.

**RC615C**  
**Whole Breast Screening**  
Stamatia V. Destounis MD (Presenter): Investigator, FUJIFILM Holdings Corporation Investigator, Seno Medical Instruments, Inc

**LEARNING OBJECTIVES**

1) Review of current screening breast ultrasound legislation and the impact on breast imaging centers.  
2) To review and discuss available automated breast ultrasound technologies utilized for screening ultrasound.  
3) Discussion of clinical experience with handheld screening ultrasound.  
4) Review of current published literature.

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**RC616**

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

*Refresher/Informatics*

ARRA PRA Category 1 Credits ™: 1.50  
ARRT Category A+ Credits: 1.50  
Thu, Dec 4 8:30 AM - 10:00 AM  
Location: S103AB

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**Participants**

Moderator  
Kenneth A. Buckwalter MD: Nothing to Disclose  
Ella A. Kazerooni MD (Presenter): Nothing to Disclose  
Brent Joseph Wagner MD (Presenter): Nothing to Disclose  
Bruce Jonathan Barron MD (Presenter): Stockholder, Immunomedics Inc

**LEARNING OBJECTIVES**

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

**ABSTRACT**

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

Participants
Moderator
Pejman Ghanouni MD, PhD: Research Grant, General Electric Company Research Grant, InSightec Ltd

Sub-Events

RC617A  Body Applications of MR-Guided High Intensity Focused Ultrasound
Wladyslaw Michal Witold Gedroyc MBBS, MRCP (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Where Can FUS be applied. 2) What are the current and future applications of FUS in the general body area. 3) What are the technological problems of FUS in this field. 4) How may these problems be overcome. 5) What requirements does a prostate FUS system require for safe and effective application. 6) What are the potential complications of prostate MR guided FUS. 7) What are the technological requirements necessary to improve MR guided focused ultrasound therapy to the liver. 8) What other areas can MR guided focused ultrasound potentially be applied to in the body.

ABSTRACT
The largest area of FUS application has been of uterine fibroids but this application has shown the potential for similar procedures to be carried out in other areas of the body. Because of the outpatient non-invasive nature of the procedure FUS becomes a highly cost-effective method of achieving destruction of abnormal tissue without invasion. Percutaneous destruction of liver tumours in a completely non-invasive manner could change therapy to the liver radically. FUS holds out such a prospect but the technological improvements required to our current machinery are substantial. The barrier of the FUS absorbing rib cage is hard to overcome and to date MR guided focused ultrasound has only been able to reach lesions that are not covered by ribs. The movement produced by respiration presents a significant problem currently addressed by controlled ventilation during FUS. Technological improvements are slowly being implemented to address these areas. Similar constraints apply to other upper abdominal organs which move with respiration and technological improvements to allow liver FUS equally apply to kidneys and spleen. New endorectal MR guided transducers which can ablate areas of the prostate under accurate MR targeting and thermal control are in phase 1 studies treating low risk prostate carcinoma and looking at safety and early efficacy. These results will be discussed. A brief discussion of MR guided focused ultrasound application to the breast and soft tissue tumours will also be presented as well as the possibility of FUS utilisation in soft tissues.

RC617B  Neurologic Applications of MR-guided HIFU
Max Wintermark MD (Presenter): Research Grant, General Electric Company Research Grant, Koninklijke Philips NV

LEARNING OBJECTIVES
1) To understand the neuro applications of HIFU. 2) To understand the challenges of applying HIFU for neuro applications. 3) To review the ongoing trials of neuro applications of HIFU.

RC617C  Treatment of Fibroids with MR-guided HIFU
Matthias Matzko MD (Presenter): CEO, Imaging Service AG Shareholder, Imaging Service AG

LEARNING OBJECTIVES
1) To become familiar with the basic physical principles of HIFU and the potential of MR guidance. 2) To approach selection criteria in MRI screening examinations for accurate indications and identify contraindications and non-suitable patients. 3) To appreciate current results and potential therapy regimens. 4) To understand recent technical developments and their potential.

RC617D  Palliation of Painful Metastases to Bone
Pejman Ghanouni MD, PhD (Presenter): Research Grant, General Electric Company Research Grant, InSightec Ltd

LEARNING OBJECTIVES
1) Therapeutic options for palliation of painful metastases to bone. 2) Patient selection for MR guided focused ultrasound palliation of painful bone metastases. 3) Results of Phase III pivotal study of ExAblate MR guided focused ultrasound for palliation of painful bone metastases. 4) Technical aspects of successful patient treatment. 5) Immediate post-treatment imaging-based assessment of results. 6) Future applications of MR guided focused ultrasound for the management of osseous metastatic disease.

ABSTRACT
Cancer patients commonly have metastases to bone; as the survival of cancer patients is prolonged by more effective therapies, the prevalence of patients with metastases to bone is also increasing. Bone metastases are often painful, and often diminish the quality of life. Radiation therapy (RT) is the standard of care for the treatment of bone metastases, but a significant subset of patients do not respond to RT. MR guided focused ultrasound non-invasively achieves localized tissue ablation and provides a proven method of pain relief in patients who do not respond to radiation therapy. MR imaging provides a combination of
tumor targeting, real-time monitoring during treatment, and immediate verification of successful
treatment. The results of the pivotal Phase III trial that led to FDA approval of the ExAblate MR guided
focused ultrasound device for the palliation of painful metastases to bone will be reviewed. In particular,
patient selection, the technical aspects of successful patient treatment, and post-treatment assessment of
results will be described. Concepts for future development of this technology with regard to the
management of osseous metastatic disease will also be presented.

RC618

Pitfalls in Oncologic Imaging

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 8:30 AM - 10:00 AM Location: E451A

LEARNING OBJECTIVES

1) Describe some common and important missed and mistaken diagnoses in body oncologic imaging with updated
information on common problematic body oncologic imaging findings.

ABSTRACT

Research consistently indicates that there are serious errors in 1.0 to 2.6% of radiology reports, and there is no reason to
believe the error rate in body oncologic imaging is substantially different. Accordingly, the recognition of potential pitfalls
that may lead to mistakes in diagnosis, especially those that lead to inappropriate management, is of major importance.
This course will highlight some of the common and important sources of error, especially those that are not widely
appreciated or are newly described.

URL's

http://www.ohsu.edu/xd/education/schools/school-of-medicine/departments/clinical-departments/diagnostic-radiology/presentations.cfm

Sub-Events

RC618A Neuroradiology
Andrei I. Holodny MD (Presenter): Employee, fMRI Consultants LLC

LEARNING OBJECTIVES

View learning objectives under main course title.

RC618B Body Imaging
Fergus V. Coakley MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

URL's

http://www.ohsu.edu/xd/education/schools/school-of-medicine/departments/clinical-departments/diagnostic-radiology/presentations.cfm

RC618C Musculoskeletal Radiology
David M. Panicek MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe various imaging pitfalls in characterizing soft tissue and bone lesions. 2) Review several
post-treatment pitfalls in bones and bone marrow.

RC621

Medical Physics 2.0: Radiography

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 8:30 AM - 10:00 AM Location: S105AB

LEARNING OBJECTIVES

1) To gain an appreciation for the broad developments in radiography technology and operation from film to digital, CR to
DR, and the implications. 2) To understand the major challenges to optimized radiography that can be addressed by physics
input and expertise.

ABSTRACT
Radiography continues to be the mainstay of medical imaging practice worldwide. The last 30 years have witnessed a number of major technological transitions in radiography, in particular from analogue to digital technologies, and from CR to DR. While these and newer advances have addressed a number of prior shortcomings, they have introduced new challenges. Image post-processing, for example, while praised as an asset of digital operation, has often been underutilized and suboptimal. This lecture aims to provide a historical perspective on these topics and to offer topics that worth the focus of the medical physics community.

**Sub-Events**

**RC621A**  
Radiography Perspective  
Ehsan Samei PhD (Presenter): Research Grant, Siemens AG Research Grant, General Electric Company Research Grant, Carestream Health, Inc

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**RC621B**  
Radiography 1.0  
A. Kyle Jones PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the testing philosophies, tests, and foci of current quality control programs in radiography. 2) Understand the motivation and basis for these current foci. 3) Investigate the limitations, shortcomings, and relevancy of these current foci in the modern radiography era.

**RC621C**  
Radiography 2.0  
Eric Laurence Gingold PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the likely changes in medical physics services for radiographic systems over the next 5-10 years. 2) Recognize the value of data logging capabilities of modern digital radiographic systems. 3) Understand how to utilize data to identify quality issues and recommend changes that can improve performance in digital radiography. 4) Understand how to employ modern image performance metrics to analyze image quality and assist facilities in optimizing the capabilities of radiographic systems. 5) Utilize modern process control methods to monitor stability.

**Active Handout**


**RC622**  
Uncertainties in Imaging for Radiation Oncology: Sources and Mitigation Techniques—Incorporation of Imaging as a Biomarker in RT

**Refresher/Informatics**

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

**Thu, Dec 4 8:30 AM - 10:00 AM  Location: S102C**

**Participants**

Moderator  
Robert Jeraj: Nothing to Disclose

**LEARNING OBJECTIVES**

1) Anatomical imaging in treatment response (RECIST, volumetrics). 2) PET in treatment response assessment (PERCIST etc) with uncertainties. 3) MRI in treatment response assessment. 4) Imaging biomarkers.

**Sub-Events**

**RC622A**  
Introduction to Biomarkers  
Robert Jeraj (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Imaging biomarkers and surrogate endpoints. 2) Prentice’s criteria vs real world. 3) Imaging biomarker characteristics. 4) Imaging biomarker validation and qualification.

**RC622B**  
PET Assessment/Uncertainties  
Stephen R. Bowen PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the advantages and disadvantages of PET/CT as a biomarker for radiation oncology. 2) Understand sources of bias and variance in PET/CT imaging, both in data acquisition and analysis. 3) Understand the limitations of functional PET/CT techniques currently being used to evaluate treatment effect.
MRI Assessment/Uncertainties

Edward F. Jackson PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the physical principles of functional MR techniques currently being used to evaluate treatment effect. 2) Understand selected applications of each of these techniques to the assessment of radiation therapy. 3) Understand current limitations of each of the techniques.

URL's

web.me.com/efjackson

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Minicourse: Current Topics in Medical Physics—Nuclear Cardiac Imaging for Physicists

Participants

Moderator
G. Donald Frey PhD : Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will understand the role of nuclear cardiology in the diagnosis of cardiac disease. 2) The participant will understand the role of the medical physicist in PET imaging of the heart. 3) The participant will understand the role of SPECT imaging of the heart.

Sub-Events

RC623A  Introduction

G. Donald Frey PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) The participant will have an overall orientation to the role of medical physics in nuclear cardiology.

ABSTRACT

This section of the course will provide an overall introduction

RC623B  SPECT Imaging of the Heart

Mark T. Madsen PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how cardiac SPECT studies are acquired. 2) Understand how cardiac SPECT studies are reconstructed and what corrections are required. 3) Understand how cardiac SPECT studies are analyzed. 4) Become familiar with cardiac SPECT instrumentation.

ABSTRACT

Cardiac SPECT is the most common nuclear medicine procedure and it contributes nearly 85% of the radiation dose associated with nuclear medicine imaging. In this presentation, the instrumentation and algorithms associated with cardiac SPECT will be reviewed. We begin with conventional general purpose SPECT systems that rely on parallel collimation along with the associated special purpose cardiac SPECT systems that are based on the conventional approach. Recent advances in SPECT instrumentation have made available cardiac systems that rely on novel collimation and detector systems and these will also be reviewed. SPECT reconstruction approaches will be discussed including methods for motion, scatter and attenuation correction. Commercially available resolution recovery software for improving image quality and potentially reducing patient dose will round out the presentation.

RC623C  PET Imaging of the Heart

Sameer Tipnis PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To understand the basic physics of cardiac PET imaging and the differences with cardiac SPECT. 2) To learn the proper way of acquiring data, including ECG gating, choice of bins, list mode data acquisition. 3) To understand the factors that affect image quality. 4) To learn tips for acquiring good clinical images. 5) To understand the role of dynamic PET imaging for determination of coronary flow reserve (CFR).
RC624

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

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Participants

Moderator
Herbert Y. Kressel MD: Royalties, Bayer AG

Jeffrey S. Klein MD (Presenter): Nothing to Disclose
Herbert Y. Kressel MD (Presenter): Royalties, Bayer AG

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 4) Detail how a reviewer can receive AMA PRA Category 1 CME credit for manuscript review

ABSTRACT

Peer review is, 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.

URL’s


Active Handout


RC625

Quantitative Imaging: Functional MRI (fMRI)

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Sub-Events

RC625A

Calibrated Blood Oxygenation Level Dependent (BOLD) fMRI

Rasmus Birn PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Know what physiological mechanisms link neuronal activity and the measured blood oxygenation level dependent (BOLD) fMRI signal. 2) Know the sources of variability in the amplitude of the BOLD fMRI signal across the brain and across individuals. 3) Be aware of current approaches to obtain more quantitative measures of neuronal activity with fMRI.

URL’s

http://mywebspace.wisc.edu/rbirn/web/

RC625B

More Quantitative fMRI Paradigms for Presurgical Mapping of the Visual System

Edgar A. Deyoe PhD (Presenter): Stockholder, Prism Clinical Imaging, Inc Board of Directors, Prism Clinical Imaging, Inc

LEARNING OBJECTIVES

1) Review the functional organization of the human visual cortex. 2) Become familiar with state-of-the-art methods for presurgical mapping of the visual system with fMRI. 3) Learn of new methods for visualizing and interpreting fMRI brain maps of the visual system. 4) Become aware of interpretational issues such as neurovascular uncoupling that can significantly affect interpretation in a presurgical mapping context.

ABSTRACT

The complexity of MRI technology and the wealth of new information it provides can leave clinicians hard pressed to stay abreast of the latest developments and applications, especially since the field continues to evolve at a brisk pace. The goal of this session will be to review clinically relevant aspects of fMRI methods and their use in mapping the visual system to aid diagnosis of vision-related CNS diseases and to assist treatment planning, delivery and followup. The session will include a review of fundamental organizational principles of the human visual system with an emphasis on those properties that may be particularly relevant for clinical applications. Some principles, such as retinotopic organization may be generally familiar, but the ability to map this organization in detail quantitatively in individual patients and its utility in specific clinical applications is likely to be novel. Unique methods will be described for visualizing this organization both within the brain and as it relates to the patient’s visual field and scotomata. The session will describe specific clinical applications of visual system mapping with fMRI and will present case studies.
to highlight such applications. Also, included is a description of methodology aimed at streamlining the clinical workflow and highlighting practical issues that should be considered to obtain high quality data with clinical patients. The overall goal is to show how it is possible to spend as little as 10 minutes of fMRI scan time yet obtain information that can be invaluable for diagnosis and treatment of patients with brain tumors, arteriovenous malformations, epilepsy and other pathologies that can impact central visual pathways.

**BOLD Cerebrovascular Reactivity Mapping as Applied to Brain Tumor fMRI**

**Jay J. Pillai** MD (Presenter): Medical Advisory Board, Prism Clinical Imaging, Inc

**LEARNING OBJECTIVES**

1) Understand the role of breath hold cerebrovascular reactivity (BH CVR) mapping in the assessment of neurovascular uncoupling potential. 2) Appreciate how neurovascular uncoupling may affect the reliability of BOLD fMRI activation maps. 3) Describe how BH CVR mapping can be performed in brain tumor patients.

**ABSTRACT**

The phenomenon of neurovascular uncoupling (NVU) is an important limitation of blood oxygen level dependent (BOLD) functional MRI (fMRI). One effective and practical method for assessment of risk of NVU is BOLD breath hold cerebrovascular reactivity (BH CVR) mapping. BH CVR mapping, similar to MR perfusion methods, allows assessment of regional hemodynamic impairment that may result in NVU and thus may lead to false negative activation on task-based sensorimotor or language fMRI that may be used for presurgical mapping in patients with brain tumors and other resectable brain lesions. However, unlike MR perfusion imaging, which assesses static or baseline perfusion to brain tumors and peritumoral regions, BOLD BH CVR mapping enables a dynamic assessment of cerebrovascular response, and its results can be applied to any task-based activation map. This lecture will describe the technique of BH CVR mapping, some of its strengths and limitations, and include cases in which interpretation of clinical fMRI exams has been affected by the additional information provided by these maps.

**RC627**

**Changing Radiologist-Hospital Relationships**

Refresher/Informatics

**Participants**

Moderator
Syed Furqan Zaidi MD : Nothing to Disclose
Jonathan Breslau MD (Presenter): Investor, BioIncept, LLC
Giles W. Boland MD (Presenter): Principal, Radiology Consulting Group

**LEARNING OBJECTIVES**

1) Identify changes in the relationship between hospitals and radiologists. 2) Learn about different models of radiology practice including employed, academic, private practice and their different relationships with hospitals. 3) Learn about evolving practice models for hospital based radiologists including co-management, pay for performance structures, and hybrid relationships in academic centers. 4) Learn about evolving compensation models away from traditional fee for service, including bundling, ACO's, and at-risk contracts.

**ABSTRACT**

The healthcare landscape in the US is changing rapidly with the pressures of healthcare reform and rising costs forcing consolidation and changes in relationships between hospitals and radiologists. Hospitals are looking for alignment with both their employed and private practice radiologists. Radiology groups are under additional pressures of competition within radiology between private practice, academic and national corporate radiology groups in a landscape of declining reimbursement and pressures on the traditional fee for service business model. This session aims to address ways that different types of radiology groups are facing the changing landscape. There will be different models presented including employed, academic, and private practice models. There will be examples presented on different contractual relationships evolving from the traditional exclusive radiology services contract including co-management and pay for performance structures. There will also be discussion of compensation models that may evolve within ACOs and other structures that hold providers accountable for the total cost of care.

**RC629**

**HCC Diagnosis Using LI-RADS (An Interactive Session)**

Refresher/Informatics

**Sub-Events**

**RC629A**

**MRI Features**

Benjamin M. Yeh MD (Presenter): Research Grant, General Electric Company Consultant, General Electric Company

**LEARNING OBJECTIVES**

1) Review underlying clinical scenarios that predispose patients to develop hepatocellular carcinoma. 2) Understand typical imaging appearances at MR imaging such that when characteristic imaging features are seen in the correct clinical setting, we can be certain that the diagnosis is hepatocellular carcinoma. 3) Describe variant features and secondary signs that are either suggestive of, or argue against, the...
diagnosis of hepatocellular carcinoma.

**RC629B**
**LI-RADS Principles**
Cynthia Sawhney Santillan MD (Presenter): Consultant, Robarts Clinical Trials Research Group

**LEARNING OBJECTIVES**
1) To familiarize radiologists with the current version of the Liver Imaging Reporting and Data System (LI-RADS) and its associated lexicon, atlas, and reporting recommendations. 2) To review the categories for liver observations in LI-RADS. 3) To demonstrate how to access and use the algorithm for determining the category of a liver observation.

**URL’s**
http://www.acr.org/Quality-Safety/Resources/LIRADS

**RC629C**
**LI-RADS Cases**
Reena Chetna Jha MD (Presenter): Consultant, CeloNova BioSciences, Inc

**LEARNING OBJECTIVES**
1) We will review LI-RADS categories, and criteria for classification by means of clinical cases. 2) Classic and atypical cases will be presented with audience participation to reinforce the LI-RADS algorithm.

**RC629D**
**Reporting LI-RADS Results**
Mustafa Rifaat Bashir MD (Presenter): Research support, Siemens AG Research support, Bayer AG

**LEARNING OBJECTIVES**
1) To discuss standards for liver lesion reporting, using the Liver Imaging Reporting and Data System (LI-RADS).

**ABSTRACT**
The Liver Imaging Reporting and Data System (LI-RADS) includes a reporting template for contrast-enhanced CT and MRI, and minimum reporting standards. This talk will discuss those reporting standards and provide tips for clear and concise reporting.

**RC631**
**Tumor Ablation beyond the Liver: Practical Techniques for Success (How-to Workshop)**

**Refresher/Informatics**

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

**Thu, Dec 4 8:30 AM - 10:00 AM Location: SS02AB**

**Participants**
Debra Ann Gervais MD (Presenter): Research Grant, Covidien AG
Terrance T. Healey MD (Presenter): Nothing to Disclose
Anil Nicholas Kurup MD (Presenter): Nothing to Disclose
Muneeb Ahmed MD (Presenter): Nothing to Disclose

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

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

**RC632**
**Value-Added Initiatives for a Healthcare System**

**Refresher/Informatics**

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

RC632A  Understanding Total Value Creation in Radiology
Richard Elliott Heller MD (Presenter): Consultant, Gerson Lehrman Group, Inc

LEARNING OBJECTIVES

1) Understand the difference between interpretive value and non-interpretive value and the concept of the Total Value Equation. 2) Understand how to illustrate where on the Operations Frontier Curve your practice or department wishes to place itself, and where you think you actually are. 3) Based on the above two objectives, be able to identify potential areas of improvement in your staffing model. (This course is part of the Leadership Track)

ABSTRACT

The term 'value' is popular in health care, and while universally understood to be critical to success, it is also a concept that is complex and can be challenging to evaluate. This talk analyzes the idea of value and value creation in the radiology department, and uses the Total Value Equation as a framework to deconstruct the activities of the department into interpretive and non-interpretive. By understanding these ideas, the radiology practice leader is better able to manage their resources and maximize their value production.

RC632B  Imaging Informatics
Keith J. Dreyer MD,PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Develop an understanding of the essential Informatics skills required for a leader to be successful. 2) Develop an understanding of the common Informatics errors made by leaders in academic and private practices. 3) Acquire the skills of Informatics planning needed to ensure that the success of your organization is sustainable over time. (This course is part of the Leadership Track)

RC632C  Radiology's Impact on the Hospital's Bottom Line
Bernard F. King MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify methods to derive meaningful financial and clinical metrics and analytics demonstrating how Radiology contributes to the bottom line (tangible added value). 2) Developing departmental dashboards supporting HealthCare system balanced score cards etc. 3) Identify methods for improving imaging report turn around times to support initiatives to decrease hospital length of stays thus improving bottom line. (This course is part of the Leadership Track)

RC650

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

Refresher/Informatics

LEARNING OBJECTIVES

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

ABSTRACT

Pre- and Postbiopsy Assessment
Richard Silberglet MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Be familiar with all required aspects of the pre-biopsy work-up, including medications, laboratory values, and review of relevant prior imaging. 2) Be familiar with solutions to address to complications or other unexpected events which may arise during the course of spine biopsy. 3) Be comfortable in performing the post procedure assessment of the patient after spinal biopsy.
Equipment Used for Image-guided Biopsies of the Spine
Michele Hackley Johnson MD (Presenter): Committee member, Boston Scientific Corporation

LEARNING OBJECTIVES

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

Thoracic and Lumbar Biopsies
John L. Go MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

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

Cervical Spine Biopsies
A. Orlando Ortiz MD, MBA (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

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

ABSTRACT

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

Disc Biopsy and Aspiration
Amish H. Doshi MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Disc Biopsy and Aspiration
Amish H. Doshi MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify basic skills, techniques, and pitfalls of freehand invasive sonography. 2) Discuss and perform basic skills involved in thermal tumor ablation in a live learning model. 3) Perform specific US-guided procedures to include core biopsy, abscess drainage, vascular access, cyst aspiration, soft tissue foreign body removal, and radiofrequency tumor ablation. 4)
ABSTRACT

The acceptance of the risks associated with radiation is conditional on the benefits to be gained from the use of radiation. The risks must be restricted and protected against by the application of radiation safety standards. A significant part of the challenge of patient dose management in CT arises from the fact that over-exposure in CT is frequently not detected. In contrast to film-based radiography where overexposure results in a dark image, increasing dose in CT and in other digital imaging techniques results in images with: (1) less noise (improved visual appearance) and (2) fewer streak artifacts, (3) although not necessarily with greater diagnostic information. Image quality in CT often exceeds the clinical requirements for diagnosis. It is critical to have a thorough understanding of the basics of radiation dose in CT before we explore the multiple issues around opportunities to reduce these dose parameters. Furthermore, it is also critical to comprehend the role of newer technologies, innovations, and developments that are rapidly taking place to address radiation dose reduction in CT - both on the vendor as well as on the private and academic communities. A through and comprehensive understanding of the quality and patient safety issues around this is also critical to making sound decisions around imaging on multiple levels. Different organs have different sensitivities to radiation. Tissue Weighted Factor, WT takes into account the risk to the person exposed to radiation that is not uniform over the entire body. As an example, if 1 mSv is received only by the lungs, this results in an effective dose to that person of 0.12 mSv. This means that 1 mSv received by the lungs poses approximately the same risk as 0.12 mSv to the entire body. Fundamentals such as these will be presented in easily digestible chunks in the refresher course. Also covered will be Protocol Optimization, Scanner Interfacing, Data Connectivity and Interoperability.

LEARNING OBJECTIVES

1) Number of CT scans is increasing annually. 2) Wider adoption/availability of CT scanners. 3) Indications for CT use are increasing (without possible consideration for risks). 4) Rapid increase in number of protocols: Varying equipment leading to protocol variance. A thorough outline of patient-centric approach to dose optimization will be covered, as well as data mining dose data for improved quality, safety, and outcomes.

Before the Scan: Optimizing Dose before the Patient Is On the Table

LEARNING OBJECTIVES

1) Number of CT scans is increasing annually. 2) Wider adoption/availability of CT scanners. 3) Indications for CT use are increasing (without possible consideration for risks). 4) Rapid increase in number of protocols: Varying equipment leading to protocol variance. A thorough outline of patient-centric approach to dose optimization will be covered, as well as data mining dose data for improved quality, safety, and outcomes.

ABSTRACT

The acceptance of the risks associated with radiation is conditional on the benefits to be gained from the use of radiation. The risks must be restricted and protected against by the application of radiation safety standards. A significant part of the challenge of patient dose management in CT arises from the fact that over-exposure in CT is frequently not detected. In contrast to film-based radiography where overexposure results in a dark image, increasing dose in CT and in other digital imaging techniques results in images with: (1) less noise (improved visual appearance) and (2) fewer streak artifacts, (3) although not necessarily with greater diagnostic information. Image quality in CT often exceeds the clinical requirements for diagnosis. It is critical to have a thorough understanding of the basics of radiation dose in CT before we explore the multiple issues around opportunities to reduce these dose parameters. Furthermore, it is also critical to comprehend the role of newer technologies, innovations, and developments that are rapidly taking place to address radiation dose reduction in CT - both on the vendor as well as on the private and academic communities. A through and comprehensive understanding of the quality and patient safety issues around this is also critical to making sound decisions around imaging on multiple levels. Different organs have different sensitivities to radiation. Tissue Weighted Factor, WT takes into account the risk to the person exposed to radiation that is not uniform over the entire body. As an example, if 1 mSv is received only by the lungs, this results in an effective dose to that person of 0.12 mSv. This means that 1 mSv received by the lungs poses approximately the same risk as 0.12 mSv to the entire body. Fundamentals such as these will be presented in easily digestible chunks in the refresher course. Also covered will be Protocol Optimization, Scanner Interfacing, Data Connectivity and Interoperability.

During the Scan: Patient-Centric Imaging

LEARNING OBJECTIVES

View learning objectives under main course title.

After the Scan: Data-Mining Dose Data for Improved Quality, Safety, and Outcomes
Health IT Incentive Programs: Experience from Private Radiology Practices

**LEARNING OBJECTIVES**

1. Learn options for radiologists to approach Health IT Incentives (Meaningful Use).
2. Understand mechanics to attest for Health IT Incentives (Meaningful Use Stages 1 and 2).
3. Understand the future for radiology and Health IT Incentives Programs.

**ABSTRACT**

Governmental Health IT Incentives such as Meaningful Use of electronic health records are dramatically changing healthcare and radiology. This session focuses on their effect on private practice radiologists. Speakers will demonstrate the spectrum of approaches to Meaningful Use, from full radiology implementation to the temporary 'opt-out' choice. New this year is a high-level ONC (Office of the National Coordinator) perspective on current and future Health IT Incentives and how they may affect radiologists.

**Practical Informatics for the Practicing Radiologist: Part One (In conjunction with the Society for Imaging Informatics in Medicine)**

**LEARNING OBJECTIVES**

1. Define and describe the fundamental components of imaging informatics in a very practical and easy-to-understand way.
2. Understand methods to minimize distraction and reporting time when using speech recognition and structured reporting.
3. Understand the history and basic principles of business analytics.

**ABSTRACT**

Understanding how the basic systems in a radiology department interact to provide complete workflow is an important building-block for radiologists interested in informatics. This presentation will outline the RIS, PACS, and Voice recognition systems and illustrate how they interact as we follow a patient through the radiology department.

**Challenges in Enterprise Imaging**

**LEARNING OBJECTIVES**

1. Describe the concept of an enterprise imaging archive.
2. Describe the differences between DICOM-based imaging and non-DICOM-based imaging.
3. Identify the unique challenges associated with incorporating non-DICOM images into an enterprise imaging archive.

**ABSTRACT**

Over the past 20 years, the field of radiology has built an impressive digital infrastructure, automating
many portions of the imaging process from the time of order entry through image distribution. With the advent of small, low-cost, high quality digital cameras, other medical specialties have turned to imaging to visualize and document disorders yet, they have not implemented the same type of digital infrastructure as radiology. Today, thousands of medical images are obtained in hospitals each day. With the increasing reliance on imaging, there is a greater need to build systems and processes to obtain, store, and distribute these images across the enterprise so that health care providers can better care for their patients. Even though many of these problems have been solved in radiology, the solutions are not easily transferred to other specialties due to the differences in imaging hardware and the image acquisition workflow. The purpose of this talk is to describe the problems facing hospitals as they begin to build enterprise imaging archives and to discuss potential solutions to these problems.

RCC51C
The Road Ahead in Radiology Informatics
Paul G. Nagy PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Discuss the current state of market penetration of RIS and PACS in the US. 2) Identify several commercial areas of innovation in the RIS. 3) Illustrate a model for a practice to assess how competitively they are leveraging informatics.

V瑟51
Emergency Radiology Series: Contemporary and (Sometimes) Controversial Topics in Imaging of Trauma

Series Courses

ARRT Category A+ Credits: 4.00
Thu, Dec 4 8:30 AM - 12:00 PM Location: S405AB

Participants
Moderator
Clint W. Sliker MD : Nothing to Disclose
Mariano Scaglione MD : Nothing to Disclose
Ferco H. Berger MD : Nothing to Disclose

Sub-Events
VSER51-01 Imaging of the Polytrauma Patient: Role of Whole-Body CT
Savvas Nicolaou MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Appreciate the rationale for Whole Body Imaging in assessing the polytrauma patient. 2) Compare advantages of whole body versus segmental MDCT protocol. 3) Demonstrate significance of arterial and portal venous phase imaging in the setting blunt abdominal trauma (BAT), and the role of whole body imaging in the setting of BAT. 4) Understand and review strategies for reducing radiation exposure. 5) Discuss strategies and techniques for optimization of whole body imaging protocols in the trauma setting. 6) Discuss Future Directions to allow bridging of anatomy and function.

VSER51-02 Are We Missing Traumatic Bowel and Mesenteric Injuries?
Bret Allan Landry MD (Presenter): Nothing to Disclose, Samir Faidi MD, FR CPC : Nothing to Disclose, Angela Coates MD : Nothing to Disclose, Michael Nathan Patlas MD, FR CPC : Nothing to Disclose

PURPOSE
Traumatic bowel and mesenteric injury (TBMI) is an uncommon entity that can be lethal if not detected and treated in a timely manner. The purpose of our study was to evaluate the diagnostic accuracy of 64MDCT for the detection of TBMI in patients at our level 1 trauma centre.

METHOD AND MATERIALS
We used our hospital’s trauma registry to identify patients with a diagnosis of TBMI from January 1, 2006 to June 30, 2013. Only patients who had a 64MDCT scan at presentation and subsequently underwent laparotomy/laparoscopy were included in the study cohort. Using the surgical findings as the gold standard, the accuracy of prospective radiology reports was analyzed.

RESULTS
Of the 4781 trauma patients who presented to our institution, 44(0.9%) had surgically proven TBMI. 22/44 were excluded as they did not have MDCT before surgery. The study cohort consisted of 14 males and 8 females with a median age of 41.5 years and a median Injury Severity Score of 27. 17/22 had blunt trauma and 5/22 had penetrating injury. A correct preoperative imaging diagnosis of TBMI was made in 14/17 of patients. The overall sensitivity of the radiology reports was 63.6% (95% CI: 41-82%), specificity was 79.6 % (95% CI: 67-89%), PPV was 53.9% (95% CI: 33 -73 %) and NPV was 85.5% (95% CI: 73-94 %). The accuracy was 90.5%. However, only 59 % (10/17) of patients with blunt injury had a correct preoperative diagnosis. Review of the findings demonstrated that majority of patients with missed blunt TBMI (5/7) demonstrated only indirect signs of injury.

CONCLUSION
The detection of TBMI in trauma patients on 64MDCT can be improved, especially in patients presenting with blunt injury. Missed cases in this population occurred because the possibility of TBMI was not
A Risk-Benefit Analysis of Adding an Arterial-Phase CT Abdomen When Evaluating for Splenic Trauma

**PURPOSE**

To quantify the risks and benefits of changing CT protocol in the ED/trauma setting to include an arterial phase CT of the abdomen.

**METHOD AND MATERIALS**

Several recent studies have demonstrated increased sensitivity for identifying contained splenic vascular injury (ie pseudoaneurysm and arteriovenous fistula formation) in trauma patients by the addition of arterial-phase CT abdominal imaging. However, the overall risk-benefit ratio is not known. Using published data, we quantified the number of previously undiagnosed cases of contained splenic vascular injury in trauma patients age 15 and older, as well as the number of patients for whom management would change and the number of new cancer cases induced by the increased radiation dose. During sensitivity analysis, supplemental data from a level 1 trauma center was used to help identify patient subgroups with a more favorable risk-benefit ratio.

**RESULTS**

The number needed to scan to identify one new case of contained vascular injury was 182, to change management in one patient was 255, and to induce one new cancer was 3,584. Increased dose length product (DLP) resulted in higher cancer induction risk, but this risk was relatively small and did not result in more cancer cases caused than new vascular injury cases detected over a range of normal DLP values. Analysis using the age distribution of trauma patients at our institution and an age-dependent cancer product (DLP) resulted in higher cancer induction risk, but this risk was relatively small and did not result in more cancer cases caused than new vascular injury cases detected over a range of normal DLP values.

**CONCLUSION**

The addition of an arterial phase CT abdomen to a trauma protocol for the assessment of contained splenic vascular injury has a favorable risk-benefit ratio across a range of typical DLP values.
CLINICAL RELEVANCE/APPLICATION
The addition of an arterial phase CT abdomen to a trauma protocol for the assessment of contained splenic vascular injury has a favorable risk-benefit ratio across a range of typical DLP values.

V瑟51-05  Blunt Aortic Injury: Still an Enigma
Kathirkamanathan Shanmuganathan MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Demonstrate the spectrum of traumatic aortic injury: typical, atypical and minimal injury. 2) Discuss the role of imaging and treatment of traumatic aortic injury.

V瑟51-06  Utility of the CT Severity Index for Determining the Outcome of Embolization as Primary Therapy for Severe Blunt Splenic Trauma with Splenic Injury
Armonde Baghdanian MD (Presenter): Nothing to Disclose, Brian Michael Currie BS : Nothing to Disclose, Artifur Baghdanian MD : Nothing to Disclose, Christina Alexandra Lebedis MD : Nothing to Disclose, Stephan W. Anderson MD : Nothing to Disclose, Jorge A. Soto MD : Nothing to Disclose, Anthony Samuel Armetta MD : Nothing to Disclose

PURPOSE
To determine if the CT Severity Index predicts the need for subsequent splenectomy in patients who undergo splenic artery embolization as the primary therapy of severe blunt splenic injuries.

METHOD AND MATERIALS
This retrospective study was HIPAA compliant and IRB approved with waiver of informed consent. Twenty-five adult blunt splenic trauma evaluated with abdominal CT between 1/1/2006 and 1/31/2013 who subsequently underwent and survived splenic artery embolization were included. The study population included 19 male and 6 female patients. Two radiologists retrospectively and independently reviewed the CT images and classified splenic injuries using the CT Severity Index: intraperitoneal active extravasation (grade 4b), intrasplenic vascular injury (grade 4a) and no vascular injury (grades 2 or 3). Another investigator reviewed the electronic medical records and documented whether or not each patient required splenectomy for definitive therapy. Two-tailed Fisher’s exact test was used to evaluate the association between the admission CT severity index and the success rate of splenic embolization as primary therapy (defined by stable patient discharge without the need for surgical splenectomy).

RESULTS
CT severity Indices: grade 4b (n=13), grade 4a (n=9), grade 3 (n=2) and grade 2 (n=1). Of the 25 patients, 21 recovered with no additional intervention and were determined to have a successful outcome: Ten with grade 4b, eight with grade 4a and three with grades 2 or 3. Four patients required splenectomy and the embolization procedure was deemed a failure: three with grade 4b and one with grade 4a. Thus, 19/13 (77%) patients with grade 4b and 11/12 (92%) patients with grade 2 to 4a injuries had successful embolization procedures as primary therapy. This difference was not statistically significant (p >.05).

CONCLUSION
The majority of patients with blunt splenic injury can be treated with arterial embolization and will not require a splenectomy. This includes patients with intraperitoneal active extravasation (CT severity index grade 4b).

CLINICAL RELEVANCE/APPLICATION
Embolization can be used to successfully treat all types of vascular injuries in the spleen caused by blunt trauma, including free extravasation of contrast-enhanced blood into the peritoneal cavity.

V瑟51-08  MDCT of Blunt and Penetrating Diaphragmatic Injuries
Felipe Munera MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To discuss the role of MDCT in patients with blunt and penetrating diaphragmatic injuries. 2) Review the MDCT findings of diaphragmatic injuries. 3) Describe potential pitfalls.

ABSTRACT
Diaphragmatic Injuries remain a challenging diagnosis with potential catastrophic delayed complications. A high degree of suspicion in every case of severe blunt thoracoabdominal trauma or penetrating thoracoabdominal injury is essential. This presentation will provide a practical tutorial for radiologists hoping to improve their interpretive accuracy for both blunt and penetrating DIs. The CT signs of diaphragmatic injuries will be explained. A number of instructive cases will be presented, including frequent diagnostic pitfalls.

V瑟51-09  Analysis of Diaphragmatic Motion Artifacts in Ultra High-Pitch Dual Source Computed Tomography of the Thorax in Trauma Patients
Teresa I-Han Liang MD (Presenter): Nothing to Disclose, Patrick McLaughlin FFR(RCSI) : Nothing to Disclose, Chesnal Dey Arepalli MD : Nothing to Disclose, Patrick McLaughlin FFR(RCSI): Nothing to Disclose, Luck Jan-Luck Louis MD : Nothing to Disclose, Ana-Maria Bilawich MD : Nothing to Disclose, John R. Mayo MD : Speaker, Siemens AG, Savvas Nicolaou MD : Nothing to Disclose

PURPOSE
Diaphragmatic injuries have a marked impact on the management and prognosis of trauma patients. Motion artifacts may obscure diaphragm injuries during CT of trauma patients with low Glasgow Coma Scale scores. The authors present a novel methodology to decrease the impact of motion artifacts on diaphragmatic evaluation in high-contrast, high-pitch dual source computed tomography.

ABSTRACT
Due to the rapid advancement in dual source computed tomography (CT) technology, there is an increasing trend of using high-pitch CT protocols in trauma. However, the diaphragm and the diaphragmatic peritoneal surfaces are situated in the periphery and are affected by respiratory motion. This study evaluates the significance of respiratory motion artifacts on CT images of the diaphragm and the diaphragmatic peritoneal surfaces in trauma patients using high-pitch dual source CT technology and recommend an improved method to minimize motion artifacts. The authors present a novel methodology to decrease the impact of motion artifacts on diaphragmatic evaluation in high-contrast, high-pitch dual source CT.
Scale (GCS) scores or those who are intubated and ventilated. CT acquisition times are dramatically reduced by using dual source ultra-high pitch (DS-UHP) as compared with conventional single source (SS) protocols. The purpose of this study was to evaluate diaphragmatic motion on simultaneously acquired DS-UHP and SS CT scans in trauma patients.

METHOD AND MATERIALS
Seventy-five consecutive trauma patients who presented to a level one trauma centre over a 6 month period scanned with a standardized trauma protocol including both DS-UHP chest (pitch = 1.7-3.2) and SS abdominal CT scans (pitch =0.6) were reviewed retrospectively. Subjective analysis of diaphragmatic motion was performed in consensus by two readers using a 4 point likert scale in 7 regions of the diaphragm on coronal 3mm and axial 1mm-3mm slices. An overall confidence score to exclude a diaphragmatic tear based on all coronal and axial images available was also determined (1 to 10, 10 being completely confident and 1 being impossible to exclude). Wilcoxon Rank Sum tests were used for statistical analysis and p < 0.05 was considered significant.

RESULTS
The mean overall confidence score for the DS-UHP was 9.85, which was significantly better than the mean score of 7.66 for SS images (p < 0.0001). The scores for diaphragmatic motion on coronal and axial images were significantly better for DS-UHP images in all areas when compared individually (p < 0.0001). Additionally, utilizing the overall coronal image scores, the subjective diaphragmatic motion was significantly less in the DS-UHP images than the SS images (p < 0.0001).

CONCLUSION
Ultra high-pitch is advantageous as it allows for better evaluation of diaphragmatic structures by minimizing motion artifacts on images of freely breathing trauma patients.

CLINICAL RELEVANCE/APPLICATION
An ultra high-pitch dual source mode is valuable in trauma patients who are unable to breath-hold as it allows minimization of motion artifacts of the diaphragm as compared with conventional single source reconstructions.

Are We Missing Traumatic Diaphragmatic Rupture?

Vincent Andrew Leung MD (Presenter): Nothing to Disclose, Susan Reid MD, FRCPC : Nothing to Disclose, Angela Coates MEd : Nothing to Disclose, Michael Nathan Patlas MD, FRCPC : Nothing to Disclose

PURPOSE
Traumatic diaphragmatic rupture (DR) is an uncommon injury that can be lethal if not detected and treated in a timely manner. The purpose of our study was to evaluate the diagnostic accuracy of 64MDCT for the detection of DR in patients at our level 1 trauma centre.

METHOD AND MATERIALS
We used our hospital’s trauma registry to identify patients with a diagnosis of DR from January 1, 2008 to December 31, 2012. Only patients who had a 64MDCT scan at presentation and subsequently underwent laparotomy/laparoscopy were included in the study cohort. Using the surgical findings as the gold standard, the accuracy of prospective radiology reports was analyzed.

RESULTS
Of the 3225 trauma patients presented to our institution, 38(1.2%) had a DR. Fourteen of the 38 were excluded as they did not have MDCT pre-surgery. The cohort consisted of 20 males and 4 females with a median age of 34.5 years and a median Injury Severity Score of 26. Fifteen had a blunt trauma while 9 had a penetrating injury (PI). The overall sensitivity of the radiology reports was 66.7% (95% CI: 44.7-84.3%), specificity was 100% (95% CI: 94-100%), PPV was 100% (95% CI: 79.2-100%) and NPV was 88.4 (95% CI: 78.4-94.8%). The accuracy was 91%. However, only 3/9 with PI (33%) had a correct preoperative diagnosis. Most of the missed cases (4/6) had only indirect signs of injury.

CONCLUSION
The detection of DR in trauma patients on 64MDCT can be improved, especially in patients presenting with PI. Most missed cases occurred because the possibility of DR was not raised despite the presence of indirect evidence.

CLINICAL RELEVANCE/APPLICATION
The prospective diagnosis of DR remains challenging despite advances in CT technology and widespread use of 64MDCT.

CTA of Blunt and Penetrating Peripheral Vascular Injuries

Scott David Steenburg MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Describe the optimal CTA imaging protocol for the evaluation of suspected peripheral vascular injuries. 2) Identify the various imaging manifestations of peripheral vascular injuries. 3) Recognize CTA limitations and pitfalls in the diagnosis of peripheral vascular injuries. 4) Recognize when further evaluation with catheter angiography or surgical exploration are required.

Active Handout
**VSER51-12**  
*Predicting Mortality from Hypovolemic Shock Complex in the Polytrauma Setting*  
David Tso MD (Presenter): Nothing to Disclose, Jennifer Wang BS: Nothing to Disclose, Patrick McLaughlin FFR(RCSI): Nothing to Disclose, Savvas Nicolaou MD: Nothing to Disclose

**PURPOSE**  
This study examined how the constellation of radiological findings seen in hypovolemic shock complex on a Multi-Detector Computed Tomography (MDCT) scan correlate with survival of polytrauma patients.

**METHOD AND MATERIALS**  
A retrospective study design was undertaken examining patients involved in severe blunt trauma with an Injury Severity Score (ISS) $\geq 16$ who were admitted to the emergency department (ED) at a Level I Trauma Center between July 2011 and June 2013. Patients underwent a standardized multi-phasic whole body MDCT protocol obtained from a single CT scanner located within the ED. Radiological findings of hypovolemic shock were identified from the scan including vascular and non-vascular findings. Radiological variables were correlated with clinical and 30-day mortality data.

**RESULTS**  
50 patients were identified, of which 17 died and 33 survived their injuries. The mortality cohort had lower Glasgow Coma Score (GCS) (6.0 vs. 11.0, $p<0.01$).

**CONCLUSION**  
Small caliber of the great vessels and decrease perfusion of the spleen and renal medulla were seen in the mortality group. Contrast enhancement of the left ventricular chamber was greater in the mortality cohort which may be a novel indicator of low cardiac output or increase in systemic vascular resistance in the context of hypovolemic shock.

**CLINICAL RELEVANCE/APPLICATION**  
Quantitative analysis of left ventricular chamber enhancement, diameter of the great vessels, and spleen and renal medulla enhancement on multi-phasic whole body MDCT scans may identify polytrauma patients at risk of death.

**VSER51-13**  
*The Effect of Soft Tissue Damage Volume on Systemic Inflammation and Organ Failure in Multiple Injury Patients*  
Scott David Steenburg MD (Presenter): Nothing to Disclose, Travis Frantz: Nothing to Disclose, Todd McKinley MD: Nothing to Disclose, Greg Gaski MD: Nothing to Disclose

**PURPOSE**  
The Systemic Inflammatory Response Syndrome (SIRS) can lead to organ failure and death in multiply injured patients (MIPs). SIRS results primarily from an immune response to endogenous molecules thought to be liberated from damaged tissue. However, it is not known how the magnitude of tissue injury affects systemic inflammation and organ dysfunction. It is plausible that certain tissues are more prone to release of inflammatory mediators leading to SIRS, and that the magnitude of soft tissue injury may correspond with the degree of systemic inflammation and subsequent organ dysfunction. The purpose of this study was to determine how the total volume of soft tissue damage, as quantified on admission whole body CT scan, correlates with the magnitude of inflammation and organ dysfunction in MIPs.

**METHOD AND MATERIALS**  
Clinical data from 51 MIPs (ISS $\geq 18$, age 18-65), admitted to the ICU for a minimum of 6 days, were used to calculate daily SIRS scores (0 to 4) and daily Sequential Organ Functional Assessment scores (SOFA; 0 - 24). The Soft Tissue Damage Volume Score (STDVS) was calculated by combining the volumetric measurements of all soft tissue injuries (extravascular blood products) in each patient as measured on admission whole body CT scans. Regression analyses evaluated correlations between STDVS and both SIRS and SOFA scores.

**RESULTS**  
The results demonstrate two distinct patient populations; those at High Risk and those at Low Risk for subsequent inflammation and organ dysfunction. The average SIRS score vs STDVS slope was 10.5x higher in high risk patients (Fig 1, $p<0.01$) and average SOFA scores vs STDVS slope was 6.14X higher in high risk patients ($p<0.01$). There is a linear relationship between the STDVS and the SIRS and SOFA scores for these two patient populations.

**CONCLUSION**  
The magnitude of systemic inflammation and organ dysfunction is a function of STDVS. These results demonstrate a dichotomous response of how MIPs tolerate soft tissue damage, suggesting that some patients are at higher risk of systemic inflammation than others.

**CLINICAL RELEVANCE/APPLICATION**  
STDVS as calculated on admission CT may serve as a potential clinical tool for predicting systemic inflammation and organ dysfunction during the recovery process. Further investigations are required to elucidate the underlying pathophysiologic pathways for how soft tissue damage causes inflammation and organ dysfunction in MIPs.

**VSER51-14**  
*Streamlining Emergent Hand and Wrist Radiography*  
Henry Chou MD (Presenter): Nothing to Disclose, Scott David Steenburg MD: Nothing to Disclose, Jeffrey William Dunkle MD: Nothing to Disclose, Sean D. Gussick MD: Nothing to Disclose, Matthew James Petersen MD: Nothing to Disclose, Marc D. Kohli MD: Research Grant, Koninklijke Philips NV Research Grant, Siemens AG, Changyu Shen PhD: Nothing to Disclose, Hongbo Lin MS: Nothing to Disclose

**PURPOSE**  
Physicians often order both a three-view study of the hand and four-view study of the ipsilateral wrist.
Physicians often order both a three-view study of the hand and four-view study of the ipsilateral wrist following hand and/or wrist injury. Because hand radiographs include visualization of the carpus, we set out to determine whether a modified study using fewer wrist radiographs performs comparably to the traditional hand and wrist series in the evaluation of acute hand and wrist abnormalities.

**METHOD AND MATERIALS**

This retrospective study was approved by the institutional review board, and the need to obtain informed consent was waived. Two hundred forty patients (50% male; age range 18-92y) with unilateral three-view hand (posteroanterior, oblique, and lateral) and four-view wrist (posteroanterior, oblique, lateral, and ulnar deviation) radiographs obtained concurrently in the emergency setting were included in this study. Four experienced emergency radiologists, blinded to the original report and clinical records, interpreted the original seven images. The patients' radiographs were then recombined to include only the three hand images and a single ulnar deviated wrist view. These were interpreted by the same radiologists following an eight week delay and in random sequence to reduce memory bias. Two radiologists independently evaluated each patient's studies. Data analysis was performed using kappa statistics to measure agreement between the seven- and four-view image interpretations.

**RESULTS**

A total of 479 reports were generated in each of the seven- and four-view image sets, with 142 (29.6%) of the seven-view and 125 (26.1%) of the four-view reports conveying certain or suspected acute osseous findings. Statistical analysis yielded an average inter-method kappa coefficient of 0.818 for the four radiologists, which represents strong agreement between the seven- and four-view interpretations.

**CONCLUSION**

The modified four-view hand and wrist radiographic series produces diagnostic results comparable to the traditional hand and wrist series in the acute clinical setting.

**CLINICAL RELEVANCE/APPLICATION**

A modified four-view hand and wrist radiographic study is effective for assessing acute hand and wrist injury while reducing cost, time, and radiation dose.

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**VSIR51**

**Interventional Series: Peripheral and Visceral Occlusive Disease**

**Series Courses**

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Thu, Dec 4 8:30 AM - 12:00 PM  Location: N226

**Participants**

Moderator
Parag J. Patel MD : Consultant, Medtronic, Inc Consultant, C. R. Bard, Inc Consultant, Cook Group Incorporated Speakers Bureau, Medtronic, Inc Consultant, Penumbra, Inc

**LEARNING OBJECTIVES**

1) Describe recent evidence concerning the use of renal denervation for malignant hypertension. 2) Explain the use of radial artery access. 3) Outline 3 recommendations for endovascular treatment of peripheral vascular disease. 4) List two important studies published on vascular disease in the past year. 5) Describe 2 uses of stent grafts.

**Sub-Events**


Marcelo Guimaraes (Presenter): Consultant, Cook Group Incorporated Consultant, Baylis Medical Company Consultant, Terumo Corporation Patent holder, Cook Group Incorporated

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**VSIR51-02**  Limitations and Complications of Trans-brachial Arterial Access for Endovascular Treatment of the Peripheral Vasculature: A Contemporary and Prospective Comparison to Trans-femoral Access

Karla Maria Treitl MD (Presenter): Nothing to Disclose, Maximilian F. Reiser MD : Nothing to Disclose, Marcus Treitl MD : Nothing to Disclose

**PURPOSE**

Trans-brachial (TB) access for intervention is still believed to be dangerous, despite its advantages for the interventionalist and patient. The Aim of the study was to prospectively assess current limitations and complication rates of the TB access technique for endovascular treatment of peripheral vascular pathologies in comparison to the trans-femoral (TF) access technique for the first time.

**METHOD AND MATERIALS**

In total, 300 patients (202 m; age 68.7 ± 11.0yrs) with arterial occlusive disease underwent endovascular therapy via a TB or TF access. Peri-procedural data (sheath size, dose area product, fluoroscopy examination time) were analyzed. Post-procedural complications of the puncture sites were categorized as minor (local hematoma, pseudoaneurysm, embolization, dissection, minor bleeding) and major (thrombotic occlusion, hematoma requiring surgery, major bleeding, nerve injury) and analyzed by the
RESULTS
The minor and major complication rates of both groups did not significantly differ (21/14.0% vs. 26/17.3%; P=0.26; 4/2.7% vs. 3/2.0%; P=0.50). The dose area product and the fluoroscopy time were significantly higher in the TB group (12752.1 ± 9524.5 cGycm² vs. 6073.2 ± 6568.5 cGycm²; P=0.00; 24.3 ± 18.4 min vs. 18.9 ± 12.6 min; P=0.01), though examination times were comparable (121.8 ± 48.9 min vs. 125.0 ± 44.2; P=0.57).

CONCLUSION
Results and complication rates of the TB-access are comparable to the TF-access for endovascular treatment of target lesions in peripheral or visceral artery occlusive disease, making it a safe and important alternative to TF access in selected cases. It is associated with a higher radiation exposure.

CLINICAL RELEVANCE/APPLICATION
• Alternative access routes than the TF approach are necessary with increasing complexity of peripheral vascular disease or for certain peripheral artery targets • Puncture of the brachial artery is believed to have a higher risk for long term complications like nerve injury or vessel occlusion • Prior studies lack a direct comparison of TB and TF access complications and / or lack a standardized follow-up • In this prospective and comparative observation: o the minor and major complications rates of TB and TF access are comparable o the TB access leads to a higher radiation exposure o the TF access still is a valid alternative in patients, who cannot be examined or treated trans-femorally

VSIR51-03
Long-term Results after Balloon Angioplasty of the Crural Arteries: Which Variables Influence Limb Salvage and Patient Survival?
Inge Kaare Tesdal MD (Presenter): Nothing to Disclose, Christian Krzemien MD: Nothing to Disclose
Christel Weiss: Nothing to Disclose

PURPOSE
To evaluate the technical and clinical success rates, procedure-related complications, and long-term results for patients who underwent angioplasty of the crural arteries.

METHOD AND MATERIALS
Retrospectively we evaluated all patients who underwent angioplasty of the crural arteries due to critical chronic limb ischemia or severe claudication in the time period from 1/2002 to 12/2005. These patients were contacted in the time period from 1/2009 to 12/2010, and a follow-up examination including angiography was performed or telephone interviews were conducted with patients, relatives and referring doctors for follow-up. The primary end points were the limb salvage rate and patient survival rate. The secondary end points included the complication rate, technical success rate, and patency rate. The prognostic relevance of treatment and selected variables with respect to limb salvage and patient survival were analyzed with multiple logistic regression

RESULTS
212 patients with a mean age of 77.8 years (99 women and 113 men) underwent crural angioplasty on 239 limbs, 78 patients (32.6%) suffered from severe claudication (Rutherford category 3) and all others had critical chronic limb ischemia (category 4 to 6, resp. Fontaine-stage 3 and 4). The technical success rate was 98.4% and the complication rate (SIR classification) was 9.1% (5.2% major). After a mean follow-up of 3.7 years, 48 patients (22.6%) experienced minor- or major-amputation on 53 legs (22.2%). The limb salvage rate (Kaplan-Meier estimation) was 85.4% after 5 years. The mean survival rate according to Kaplan-Meier was 79.7%, 72.2%, 67.3% and 51.4% after 1, 2, 3 and 5 years, respectively.

Results of multiple logistic regression analysis showed that negative prognostic variables with respect to patient survival were amputation (p=0.0017) and dialysis (p<0.001) and with respect to limb salvage dialysis (p<0.0001) and non-patent peroneal artery (p<0.0001).

CONCLUSION
Balloon angioplasty of the crural arteries shows a high technical success rate with an acceptable complication rate. Dialysis and non-patent peroneal artery are negative prognostic variables for the clinical long-term success. However, the survival rate was limited by the co-morbidity and the high age in this patient group.

CLINICAL RELEVANCE/APPLICATION
Peroneal artery should be the preferred crural artery to be recanalized

VSIR51-04
Evaluation of a Novel Bioabsorbable and Non-synthetic Vascular Closure Device: FISH in Daily Routine
Marcus Treitl MD (Presenter): Nothing to Disclose, Maximilian F. Reiser MD: Nothing to Disclose, Karla Maria Treitl MD : Nothing to Disclose

PURPOSE
Vascular closure devices are typically made of synthetic materials, inducing an inflammation of the vessel wall that can cause scaring over of the access vessel. A novel femoral introducer sheath and hemostatic device (FISH) introduces small intestinal submucosa (SIS), that is known from treatment of burn wounds, as a closing agent into the vessel wall. In contrast to other devices this is meant to induce wound healing instead of scarring over. We present first results of the usage of this novel closure device in daily routine.

METHOD AND MATERIALS
132 consecutive patients (88 m; mean age 71.5yrs) with indication for endovascular treatment of peripheral artery disease received the FISH device for closure of the access vessel. Technical success of device deployment, the time to hemostasis, as well as the time to ambulation were recorded. Control of the access site was done by clinical examination and duplex ultrasound the following day. Small hematomas and bleedings were assessed as minor complications, whereas pseudoaneurysms or bleedings requiring surgical intervention were assessed as major complications.
Renal sympathectomy and renal denervation: New developments and clinical relevance.

**METHOD AND MATERIALS**

Percutaneous unilateral perirterial injection of 10 ml of a mixture of Vincristin 0.1 mg dissolved in 0.9% Saline, Bupivacaine and Accupaque 250 (ratio 7:2:1) was performed in 6 normotensive pigs. Needle placement and injections were performed under CT-guidance in all animals. Blood pressure measurements and CT scans of the kidneys perirterial structures were performed immediately pre- and post intervention and 4 weeks after treatment. After euthanasia Noradrenalin (NE) concentration of both kidneys was determined. The renal arteries and the surrounding tissue were examined histologically to look for induced nerve fibre degeneration.

**RESULTS**

All procedures were technically successful with good perirterial distribution of the injectant. No major events occurred. No postinterventional complications were observed. NE concentration of the renal parenchyma was significantly lower on the treated side in all pigs with a mean decrease of 53.5% (min: 43%, max: 66%) compared to the contra-lateral untreated kidney. Histological examination revealed neural degeneration in all animals.

**CONCLUSION**

CT-guided needle-based percutaneous perirterial Vincristin injection for renal sympathetic degeneration was feasible, effective and safe. This approach may be an alternative to the catheter-based techniques in the treatment of therapy resistant hypertension.

**CLINICAL RELEVANCE/APPLICATION**

Renal sympathectomy and renal denervation may be an alternative to catheter-based techniques.
VSIR51-08  
**Accuracy of Simple Visual Estimation in Grading Peripheral Arterial Stenosis—Is Eyeballing Enough?**

Melanie B. Schernthaner MD (Presenter): Nothing to Disclose, Matthew Benenati: Nothing to Disclose, Reza Rajebi MD: Nothing to Disclose, Gail Walker PhD: Nothing to Disclose, Constantino Santiago Pena MD: Speakers Bureau, W. L. Gore & Associates, Inc Speakers Bureau, Cook Group Incorporated Speakers Bureau, Koninklijke Philips NV Advisory Board, C. R. Bard, Inc Advisory Board, Boston Scientific Corporation Advisory Board, Guerbet SA

**PURPOSE**  
To evaluate accuracy, inter-observer and intra-observer reliability of simple visual estimation (SVE) in grading peripheral arterial stenosis compared to calibrated measurements.

**METHOD AND MATERIALS**  
23 interventionalists with a wide range of experience (1-30 years) and subspecialty training (IR (13), Neuro-IR (2), interventional-cardiology (4) and vascular surgery (4)) reviewed 42 angiographic images of peripheral and carotid arteries in two sessions. Images where shuffled between readings. An independent team measured all lesions using manual calipers. A +/- 5% error was considered as threshold for accurate visual estimation. Lesions were categorized by clinical significance (80% severe). SVE was compared for agreement by weighted kappa statistics. Reliability was assessed by intraclass correlation.

**RESULTS**  
Overall accuracy of SVE in grading stenosis was 28.3% and 27.4% for the two assessments. Errors in excess of +/- 5% occurred in 71.7% and 72.6% respectively. Agreement with respect to clinical category was fair with a weighted kappa of 0.579 in the first testing session and 0.588 in the second. 92.6% and 93.8% of severe lesions, 40.9% and 41.5% of significant lesions and 71.5% and 73.3% of insignificant lesions were correctly identified in the first and second sessions respectively. In the first session 53.0% of significant and 4.4% of insignificant lesions were categorized as severe stenosis. 49.9% of significant lesions and 4.6% of insignificant lesions were underestimated as severe in the second session. Intra-rater reliability was good (0.990) and inter-rater reliability was fair for assessment of peripheral arteries (0.823, 0.809), and carotids (0.748, 0.708). Accuracy did not differ in relation to years of experience or specialty.

**CONCLUSION**  
Despite good intra-observer reliability, inter-observer reliability was fair. Estimation of peripheral arterial stenosis often results in overestimation of stenosis, most pronounced in the 60-80% range. There were no significant differences based on years of experience in practice or specialty. Visual estimates of stenosis potentially lead to therapeutic decisions based on inaccurate information.

**CLINICAL RELEVANCE/APPLICATION**  
Clinical decision making should be based on caliper measurements especially in non-significant stenoses.

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VSIR51-09  
**Evaluation of Infrapoplitial Blood Flow Changes During Endovascular Revascularization Using 2D X-ray Perfusion Software: A Pilot Study**

Michelle D.M.E. Meeks MSc: Research Consultant, Koninklijke Philips NV, Julie Mayer: Nothing to Disclose, Pascal Desgranges: Nothing to Disclose, K. You: Nothing to Disclose, Jean-Francois Deux (Presenter): Nothing to Disclose, Hicham Herve Kobeiter MD: Nothing to Disclose

**PURPOSE**  
To evaluate a 2D X-ray Perfusion software to quantify infrapoplitial blood flow changes during endovascular revascularization of femoropopliteal lesions.

**METHOD AND MATERIALS**  
Fifteen patients undergoing endovascular revascularization were included in this study. Forty-one vessels were analyzed using 2D Perfusion software (Philips Healthcare, Best, The Netherlands). 2D Perfusion images could be collected after regular DSA, without additional radiation or contrast usage. A region of interest was drawn in the distal part of the 3 tibial arteries. Parameters: -time to peak (TTP), -wash in rate (WIR) and -arrival time (AT) were calculated. Parametric differences, before and after revascularization and between Rutherford classes, were statistically compared using paired and one-sample Student’s t-test, respectively.

**RESULTS**  
Eight patients suffered from Rutherford class <3 and 7 from Rutherford class ≥ 3. Ten patients underwent SFA stent placement, the remaining five were treated with balloon angioplasty of the SFA and/or popliteal tibial arteries. Results demonstrated significant differences after revascularization in TTP (7% decrease), WIR (41% decrease) and AT (35% increase). Sub analysis showed a significant difference (p=0.004) in arrival time in CLI patients when compared to PAD patients, respectively a 40% decrease and 2.7% increase after revascularization.

**CONCLUSION**  
2D Perfusion software allows for hemodynamic measurement of flow differences after endovascular revascularization. CLI patients, at rest, demonstrate a faster arrival time after revascularization when compared to PAD patients. This could be explained by the symptomatic appearance of vascular disease in PAD patients during physical exercise. Further research is needed to prove whether these hemodynamic differences are related to clinical outcome and tissue reperfusion.

**CLINICAL RELEVANCE/APPLICATION**  
2D X-ray Perfusion Software is a promising post-processing imaging technique to increase our knowledge on blood flow characteristics in patients with Peripheral Artery Disease.

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VSIR51-10  
**Updates in Vascular Disease**

Parag J. Patel MD (Presenter): Consultant, Medtronic, Inc Consultant, C. R. Bard, Inc Advisory Board, Boston Scientific Corporation Advisory Board, Guerbet SA

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Stent Grafts Explained

Lindsay S. Machan MD (Presenter): Medical Advisory Board, Boston Scientific Corporation Medical Advisory Board, Arsenal Medical Inc Steering Committee, Cook Group Incorporated Stockholder, Analytics 4 Life Stockholder, Calgary Scientific, Inc Stockholder, Harmonic Medical Stockholder, IKOMED Technologies Inc Stockholder, Nitinol Devices & Components, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

VSMK51

Musculoskeletal Series: Knee Imaging

Series Courses

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<td>MR Imaging Characteristics and Clinical Symptoms Related to Displaced Meniscal Flap Tears</td>
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LEARNING OBJECTIVES

The ‘Knee Imaging’ Series Course will review the multimodality imaging features of knee pathology through 5 expert refresher courses interspersed among multiple scientific presentations.

Sub-Events

VSMK51-01  MRI of Meniscal Tears

Mark W. Anderson MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) describe the normal anatomy of the medial and lateral menisci, including their tibial and capsular attachments, as well as key differences in their morphology. 2) list the three primary types of meniscal tears and the most important features of each for the surgeon. 3) discuss the most common types of displaced meniscal tears and where to look for them on MR images.

VSMK51-02  MR Imaging Characteristics and Clinical Symptoms Related to Displaced Meniscal Flap Tears

Valentin Lance MD (Presenter): Nothing to Disclose, Ursula Renate Heilmeier MD : Nothing to Disclose, Gabby B. Joseph : Nothing to Disclose, Benjamin Ma MD : Nothing to Disclose, Lynne S. Steinbach MD : Nothing to Disclose, Thomas M. Link MD, PhD : Research funded, General Electric Company Research funded, InSightec Ltd

PURPOSE

(1)To describe MR characteristics of meniscal flap tears (2)To investigate associated imaging findings such as the presence of bone marrow edema pattern, degree of cartilage loss, synovitis and capsular ligamentous injury and (3)To correlate these MR findings to clinical presentation in groups stratified by surgical versus non-operative management.

METHOD AND MATERIALS

307 patients with MR diagnosis of flap tear were identified through a retrospective query of the hospital radiologic database and chart review from 2010 to 2013. Clinical history and flap tear related treatment were recorded for each subject. Subjects were excluded if MR imaging included signs of traumatic injury such as fracture, ACL or PCL tear, severe osteoarthritis or if the size of the flap tear was not measurable in the sagittal or coronal images. 58 subjects (35 men and 25 women, mean age 49.6±14.5 yrs) were included. MR studies of the knee were reviewed and graded for flap tear location, size and presence of additional knee abnormalities by two radiologists. Statistical analysis employed t-tests, Spearman correlations, linear regression and logistic regression models.

RESULTS

The medial meniscus was the most common site of flap tears (87%, 52/60), with inferior displacement in 78% (47/60). Average flap area was 18.3±18.1mm². Bone marrow edema pattern was present in 36.2% and cartilage defects in 25.9%. Synovitis was present in 48.3%, and complete medial meniscofemoral and meniscotibial ligament tears in 6.6% and 3.4%, respectively. Comparing MR characteristics to clinical pain scores, we found that the degree of tibial cartilage loss was positively correlated with the visual analog pain scale (p=0.03). Comparing operative to non-operative groups, patients who underwent arthroscopic surgery were younger than those who did not (45.6±12.3 years vs 55.3±15.7 years, p=0.01), and more likely to present with a positive clinical McMurray test (79.4% vs 41.7%, p=0.01).

CONCLUSION

Medial meniscal and inferiorly displaced flap tears are the most common tear pattern. A greater degree of cartilage loss involving the tibia was associated with increasing pain scores. Those undergoing arthroscopy
VSMK51-03  
Meniscal Surgery Markedly Increases Risk for Incident Osteoarthritis and Cartilage Loss in the Following Year

Frank W. Roemer MD (Presenter): Chief Medical Officer, Boston Imaging Core Lab LLC Research Director, Boston Imaging Core Lab LLC Shareholder, Boston Imaging Core Lab LLC, Kent Chian - Kwoh MD: Advisory Panel, Pfizer Inc Data Safety Monitoring Board, Novartis AG, Michael Hannon: Nothing to Disclose, Jason Grago: Nothing to Disclose, David J. Hunter MD, PhD: Royalties, DJD Global, Inc, Ali Guermazi MD, PhD: President, Boston Imaging Core Lab, LLC Research Consultant, Merck KgaA Research Consultant, Sanofi-Aventis Group Research Consultant, TissueGene, Inc

PURPOSE
To assess whether meniscal surgery increases risk for incident radiographic osteoarthritis (ROA) and cartilage loss in the following year.

METHOD AND MATERIALS
Participants were drawn from the Osteoarthritis Initiative (OAI) including 4796 participants with, or at risk of knee OA. We studied 355 knees that developed incident ROA before the 60 month visit that were matched with a control knee that did not develop incident ROA. Matching was done by gender, age within 5 years, and baseline Kellgren-Lawrence grading (KLG) of both, the index and collateral knees. MRIs were read for medial and lateral meniscal damage (including maceration) and for cartilage morphology using the MOAKS system at one year prior and at the case defining visit (KLG ≥ 2). Conditional logistic regression adjusted for BMI was applied to assess risk of incident ROA for knees that had surgery in the year prior to developing incident ROA, and for knees with prevalent meniscal damage. Logistic regression adjusted for BMI and the matching criteria was used to assess risk of cartilage loss.

RESULTS
Subjects were on average 60.2 years old (SD ± 8.6), predominantly female (66.5%) and overweight (mean BMI 28.2 SD ± 4.5). 31 (4.4%) knees underwent meniscal surgery during the year prior to the case defining visit. 238 (34.9%) knees had prevalent meniscal tears and 42 (6.2%) knees showed any meniscal maceration one year prior to the case-defining visit. All (n = 31, 100%) knees that had meniscal surgery and 58.9% (n = 165) of the knees with prevalent meniscal damage developed incident ROA (OR = 2.68, 95% CI [1.81, 3.89]). 39.5% (n=107) of knees with prevalent meniscal damage and 80.8% (n = 21) of knees with surgery showed cartilage loss. Risk of cartilage loss was significantly increased for knees exhibiting any prevalent meniscal damage without surgery (OR=1.5 95% confidence interval [CI] [1.1,1.2]), and markedly further increased for knees that had surgery (OR=13.1 95% CI [4.7,36.3]).

CONCLUSION
In a cohort with risk factors for ROA, all knees undergoing meniscal surgery developed incident ROA. Furthermore, risk for cartilage loss is much higher for knees undergoing surgery compared to knees with prevalent meniscal damage.

CLINICAL RELEVANCE/APPLICATION
Meniscal surgery has deleterious effects on joint structure in knees without ROA, but at risk of developing ROA. The decision for meniscal surgery needs to be carefully considered in order to avoid accelerated disease onset.

VSMK51-04  
ACL Injuries

Thomas M. Link MD, PhD (Presenter): Research funded, General Electric Company Research funded, InSightec Ltd

LEARNING OBJECTIVES
1) Understand anatomy, function and physiology of the ACL and the mechanism of ACL injury. 2) Demonstrate direct and indirect radiographic and MRI signs of acute ACL tears and associated injuries. 3) Analyze imaging findings related to chronic tears and other abnormalities of the ACL. 4) Identify imaging signs of intact ACL repair, complications and failure.

VSMK51-05  
In Search of a Soft Tissue Segond: Anterolateral Ligament and Its Neighbors

Brian Scott Martell MD (Presenter): Nothing to Disclose, Leon Lenchik MD: Nothing to Disclose, Scott David Wuertz MD, MS: Nothing to Disclose, Maha Torabi MD: Nothing to Disclose

PURPOSE
Anterolateral ligament (ALL) is a controversial term recently introduced into the orthopedic literature as a potential source for Segond fractures. ALL injuries that do not result in Segond fractures may still contribute to knee instability. The purpose of our study was to determine if anterolateral knee injuries are more common in patients with arthroscopically proven ACL tears compared to controls.

METHOD AND MATERIALS
Retrospective review of 122 consecutive knee MRIs in patients under age 50 who had arthroscopies performed by the same orthopedic surgeon. Patients with revision ACL surgery and those with Segond fractures were excluded. 29 patients with first-time ACL reconstruction were compared to 29 age-matched controls with normal ACL at arthroscopy. Preoperative MR images in both groups were reviewed by consensus of two expert readers, blinded to surgical intervention. The anterior lateral corner of the knee was evaluated on axial and coronal images, from the iliotibial band anteriorly to the fibular collateral ligament posteriorly. In particular, the tibial attachment of the ALL (and other meniscotibial structures)
was carefully scrutinized. The ALL was categorized as present or absent. When the ALL was present, it was categorized as torn or intact. In all cases, the presence of soft tissue edema in the anterolateral corner was recorded.

RESULTS

Meniscotibial portion of ALL was visualized in 24 of 29 (83%) patients without ACL tears and 23 of 29 (79%) patients with ACL tears. ALL was torn in 1 of 29 (3%) patients without ACL tears and 1 of 29 (3%) patients without ACL tears and 19 of 29 (66%) patients with ACL tears. The combination of soft tissue edema and nonvisualized ALL was more common in patients with ACL tears (17%) compared to controls (0%).

CONCLUSION

Meniscotibial portion of ALL is commonly visualized but rarely torn. The presence of edema in the expected location of ALL is common in patients with ACL tears.

CLINICAL RELEVANCE/APPLICATION

Whether ALL is a new structure or a new name for the mid-third capsular ligament; some authors suggest that it contributes to knee instability even in the absence of a Segond fracture. Further work is needed to determine if anterolateral edema on MR imaging contributes to knee instability and if such signal is associated with ALL tears (soft-tissue Segonds).

VSMK51-06  
Mucoid Degeneration of the Anterior Cruciate Ligament: Prevalence and Association with Cartilage and Meniscal Integrity at MR Imaging

Robert Michael Kwee (Presenter): Nothing to Disclose  
Bashir Zikria: Nothing to Disclose  
John A. Carrino MD, MPH: Consultant, BioClinica, Inc Consultant, Pfizer Inc Advisory Board, General Electric Company  
Shadpour Demehri MD: Nothing to Disclose

PURPOSE

To assess the prevalence of mucoid degeneration of the anterior cruciate ligament (ACL) and its association with cartilage and meniscal abnormalities using magnetic resonance imaging (MRI) of the knee.

METHOD AND MATERIALS

Institutional review board approval was obtained and patient consent was waived for this HIPAA-compliant, retrospective study. Four hundred and seventy-one consecutive knee MRI examinations were identified. Fifty-three consecutive knee MRIs with mucoid degeneration of the ACL (M/F=0.71; median age of 53.6 years, range 26-81) were identified and matched with age and sex to 106 consecutive control knee MRIs without mucoid degeneration or tear of the ACL using frequency matching (case-control ratio of 1:2). Abnormalities of the cartilage of the medial (MTC) and lateral (LTC) tibiofemoral compartments and menisci were semiquantitatively assessed by using the Whole-Organ MR Imaging Score (WORMS) system. Differences in cartilage and meniscal abnormalities between patients with mucoid ACL degeneration and controls were assessed by performing chi-square and Mann-Whitney U tests.

RESULTS

Prevalence of mucoid degeneration of the ACL was 12.8%. Patients with mucoid ACL degeneration were older than all other patients (mean age of 53.6 vs. 43.7 years, P<0.001) but there was no gender predilection (P=0.319). The frequency of severe cartilage damage (WORMS ≥5) in the MTC was significantly higher in knees with mucoid ACL degeneration than in the control group (49.1% vs. 18.9%, P<0.001), but there was no significant difference in the LTC (13.2% vs. 8.5%, P=0.351). Knees with mucoid ACL degeneration had significantly more meniscal damage compared to controls (mean WORMS of medial meniscus of 2.7 vs. 2.1, P=0.033; and mean WORMS of lateral meniscus of 1.1 vs 0.6, P=0.012).

CONCLUSION

Prevalence of mucoid degeneration of the ACL in patients referred for knee MR imaging is 12.8%. The presence of mucoid degeneration of the ACL is strongly associated with severe MTC osteoarthritis (OA) as well as more meniscal damage.

CLINICAL RELEVANCE/APPLICATION

Given the known association between ACL insufficiency and development of MTC OA, our results suggest that patients with mucoid ACL degeneration should also be carefully examined for ACL instability.

VSMK51-07  
Patellofemoral Disease

Mario P. Padron MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

VSMK51-08  
Realtime Dynamic CT of the Patellofemoral Joint: A New Approach to the Old Problem of Patellar Maltracking

Daniel Fascia (Presenter): Nothing to Disclose  
Dimitri Amiras: Nothing to Disclose  
Andrew Hohnen MD: Nothing to Disclose  
Nicholas Dominic Karl Wambeek MBBS: Nothing to Disclose

PURPOSE

Patellar maltracking is a significant problem affecting a young and active population which often results in premature osteoarthritis. It is said to be related to a combination of anatomical and biomechanical factors. So far radiological assessments with CT and MR have focussed on static anatomical assessment. Utilising
fast multi-slice cinematic CT, we have designed a method to assess the patellofemoral joint during realtime dynamic patient initiated active motion, allowing both conventional anatomical assessment and biomechanical analysis during the same study.

METHOD AND MATERIALS
Symptomatic patients were selected by Orthopaedic surgeons using the Lysholm knee score. Using a 256-slice Philips Brilliance CT, patients were scanned whilst actively extending their knee joints from 0 to zero degrees. Axial volume rendered images of the patellofemoral joint were generated from the animated sequence to recreate the patellar skyline view. Standard anatomical patellofemoral measurements as well as dynamic measurements to assess extent of patellar lateralisation and tilt were taken.

RESULTS
Our new dynamic CT method was effective in demonstrating patellar maltracking in patients with abnormal patellofemoral anatomy. It additionally had the advantage of demonstrating occult maltracking in a number of patients whose standard anatomical assessment was within normal ranges. Average radiation doses were acceptably low with a calculated body effective dose delivered

CONCLUSION
Dynamic CT of the patellofemoral joint during active patient motion is highly effective at quantifying the degree of patellar lateralisation and tilt during maltracking. It also has the unexpected advantage of revealing maltracking in a number of anatomically normal but symptomatic patients.

CLINICAL RELEVANCE/APPLICATION
Our novel method of imaging the patellofemoral joint is a sensitive way of detecting maltracking in symptomatic patients and quantifying it. It has the advantage of being both more sensitive to maltracking and adding useful biomechanical information compared with current static anatomical cross sectional methods. The technique uses an acceptably low radiation dose for use in the target young-active population.

Magnetic Resonance Imaging (MRI)—Based Morphological and Alignment Assessment of the Knee Joint and its Relationship with Proximal Patellar Tendinopathy

Michel D. Crema MD (Presenter): Shareholder, Boston Imaging Core Lab, LLC, Larissa Garcia de Oliveira Cortinas MD: Nothing to Disclose, Giovanni L. Ingham: Nothing to Disclose, Rene Abdalla MD, PhD: Nothing to Disclose, Abdalla Y. Skaf MD: Nothing to Disclose

PURPOSE
Proximal patellar tendinopathy (PPT) is one of the most common overuse injuries of the knee. Knee morphology and alignment may play a role in the pathogenesis of PPT. The aim of this study was to assess the differences in morphology and alignment of the knee using MRI, focusing on the patellofemoral (PF) joint, between patients with PPT and controls.

METHOD AND MATERIALS
We retrospectively included 35 patients with clinically diagnosed and unequivocal findings of PPT on knee MRI (case group). For the control group, we retrospectively included 70 patients who underwent knee MRI for other reasons, without clinical or MRI findings of PPT. Patients and controls were matched for age and gender, with all subjects reporting frequent physical activity. Knee MRIs were evaluated by two musculoskeletal radiologists, who assessed parameters regarding patellar morphology (subchondral Wiberg index and subchondral Wiberg angle - sWA), trochlear morphology (medial/lateral trochlea length ratio and trochlear inclination angles), PF alignment (lateral patellar displacement, patellar inclination angle, Insall-Salvati (IS) and Eaton-Deshamps ratios), tibial tuberosity-trochlear groove distance, and tibiofemoral (TF) alignment (angle). The differences in parameters between cases and controls were assessed using Student’s t-test. Logistic regression was applied to assess the associations between the parameters measured on MRI and PPT.

RESULTS
The patellar height IS ratio was significantly different between cases and controls (1.37 ± 0.21 and 1.24 ± 0.19 respectively; p=0.003). The sWA was significantly higher in cases vs. controls (136.8 ± 7.4 and 131.7 ± 8.8 respectively, p=0.004). The TF angle was also different between cases and controls (+4.7 ± 2.5 and +2.5 ± 3.7 respectively, p=0.002). After applying logistic regression, patellar morphology (sWA), patellar height (IS ratio), and the TF angle were significantly associated with PPT (odds ratios [95%CI] of 1.1 (1.0, 1.2); 1.3 (1.0, 1.7); and 1.2 (1.1, 1.5); respectively).

CONCLUSION
Some MRI-based measures of patellar morphology (sWA) and alignment (patellar height and TF angle) were shown to be useful in discriminating between controls and those with PPT.

CLINICAL RELEVANCE/APPLICATION
Assessment of patellar morphology and height, as well as TF angle should be considered in athletes at risk for PPT, as it may help planning their training and potentially avoid PPT development.

Pre- and Postoperative Cartilage Imaging

Carl Scherman Winalski MD (Presenter): Institutional service agreement, sanofi-aventis Group Institutional service agreement, Bioclinica, Inc Institutional service Agreement, CarbiHeal Institutional Research Grant, The Procter & Gamble Company Shareholder, Pfizer Inc Shareholder, General Electric Company

LEARNING OBJECTIVES
1) Gain knowledge of the basic mechanisms of cartilage injury. 2) Learn to recognize and describe the MR appearances of cartilage abnormalities. 3) Become familiar with the types of cartilage lesions that are commonly missed, the technical limitations of MR imaging and methods to optimize lesion evaluation. 4) Understand the goals of articular cartilage repair and the basic surgical techniques. 5) Be able to analyze postoperative MR studies following surgical cartilage repair to report the clinically important features and common complications.
**VSMK51-11**  
**Quantitative CT Arthrography of the Human Knee to Measure Cartilage Biochemical Composition: Results of an In-Vivo Validation Study Against Ex-Vivo Reference Standards**

Jasper Van Tiel MD (Presenter): Nothing to Disclose, Michel Siebelt MD: Nothing to Disclose, Max Reijman: Nothing to Disclose, Koen Bos: Nothing to Disclose, Erwin Waarsing: Nothing to Disclose, Jan Verhaar: Nothing to Disclose, Gabriel P. Krelin MD, PhD: Consultant, General Electric Company Research Grant, Siemens AG Research Grant, Erwin H.G. Oei MD, PhD: Nothing to Disclose

**PURPOSE**

Recently, the ability of CT arthrography (CTa) to quantitatively measure knee cartilage composition in terms of its sulphated glycosaminoglycan (sGAG) content has been demonstrated in an ex-vivo study using human cadaveric knee joints. Since a validation study comparing in-vivo acquired CTa outcomes against ex-vivo reference standards for cartilage composition has not yet been performed, the aim of the present study was to perform such a validation in humans with knee OA.

**METHOD AND MATERIALS**

We included 12 knee OA patients (Kellgren and Lawrence grade 2-4) who underwent CTa one month before total knee replacement (TKR). Mean X-ray attenuation values were calculated in 6 regions of interest (ROIs) of the articular cartilage (medial and lateral weight-bearing femoral condyles and tibial plateau and non-weight-bearing cartilage of the condyles). All cartilage ROIs were harvested during TKR and rescanned with contrast-enhanced microCT (CE-μCT). Mean CE-μCT X-ray attenuation values served as surrogate reference standard for cartilage sGAG content since it has been shown to accurately measure sGAG. We analyzed the correlation between mean CTa X-ray attenuation and mean CE-μCT X-ray attenuation with linear regression.

**RESULTS**

Mean X-ray attenuation values of the different ROIs ranged from 115 to 455 Hounsfield Units. Outcomes of CTa had a strong correlation with reference CE-μCT X-ray attenuation, representing sGAG content of articular cartilage, in the femoral (r= 0.76; p< 0.0001; r^2= 0.58), in the tibial (r= 0.77; p< 0.0001; r^2= 0.59) and in the tibiofemoral cartilage (r= 0.76; p= 0.0001; r^2= 0.57) (figure 1).

**CONCLUSION**

Our results suggest that CTa can accurately measure sGAG content of articular cartilage in human knee joints in-vivo. The coefficient of determination, however, is only moderate and therefore CTa outcomes are likely to be also influenced by other composites of cartilage, e.g. collagen. Despite the use of an intra-articular contrast agent and ionizing radiation, CTa might become a relatively cheap and quick alternative to MRI based techniques to quantitatively measure cartilage composition in patients with contra-indications for MRI.

**CLINICAL RELEVANCE/APPLICATION**

CT arthrography can accurately measure cartilage sulphated glycosaminoglycan content in human knee joints in-vivo and might become a cheap and fast alternative to similar MRI based techniques.

**VSMK51-12**  
**Diameters of Femoral and Tibial Tunnels on CT after ACL Reconstruction with Double Bundle Technique Using Auto-hamstring Graft: Correlation with Functional and Clinical Scores**

Young Cheol Yoon MD: Nothing to Disclose, Soo Jeong Yoon MD (Presenter): Nothing to Disclose

**PURPOSE**

Bone tunnel enlargement after anterior cruciate ligament (ACL) reconstruction represents a well-established phenomenon. Clinically, bone tunnel enlargement in the revision ACL reconstruction represents a great challenge to surgeons, may require staged reconstruction and additional operative procedures. To our knowledge, clinical significance of bone tunnel enlargement is not well established and does not known how affect clinical outcome. This study aimed to evaluate correlations between diameter of bone tunnel using computed tomography (CT) with respect to functional and clinical scores.

**METHOD AND MATERIALS**

Forty-seven patient (41 males and 6 females, mean age of 34 years old) who underwent ACL reconstruction with double bundle technique using auto-hamstring graft and had immediate postoperative (range: 1-4 days, mean of 2.5 days) and follow-up CT scans (range: 297-644 days, mean of 410.4 days) entered this study. Diameter of each tunnel (two femoral and two tibial) of both immediate postoperative (D1) and follow-up CT (D2) scans were independently measured by two MSK fellowship trained radiologists. They obtained diameters of each tunnel at 5 levels (proximal end, midportion, distal end, one-quarter and three-quarter portion) from longitudinal plane of each tunnel using double oblique multiplanar reconstruction, and a mean value among five diameters of each tunnel was regarded as diameter of it. Evaluation of graft stability and clinical performance was performed with functional (KT-2000) and clinical scores (IKDC objective, Lysholm). Correlation analysis was performed between D2 and functional and clinical scores, and D2/D1 and functional and clinical scores.

**RESULTS**

Correlation analysis showed no significant relationship between D2 and functional and clinical scores nor D2/D1 and functional and clinical scores (P>0.05). There were no significant effect of age, gender and side (P>0.05). Interobserver variability for measurements shows moderate to excellent (0.4133 to 0.9716). Intraobserver variability measurements show excellent ranging between 0.9911 and 0.8891.

**CONCLUSION**

Bone tunnel enlargement after anterior cruciate ligament (ACL) reconstruction by double bundle technique using auto-hamstring graft may not be correlated with graft stability or clinical outcome.

**CLINICAL RELEVANCE/APPLICATION**
**Unicompartamental Knee Arthroplasty MRI: Impact of Slice-Encoding for Metal Artifact Correction MRI on Image Quality, Findings, and Therapy Decision**

**Christoph Amadeus Agten MD (Presenter):** Nothing to Disclose  
Filippo Del Grande MD, MBA: Nothing to Disclose  
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Samuel Blatter: Nothing to Disclose  
Christian W. A. Pfirrmann MD, MBA: Advisory Board, Siemens AG Consultant, Medtronic, Inc  
Reto Sutter MD: Nothing to Disclose

**PURPOSE**

To evaluate the impact of slice-encoding for metal artifact correction (SEMAC) on image quality, findings, and therapy decision in patients with unicompartmental knee arthroplasty (UKA).

**METHOD AND MATERIALS**

Forty-five painful UKAs were examined (1.5T-MRI, coronal STIR, sagittal proton-density (PD)-weighted sequence, each with SEMAC and high-bandwidth). Artifact size on each sequence was measured (1 reader). Image quality, anatomic depiction, and clinically relevant findings were compared between SEMAC and high-bandwidth sequences (2 readers). In 30 patients therapy decision and confidence (0=unsure, 10=sure) were retrospectively assessed by two orthopedic surgeons without MRI, with MRI using high-bandwidth, and with MRI using SEMAC. Wilcoxon test, McNemar test, Cochran’s Q, and Friedman Test were employed for statistics.

**RESULTS**

SEMAC reduced mean artifact size for STIR (11.8cm² vs. 37.7cm²; \( P < .0005 \)) and PD (16.8cm² vs. 18.9cm²; \( P < .0005 \)). SEMAC showed more blurring than high-bandwidth (\( P < .0005 \)). STIR-SEMAC was better in depiction of anatomic structures around the UKA (\( P < .003 \) and \( P < .034 \) for reader 1 and 2, respectively), except for the anterior meniscal root for reader 2 (\( P = .987 \)). PD-SEMAC was inferior in depiction of meniscal roots and cartilage (\( P < .0005 \)). STIR-SEMAC revealed significantly more bone marrow edema (29 vs. 18 patients, \( P < .001 \) for reader 1 / 30 vs. 13 patients, \( P < .0005 \) for reader 2). PD-SEMAC was substantially worse in detecting meniscal lesions (6 missed, \( P = .031 / 9 \) missed, \( P = .004 \), by reader 1 and 2, respectively). Revision-surgery was the chosen therapy in 12 and 11 patients for orthopedic surgeon 1 and 2 without MRI. With high-bandwidth MRI revision-surgery was chosen in 15 and 14 patients, and with SEMAC-MRI in 19 and 14 patients (\( P < .005 \) for surgeon 1, \( P = .05 \) for surgeon 2). Mean confidence increased from 6.97 without MRI to 7.57 with SEMAC-MRI (surgeon 1; \( P = .001 \)) and 6.90 to 6.93 (surgeon 2; \( P = .257 \)).

**CONCLUSION**

STIR-SEMAC was useful for detection of bone marrow edema and influenced the orthopedic surgeons’ decisions and confidence towards surgery. PD-SEMAC was of inferior image quality and led to missed meniscal lesions in some cases.

**CLINICAL RELEVANCE/APPLICATION**

In patients with unexplained painful unicompartmental knee arthroplasty, STIR-SEMAC may reveal bone marrow edema as a potential source of pain and is therefore useful in a knee MRI protocol.
imaging techniques in the assessment of tumor activity following therapy.

**Identification of Glioblastoma Radiophenotypes in Patients with 1p/19q Co-deletion**

Ahmed M. Amer MD : Nothing to Disclose, Ginu A. Thomas MBBS : Nothing to Disclose, Jixin Wang PhD : Nothing to Disclose, Pascal O. Zinn MD : Nothing to Disclose, Rivka Rachel Coen MD (Presenter): Nothing to Disclose

**PURPOSE**

To create an imaging genomic biomarker signature in order to identify those Glioblastoma patients (GBM) with 1p/19q deletion. Recent prospective randomized clinical trials have validated correlations between 1p/19q codeletion and increased overall survival of patients treated with radiation therapy with or without chemotherapy.

**METHOD AND MATERIALS**

Using The Cancer Genome Atlas (TCGA), we identified 99 treatment naive GBM patients for whom both gene and miRNA expression profiles including the 1p/19q codeletion status, and pretreatment brain MR Imaging from The Cancer Imaging Archive(TCIA) were available. The VASARI feature set and 3D Slicer software 3.6 (http://www.slicer.org) were used for image analysis and image review was done in consensus by 2 neuroradiologists. Fluid Attenuated Inversion Recovery (FLAIR) was used for segmentation of the edema/cellular infiltration and Post GD T1-weighted imaging (T1WI) for segmentation of tumor enhancement and necrosis. Imaging parameters were then correlated with 1p/19q deletion status and gene expression profiles. Multiple complex biomarker signatures based on gene profiling and survival were created.

**RESULTS**

A novel imaging biomarker signature using multiple imaging parameters predicted 1p/19q co-deletion in patients with GBM. These were also associated with overall survival and progression-free survival.

**CONCLUSION**

Imaging genomic signatures can be expected to promote a more robust personalized approach to patient care and accelerate drug development and help stratify patients in clinical trials. An imaging biomarker signature was created using both qualitative and quantitative imaging parameters that predicted 1p/19 deletion status and expression.

**CLINICAL RELEVANCE/APPLICATION**

Prediction of 1p/19q status promotes a more effective personalized therapy and help stratify patients in clinical trials.

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**Longitudinal 3D MR Spectroscopic Imaging of 2-Hydroxyglutarate in Patients with Mutant IDH1 Glioma Undergoing Radiochemotherapy**

Ovidiu C. Andronesi MD, PhD (Presenter): Nothing to Disclose, Franziska Loebel MD : Nothing to Disclose, Wolfgang Bogner MSC : Nothing to Disclose, Malgorzata Marianska PhD : Nothing to Disclose, Elizabeth Gerstner MD : Nothing to Disclose, Andrew S Chi MD,PhD : Nothing to Disclose, Tracy T. Batchelor MD : Nothing to Disclose, Daniel P Cahill : Nothing to Disclose, Bruce R. Rosen MD, PhD : Research Consultant, Siemens AG

**PURPOSE**

The hallmark metabolic alteration of mutant IDH gliomas is the production of 2-hydroxyglutarate (2HG) which may play a central role in downstream effects. Hence, 2HG may be an ideal biomarker for both diagnosing IDH mutations and monitoring response to treatment. 2HG can be measured in-vivo by magnetic resonance spectroscopy and there is significant interest in developing methodology that performs reliably in patients. Here we present results obtained with a new 3D MR spectroscopic imaging (MRSI) sequence that maps 2HG over the entire volume of the tumor during treatment.

**METHOD AND MATERIALS**

A robust 3D MRSI sequence for 2HG imaging was newly developed by integrating adiabatic J-difference spectral editing, spiral imaging, and real-time motion correction. The acquisition parameters were: TR=1.6s, TE=68ms, FOV=200x200x200 mm3, acquisition matrix 10x10x10, NA=20, acquisition time TA=9:55 min:s. Spectra were fitted with LCModel software. Measurements were performed on a 3T MR scanner. 3D MRSI was performed in 20 patients with mutant IDH1 gliomas (WHO grades I-IV) consented with an approved IRB protocol. A baseline scan was done after surgery and before start of adjuvant treatment. At the moment 9 patients have completed a second post-treatment scan. Adjuvant treatment included radiotherapy and/or chemotherapy. The post-treatment scan was done in a time interval of 1-3 months after treatment.

**RESULTS**

Detectable levels of 2HG were measured in all patients that did not have gross total resection of tumor. 3D metabolic maps were obtained for 2HG, choline, N-acetyl-aspartate, glutamate-glutamine, and lactate. In 9 patients who have undergone both pre- and post-treatment scans, 4 demonstrated marked decrease (30-50%) in the levels of 2HG after completion of adjuvant therapy as shown in Figure 1. The remainder showed partial reduction of 2HG, with no patients showing increased 2HG levels.

**CONCLUSION**

We demonstrate for the first time that 3D imaging of 2HG is clinically feasible in patients with IDH1 mutated gliomas. Quantification of 2HG levels in a cohort of mutant IDH glioma patients shows measurable changes during treatment.

**CLINICAL RELEVANCE/APPLICATION**

VSNR51-02

VSNR51-03
2HG imaging could be used to answer clinically important questions of true-/pseudo-response and true-/pseudo-progression in mutant IDH glioma patients. 3D mapping of 2HG and other metabolites is important to capture tumor heterogeneity and reduce variability in longitudinal studies.

**VSNR51-04**

**Prognostic Value of ADC and Its Correlation with Methylguanine-DNA-Methyltransferase (MGMT) Promotor Methylation Status and Epidermal Growth Factor Receptor (EGFR) Amplification and Survival in Glioblastoma Multiforme (GBM)**

Romina Zalarz MD (Presenter): Nothing to Disclose, Miguel David Hernandez Arguello MD: Nothing to Disclose, Maria Paramo Alfaro MD: Nothing to Disclose, Pablo Daniel Dominguez MD: Nothing to Disclose, Jose Luis Zubieta: Nothing to Disclose, Jose Luis Solorzano: Nothing to Disclose, Paula Barquin Garcia MD: Nothing to Disclose, Maria De Los Reyes Garcia de Eulate: Nothing to Disclose

**PURPOSE**

To analyse whether apparent diffusion coefficient (ADC) values correlate with survival and with methylguanine-DNA-methyltransferase (MGMT) promoter methylation status and epidermal growth factor receptor (EGFR) amplification on glioblastoma multiforme (GBM).

**METHOD AND MATERIALS**

72 patients with untreated GBM before surgery were analysed (mean time MRI-Surgery=6 days). Patients were followed-up for at least 12 months or until death. A ROI were drawn on ADC-map in the highest restriction region of the tumor and on the normal-appearing contralateral white matter (NCWM).

ADCmin-values and ADC-index defined as a ratio between tumoral ADCmin and NCWM-ADCmean were evaluated. MGMT-status(n=60), EGFR amplification(n=53), KPS, tumoral and residual volume, progression-free survival (PFS) and overall survival (OS) were analysed. Kaplan-Meier and Cox-regression model were performed.

**RESULTS**

53 patients had complete resection. Presurgical and post-surgical mean tumoral volume were 42.4cm3 and 0.57cm3 respectively. Methylated-MGMT-status(n=27) and low ADC-values(<0.7) correlates with a decrease in PFS and OS (p<0.001). EGFR amplification (n=19) was correlated with a decrease in PFS (p=0.029) only when low ADC values and non-methylated-MGMT-status were present. EGFR amplification was not correlated with a poor outcome in the group of higher ADC values and MGMT methylated status (p>0.001). On Kaplan-Meier analyses MGMT-status correlated better with PFS (p=0.002), while ADC values correlate better with OS (p 0.001). In the multivariate analysis low ADC values and MGMTNM status were significant predictors of prognosis when they were adjusted by clinical variables (p= 0.001 and p=0.037, respectively).

**CONCLUSION**

The combined use of ADC values and MGMT-status are stronger predictors than using separated in GBM and could modulate outcome in patients with EGFR amplification.

**CLINICAL RELEVANCE/APPLICATION**

ADC values in GBM correlates significantly with survival, independently of the MGMT and EGFR status. Therefore, ADC values could be used as independent predictors of survival in those patients.

**VSNR51-05**

**Automated Task-Free Resting-State Functional MRI to Define Critical Margins in Surgical Planning for Brain Tumor Surgery**

Wolfgang Gaggl PhD (Presenter): Researcher, Prism Clinical Imaging, Inc, Svyatoslav Vergun: Nothing to Disclose, Matthew Andreoli: Nothing to Disclose, Veena A. Nair PhD: Nothing to Disclose, Vivek Prabhakaran MD, PhD: Nothing to Disclose

**PURPOSE**

Resting state functional MRI (rs-FMRI) enables clinicians to define critical areas and margins for pre-surgical planning of brain tumor resections without requiring the active participation of the patient. While task-based fMRI has gained utility in the clinical environment, rs-FMRI needs to be automatized and verified in tumor patients to be useful as a reliable clinical tool.

**METHOD AND MATERIALS**

Data were acquired from 48 patients (24 with brain tumors, 24 epilepsy and vascular lesions) including rs-FMRI, task-based fMRI, diffusion tensor imaging (DTI) and structural MRI on 1.5T and 3T MRI scanners. Data were preprocessed (Allen EA, 2011) using AFNI (NIH, Bethesda, MD) and FSL (Oxford, UK) and decomposed into individual functional network components using independent component analysis (ICA) implemented in the GIFT toolbox (MRN, Albuquerque, NM) calculated for 28 and 75 components. ICA components were both manually identified by a trained radiologist overlaid on the anatomical and DTI images and compared by spatial correlation to published template components from healthy subjects (Calhoun, 2008). Predictive values from radiologist vs. automation where generated as well as ranked cross-correlation values.

**RESULTS**

Reproducible ICA components could be identified from both the 28 and 75 component analyses. Higher component numbers resulted in higher spatial detail and higher classifier values, but occasionally led to functional networks distributed across several components. The median classifier achieved better than 80% agreement. Using the non-deformable MNI registration to warp templates into subject space, templates showed considerable overlap with the tumor in some instances. Calculated ICA components, however, followed the outline of the tumor highlighting functional gray matter as classified by a clinician.

**CONCLUSION**
Our automated classification allows extraction of functional network components quickly with good agreement to the manual reader and with seamless FMRI workflow. A larger functional component template library for use with clinical patient populations is currently underway for further validation and improvement of classification accuracy.

**CLINICAL RELEVANCE/APPLICATION**

Task-free functional MRI can aid in identification of eloquent brain tissue in tumor resections by outlining functional networks and critical margins where active patient participation is not possible.

**VSNR51-06**

**Role of the Radiologist in Pre-op Brain Tumor Mapping**

John L. Ulmer MD (Presenter): Stockholder, Prism Clinical Imaging, Inc Medical Advisory Board, General Electric Company

**LEARNING OBJECTIVES**

1) Discuss the differences between image-centric and patient-centric perspectives in clinical Neuroradiology and presurgical brain mapping. 2) Cite the utility of clinical assessments and the electronic medical record in presurgical brain mapping. 3) Discuss the impact of presurgical brain mapping on surgical decision making.

**VSNR51-07**

**Imaging Biomarkers of CNS Tumor Treatment Response**

Benjamin Michael Ellingson MS, PhD (Presenter): Research Consultant, MedQIA Imaging Core Laboratory Research Consultant, F. Hoffmann-La Roche Ltd Research Consultant, Tocagen Inc Research Consultant, Boston Scientific Corporation Research Consultant, Amgen Inc Research Grant, Siemens AG Research Grant, F. Hoffmann-La Roche Ltd

**LEARNING OBJECTIVES**

1) Participants will comprehend the current RANO criteria and its limitations in practice. 2) Participants will gain an appreciation for how to use T2/FLAIR to measure response, challenges associated with T2/FLAIR, and potential solutions for measuring noneenhancing tumor response. 4) Participants will comprehend basic and advanced diffusion MR biomarkers to treatment response. 5) Participants will comprehend basic and advanced perfusion MR biomarkers to treatment response. 6) Participants will comprehend basic pH-weighted MR response using CEST imaging. 7) Participants will comprehend basic and advanced PET imaging response.

**ABSTRACT**

Depths of novel imaging biomarkers are now available for evaluating biological response to new therapies in CNS tumors. The current course will briefly outline the current Response Assessment in Neuro-Oncology (RANO) criteria, including limitations when implementing in multicenter trials. The use of digital T1 subtraction maps as a method for measuring enhancing tumor volume in the presence of agents that reduce vascular permeability will be discussed. T2/FLAIR response, challenges associated with interpreting T2/FLAIR response, and a potential solution for measuring noneenhancing tumor response using T2 relaxometry will be described. This course will outline simple and advanced diffusion MR biomarkers for patient stratification and response assessment, including ADC histogram analysis, functional diffusion mapping, voxel-wise proliferation and invasion modeling, and DREAM-MRI. Simple and advanced perfusion MR biomarkers, including DSC-MRI, DCE-MRI, and a new pharmacokinetic perfusion-diffusion model will be described. The use of pH-weighted MR response to therapy will also be discussed using CEST imaging. Lastly, basic and advanced PET imaging techniques will be described in the context of response assessment and drug target efficacy.

**VSNR51-08**

**The DTI Challenge Initiative on the Standardized Evaluation of DTI Tractography for Neurosurgical Planning**


**PURPOSE**

To provide standardized evaluation of Diffusion Tensor Imaging (DTI) tractography algorithms for mapping white matter pathways during glioma resection

**METHOD AND MATERIALS**

Nineteen tractography teams reconstructed the corticospinal (CST) tract on a series of 11 cases presenting with a glioma near the motor cortex area (high-grade n=7, low-grade n=4), in the three editions of the DTI Tractography Challenge at the MICCAI 2011, 2012 and 2013 conference. The datasets included DTI scans (20 and 30 gradient directions, b-value=1000 s/mm²) acquired on a 3T scanner, and co-registered T1-weighted and FLAIR scans with segmented tumor and edema. Participating teams were required to submit part of their tractography results prior to the workshop, and to process two cases in a limited time at the event and four DTI experts evaluated and discussed the tractography reconstructions using a web-based questionnaire with standardized views of the tractography results. Variability among methods was quantified based on the Dice coefficient of bundle overlap of the voxelized tracts.
METHOD AND MATERIALS

The 232 corticospinal tracts submitted to the three editions of the DTI Challenge workshop showed a large inter-algorithm variability (average Dice coefficient of overlap: 0.23(tumor), 0.22(contralateral)). Standardized review of the results demonstrated that most algorithms could reconstruct the CST projection to the cortical motor foot area and identified limitations in the ability of some methods to track the lateral projections to the face and hand areas, as well as false-negative and false-positive tracts in both hemispheres. Improvements of the tractography reconstructions from year 1 to year 3 indicate this collaborative effort is a learning experience for the community.

CONCLUSION

DTI tractography reconstructions are complex geometric models of white matter anatomy that can provide clinically relevant information for the planning of glioma resection in eloquent areas. By providing a benchmark for the standardized evaluation of tractography algorithms on a common series of clinical data, the DTI tractography challenge initiative aims to accelerate the translation of novel tractography tools from research to the clinics.

CLINICAL RELEVANCE/APPLICATION

Standardized evaluation of DTI tractography techniques can help establish the validity of tractography-derived information to assist in neurosurgical decision-making.

RESULTS

Longitudinal radiological analysis showed that 39 patients had true progression or recurrence and 14 patients had pseudoprogression. The true progression or recurrence is associated with APT hyperintensity, compared to contralateral normal-appear white matter, while pseudoprogression is associated with APT isointensity to mild hyperintensity. The average APT signal intensity was significantly higher in the true progression/recurrence group (2.76% ± 0.55%) than in the pseudoprogression group (1.19% ± 0.40%; P < 0.001). Based on the receiver operating characteristic (ROC) analysis, the cutoff APT signal intensity value was 1.89%, with a sensitivity of 100% and a specificity of 92.9%.

CONCLUSION

The APT-MRI signal may be a valuable imaging biomarker to distinguish between tumor progression or recurrence and pseudoprogression whose diagnosis typically needs repeated surgery or longitudinal MRI scanning over several months.

CLINICAL RELEVANCE/APPLICATION

APT image can help distinguish pseudoprogression from true progression or recurrence. Such a distinction may avoid the time-consuming longitudinal MRI analysis and repeated craniotomy or biopsy.

RESULTS

The 232 corticospinal tracts submitted to the three editions of the DTI Challenge workshop showed a large inter-algorithm variability (average Dice coefficient of overlap: 0.23(tumor), 0.22(contralateral)). Standardized review of the results demonstrated that most algorithms could reconstruct the CST projection to the cortical motor foot area and identified limitations in the ability of some methods to track the lateral projections to the face and hand areas, as well as false-negative and false-positive tracts in both hemispheres. Improvements of the tractography reconstructions from year 1 to year 3 indicate this collaborative effort is a learning experience for the community.

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DTI tractography reconstructions are complex geometric models of white matter anatomy that can provide clinically relevant information for the planning of glioma resection in eloquent areas. By providing a benchmark for the standardized evaluation of tractography algorithms on a common series of clinical data, the DTI tractography challenge initiative aims to accelerate the translation of novel tractography tools from research to the clinics.

CLINICAL RELEVANCE/APPLICATION

Standardized evaluation of DTI tractography techniques can help establish the validity of tractography-derived information to assist in neurosurgical decision-making.

METHOD AND MATERIALS

Total 53 patients with pathologically confirmed high-grade gliomas (anaplastic astrocytoma or glioblastoma) were assessed. All patients provided written informed consent as required. Eligibility criteria included: treated with concurrent chemotherapy and radiation therapy (CCRT) after surgical resection, developed new or enlarged contrast enhanced lesions after CCRT, and had standard clinical MRI before and after CCRT. APT-MRI scanning was performed at 3T (3D sequence; 15 slices; 4.4 mm thickness). APT-weighted MRI signals were calculated using magnetization transfer ratio asymmetry at 3.5ppm with respect to water. MRI analysis was made, blinded to pathologic diagnosis, based on longitudinal signal changes in T2W, FLAIR, DWI and gadolinium enhancement on T1W, lasting at least six months.

RESULTS

Longitudinal radiological analysis showed that 39 patients had true progression or recurrence and 14 patients had pseudoprogression. The true progression or recurrence is associated with APT hyperintensity, compared to contralateral normal-appear white matter, while pseudoprogression is associated with APT isointensity to mild hyperintensity. The average APT signal intensity was significantly higher in the true progression/recurrence group (2.76% ± 0.55%) than in the pseudoprogression group (1.19% ± 0.40%; P < 0.001). Based on the receiver operating characteristic (ROC) analysis, the cutoff APT signal intensity value was 1.89%, with a sensitivity of 100% and a specificity of 92.9%.

CONCLUSION

The APT-MRI signal may be a valuable imaging biomarker to distinguish between tumor progression or recurrence and pseudoprogression whose diagnosis typically needs repeated surgery or longitudinal MRI scanning over several months.

CLINICAL RELEVANCE/APPLICATION

APT image can help distinguish pseudoprogression from true progression or recurrence. Such a distinction may avoid the time-consuming longitudinal MRI analysis and repeated craniotomy or biopsy.
37/123 patients enrolled consented to DSC-MRI plus conventional MRI, 13 (mean age 54±14 years, 7 men) with DSC-MRI at baseline plus 2 weeks after start of treatment. Two central readers determined response status at 2 weeks using 2D-T1 enhancement and Macdonald threshold criteria with adjudication if necessary. Enhancing ROIs were also defined semi-automatically from thresholded 2D-T1 difference images and used to calculate volume (rCBV; TE=30-105ms) and Flamsteed error factor. Post-processing leakage correction normalized to normal-appearing white matter. Kaplan-Meier survival estimates and log rank test (2-sided) were used to determine if response status on 2D-T1 MRI and rCBV changes on DSC-MRI were predictive of PFS and OS, respectively. Fisher’s exact test (2-sided) was used to determine association between change in rCBV and response status on 2D-T1 MRI.

RESULTS

At 2 weeks, there were 3 responders and 10 non-responder/non-progressors (NR-NPs) on 2D-T1, and 4 positive and 9 negative changes from baseline in rCBV. One patient (NR-NP, positive rCBV change) had progressed clinically before week 2 and was excluded from PFS analyses. PFS was significantly worse for patients with increasing vs. decreasing rCBV (p=0.0034), but not for responders vs. NR-NPs (p=0.44). Similarly, survival time was significantly shorter for patients with increasing vs. decreasing rCBV (p=0.0015) but not for responders vs. NR-NPs (p=0.92). There was no significant association between positive vs. negative change in rCBV and responders vs. NR-NPs on 2D-T1 MRI (p=1.0).

CONCLUSION

After 2 weeks of anti-VEGF therapy, change in rCBV from baseline has highly significant prognostic value for PFS and OS, whereas 2D-T1 response status does not.

CLINICAL RELEVANCE/APPLICATION

Early increase in rCBV may be a useful MRI biomarker for the failure of anti-VEGF therapy, permitting a timely switch to alternative trials when necessary.

Funded through NCI U01-CA079778 and U01-CA080098.

### VSNR51-11

**pH-Weighted Molecular MRI of Human Brain Tumors Using Amine CEST**


**PURPOSE**

Acidosis is a hallmark of the tumor extracellular microenvironment. Additionally, studies have shown that tumor regions have increased amino acid uptake in order to meet high metabolic demands. Chemical exchange saturation transfer (CEST) MRI is a non-invasive imaging technique that can provide molecular information about the functional groups of molecules. The CEST signal is sensitive to many factors that affect chemical exchange between molecules, including metabolite concentration and pH. In the current study, we develop and test CEST MRI targeted to the amino acid amine group as a pH-weighted imaging biomarker for identifying cancer tissue in patients with various brain tumors.

**METHOD AND MATERIALS**

Samples of glutamine in water at varying pH (4.0 to 8.6 in units of 0.2) were created at varying concentration. Additionally, samples of phenylalanine and glycine were created for the same pH range. CEST data for these samples were collected at 3T on a Siemens Trio scanner (B1=2μT, 15 100-ms RF saturation pulses, 51 spectral points, ± 5.0 ppm). A normalization image was acquired by setting B1=0. Additionally, serial CEST data for a cohort of 12 GBM patients before, during, and after radiochemotherapy. Image-guided biopsies were obtained in an additional two patients with suspected tumor recurrence.

**RESULTS**

Results show high CEST asymmetry in low pH values between 5.0-7.0 pH and with increasing amino acid concentration. In GBM patients, changes in elevated CEST signal during radiotherapy provided early, independent information regarding the status of the tumor. Some patients showed continual increase in CEST positive regions during therapy, which was followed by early tumor progression (Fig. 1A). In cases of confirmed pseudoprogression, no elevated CEST asymmetry was noted despite an increase in tumor volume on anatomical images (Fig. 1B). Image-guided biopsies of CEST positive locations confirmed tumor, whereas CEST negative regions showed gliosis and little tumor activity.

**CONCLUSION**

CEST MRI targeted to the amine protons may provide a pH-weighted imaging biomarker for identifying regions of active tumor proliferation in patients with brain tumors.

**CLINICAL RELEVANCE/APPLICATION**

An non-invasive imaging method for obtaining tissue pH information would be invaluable as a tool for detecting human cancers and characterizing tumor response to therapy.

### VSNR51-12

**New PET CNS Oncology Approaches**

Lance T. Hall MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the role of F-18 FDG in brain tumor imaging. 2) Discuss metabolic brain tumor imaging with amino acids and proliferation markers and learn the complimentary information provided to MRI techniques. 3) Introduce novel alkylphosphocholine analogues, CLR1404 and CLR1502, that can be used for PET imaging, in vivo optical imaging, and therapy of brain tumors.
**Optimized Neuroimaging in Infants Using a Prototype Dedicated16-Channel Neonatal Head Coil**

Maura E. Ryan MD : Nothing to Disclose, Jie Deng PhD (Presenter): Nothing to Disclose, Jingyi Xie PhD : Employee, Siemens AG, Shivraman Giri PhD : Employee, Siemens AG, Abraham Padua : Employee, Siemens AG

**PURPOSE**

Magnetic resonance imaging (MRI) is highly sensitive for evaluating intracranial pathology in newborns and infants, and can detect abnormalities not evident by ultrasound or computed tomography. However, MRI in this population can be technically difficult due to small size, motion and limited parenchymal contrast. Many infants are currently imaged with larger than necessary commercially available head coils or smaller coils designed for other uses. A dedicated phase array head coil with a smaller field of view (FOV) would allow for improved image quality through greater signal to noise, increased field uniformity, and shorter imaging times.

**METHOD AND MATERIALS**

A prototype 16 channel phased-array head coil (Siemens AG, Healthcare sector, Erlangen, Germany) was designed for neonatal and infant neuroimaging. Three of the posterior arrays overlapped with the standard spine array and could be used for cervical spine imaging as well. Imaging was performed on either a 1.5T or 3T (MAGNETOM Aera/Skyra, Siemens AG, Healthcare Sector, Erlangen, Germany) MRI scanner following the clinically diagnostic exam with standard commercially available head coils. Imaging parameters, well as subjective assessment of image quality were compared. Phantom measurements of signal to noise ratio (SNR) were also assessed.

**RESULTS**

30 examinations were performed with the prototype neonatal head coil. Patients ranged in age from 4 days to 6 months. Clinical indications included suspected structural abnormality (21), mass (5) seizure (2) and infection (1). Significant pathology was identified in approximately half of the studies (13/13 brain; 6/8 orbit/face/JAC, 3/9 spine). All pathology evident on comparable sequences on the commercial head coil was also detectable on the research coil. Some findings and anatomic evaluation were qualitatively better appreciated on research coil images (figure). The smaller FOV and higher SNR enabled higher resolution imaging without increasing imaging time.

**CONCLUSION**

There are several keys to minimizing sedation in Pediatric Neuroimaging. Most important are targeting the study to obtaining the specific answer requested by the referring clinician, and obtaining the data as efficiently as possible by using sequences that will answer the question in the shortest time. The second is that the strategy changes depending upon the age of the patient: neonates most often can be scanned without sedation; a relatively short scan can be performed on infants by the 'feed and swaddle' method, and older children (6 years and above) can very frequently be studied without sedation if training and/or a training session before the scan to reduce anxiety is useful. Use of a system that allows the child to watch a movie of their own choice is very helpful as well.

**ABSTRACT**

There are several keys to minimizing sedation in Pediatric Neuroimaging. Most important are targeting the study to obtaining the specific answer requested by the referring clinician, and obtaining the data as efficiently as possible by using sequences that will answer the question in the shortest time. The second is that the strategy changes depending upon the age of the patient: neonates most often can be scanned without sedation; a relatively short scan can be performed on infants by the 'feed and swaddle' method, and older children (6 years and above) can very frequently be studied without sedation if training and/or a training session before the scan to reduce anxiety is useful. Use of a system that allows the child to watch a movie of their own choice is very helpful as well.
In comparison to commercially available standard head or small part coils, the use of a dedicated neonatal head coil enables small FOV imaging with better SNR to improve diagnostic quality and decrease imaging time in infant patients.

**CLINICAL RELEVANCE/APPLICATION**

Neuroimaging in infants is technically difficult and the use of a dedicated neonatal head coil can improve diagnostic confidence.

**VSPD51-03**

**Efficacy of Ultrasound Elastography in Detecting Active Myositis in Children. Can It Replace MRI?**

Netanel Berko MD (Presenter): Nothing to Disclose, Arielle Hay MD: Nothing to Disclose, Yonit Sterba MD: Nothing to Disclose, Dawn Wahezi MD, MS: Nothing to Disclose, Hillel Cohen PhD, MPH: Nothing to Disclose, Terry L. Levin MD: Nothing to Disclose

**PURPOSE**

To compare strain ultrasound elastography with magnetic resonance imaging (MRI) of the quadriceps muscles for the detection of active myositis in children with inflammatory myositis.

**METHOD AND MATERIALS**

Multisequence noncontrast MRI of the quadriceps muscles was compared to grey scale and cine ultrasound elastography in eighteen children with inflammatory myositis (15 juvenile dermatomyositis, 2 systemic lupus erythematosus, 1 polymyositis; 15 girls, 3 boys; mean age 10.5 +/- 4.7 years; range 3-19 years). Active myositis was defined on MRI as increased muscle signal on T2-weighted images. Elastography images were evaluated based on a previously published numerical scale of muscle elastography in normal children by two radiologists in consensus, blinded to the patients’ MRI findings. Disease duration, serum muscle enzyme levels, and clinical assessment of active versus inactive disease were correlated with imaging findings. Statistical analyses were performed with Fisher’s exact test, Spearman’s correlation and Mann-Whitney U test as appropriate. *P* value < 0.05 indicated statistical significance.

**RESULTS**

Quadriceps muscle signal was normal on T1-weighted images in all subjects. T2 hyperintensity was present in 9 subjects; of these, elastography was abnormal in two (decreased elasticity) and normal in seven. Twelve patients had normal MRI; elastography was normal in 7 and abnormal in 5 (decreased elasticity). MRI signal hyperintensity and increased muscle echogenicity correlated strongly with clinically active disease (*p* = 0.035 and *p* = 0.015, respectively). However, there was no significant correlation between elastography and clinically active disease (*p* = 0.144), or elastography and MRI (*p* = 0.64). A nonsignificant trend toward decreased muscle elasticity in children with longer disease duration was present (*p* = 0.265).

**CONCLUSION**

Ultrasound elastography does not accurately detect active myositis in children with inflammatory myositis.

**CLINICAL RELEVANCE/APPLICATION**

Ultrasound elastography does not replace MRI as the gold standard for detecting active myositis in children.

**VSPD51-04**

**Minimizing Sedation and Radiation in Pediatric Cardiovascular Imaging**

Rajesh Krishnamurthy MD (Presenter): Research support, Koninklijke Philips NV Travel support, Koninklijke Philips NV

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**VSPD51-05**

**Clinical Validation of Using Free Breathing Navigator Echo and Triggered Cardiac Gated Delayed Myocardial Enhancement MR Imaging in Sedated Infants**

Ryutaro Matsuura MSc (Presenter): Nothing to Disclose, Yuichi Omura: Nothing to Disclose, Noriaki Akagi BS: Toshiba Itoh is employee of Siemens Healthcare, Sachiko Goto PhD: Nothing to Disclose, Yoshiharu Azuma PhD: Nothing to Disclose, Shuhei Sato MD, PhD: Nothing to Disclose, Seiji Tahara: Nothing to Disclose

**PURPOSE**

The delayed myocardial enhancement on MRI is preferred sequence in order to evaluate state of myocardium. However it is not yet performed to a sedated infant with congenital heart disease who has high heart rate and small myocardium since it requires suspended respiration. In this study, we validate a navigator echo triggered sequence that drives the magnetization before cardiac gated inversion recovery-T1 turbo field echo (IR-T1TFE) acquisition in the sedated free breathing pediatric population.

**METHOD AND MATERIALS**

Cardiac MRI was performed with clinical trial on 24 sedated infants with single ventricle (female: 11, male: 13) ranged in age from 0 to 5 years (mean age: 2.3 years). The Gadoteridol (0.4ml/kg) was injected into them as the contrast media. Imaging (Figure 1) was performed on a 1.5T MR scanner (Phillips Achieva 1.5T). To compare image quality, we calculated the signal to noise ratio (SNR) and contrast to noise ratio (CNR) of two image groups which were obtained by using respiratory triggering with navigator echo and without navigator echo. Wilcoxon signed rank test was performed to compare the significant difference among two image groups at each result. Furthermore, all the images were visually assessed by 2 radiologists who are specialist of cardiac MRI.
RESULTS

The SNR with navigator echo was higher than without navigator echo. The CNR shows no significant difference. The visual assessment scores with navigator echo were consistently better than without navigator echo. The high spatial resolution and low noise for a clinical image is required in order to diagnose, especially in an infant cardiac MRI. In this study, free breathing navigator echo has the advantage which decreases the motion artifact caused by respiration. It brings the improvement of the noise and spatial resolution for a clinical image.

CONCLUSION

Cardiac gated IR-T1FFE sequence for free breathing and using navigator echo triggered respiration allows clinically diagnostic images in sedated infants with improvement of the noise and spatial resolution for a clinical image.

CLINICAL RELEVANCE/APPLICATION

Free breathing navigator echo triggered respiration IR-T1FFE allows diagnostic image in sedated infant with improved good SNR and spatial resolution.

VSPD51-06

Pediatric Thoracic CT Angiography at 70 kVp: A Phantom Study to Investigate Effects on Diagnostic Quality and Patient Radiation Dose

Robert MacDougall MSc (Presenter): Nothing to Disclose, Edward Yungjae Lee MD, MPH: Nothing to Disclose, Patricia Louise Kleinman: Nothing to Disclose

PURPOSE

Feasibility of performing pediatric computed tomography angiography (CTA) at 70 kVp. Low kVp scanning has the potential to allow for reduced patient dose and improved diagnostic quality by virtue of increased contrast enhancement in the vessel. This phantom study aims to systematically evaluate the potential for dose reduction/improved image quality at 70 kVp in pediatric CTA exams for various patient sizes, contrast concentrations and reconstruction algorithms.

METHOD AND MATERIALS

Four anthropomorphic pediatric thoracic phantoms were used (nominal ages: newborn, 1, 5, 10 years). Phantoms contained holes (1 cm diameter) in the center and periphery. Rods with iodine concentrations of 0, 3, 6, 8, 10, 15 mg/cc (HU = 0, 85, 170, 230, 290, 450) were manufactured. Contrast rods were inserted into the phantom center between the lung regions. Each phantom size and concentration was scanned with the clinical CTA protocol (80 kVp) as well as 70, 100, 120 and 140 kVp (Siemens Biograph mCT). The mA was fixed and adjusted at each kVP to match the CTDI obtained with the 80 kVP clinical protocol. Images were reconstructed using FBP and Iterative Reconstruction (SAFIRE). For each image set, the Contrast to Noise Ratio (CNR) was averaged over five images. Using the method of calculating the Relative Dose Factor (RDF) to optimize CNR with noise constraints (Yu, 2009), the RDF was calculated for each image set.

RESULTS

At conservative levels of noise constraint (< 1.25), there were conditions that resulted in an increased Relative Dose Factor at 70 kVp. The RDF showed dependence on the noise constraint parameter and iodine concentration. The RDF was lower at 70 kVp in all phantom sizes for noise constraints > 1.5.

CONCLUSION

These results challenge conventional wisdom that ‘if 80 kVp is good, 70 kVp is better’. It is important to understand the factors that potentially allow for reduced dose at 70 kVp. It is accepted that the noise constraint should be lower for children, as children have smaller organs and less adipose tissue. Under such conditions, 70 kVp scanning provides benefits in a very limited set of clinical situations that depend on patient size and contrast concentration.

CLINICAL RELEVANCE/APPLICATION

We present the specific conditions where 70 kVp is appropriate and warn against scenarios where scanning at 70 kVp is inappropriate. This information is valuable to end-users designing pediatric CTA protocols on scanners with 70 kVp capability.

VSPD51-07

A Prospective Clinical Trial for the Determination of Minimum Radiation Dose in Pediatric Cardiovascular CTA

Aya Kino MD (Presenter): Nothing to Disclose, Jia Wang PhD: Nothing to Disclose, Beverley Mansfield Newman MD, MBChB: Nothing to Disclose, Frandics Pak Chan MD, PhD: Nothing to Disclose

PURPOSE

We conduct a prospective clinical trial to evaluate the minimum radiation dose, in terms of equivalent dose (ED) and organ doses (OD), that can produce diagnostic studies in children who underwent cardiac gated (CG) and high-pitch (HP) CTA. We also examine dose savings from image based iterative reconstruction (SAFIRE).

METHOD AND MATERIALS

With IRB approval, pediatric patients referred for thoracic CTA were recruited for a split dose protocol in which a high-dose and a low-dose scans were performed in tandem under a single contrast bolus and breath-hold on a Siemens Flash scanner. The tube current in each scan was adjusted such that the combined CTDI was the same as a routine scan. Other scan controls, such as CG versus HP mode, tube-voltage, contrast protocol, and scan range were chosen according to the clinical needs. Images were reconstructed at 0.6 mm thickness without SAFIRE and with SAFIRE at all levels (1-5). Two cardiac radiologists categorized these images as diagnostic without SAFIRE, diagnostic with SAFIRE, and non-diagnostic at any SAFIRE level. ED was estimated from patient size and DLP. OD was calculated with an image-based Monte Carlo simulation.
RESULTS

31 patients (age 8 weeks to 7 years old, weight 4 to 74 kg) were recruited, producing 62 scans. 48 scans are HP and 14 scans are CG. Among diagnostic studies without SAFIRE, the average ED for first-pass HP at ED was 0.78 mSv, and the OD were 2.41 mSv for lung, bone, liver, and breast were 0.35, 3.13, 1.25, and 1.19 mGy. Dose values for delay-phase HP are similar. For CG, the average ED is 1.33 mSv, and the OD for lung, bone, liver, and breast were 7.93, 16.65, 8.53, and 10.2 mGy, respectively. Among diagnostic studies with SAFIRE, the average ED for first-pass HP at ED was 1.8-2.0 mSv for delay-phase HP and 3.1-4.0 mSv for CG. Nondiagnostic first-pass HP at ED as low as 0.12 mSv are convertible to diagnostic studies with SAFIRE. The highest ED values for unrecoverable studies are 0.55 mSv for delay-phase HP and 0.93 mSv for CG.

CONCLUSION

With currently technology, we can expect a minimum dose of 0.1 to 0.5 mSv for non-gated CTA and 1 mSv for retrospectively gated CTA. In routine practice, actual dose will be higher, depending on patient size and protocol.

CLINICAL RELEVANCE/APPLICATION

Pediatric cardiovascular CTA of the chest should aim for less than 1 mSv for non-gated studies and 3 mSv for gated studies.

VSPD51-08 Minimizing Sedation in Pediatric Abdominal and Musculoskeletal MRI

Shreyas Shreenivas Vasanawala MD, PhD (Presenter): Research collaboration, General Electric Company Stockholder, Morpheus Imaging, Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Sedation for pediatric MRI has multiple disadvantages. It confers risk of adverse events for what is an otherwise non-invasive procedure. Additionally, sedation contributes to cost, makes exam scheduling complex, and leads to inefficient imaging utilization. This presentation will present some approaches to reduce the incidence, duration, and depth of sedation for pediatric abdominal and musculoskeletal indications. An overview of child developmental approaches that reduce the incidence of sedation will be given. Then an approach for compact protocols to minimize duration of sedation will be presented. This will be followed by discussion of methods of managing respiratory motion artifacts without periods of suspended respiration, thus reducing depth of anesthesia.

VSPD51-09 Rapid MRI in Pediatric Appendicitis without Contrast or Sedation

Ryne Didier MD (Presenter): Nothing to Disclose, Bryan Robert Foster MD : Nothing to Disclose, Fergus V. Coakley MD : Nothing to Disclose, Sanjay Krishnaswami MD : Nothing to Disclose, David Spiro MD : Nothing to Disclose, Katharine Lee Hopkins MD : Nothing to Disclose

PURPOSE

Historically, limited availability, high cost and motion artifact prevented the use of MRI in the evaluation of acute pediatric appendicitis. However, recent developments have allowed utilization even in non-sedated pediatric patients. Concerns regarding ionizing radiation employed by CT have encouraged use of alternative imaging modalities. The purpose of this study was to evaluate the performance characteristics of MRI without contrast or sedation in the diagnosis of pediatric appendicitis.

METHOD AND MATERIALS

Patients <18 years of age with suspected acute appendicitis who underwent clinically indicated US were eligible. No contrast or sedation was administered. After a scout sequence was performed, five sequences were obtained including diffusion weighted imaging (DWI). The duration from the scout sequence to the presence of images in PACS (overestimate of total scan time) was recorded. Previously established diagnostic criteria for acute appendicitis were used to interpret the MR by two blinded reviewers. In the case of discrepancy, the official report issued by a non-binded radiologist was used as a ‘tie-breaker.’ Results were compared with US results, clinical outcome, operative reports, and surgical pathology results, if available.

RESULTS

To date, 36 examinations have been performed, 21 females (58%) and 15 males (42%). Mean age was 11.05 years (3.16-17.9). The examination was tolerated by all participants. The two reviewers demonstrated good agreement (kappa = 0.667). 5 discrepancies were identified; two were resolved by the ‘tie-breaker.’ The average time from scout to PACS was 27.44 minutes. The protocol yielded 92.9% sensitivity and 90.9% specificity for acute appendicitis with a diagnostic accuracy of 89.7%. Two false positives and one false negative were reported which were concordant with the ultrasound results. Additionally, these three studies produced discrepant results among the two reviewers. All three patients ultimately underwent appendectomy based on clinical data.

CONCLUSION

Preliminary implementation of a rapid MRI protocol without contrast or sedation in the evaluation of pediatric appendicitis yielded promising performance characteristics. Although further investigation is warranted, this imaging protocol may provide clinicians with an alternative to CT.

CLINICAL RELEVANCE/APPLICATION

Rapid MRI without contrast or sedation is a promising alternative to CT in the evaluation of pediatric appendicitis.
Utility of a Motion Correction with Radial Blades (BLADE) MRI Sequence over Standard Single Shot Turbo Spin Echo (HASTE) T2 Weighted Imaging in Pediatric Abdominal MRI

Unni K. Udayasankar MD, FRCP (Presenter): Nothing to Disclose, Chakradhar Reddy Thupili MD: Nothing to Disclose, Jennifer Bullen MSc: Nothing to Disclose, Neil Vachhani MD: Nothing to Disclose, Cheol Min Park MD: Nothing to Disclose

PURPOSE

The BLADE MRI images were significantly superior for sharpness of the liver edge, definition of portal triad, and for respiratory motion artifacts on subjective evaluation (p < 0.001 for both readers). 30/58 studies demonstrated intra-abdominal lesions, and BLADE images also demonstrated significantly improved lesion conspicuity and sharpness of the portal triad, and lesion conspicuity. For quantitative comparison, ROIs were placed in similar areas of fat and air to measure signal intensity and noise levels. Wilcoxon signed rank test (qualitative) and paired t test (quantitative) were used for statistical evaluation.

RESULTS

In pediatric abdominal MRI, BLADE T2 weighted images demonstrate significantly improved image quality with better definition of the portal triad, liver edge and with reduced respiratory motion artifact when compared with the standard HASTE T2 sequence.

CLINICAL RELEVANCE/APPLICATION

BLADE T2 weighted sequence improves overall image quality of abdominal MRI in children and could function as an alternative to standard single shot fast spin echo sequence.

Predictable Index of Vesicoureteral Reflux (VUR) in Children with Urinary Tract Infection (UTI): Usefulness of Intravoxel Incoherent Motion (IVIM) Diffusion Weighted Magnetic Resonance Imaging (DW-MRI)

Jeong Woo Kim MD (Presenter): Nothing to Disclose, Chang Hee Lee MD: Nothing to Disclose, Yang Shin Park MD: Nothing to Disclose, Jong Mee Lee: Nothing to Disclose, Jae Woong Choi MD: Nothing to Disclose, Kyong Ah Kim MD: Nothing to Disclose, Cheol Min Park MD: Nothing to Disclose

PURPOSE

To compare the index values made by combination of diffusion parameters between the “reflux” kidney and the “non-reflux” kidney and to evaluate the feasibility of IVIM DWI for predicting vesicoureteral reflux in children with urinary tract infection.

METHOD AND MATERIALS

This retrospective study was approved by our institutional review board and the requirement for informed consent was waived. 83 kidneys from 57 pediatric patients with UTI were included. Kidneys were classified into two groups “reflux” kidney and “non-reflux” kidney according to the results of voiding cystourethrogram(VCUIG). DWI using IVIM was performed with eight b factors. ADC, true diffusion coefficient(D), pseudo-diffusion coefficient(D*), and perfusion fraction(f) in the renal pelvises of both “reflux” and “non-reflux” kidneys were measured five times by a radiologist and compared between the two groups. We used the median value of the measurements as the representative value of the measured parameter. Additionally, four indices(D*/ADC, D*/D, f/ADC and f/D) were developed by combining diffusion parameters and four indices were also calculated. ROC curve analyses were performed for each index to evaluate their diagnostic performance and to identify optimal cut-off value to predict the VUR.

RESULTS

VURs were detected in 21 kidneys on VCUIG. Among ADC- and IVIM-derived parameters, ADC and D were significantly lower in the renal pelvis of the “reflux” kidney than that of the “non-reflux” kidney while D* and f were significantly higher. (p = 0.037, 0.020, 0.010, and <0.001, respectively) Four indices(D*/ADC, D*/D, f/ADC, and f/D) were all significantly higher in the renal pelvis of the “reflux” kidney than that of the “non-reflux” kidneys. (p = 0.022, 0.008, <0.001, and <0.001, respectively) In ROC curve analysis, f/D showed the highest AUC (Az = 0.813) with optimal cut-off value of 7.33 and corresponding sensitivity and specificity of 85.7 and 64.5%, respectively.

CONCLUSION

Perfusion fraction(f) was significantly higher in the renal pelvis of the "reflux" kidney than that of the "non-reflux" kidney. Our new index, f/D could detect VUR with relatively high sensitivity. In the future, IVIM DWI which is both radiation and contrast media-free, can be used for detecting VUR in children with UTI and further replace VCUIG.

CLINICAL RELEVANCE/APPLICATION

Index of VUR in IVIM DW-MRI which is both radiation and contrast media-free can be easily calculated and may be used prior to VCUIG study.

Reliability of Contrast-enhanced Voiding Urosonography with a Second Generation Ultrasound Contrast-agent in the Diagnosis and Grading of Vesicoureteral Reflux

Frederica Papadopoulou MD (Presenter): Nothing to Disclose, Aikaterini Ntouli Maria PhD: Nothing to Disclose, J. Christopher Edgar PhD : Nothing to Disclose, Kassa Darge MD, PhD : Nothing to Disclose, Ellen Park MD, MS: Nothing to Disclose, Cheol Min Park MD: Nothing to Disclose, Yang Shin Park MD: Nothing to Disclose
Disclose

PURPOSE

The diagnostic accuracy of contrast-enhanced voiding urosonography (ce-VUS) in the diagnosis and grading of vesicoureteral reflux (VUR) is high compared to voiding cystourethrography. However, its reliability has not been yet adequately evaluated. The purpose of this study is to assess the reliability of ce-VUS in VUR detection and grading by estimating the inter- and intra-observer agreement of two pediatric radiologists.

METHOD AND MATERIALS

Two hundred ten children (86 boys/124 girls, mean-age 2.7y) with 421 pelvi-ureteral-units underwent ce-VUS examination with a second-generation contrast-agent to assess possible (180) or follow-up known (30) VUR. The video-clips of all ce-VUS examinations were twice independently assessed by two pediatric radiologists 4-6 weeks apart. The inter- and intra-observer agreement was estimated by kappa statistic.

RESULTS

The inter- and intra-observer agreement of both radiologists regarding the presence or grading of VUR was excellent (k>0.94). There were only two disagreements regarding the presence of VUR (grade I and II false-negative and false-positive respectively). There were 5 cases of disagreement in VUR grading: three cases of VUR grade II-III and two cases grade III-IV. VUR was detected in 123(29%) pelvi-ureteral-units of 87 (41.4%) children and it was more common in completely duplicated ureters (6/7) than in single ones (p=0.03). The rate of VUR was independent of sex, age and presence or side of hydronephrosis (p>0.05).

CONCLUSION

The reliability of ce-VUS with a second generation ultrasound contrast-agent in VUR detection and grading is high. Ce-VUS could be used as a radiation-free alternative.

CLINICAL RELEVANCE/APPLICATION

To demonstrate the reliability of ceVUS for vesicoureteral reflux detection in children

VSPD51-13 Comparative Assessment of New Generation CT Scanners for Pediatric Applications
Whal Lee MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

VSPD51-14 Impact of Iterative Reconstruction and Low Dose on Low Contrast Detectability in Pediatric Patients in CT
Usman Mahmood MS (Presenter): Nothing to Disclose, Yusuf Emre Erdi DSc: Nothing to Disclose

PURPOSE

To determine low contrast detectability (LCD) in the pediatric patient while maintaining the noise magnitude and texture.

METHOD AND MATERIALS

A CIRS liver phantom with three rows of 7 spherical targets, ranging from 10 mm to 2.5 mm, that are 5, 10, and 20 HU below the liver equivalent background was used to assess low contrast detectability. A Gammex 464 CT accreditation phantom was used to calculate CNR. The minimum observable spherical target was detected under appropriate viewing conditions. CNR was calculated according to the method described in the ACR CT phantom scanning instructions. The phantoms were scanned with the current pediatric CT protocol (80 mA, 10% iterative reconstruction). In order to maintain an equivalent level of noise in the reduced dose protocol (45 mA, 40% iterative reconstruction), a decrease in mA was accompanied by an increase in iterative reconstruction. Multiple levels of mA and iterative reconstruction between the current protocol and the reduced protocol have also been investigated.

RESULTS

A minimum spherical target diameter of 6.3 mm was detectable on reconstructed images acquired with the current CT protocol. With the reduced dose protocols, a minimum spherical target diameter of 9.5 mm was detectable on the reconstructed images. CNR was 0.593 ± 0.006 for all protocols. For an equivalent noise magnitude and texture as the current CT protocol, CTDI was found to decrease by up to 43%.

CONCLUSION

Optimization of CT protocols, while maintaining an equivalent noise magnitude and texture of CT images, leads to a loss of LCD. Furthermore, trying to optimize protocols based on the CT accreditation phantom alone may not be enough for optimum LCD.

CLINICAL RELEVANCE/APPLICATION

Dose reduction achieved with a decreased mA and increased application of iterative reconstruction may result in a loss of LCD.

VSPD51-15 Radiation Dose Reduction in Pediatric Body CT Using a Novel Image-based Denoising Technique

Lifeng Yu PhD (Presenter): Nothing to Disclose, Joel Garland Fletcher MD: Grant, Siemens AG, Maria Shiung: Nothing to Disclose, Kristen Barry Thomas MD: Nothing to Disclose, Jane Sexton Matsumoto MD: Nothing to Disclose, Shannon Nicole Zingula MD: Nothing to Disclose, Cynthia H. McCollough PhD: Research Grant, Siemens AG
PURPOSE

To evaluate the radiation dose reduction potential of a novel image-based denoising technique in pediatric body CT exams and compare it with an iterative reconstruction (IR) method.

METHOD AND MATERIALS

Fifty pediatric CT exams (25 chest, 25 abdominopelvic (AP)) acquired using a weight-based low-kV protocol were included in this retrospective study. For each case, we used a validated noise-insertion tool developed in our lab to simulate half-dose images. A novel denoising technique, adaptive non-local means (aNLM) filter, which was developed in our institution, was applied to the half-dose images. An IR method (SAFIRE, Siemens) was also used to reconstruct the half-dose images. Three pediatric radiologists evaluated 4 sets of images for each of the 50 cases: (1) full dose + filtered-backprojection (FBP), (2) half dose + FBP, (3) half dose + IR, and (4) half dose + aNLM, in a randomized and blinded fashion. The overall image quality and the diagnostic confidence for each organ (chest: lung and mediastinum; AP: liver, kidney, and small bowel) were rated using a five point scale. For each case, each reader ranked dose/reconstruction method preference using a side by side comparison. Image sharpness for AP exams was rated.

RESULTS

The original CTDIvol was 5.3±2.1 mGy for AP exams and 2.4±1.1 mGy for chest exams. At half dose, both IR and aNLM improve the overall image quality over the FBP for both chest and AP exams (p<0.01). In AP, there was no significant difference between aNLM denoised images at half dose and the original full dose images (3.61±1.01 vs. 3.55±0.86, p=0.54), and aNLM performed better than IR (3.61±1.01 vs. 3.33±0.89, p<0.01). In chest, there was no significant difference between IR at half dose and the original full dose images (4.12±0.61 vs. 4.16±0.58, p=0.66), but IR performed better than aNLM (4.12±0.61 vs. 3.68±0.69, p<0.01). The organ-specific diagnostic confidence and preference order were consistent with the overall image quality evaluation.

CONCLUSION

The use of a novel image-based denoising technique resulted in a 50% radiation dose reduction in pediatric AP CT while maintaining the same diagnostic quality as in the full dose FBP images. IR image quality was worse than aNLM in the abdomen, but better in the chest.

CLINICAL RELEVANCE/APPLICATION

A novel denoising technique, which can be implemented across all scanner platform, can preserve diagnostic image quality despite a 50% radiation dose reduction in pediatric AP CT.
METHOD AND MATERIALS

This retrospective study was approved by our institutional review board. Total 44 consecutive patients (mean age: 56.1 ± 18.1) who were underwent CTV using 80 kVp for evaluation of deep vein thrombosis (DVT) were enrolled. The same raw data were reconstructed using FBP, ASIR and MBIR. Objective image quality (vascular enhancement, noise, contrast to noise ratio (CNR)) were measured in the inferior vena cava (IVC), femoral vein (FV) and popliteal vein, respectively by independent two radiologists who blinded to reconstruction method. In addition, subjective image parameters (image quality, image noise, confidence to find DVT) were assessed using a 5 point scale system by same two radiologists independently. Data were analyzed using repeated measures ANOVA and effective dose was estimated using the dose-length product (DLP).

RESULTS

All images reconstructed by MBIR were acceptable for diagnosis and DVT was diagnosed in 8 patients (18.2%). The mean CNR of MBIR was significantly higher than those of FBP and ASIR in the IVC, FV and popliteal vein and images in MBIR had significantly lower objective image noise (p < 0.01). However, mean vascular enhancement of MBIR was not significantly different from those of FBP and ASIR. In addition, the subjective image quality and confidence of find DVT of MBIR was significantly higher than those of the others (p < 0.01) while MBIR had the lowest score for subjective image noise (p < 0.01). The mean DLP was 364.31 ± 61.20 mGy cm.

CONCLUSION

CTV using 80 kVp with MBIR provided diagnostic acceptable image quality for evaluation of DVT with low radiation dose and it was superior to FBP and ASIR in objective and subjective image quality.

CLINICAL RELEVANCE/APPLICATION

CTV using 80 kVp with MBIR will be optimal protocol for diagnosis of DVT with lowest radiation dose.
abdomen following routine or CTA protocols. A subset of 36 examinations were chosen that had mean aortic attenuation of less than 200 HU calculated as the average of 8 regions of interest within the aorta. Subjective evaluation of vascular enhancement and overall image noise was graded on a 5-point scale (1 = Non-diagnostic, 5 = Excellent). Monoenergetic image sets of 40 to 180 kVp at every 10 kVp were created. An ideal monoenergetic energy level was chosen as the highest energy that provided mean aortic attenuation greater than 200 HU and maintained diagnostically acceptable subjective image noise and vascular enhancement. At this energy level attenuation, noise, and signal-to-noise ratios as well as subjective image quality and vascular enhancement were compared to the standard 120 kVp polyenergetic study. Paired t-test and Wilcoxon signed-rank test were used for analysis.

RESULTS
34 studies (94%) met criteria for successful optimal monoenergetic reconstruction, with a mean optimal energy of 57 ± 6.4 keV. Optimizing energy levels significantly increased aortic attenuation compared to the 120 kVp studies by an average of 66% (239 ± 25 vs. 144 ± 25 HU; p < .001). Image noise averaged 16% higher in the monoenergetic energy studies than the 120 kVp exams (19.6 ± 3.9 vs. 16.9 ± 4.1; p < .001), while SNR was 41% higher (13.3 ± 2.9 vs. 9.4 ± 2.5; p < .001). Subjective vascular enhancement was significantly higher on the monoenergetic images (4.7 vs 2.4, p < .001). While subjective image noise increased (4.2 vs. 5.0, p < .001), the resulting image set was diagnostically acceptable.

CONCLUSION
SDCT enables retrospective creation of an optimal monoenergetic image set which achieves attenuation levels comparable with dedicated aortic angiographic exams and remains acceptable for diagnosis despite increased image noise.

CLINICAL RELEVANCE/APPLICATION
SDCT enables the creation of retrospective aortic angiograms from studies that otherwise may not be diagnostic, suggesting the ability to create angiograms from routine or low contrast studies.


Philipp Riffel MD (Presenter): Nothing to Disclose, Stefan Haneder MD: Nothing to Disclose, Holger Haubenreisser: Nothing to Disclose, Bernhard Schmidt PhD: Employee, Siemens AG, Stefan Oswald Schoenberg MD, PhD: Institutional research agreement, Siemens AG, Thomas Henzler MD: Nothing to Disclose

PURPOSE
Previous studies demonstrated that calculated low keV monoenergetic datasets from Dual energy (DE)CT abdominal angiography imaging does not significantly improve contrast-to-noise ratio (CNR) when compared to the polyenergetic images (PEI), which is due to the dramatic increase in image noise at lower keV levels. The recently introduced frequency-split technique combines the lower spatial frequency stack for noise at high keV levels with the high spatial frequency stack for image noise at high keV levels to calculate noise-reduced images at ultra-low keV levels below 70 keV. The aim of this study was to compare objective image quality indices in DECT angiography studies of the abdomen using conventional polyenergetic images (PEIs) and virtual monoenergetic images (MEIs) at different keV levels using the frequency-split technique.

METHOD AND MATERIALS
20 patients (14 male; mean age 70±10 years) who underwent DECT angiography of the abdomen were retrospectively included in this study. MEIs from 40 to 120 keV were reconstructed using the frequency-split technique. Signal intensity, noise, signal-to-noise ratio (SNR) and CNR were assessed in infrarenal aorta, superior mesenteric and external iliac arteries. Comparisons between MEIs and PEIs were performed using a Mann-Whitney U test.

RESULTS
60 arteries were evaluated. 40 keV MEIs resulted in significantly higher signal intensity (+254% on average; all p < 0.05) compared to PEIs at slightly higher SNR (+7% on average; p > 0.05). Highest CNR values were found in 40 keV MEIs (9 ± 0.8 HU, 7 ± 1.6 HU, 9 ± 1.4 HU in the infrarenal aorta, superior mesenteric and external iliac arteries, respectively), which were significantly higher compared to PEI (7 ± 1 HU, 5 ± 1.5 HU, 7 ± 1.5 HU in the infrarenal aorta, superior mesenteric and external iliac arteries, respectively, all p < 0.05).

CONCLUSION
Combining the lower spatial frequency stack for contrast at low keV levels with the high spatial frequency stack for noise at high keV levels leads to improved image quality of ultra-low keV monoenergetic abdominal DECT datasets when compared to previous monoenergetic reconstruction techniques without the frequency-split technique.

CLINICAL RELEVANCE/APPLICATION
With a frequency split approach, 40 keV MEIs provide improved objective image quality in DECT abdominal angiography compared to standard PEI. Their additional reconstruction might improve diagnostic accuracy.

Substantial Radiation Dose Reductions in Wide-Range CT Angiography using an Integrated Detector Design, Ultra High-Pitch Acquisition, Auto-kVp-Selection and Model-based Iterative Reconstruction

Florian Schwarz MD (Presenter): Nothing to Disclose, Matthias Hintz: Nothing to Disclose, Christopher Uebelis MD: Nothing to Disclose, Alexander Sterzik: Nothing to Disclose, Christian Kuppert MD, PhD: Nothing to Disclose, Maximilian F. Reiser MD: Nothing to Disclose, Hans-Christoph Richard F. Becker MD, PhD: Speaker, Bracco Group Speaker, Bayer AG Speaker, Guerbet SA Speaker, Siemens AG Consultant, Amgen Inc, Andreas Pomscard MD: Nothing to Disclose, Marcus MD: Nothing to Disclose, Dominik Zinser BS: Nothing to Disclose, Vera Sophie Schneider BS: Nothing to Disclose

PURPOSE
To evaluate image quality and radiation dose saving potential of a CT scan protocol that uses a detector with integrated signal-transformation, a high-pitch acquisition technique, automatic kVp selection and an
iterative reconstruction algorithm.

**METHOD AND MATERIALS**

Between January and April 2014, 55 consecutive patients underwent CT angiography (CTA) of the chest, abdomen and pelvis on a third-generation dual-source CT using an ultra high-pitch (73 cm/s) acquisition protocol, topogram-based automatic kVp selection and mAs modulation in combination with a model based iterative reconstruction algorithm (group 1). As a control group, 55 patients who had undergone CTA with comparable scan ranges on a second-generation dual-source CT in 2012 and 2013 were matched according to gender, age and BMI (group 2). In all patients, 20 vascular segments were analyzed for attenuation and image noise by two readers on 3.0mm slices. Signal-to-Noise ratio (SNR) and Contrast-to-Noise ratio (CNR) were calculated for all segments. Dose-Length-Product (DLP) was documented to calculate effective dose.

**RESULTS**

There were no significant differences in age, weight or BMI between groups. In group 1, tube potential was 90kVp, 80kVp and 70kVp in 29 (53%), 24 (43%) and 2 (4%) patients. In group 2, tube potential was 140kVp, 120kVp and 100kVp in 7 (13%), 29 (53%) and 19 (34%) patients. Across all vascular segments, SNR and CNR were considerably higher in group 1 (SNR: 29.6 ± 3.3 vs. 21.0 ± 3.0; CNR: 28.7 ± 3.9 vs. 18.3 ± 2.9, both p’s < 0.01). DLP, on the other hand, was substantially lower in group 1 (230 ± 63 vs. 391 ± 166 cm*mGy, p<0.001).

**CONCLUSION**

In third-generation dual-source CT scanners, the combination of an integrated detector design, a high-pitch acquisition technique, automatic kVp selection and iterative-reconstruction algorithms results in dose reductions of at least 40% in comparison with earlier scanner generations at preserved image quality.

**CLINICAL RELEVANCE/APPLICATION**

This study highlights the importance of a rapid and successful translation of the considerable engineering progress of the last years into radiation dose reduction and thus patient benefit.

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**Dual-Energy and Low kVp CTA**

Dominik Fleischmann MD (Presenter): Research support, Siemens AG

**LEARNING OBJECTIVES**

1) Understand the basic principles and technical basics of dual energy CTA. 2) Describe two components of dual energy imaging including material decomposition and virtual monochromatic spectral imaging. 3) Review the experimental studies and discuss the potential clinical application to vascular systems.

**Implications for Contrast Medium Delivery**

Carlo Catalano MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the basic principles and technical basics of dual energy CTA. 2) Describe two components of dual energy imaging including material decomposition and virtual monochromatic spectral imaging. 3) Review the experimental studies and discuss the potential clinical application to vascular systems.

**Diagnostic Accuracy of Low kV CT-angiography (CTA) by using 256 Multi Detector CT Scanner (MDCT) Combined with Low Contrast Medium Volume in the Assessment of Abdominal Aorta Disease**

Cammillo Roberto Giovanni Leopoldo Talei Franzesi : Nothing to Disclose, Davide Ippolito MD : Nothing to Disclose, Davide Fior MD (Presenter): Nothing to Disclose, Sophie Lombardi : Nothing to Disclose, Sandro Sironi MD : Nothing to Disclose

**PURPOSE**

The aim of our study was to reduce the radiation dose exposure and contrast medium volume in the evaluation of abdominal aorta disease, using low-kV setting CT-angiography (CTA) protocol.

**METHOD AND MATERIALS**

A total of 84 patients (35 women and 49 men; mean age 66.5 years; range, 37-86 years) with abdominal aorta disease, from June 2011 to December 2013, were prospectively enrolled. All patients underwent 256MDCT scan examination of abdominal aorta (Brilliance-iCT, Philips, NL). Forty-six patients were evaluated using low-dose radiation protocol (100kV; automated tube current modulation) and ultra low-contrast volume (40ml; 4ml/s; 350mgI/ml). A control group of 38 patients underwent standard CTA protocol (120kV; automated tube current modulation) with standard contrast volume (80ml). Intravessel density measurements (HU) were performed manually drawing a region of interest (ROI) in the lumen of abdominal aorta, renal arteries and common iliac arteries. The radiation dose exposure (dose-length product, DLP; CT dose index, CTDIvol) and the signal-to-noise ratio (SNR) were also calculated. The data were then compared and statistically analyzed.

**RESULTS**

All exams were presented high diagnostic quality, permitting thus the correct visualization of the main aortic branches and vascular wall. Higher density measurements were obtained in low-kV protocol as compared to control group, in abdominal aorta (mean attenuation value 343HU vs 320HU), renal arteries (320HU vs 280HU) and common iliac arteries (320HU vs 320HU). No significant noise increase was observed in the study group (mean signal to noise ratio SNR 15.2) in comparison to control group (SNR 18.6). A significant (p<0.05) overall reduction of 65% in radiation dose exposure was obtained using low-kV protocol (DLP 335mGy*cm; CTDIvol 5.8mGy) as compared to control group.
CONCLUSION

Low-kV CTA by using 256 MDCT scanner permits to significantly reduce the radiation dose exposure (over 65%) and the amount of contrast media volume injected, maintaining high diagnostic quality as compared to standard protocol, reducing also the risk of renal damage.

CLINICAL RELEVANCE/APPLICATION

Low kV protocol with low contrast media volume reduces the radiation exposure, preserving renal function and providing an effective tool for the evaluation of patients with abdominal vascular disease.

VSVA51-10

CT Angiography of the Abdomen and Pelvis in Azotemic Patients utilizing 80 kVp Technique and Low Dose Iodinated Contrast—Comparison with Routine 120 kVp Technique

David Knipp MD : Nothing to Disclose, Jason Wayne Mitchell MD : Nothing to Disclose, Barton Frederick Lane MD : Nothing to Disclose, Barry David Daly MD (Presenter): Research Grant, Koninklijke Philips NV

PURPOSE

Reduction of iodinated contrast load for CTA is of importance in azotemic patients, especially those who are not dialysis dependent, and may be achieved with the improved iodine absorption of lower kVp techniques. We compared quantitative and qualitative scan data in two abdominopelvic CT Angiography (AP-CTA) protocols, one with a 50% reduced dose of iodinated contrast @ 80 kVp, the other with a standard dose @ 120 kVp. Radiation dose was also compared between the two techniques.

METHOD AND MATERIALS

A chart review was performed yielding 103 patients who underwent AP-CTA on 64 or 256 channel CT scanners with 320-350 mg I/mL contrast: 49 with 30-60 mL (mean 48) at 80 kVp, and 54 controls with 90-100 mL (mean 98) at 120 kVp. Objective image quality parameters included arterial attenuation, noise, and contrast to noise ratio (CNR) measured at 6 levels in the aorta and iliac arteries. Subjective assessment of image quality (IQ), enhancement intensity (EI) and image noise (IN) was scored blindly at the same levels by three attending radiologists on a 3 point scale. Iterative reconstruction (iDose, Philips Healthcare, Cleveland, OH) was utilized in 18 and 49 of the 120 and 80 kVp groups respectively. Radiation dose (CTDIvol and DLP) was recorded in each case.

RESULTS

The aggregate of 6 level CNR for the 120 kVp group was 12.4 ± 4.6, compared to 11.8 ± 7.0 for the 80 kVp group (p =0.60). The 120 kVp technique scored better for subjective IQ (p=0.042) and IN (p=0.004) but not for EI (p=0.205). No study had to be repeated. Radiation dose was significantly higher in the 120 kVp than 80 kVp group (DLP 973 ± 344 and 482 ± 206 (mg*cm) respectively (p<0.0001)). In the 80 kVp group, serum creatinine pre-and post AP-CTA (means 3.7 and 3.4 mg/dl respectively) showed no significant change (p=0.172).

CONCLUSION

Based upon objective CNR and subjective EI scores, the 80 kVp technique with 50% lower iodine contrast dose allowed satisfactory AP-CTA studies without nephrotoxicity in azotemic patients. Use of iterative reconstruction in all 80 kVp group cases contributed to a 43% mean radiation dose reduction. Negative but potentially reversible sequelae of this major drop in radiation dose included increased IN and reduced subjective IQ.

CLINICAL RELEVANCE/APPLICATION

In azotemic patients, 80 kVp technique using 50% lower iodinated contrast dose and iterative reconstruction allows safe and satisfactory AP-CTA studies with major radiation dose reduction.

VSVA51-11

Dual-Phase Triple Split-Bolus Protocol for Pre-Operative CT Evaluation of Laparoscopic Donor Kidney Anatomy: A Way for Dose Reduction

Roberto Iezzi MD (Presenter): Nothing to Disclose, Michele Fabio La Torre MD : Nothing to Disclose, Alessandra Guerra MD : Nothing to Disclose, Massimiliano Nestola MD : Nothing to Disclose, FRANCO CITTERIO MD : Nothing to Disclose, Lorenzo Bonomo MD : Nothing to Disclose

PURPOSE

To evaluate the diagnostic performance of a triple bolus dual-phase acquisition protocol (unenhanced/combined artero-venous-excretory phases) for the preoperative assessment of kidney anatomy in renal laparoscopic living donors.

METHOD AND MATERIALS

Twenty consecutive patients, referring to our department to undergo CT evaluation prior to living donor nephrectomy, were enrolled in our single-center prospective randomized comparison of 2 CT-acquisition protocols. Ten patients (Group A) underwent standard quadri-phase CT-examination (unenhanced, arterial, venous, and delayed phases) during a single injection bolus of 100 ml of contrast medium whereas the last 10 patients (Group B) underwent a dual-phase CT protocol (unenhanced and combined artero-venous-excretory phases). Combined artero-venous-excretory phase (Renal Triple-Rule-Out) was performed with a triple split-bolus injection protocol (CM: 30+30+40 ml, @4mL/sec) and an optimized time delay triggered to opacify both artery, veins and renal pelvis opacification at the same time. CT-images were quantitatively and qualitatively compared by two blinded independent readers. The 2 protocol were also compared in terms of diagnostic performance using the surgical assessment during nephrectomy, as gold standard.

RESULTS

All CT examinations were considered technically adequate and no complications occurred. Significantly
higher vascular attenuation values (renal arteries and veins) were obtained in Group A. No significant differences were noted in terms of image quality with either axial source images or 3D reconstructions. Likewise, no significant differences were found among the two protocols in terms of noise. No beam-hardening artifacts due to renal pelvis opacification affecting image interpretation were found. No significant differences were found among the two groups with regard to diagnostic performance. Overall dose reduction of 60% was achieved in Group B.

**CONCLUSION**

Renal Triple-Rule-Out CT Protocol by using a triple-bolus injection protocol is feasible and effective in the preoperative planning of laparoscopic living kidney donors, without compromising image quality and diagnostic performance with a substantial reductions of radiation dose.

**CLINICAL RELEVANCE/APPLICATION**

Renal-Triple-Rule-Out CT protocol may allow a significant reduction in radiation burden in renal laparoscopic living donor without affecting an accurate pre-treatment planning.

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**Gravitational Gradient (GG) in Abdominal Aortic Aneurysms (AAA) during CT Angiography (CTA) as a Sign of Disturbed Hemodynamics and Adverse Clinical Outcome**

Elizabeth George MD, Nothing to Disclose, Michael Lally Steigner MD, Speaker, Toshiba Corporation, Antonios Antoniadis, Nothing to Disclose, Michael Hanley MD, Nothing to Disclose, Frank John Rybicki MD, PhD, Research Grant, Toshiba Corporation, Dimitris Mitsouras PhD (Presenter): Nothing to Disclose, Amir Imanzadeh MD: Nothing to Disclose, Kanako Kunishima Kumamaru MD, PhD: Nothing to Disclose, Yiannis M. Chatzizisis MD: Nothing to Disclose, Ruth M. Dunne MBCh: Nothing to Disclose, Andreas Giannopoulos MD: Nothing to Disclose

**PURPOSE**

A recently proposed sign at CTA, the "gravitational gradient" (GG), quantifies the antero-posterior inhomogeneity of luminal contrast enhancement under the hypothesis that it may signify slow flow in large vessels. We thoroughly investigated the GG in infrarenal AAA as a source of hemodynamic information and assessed its relevance with respect to rapid AAA growth.

**METHOD AND MATERIALS**

The GG was measured in 67 consecutive pre-repair CTAs and used to classify patients as high (≥1.4) or normal (<1.4) GG (Figure). We compared the two groups for a) cardiovascular (CV) status, including ejection fraction; b) CTA scan and contrast delivery parameters, including timing; c) aortic and AAA geometry; d) characteristics of the blood flow patterns using computational fluid dynamics in 5 high and 5 matched normal GG patients; and e) AAA growth change in post-repair CTA available in 10 high GG patients.

**RESULTS**

18% of AAAs (n = 12) exhibited a high GG≥1.4. A high GG was independent of patient CV status, CT scan/contrast delivery parameters, and AAA/aortic geometry (all p > 0.05). The only significant differences between patients with vs normal GG were a sudden drop in aortic enhancement between the renal arteries and aortic bifurcation (43±38 vs 10±39 HU drop, p < 0.05; Figure), and parameters, namely extent of retrograde flow or stasis (10±6% vs 24±2% luminal area affected, p < 0.05, Figure), helicity (54±2 vs 12±5 m2/s2, p < 0.05), and vorticity (72±25 vs 109±27 s−1, p < 0.05). In the 10 high GG patients that underwent repair, both the high GG and sudden drop in aortic enhancement across the AAA resolved (pre vs post GG = 1.9±0.5 vs 1.0±0.1, p < 0.05, HU drop = 42±4 vs 20±20, Figure). Finally, a high GG was associated with a relative risk of 2.7 (95% CI: 1.3-5.3, p < 0.05) for AAA growth >0.4 cm/yr.

**CONCLUSION**

Inhomogeneous luminal contrast enhancement in infrarenal AAA CTA as detected by the GG is associated with complex hemodynamic patterns and rapid aneurysm enlargement. Its potential use to detect patients at risk of rapid AAA growth and rupture should be further explored.

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**Quantitative Determination of Respiratory Movement of the Aorta and Side Branches**

Anna Margaretha Sailer MD, MBA, Speakers Bureau, Siemens AG, Marco Das MD: Research Consultant, Bayer AG Research Grant, Siemens AG, Geert Willems MD, PhD: Nothing to Disclose, Bart A.J.M. Wagemans MD: Nothing to Disclose, Joachim Ernst Wildberger MD, PhD: Nothing to Disclose

**PURPOSE**

Aim of this study was to quantitatively assess the magnitude and direction of respiratory movement of the aorta and side branches.

**METHOD AND MATERIALS**

This prospective study was approved by the institutional review board; informed consent was obtained from all patients. We performed a quantitative three-dimensional subtraction analysis of computed tomography during inspiration and expiration to establish the respiratory geometric movements of the aorta and side branches. 60 patients (42 men, 18 women, mean age 70 ± 9 years) with aortic disease were included. During breath-hold expiration and inspiration respectively, one millimeter (mm) slice thickness non-contrast enhanced and contrast-enhanced computed tomography of the aorta were performed respectively. By means of dedicated multiplanar reformation image subtraction software using the spine as reference spine, position of relevant aorta were analyzed. These included the diaphragm domes, anterior thorax wall, ascending thoracic aorta (AAo), the origin of the left subclavian artery (LSO), descending thoracic aorta at level of tenth thoracic vertebra (D Ao) as well as the origin of the renal arteries (RAO).

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**Renal Triple-Rule-Out CT Protocol**

Richard B. Reeder MD, Nothing to Disclose, Max G. Laub MD, PhD: Nothing to Disclose, Beat Seiler MD, PhD: Nothing to Disclose, Andreas Giannopoulos MD: Nothing to Disclose

**PURPOSE**

The Renal-Triple-Rule-Out CT protocol may allow a significant reduction in radiation burden in renal laparoscopic living donor without affecting an accurate pre-treatment planning.

**METHOD AND MATERIALS**

Aim of this study was to quantitatively assess the magnitude and direction of respiratory movement of the aorta and side branches. We thoroughly investigated the GG in infrarenal AAA as a source of hemodynamic information and assessed its relevance with respect to rapid AAA growth.

**RESULTS**

Inhomogeneous luminal contrast enhancement in infrarenal AAA CTA as detected by the GG is associated with complex hemodynamic patterns and rapid aneurysm enlargement. Its potential use to detect patients at risk of rapid AAA growth and rupture should be further explored.

**CONCLUSION**

No significant differences were found among the two groups with regard to diagnostic performance. Overall dose reduction of 60% was achieved in Group B.
RESULTS
With inspiration, the regions of interest of the aorta and side branches moved in anterior, medial and caudal direction compared to the expiration state. Threshold for vessel displacement was at least five mm anterior-posterior thoracic excursion or ten mm diaphragm dome movement. Mean 3-dimensional movement (± standard deviation) was 8.9 ± 3.6 mm (AAo), 11.1 ± 3.9 mm (LSO), 4.9 ± 2.5 mm (DAo) and 1.4 ± 1.1 mm (RAO). There was significantly less movement in the DAo compared to LSO (p < 0.001). Correlation coefficient between extent of LSO displacement and thorax excursion was 0.78.

CONCLUSION
The aorta and side branches undergo considerable respiratory movement. This finding may be important for thoracic and complex thoraco-abdominal endograft designs as well as fusion image guidance during endovascular aortic repair.

CLINICAL RELEVANCE/APPLICATION
Respiratory movement is an important contribution to understanding the aortic dynamics; it has implications especially for planning and implantation of endovascular thoraco-abdominal aortic repair.

VSVA51-14  Post Processing, Workflow and Interpretation
Karin Evelyn Dill MD (Presenter):  Nothing to Disclose
LEARNING OBJECTIVES
1) To illustrate steps in image post-processing for the interpretation of CTA images. 2) To highlight elements that can be used to optimize workflow for multiplanar reformatted images, maximum intensity projections, and three-dimensional volumes.

ABSTRACT
During this presentation, the most current post processing techniques available for CT angiography will be reviewed. The audience will understand the application of these tools for optimal image interpretation. Imaging and workflow protocols will be introduced, with the emphasis on improving patient care, as part of a multidisciplinary team.
LEARNING OBJECTIVES

1) To select the appropriate modality or modalities in evaluating a suspected or diagnosed case of pediatric CNS disease with focus on MR imaging. 2) To review key MR imaging features of pediatric brain diseases. 3) To evaluate neuroimaging of pediatric CNS disease as it relates to understanding the developing brain in childhood.

LEARNING OBJECTIVES

1) Identify the basic anatomic, physiologic and pathologic features of diseases affecting the pediatric spine. 2) Identify the key imaging features of various common pediatric spine diseases. 3) Recognize common patterns for spine and spinal cord pathology and organize these patterns into categories of diseases processes.

ABSTRACT

Common pediatric spine and spinal cord diseases will be discussed in a case-based format.

LEARNING OBJECTIVES

1) Identify the salient imaging features of common pathologies of the pediatric head and neck. 2) Identify pertinent anatomy in the neck and skull base through the illustration of head and neck pathology. 3) Recognize patterns for disease that allow a succinct differential diagnosis. 4) Apply radiologic findings to identify next appropriate steps in patient work-up.

LEARNING OBJECTIVES

1) Access the results of new research and assess their potential applications to clinical practice. 2) Improve basic knowledge and skills relevant to clinical practice. 3) Practice new techniques. 4) Assess the potential of technological innovations and advances to enhance clinical practice and problem-solving. 5) Apply principles of critical thinking to ideas from experts and peers in the radiologic sciences.

LEARNING OBJECTIVES

1) Discuss practical imaging techniques for evaluating congenital and acquired thoracic vascular disorders in children. 2) Review helpful clinical aspects and imaging findings of pediatric thoracic vascular diseases. 3) Learn characteristic imaging findings to narrow the differential diagnoses of various pediatric thoracic vascular disorders.

LEARNING OBJECTIVES

1) Identify the salient imaging features of common pathologies of the pediatric head and neck. 2) Identify pertinent anatomy in the neck and skull base through the illustration of head and neck pathology. 3) Recognize patterns for disease that allow a succinct differential diagnosis. 4) Apply radiologic findings to identify next appropriate steps in patient work-up.
LEARNING OBJECTIVES

1) Recognize the imaging appearance of conditions causing pediatric right lower quadrant pain. 2) Recognize the characteristic magnetic resonance imaging features of pediatric appendicitis. 3) Understand the imaging appearance, complications and etiologies of pediatric pancreatitis. 4) Describe the imaging features of pediatric infectious hepatobiliary disease.

MSCP52C

**Pediatric Musculoskeletal Neoplasms**

Jung-Eun Cheon MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the imaging approach to pediatric musculoskeletal neoplasms. 2) Discuss the role of different imaging modalities in the evaluation of pediatric musculoskeletal neoplasms. 3) Identify the common location and characteristic imaging findings of pediatric musculoskeletal neoplasms.

ABSTRACT

Frequency, location, and imaging characteristics are important diagnostic clues in pediatric bone and soft-tissue tumors, either benign or malignant. MR imaging has evolved as the most important diagnostic tool for local staging of primary bone and soft tissue tumors, for monitoring response to chemotherapy, and for detecting postoperative tumor recurrence. A detailed discussion of all bone and soft tissue tumors is well beyond the scope of this review; instead, we highlight the initial evaluation and staging of primary pediatric musculoskeletal neoplasms.

MSESS2

**Essentials of Postoperative Gastrointestinal Imaging**

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Thu, Dec 4 10:30 AM - 12:00 PM  Location: S406B

Sub-Events

MSESS2A

**Postoperative Upper GI**

Cheri Lee Canon MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To identify normal postoperative anatomy of the upper GI track. 2) To diagnose complications of upper GI surgeries.

MSESS2B

**Imaging of the Post-operative Pancreas**

Erik K. Paulson MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify expected cross-sectional imaging findings in patients who have undergone pancreatic surgery. 2) Identify complications in patients who have undergone pancreatic surgery.

MSESS2C

**Postoperative Liver**

Philippe Alain Soyer MD, PhD (Presenter): Research Consultant, Guerbet SA Research Consultant, Ipsen SA

LEARNING OBJECTIVES

1) To become familiar with the expected appearances of the liver following surgery. 2) To highlight the complementary role of the various imaging techniques in the diagnosis of postoperative complications. 3) To become familiar with the imaging features of early and late complications including recurrence of the initial disease. 4) To understand how CT and MR imaging can help with management decision.

MSESS2D

**Postoperative Colon**

Tracy Anne Jaffe MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To review common colon surgical procedures. 2) To review the routine radiographic findings after colorectal surgery. 3) To review the radiographic findings of complications after colorectal surgery.
**MSRT53**

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**ARRT Category A+ Credit**: 1.00

**Thu, Dec 4 10:30 AM - 11:30 AM**

**Location**: N230AB

**Participants**

Ann Oberfell JD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Access the Practice Standards for Medical Imaging and Radiation Therapy and the Rules of Ethics. 2) Analyze practice scenarios to determine if the practice meets acceptable professional performance. 3) apply the Rules of Ethics to determine if behavior complies with professional expectation and patient safety guidelines.

**ABSTRACT**

The changing healthcare environment may produce anxiety among imaging professionals as they navigate new clinical expectations balanced against professional performance guidelines. This presentation will discuss the Practice Standards for Medical Imaging and Radiation Therapy adopted by the ASRT and the Standards of Ethics adopted and enforced by the ARRT and the application and implication of each on daily practice. Specific scenarios related to practice will be analyzed utilizing the Practice Standards to determine the appropriateness of practice and the Standards of Ethics to ascertain professional ethical compliance.

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**RCA52**

**National Library of Medicine: Free Online Databases: Images and More (Hands-on)**

*Refresher/Informatics*

- **IN**
- **IN**
- **IN**

**AMA PRA Category 1 Credits ™**: 1.50

**ARRT Category A+ Credits**: 1.50

**Thu, Dec 4 10:30 AM - 12:00 PM**

**Location**: S401AB

**Participants**

Holly Ann Burt MLIS (Presenter): Nothing to Disclose

**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 rich variety of 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.

**URL’s**

- [http://nnlm.gov/training/resources/onlinedatabases.pdf](http://nnlm.gov/training/resources/onlinedatabases.pdf)

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**RCB52**

**3D Printing (Hands-on)**

*Refresher/Informatics*

- **IN**
- **IN**

**AMA PRA Category 1 Credits ™**: 1.50

**ARRT Category A+ Credits**: 1.50

**Thu, Dec 4 10:30 AM - 12:00 PM**

**Location**: S401CD

**Participants**

Frank John Rybicki MD, PhD (Presenter): Research Grant, Toshiba Corporation

Peter Constantine Liacouras PhD (Presenter): Nothing to Disclose

Amir Imanzadeh MD (Presenter): Nothing to Disclose

Dimitris Mitsouras PhD (Presenter): Nothing to Disclose

Nicole Wake MS (Presenter): Nothing to Disclose

Andreas Giannopoulos MD (Presenter): Nothing to Disclose

Catherine Phillips MD (Presenter): Nothing to Disclose

Beth A Ripley MD, PhD (Presenter): Nothing to Disclose

Tianrun Cai MD (Presenter): Nothing to Disclose

- **IN**

**LEARNING OBJECTIVES**

1) To familiarize radiologist with the general indications for 3D printing in biomedical imaging. 2) To learn the basic principles of an STL file. 3) To obtain “hands-on” experience in creating a STL file from radiology DICOM images. 4) To learn an approach to STL file manipulation to achieve a 3D printed model.
**RCC52**

**Practical Informatics for the Practicing Radiologist: Part Two (In conjunction with the Society for Imaging Informatics in Medicine)**

*Refresher/Informatics*

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

**LEARNING OBJECTIVES**

1) Describe three issues with human factors related to the modern reading room. 2) Indicate potential solutions for lighting, ambient noise, and ergonomic challenges.

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**Sub-Events**

**RCC52A**

**Saving Your Body (and Your Mind): Redesigning the Radiology Reading Environment**

Eliot L. Siegel MD (Presenter): Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XyBix Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research Grant, Herman Miller, Inc Research Grant, Virtual Radiology Research Grant, Anatomical Travelogue, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation

**LEARNING OBJECTIVES**

1) Describe three issues with human factors related to the modern reading room. 2) Indicate potential solutions for lighting, ambient noise, and ergonomic challenges.

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**RCC52B**

**Changing Information Systems: A Survival Guide**

Steven C. Horii MD (Presenter): Consultant, Carestream Health, Inc Investigator, Bracco Group Spouse, Employee, Siemens AG Consultant, PACSGEAR, Inc

**LEARNING OBJECTIVES**

1) Describe common issues facing departments changing vendors. 2) Explain the techniques that can be used at time of contracting to ensure future access to data. 3) List techniques used for image migration.

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**RCC52C**

**So Many Images, So Little Time: Advanced Imaging Techniques**

Adam Eugene Flanders MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To appreciate the diversity of advanced visualization techniques. 2) To understand how advanced visualization extends the value of medical imaging. 3) To learn how advanced visualization has changed traditional workflow strategies. 4) To appreciate some of the pitfalls of automation and the need for expert supervised assessment of advanced visualization output.

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**SSQ01**

**Breast Imaging (Breast Density and Risk Assessment)**

*Scientific Papers*

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Thu, Dec 4 10:30 AM - 12:00 PM   Location: E450A

**Participants**

- **Moderator**
  - Sughra Raza MD: Consultant, Seno Medical Instruments, Inc

- **Moderator**
  - Stamatia V. Destounis MD: Investigator, FUJIFILM Holdings Corporation Investigator, Seno Medical Instruments, Inc

- **Moderator**
  - Jennifer A. Harvey MD: Researcher, Hologic, Inc Researcher, VvCOMP, Inc Researcher, Volpara Solutions, Ltd

- **Shareholder**
  - Volpara Solutions, Ltd Shareholder, Hologic, Inc

**Sub-Events**

**SSQ01-01**

**The Potential Impact of Risk-based Screening Mammography in Women Age 40-49 Years**

Elissa Rhona Price MD (Presenter): Nothing to Disclose, Alexander W. Keedy MD: Nothing to Disclose, Rita Gidwaney MD: Nothing to Disclose, Edward A. Sickles MD: Nothing to Disclose, Bonnie N. Joe MD, PhD: Nothing to Disclose
**Impact of State Breast Density Legislation on Primary Care Physicians**


**PURPOSE**

A state breast density law, effective April 1, 2013, requires mammography facilities in this state to inform patients if they have dense breasts and to direct them to their primary physicians for questions on breast density and supplemental screening tests. This study investigates primary physician awareness of the law and its impact on outpatient primary care practice and management.

**METHOD AND MATERIALS**

An online survey was distributed to 174 physicians within a large single primary care network system in February 2014, 10 months after a state breast density law took effect. Responses were anonymous. The survey was completed by 77 physicians, 39% from Internal Medicine, 47% from Family Medicine, and 9% from Obstetrics-Gynecology departments. A slight majority (53%) were female. 72% had been practicing for greater than 10 years.

**RESULTS**

49% of respondent physicians were not aware of the Breast Density legislation prior to the survey. 32% reported noticing a change in patient levels of concern about breast density in 2013 compared to prior years. Only 3% of primary physicians were “completely comfortable” answering patient questions about breast density, while 25% were “mostly comfortable”. 51% reported themselves as “somewhat comfortable” discussing such questions and 11% were “not comfortable”. 48% of respondents reported that they “rarely” answer questions about breast density. Twenty percent of physicians reported they had ordered supplementary screening tests for women with dense breasts who had no other breast cancer risk factors. Of those that ordered additional testing, 44% ordered Breast MRI, 22% ordered whole breast ultrasound, 11% ordered tomosynthesis, and 22% ordered other unspecified testing.

**CONCLUSION**

Nearly half of physicians from one primary care network were not aware of the state’s breast density notification law, 10 months after it went into effect. Most were not completely comfortable discussing breast density with patients. Enactment of breast density notification laws without the provision of adequate primary physician education and resources is unlikely to significantly impact patient care.

**CLINICAL RELEVANCE/APPLICATION**

15 states have enacted breast density laws. Physician awareness of the laws and knowledge about breast density are crucial in deciding whether renewal or adoption in additional states is warranted.

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**Automated Volumetric Breast Density and Risk of Cancer Stratified by Pathological Attributes**

Stephen W. Duffy: Nothing to Disclose, Oliver William Edmund Morrish MSc: Nothing to Disclose, Lorraine Tucker: Nothing to Disclose, Richard Black MS: Nothing to Disclose, Fiona Jane Gilbert MD (Presenter): Speaker, Bracco Group Research Grant, GlaxoSmithKline plc Research Grant, General Electric Company

**PURPOSE**

To estimate the extent to which automatic measures of density are predictive of breast cancer risk, and in particular risk of the potentially fatal cancers which are prime targets of early detection.
METHOD AND MATERIALS
In a retrospective study of breast tomosynthesis in addition to standard full field digital mammography, we had Volpara automated volumetric density on 7019 subjects (1157 cancers) and Quantra automated volumetric density on 7005 subjects (1156 cancers). Data were analysed using logistic regression.

RESULTS
These was a significant (p<0.001) 3% (95% CI 1.5-5%) increased risk of breast cancer per 10 cm3 increase in fibroglandular (dense) tissue measured by Volpara, and a significant (p<0.001) 2% (95% CI 1.3-3%) increase per 10 cm3 as measured by Quantra. In both cases, the effect was stronger in invasive grade 3 cancers than in grade 2 or grade 1. Risk of grade 3 breast cancer increased by 4% per 10 cm3 increase in dense tissue measured by Volpara (95% CI 1.7-7%) and by 3% per 10 cm3 as measured by Quantra (95% CI 1.5-5%). The effect of neither density measure on risk varied substantially by lymph node status. The effect of Volpara density was considerably stronger for risk of invasive tumours of size greater than 20 mm, at 6% increased risk per 10 cm3 increase dense tissue (95% CI 3-9%). The effect of the Quantra measure had a weaker association with tumour size.

CONCLUSION
Automated volumetric breast density is predictive of breast cancer risk. There is evidence that it has stronger predictive power for potentially fatal large and grade 3 invasive cancers. This suggests that automated volumetric breast density has a potential role in risk stratification and management of breast cancer risk.

CLINICAL RELEVANCE/APPLICATION
Automated calculation of fibroglandular volume appears to indicate risk of developing breast cancer.

SSQ01-04
Enhanced Personalized Breast Cancer Screening Using an Ensemble Model of Mammographic Texture and Density

PURPOSE
Mammographic Density (MD) is scientifically well established as an independent breast cancer risk factor and is increasingly used in clinical practice for personalized screening. Mammographic parenchymal patterns/textures beyond MD is known to provide further risk segregation. We investigate the risk segregation potential of an ensemble of mammographic density and texture measures from FFDM.

METHOD AND MATERIALS
A case/control study was selected from the Dutch Breast Cancer Screening program. Mammograms were acquired on a Hologic Selina FFDM system with a 70μm pixel size. 250 screen detected cancer cases were chosen randomly and likewise for 750 cancer-free controls. Cases were represented by the latest cancer-free prior contralateral MLO view (if available) and otherwise by the contralateral MLO view at time of diagnosis. Controls were represented by the latest available MLO view (laterality matched individually per case). Volumetric density was calculated using Volpara 1.45. Based on a large literature review (e.g. Giger, Manduca, H€oberle, Heine), a total of 56 measures of mammographic texture were implemented and measured for each mammogram. Furthermore, a novel machine learning based texture measure was trained on an independent training set and measured on each mammogram. A multivariate logistic regression model for all 58 measured (and linearly age-corrected) markers was 5-fold cross-validated and evaluated for association to cancer outcome through AUC.

RESULTS
In total, 28 of the age-corrected markers resulted in AUCs significantly better than chance. Specifically, the novel machine learning based measure resulted in an AUC of 0.65 (95% CIs 0.61-0.69) whereas volumetric density was non-significant (AUC 0.51). The multivariate logistic regression yielded a pooled AUC across the five folds of 0.75 (0.71-0.79).

CONCLUSION
By combining a representative range of published mammographic texture measures with a novel machine learning based approach, it was possible to separate future cancer cases from healthy controls to a degree that a) clearly improves on what is attainable through density alone and b) could facilitate personalized screening of, e.g., high risk women.

CLINICAL RELEVANCE/APPLICATION
Clinical practice includes screening based on, e.g., age and family history through risk models as Gail and Tyrer-Cuzick. Such models could be enhanced by texture measures from routine mammograms.

SSQ01-05
Comparing Breast Density Measurement Techniques in Screening Digital Mammography
Oliver William Edmund Morrish MSc (Presenter): Nothing to Disclose, Lorraine Tucker : Nothing to Disclose, Richard Black MS : Nothing to Disclose, Stephen W. Duffy : Nothing to Disclose, Fiona Jane Gilbert MD : Speaker, Bracco Group Research Grant, GlaxoSmithKline plc Research Grant, General Electric Company

PURPOSE
To compare different methods of assessing breast density in a UK screening population.

METHOD AND MATERIALS
Conventional two-view digital mammograms were collected from six centres from 8867 women attending screening in the DWP screening program.
either a screening assessment clinic, or screening for family history. Breast density was assessed by 26
experienced image readers on a visual analogue scale and by two automated volumetric density tools
(QuantraTM, Hologic and VolparaTM, Matakina). Total breast volume, fibroglandular volume and percent
breast density for each view were combined logically to produce results for each woman.

RESULTS
There was a good linear correlation (R²=0.95) between Quantra and Volpara for total breast volume
with a mean difference of 43.5 cm³ (5.04% of the mean result ±0.32%, 2SEM). There was less correlation
for fibroglandular volume (R²=0.74) and the mean difference was 30.3 cm³ (21.19%±0.72%). On average
Quantra gave the larger value and the difference tended to increase with increased volume. For the
percent volume density the mean difference was 1.61% (16.32%±0.69%) and R² was 0.65. Comparison
of the observer's scores with the area-based Quantra breast density yielded a poor correlation (R²=0.31).
Exponential correlations of observer's scores with the volumetric density results gave R² values of 0.33
and 0.38 for Quantra and Volpara respectively.

CONCLUSION
There is poor correlation of breast density scored by observers and automated techniques. In part this
may be explained by differences in the quality being measured (area vs volume) and image presentation
(for presentation vs for processing). However inter-observer variability in the UK may be high as
quantitative estimations of breast density are not made routinely. If automated methods are to be used
differences in their output, caused by differences in the underlying algorithm, need to be understood.

CLINICAL RELEVANCE/APPLICATION
There are differences in the results of each of the breast density measurement methods. These
differences need to be understood if management decisions are based on breast density.

SSQ01-06
The Diagnostic Effect of Digital Breast Tomosynthesis in Relation to Visually Assessed and
Automated Volumetric Breast Density
Stephen W. Duffy : Nothing to Disclose, Oliver William Edmund Morrish MSc : Nothing to Disclose,
Lorraine Tucker : Nothing to Disclose, Richard Black MS : Nothing to Disclose, Fiona Jane Gilbert
MD (Presenter): Speaker, Bracco Group Research Grant, GlaxoSmithKline plc Research Grant, General
Electric Company

PURPOSE
To assess the benefit in terms of diagnostic accuracy of addition of digital breast tomosynthesis (DBT) by
breast density, as measured on a visual analogue scale and by automated volumetric software.

METHOD AND MATERIALS
In a retrospective study of DBT in addition to standard full field digital mammography, we had visually
assessed density on 6969 subjects (1153 cancers), Volpara automated volumetric density on 7019
subjects (1157 cancers) and Quantra automated volumetric density on 7005 subjects (1156 cancers). All
subjects had mammography by 2D digital mammography alone and by 2D digital mammography plus
DBT. Sensitivity and specificity was compared for between 2D mammography alone and 2D plus DBT using
McNemar methods.

RESULTS
Median and interquartile ranges were 38% (23-50%) for visually assessed percent density, 72 cm³
(51-103) for absolute dense volume as measured by Volpara and 93 cm³ (51-143) for absolute dense
volume measured by Quantra. Specificity was significantly improved with the addition of DBT in all
tumours and in all subgroups as defined by breast density (p<0.001 in all cases). Sensitivity was
improved significantly (p=0.03) with the addition of DBT in those subjects with visual density at or above
the 3rd quartile (50%), with 86% sensitivity (93% CI 82-90%) for 2D mammography alone and 93%
(95% CI 90-96%) for 2D mammography plus DBT. A significantly improved sensitivity (p=0.02) was also
observed for those at or above the third quartile of Volpara density (103 cm³) Volpara, with a sensitivity
of 87% (95% CI 83-91) for 2D mammography alone and 93% (95% CI 90-96%) for 2D mammography
plus DBT. No significant difference in sensitivity was observed for those with high density as measured by
Quantra, and no significant difference was observed for those with low density as measured by any of the
three methods.

CONCLUSION
DBT has the potential to improve sensitivity of mammography in women with dense breast tissue.

CLINICAL RELEVANCE/APPLICATION
In women with more than 50% breast density, the addition of DBT may increase cancer detection.

SSQ01-07
Quantitative Background Parenchymal Enhancement in Breast DCE-MRI Is Associated with
Breast Cancer Risk
Shandong Wu PhD, MSc (Presenter): Nothing to Disclose, Margarita Louise Zuley MD : Research
Grant, Hologic, Inc , Wendie A. Berg MD, PhD : Research Grant, General Electric Company Equipment support, Gamma Medica, Inc Equipment support, General Electric
Company, Brenda F. Kurland PhD : Nothing to Disclose, Rachel Jankowitz MD : Nothing to Disclose,
Jules Henry Sumkin DO : Scientific Advisory Board, Hologic, Inc , David Gur PhD : Nothing to Disclose

PURPOSE
Visually estimated background parenchymal enhancement (BPE) by BI-RADS categories in breast dynamic
contrast enhanced MRI (DCE-MRI) has been correlated with breast cancer risk in high-risk women. We
tested this association using fully automated, objectively derived, quantitative BPE measurements.
METHOD AND MATERIALS
A retrospective case-control study was performed using breast DCE-MRI scans from 102 patients (mean 47.2±7.3 YO) who underwent either open surgical biopsy or core biopsy from 2009-2011: 51 women had unilateral breast cancer and 51 were age- and unilateral breast biopsy-proven benign. The MRI was analyzed using fully automated computer algorithms, generating two quantitative BPE measures computed from the third post-contrast series: the absolute BPE volume (|BPE|) and its relative amount over the whole breast volume (BPE%). Breast density BI-RADS was retrieved from the mammography report (< 6 months) prior to diagnosis. Volumetric absolute and relative amounts of fibroglandular tissue (FGT) and FGT% were also automatically quantified from the MRI. Multivariable conditional logistic regression was performed to assess BPE measures as predictors of breast cancer risk: (comparison 1) breasts contralateral to the cancers vs. benign breasts of the controls, and (comparison 2) breasts contralateral to the cancers vs. contralateral (negative) breasts of the controls.

RESULTS
After adjustment for breast density, FGT, and FGT%, odds ratio (OR) for comparison 1 was 1.84 (95% confidence interval [CI]: 1.08, 3.14; p=0.02) for |BPE| and 3.85 (95% CI: 1.34, 11.05; p=0.01) for BPE%. OR for comparison 2 was 1.71 (95% CI: 1.08, 2.71; p=0.02) for |BPE| and 2.30 (95% CI: 1.15, 4.59; p=0.02) for BPE%. OR for breast density alone was 0.75 (95% CI: 0.35, 1.59; p=0.5). For comparison 1, OR was 1.0 (95% CI: 0.71; 1.57; p=0.5) for FGT% and 0.71 (95% CI: 0.18, 2.67; p=0.6) for FGT%; for comparison 2, OR was 1.14 (95% CI: 0.72, 1.81; p=0.6) for FGT%, and 0.70 (95% CI: 0.19, 2.52; p=0.6) for FGT%.

CONCLUSION
Increased BPE (both |BPE| and BPE%) in breast DCE-MRI are predictive of breast cancer risk, independent of measures of breast density and FGT.

CLINICAL RELEVANCE/APPLICATION
Objectively quantified BPE in breast DCE-MRI has potential for use as a biomarker of breast cancer risk and may be included to improve breast cancer risk assessment and stratification.

SSQ01-08 Imaging Biomarkers of Breast Cancer Risk: Does MRI Background Parenchymal Enhancement Increase the Likelihood of Breast Cancer in High Risk Women?
Brian Nicholas Dountchos MD (Presenter): Nothing to Disclose, Habib Rahbar MD: Nothing to Disclose, Savannah Corrina Partridge PhD: Nothing to Disclose, Larissa Korde MD, MPH: Nothing to Disclose, Sue Peacock MSC: Nothing to Disclose, Constance D. Lehman MD, PhD: Consultant, Bayer AG Consultant, General Electric Company Research Grant, General Electric Company

PURPOSE
Imaging assessments of amounts of fibroglandular tissue are known markers of breast cancer risk. Variable levels of enhancement of normal breast tissue on MRI (background parenchymal enhancement [BPE]) also may be predictive of breast cancer development. We explored whether BPE can further refine breast cancer risk assessments beyond mammographic density and amount of fibroglandular tissue on MRI in high risk women.

METHOD AND MATERIALS
After IRB approval, we identified all high risk screening MRIs at our institution from 1/2006 to 12/2011 in women ≥18 years with no history of breast cancer. Outcomes were determined from our regional tumor registry. Women diagnosed with breast cancer any time after the index MRI comprised the cancer cohort. A 1:1 case control was created from a randomized cohort of women who did not develop breast cancer by last follow-up (minimum 3 years after index MRI), matching for age and BRCA mutation, and maximizing follow-up time. BPE, amount of fibroglandular tissue on MRI, and mammographic density were assessed on index exams and compared between the cancer cohort and negative controls using conditional logistic regression analyses.

RESULTS
From 5333 exams during the study interval, 23 high risk women (6 BRCA mutations) with no history of breast cancer underwent screening MRI and were subsequently diagnosed with breast cancer during the follow-up interval (12 invasive, 11 in situ). Cancer cohort mean age was 47±10 years. Mean time-to-diagnosis of cancer was 779±600 days, and mean follow-up time for negative controls was 2037±458 days. Women with mild, moderate or marked BPE on their index MRI had an approximately 9 times greater risk of cancer diagnosis during the follow-up interval than those with minimal BPE (OR=9.0, CI: 1.1-71.0). Neither amount of fibroglandular tissue on MRI nor mammographic density was a significant predictor of cancer risk (OR=1.2, CI: 0.4-3.9; OR=1.4, CI: 0.4-4.4, respectively).

CONCLUSION
Increased BPE may be associated with a higher probability of developing breast cancer in high risk women. Amounts of fibroglandular tissue measured by mammography or MRI may be less predictive of future breast cancer diagnosis in the high risk population.

CLINICAL RELEVANCE/APPLICATION
Increasing background parenchymal enhancement on MRI correlated with future breast cancer development among high risk women and could be used as a predictive biomarker of breast cancer risk.
PURPOSE

Contrast enhancement kinetics derived from breast dynamic contrast enhanced MRI (DCE-MRI) has been shown to have diagnostic value. We investigated the relationship between objectively quantified kinetic parameters in DCE-MRI and breast cancer risk.

METHOD AND MATERIALS

A retrospective case-control study was performed based on a group of 102 women (mean 47.2±7.3 YO) who underwent breast biopsies from 2009-2011: 51 women had unilateral breast cancer and 51 were age-and date-of-MRI matched controls with a unilateral biopsy-proven benign. BI-RADS-based mammographic breast density was retrieved from the latest (< 6 months) mammography report prior to diagnosis. The breast MRI at time of diagnosis (cancer or benign) was analyzed on the normal breast contralateral to cancer (for cancer cases) or benign (for controls). The region of the fibroglandular tissue (FGT) was estimated in the MRI for each analyzed breast using a fully automated computer algorithm. Based on the enhancement time-signal intensity curves of three DCE post-contrast series, four kinetic parameters, i.e., peak enhancement, time to peak enhancement, wash-in-slope, and wash-out-slope were quantified for each voxel specifically over the estimated FGT region; mean and variance of the voxel-wise values of each of the four kinetic parameters were then computed, generating a total of 8 kinetic measures. We compared these kinetic measures between the normal breasts contralateral to the cancers and the contralateral (negative) breasts of the controls. Multivariable conditional logistic regression was performed to estimate odd ratios (ORs) for breast cancer.

RESULTS

After adjustment for breast density and the amount of FGT, the OR for mean wash-in-slope was 1.12 (95% Confidence Interval (CI): 1.01, 1.25; p=0.04) and 1.81 (95% CI: 1.13, 2.91; p=0.01) for the variance of wash-in-slope. Variance remained significant (OR was 1.80 [95% CI: 1.07, 3.03; p=0.03]), even after additional adjustment for quantitative measures of background parenchymal enhancement (BPE). The ORs for all other 6 kinetic measures were not statistically significant.

CONCLUSION

The mean and variance of wash-in-slope in breast DCE-MRI are associated with breast cancer risk.

CLINICAL RELEVANCE/APPLICATION

The kinetic parameters of wash-in-slope quantified in breast DCE-MRI show potential as biomarkers of breast cancer risk and may be included to potentially improve breast cancer risk prediction.

SSQ02

Cardiac (Dual Energy CT)

Scientific Papers

SSQ02-01

Myocardial Extracellular Volume Fraction with Dual-energy Cardiac Computed Tomography in Cardiomyopathy: Comparison with Cardiac Magnetic Resonance Imaging

Hye-Jeong Lee MD (Presenter): Nothing to Disclose, Dong Jin Im: Nothing to Disclose, Yun Jung Kim MD: Nothing to Disclose, Jin Hur MD: Nothing to Disclose, Byoung Wook Choi MD: Nothing to Disclose

PURPOSE

We evaluated the feasibility of dual-energy cardiac CT to determine extracellular volume (ECV) fraction in the assessment of cardiomyopathy with cardiac MRI as the reference standard.

METHOD AND MATERIALS

Study participants provided written informed consent to participate in this institutional review board approved prospective study. ECV was measured in patients with cardiomyopathy according to the modified 16-segment model using the following equations; on cardiac MRI, ECV = (ΔR1 of myocardium/ΔR1 of blood) x (1-hematocrit), where ΔR1 was the change in T1 relaxivity between pre and post contrast; on cardiac CT, ECV = (ΔHU of myocardium/ΔHU of blood) x (1-hematocrit), where ΔHU was the overlay HU, which is the HU difference caused by iodine through material decomposition with the dual-energy technique. The paired student t-test and agreement using the intraclass correlation coefficient (ICC) for ECV measurement between cardiac CT and cardiac MRI were evaluated on per-segment and per-patient analysis.

RESULTS

Nineteen patients with 304 myocardial segments were evaluated. For per-segment analysis, cardiac CT demonstrated a mean overlay HU of blood that was 33.46 ± 10.68 HU, with the resulting mean ECV being 35.98 ± 10.62%. The mean ECV on cardiac MRI was 35.51 ± 10.50%. There was no significant difference in mean values between cardiac CT and cardiac MRI (P = 0.105). For per-patient analysis, cardiac CT demonstrated a mean overlay
SSQ02-02  The Diagnostic Performance of Calcification Suppressed Coronary CT Angiography Using Rapid kV Switching Dual Energy CT

Yasutoshi Ohta MD (Presenter): Nothing to Disclose, Hiroto Yunaga : Nothing to Disclose, Yasuhiro Kaetsu : Nothing to Disclose, Tomomi Watanabe MD : Nothing to Disclose, Shinichiro Kitao : Nothing to Disclose, Yoshiyuki Furuse : Nothing to Disclose, Kazuhiro Yamamoto : Nothing to Disclose, Yoshihide Ogawa MD : Nothing to Disclose

PURPOSE
The aim of this study was to compare the calcification supressed MD image with the conventional virtual monochromatic single energy CT image (VMSECT) on diagnostic performance for detecting obstructive coronary artery disease (CAD) with calcification.

METHOD AND MATERIALS
Sixty-nine consecutive patients suspected or known CAD prospectively underwent DECT (Discovery CT750HD, freedom edition, GE) using rapid kV switching dual energy scan (80kV, 140kV, 600mA) before elective invasive coronary angiography (ICA). MD images (iodine density with hydroxyapatite suppression) were generated on a workstation. Coronary artery stenosis was evaluated qualitatively by MD image and conventional CTA image using VMSECT independently. Cross-sectional arc calcium was evaluated and rated on a segment model as follows: non-calcified, mild, moderate, and severe calcification. The diagnostic performance of two methods for detecting CAD (>50% luminal diameter stenosis) was compared with ICA as reference standard.

RESULTS
A total of 440 segments containing mild (139, 32%), moderate (69, 16%), and severe (31, 7%) calcification were detected and evaluated. For all calcified segments, the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) to detect >50% stenosis were 88%, 88%, 75%, and 94%, respectively for MD image and 91%, 71%, 56%, and 95%, respectively for VMSECT image. The PPV significantly improved on MD image (p<0.05).

CONCLUSION
The diagnostic performance of MD image using DECT for calcified coronary lesions was superior to VMSECT. MD image by DECT with higher PPV is suited to detect and rule out the presence of significant CAD with calcification.

CLINICAL RELEVANCE/APPLICATION
Calcium suppressed coronary CTA in material density (MD) image using rapid kV switching dual energy CT (DECT) improves diagnostic performance for detecting calcified obstructive coronary artery disease.

SSQ02-03  Dual Energy CT Myocardial Perfusion Imaging and Coronary CT Angiography for Identification of Ischemia-causing Coronary Lesions

Sung Min Ko (Presenter): Nothing to Disclose, Hweung Kgon Hwang : Nothing to Disclose

PURPOSE
To determine the diagnostic performance of stress dual energy computed tomography myocardial perfusion imaging (DECT-MPI) for identification and exclusion of coronary artery stenoses that cause ischemia.

METHOD AND MATERIALS
We performed a prospective study of consecutive patients who underwent coronary CT angiography (CCTA), DECT-MPI, invasive coronary angiography (ICA) and cardiac magnetic resonance (CMR)-MPI. DECT-MPI and CMR-MPI were evaluated for the presence or absence of myocardial perfusion defects. CCTA and ICA were evaluated for the presence or absence of anatomically obstructive stenosis, as defined by a >50% stenosis. The primary endpoint was lesion-specific ischemia on a per-patient basis, as defined by a combination of a >50% stenosis by ICA and an associated perfusion defect by CMR-MPI. In exploratory analyses, DECT-MPI and CCTA were compared directly to CMR-MPI and ICA, respectively.

RESULTS
One hundred ninety-two patients (135 men, 63.1 ± 8.0 years) comprised the study cohort. 144 (75%) patients and 257 (45%) vascular territories exhibited ischemia-causing coronary stenoses. On a vessel-based model, the sensitivity, specificity, and positive and negative predictive values to detect ischemia-causing coronary lesions were 88%, 82%, 79% and 89%, respectively for DECT-MPI and CCTA; 91%, 75%, 75% and 92%, respectively for DECT-MPI alone; and 95%, 45% 63% and 94%, respectively for CCTA alone. Area under the ROC curve for DECT-MPI and CCTA was 0.91 and 0.79, respectively.

CONCLUSION
Combined DECT-MPI and CCTA improves the identification and discrimination of ischemia-causing coronary stenosis over CCTA alone, but compared to a combined ICA/CMR-MPI, combined CCTA/stress DECT-MPI improves the predictive value for coronary stenoses causing ischemia compared to that of CCTA.
but only mildly improves the diagnostic performance of stress DECT-MPI alone.

**CLINICAL RELEVANCE/APPLICATION**

Dual energy CT (DECT) is a novel method that allows for mapping of myocardial contrast for evaluation of myocardial perfusion. Stress DECT-MPI provides clinical benefit to patients with insufficiently evaluated coronary lesions by CCTA alone.

**SSQ02-04 Dynamic Myocardial Perfusion in a Porcine Ischemia Model Using Spectral Detector CT**


**PURPOSE**

We used a prototype spectral detector CT (SDCT) scanner (Phillips Healthcare) and advanced processing for cardiac CT perfusion (CTP) in a porcine model. This scanner limits beam hardening (BH), eliminates partial scan artifacts with fast 360deg scans, and limits errors in material decomposition. Our initial studies aim at developing a methodology and determining the effect of mono-energetic (MonoE) reconstructions on quality of CTP measurements.

**METHOD AND MATERIALS**

A porcine model mimics coronary stenosis through partial occlusion of the LAD artery with a balloon catheter as adjusted with FFR measurements. Dynamic CT (120kVp/100mAs) scans were acquired at end-systole (45%RR). Projection-based MonoE images were reconstructed for energies [50,120]keV at 10keV increments. We applied 3D cubic B-spline normalized mutual-information to register reconstructed data to a common reference and created a mean CT volume. Semi-automated segmentation of the LV myocardium was performed on the average volume and propagated across the 4D sequences. Absolute myocardial blood flow (MBF) was computed using a deconvolution-based approach.

**RESULTS**

At baseline (FFR=1), MonoE images at peak enhancement, and iodine maps gave relatively uniform values within the entire myocardium, with no obvious BH artifacts, whereas at FFR=0.7, clear deficits in the LAD regions were noticed mainly for lower keV's. Mean MBF=(100.99±26.1mL/min/100g) at FFR=1 and (31.43±13.3mL/min/100g) at FFR=0.7, which corresponds to about 69% decrease in blood flow. Qualitatively, 70keV images provide a more uniform MBF map with a high contrast between ischemic and normal tissue. This contrast depends on the keV, and we used flow-CNR (or CNR_f) to evaluate this dependence. Two equally sized ROI's (same for all keVs) were manually drawn in the LAD and remote areas. We computed CNR_f as: CNR_f = (µMBF(remote) - µMBF(LAD)) / σMBF(remote). Mean CNR_f = 8.32±4.27(50keV), 7.33±3.4(70keV), and 0.94±0.52(120keV).

**CONCLUSION**

The SDCT scanner can be used to acquire high quality CTP images which are relatively artifact free. MBF decrease was only noticed in LAD territory between ischemic and baseline conditions. Flow CNR between occluded LAD and remote areas decreases for higher keVs.

**CLINICAL RELEVANCE/APPLICATION**

Adding robust cardiac CTP to coronary CTA will create a powerful non-invasive diagnostic test for cardiovascular disease and an ideal gatekeeper exam for cardiac catheterization.

**SSQ02-05 Cardiac Spectral CT: Iodine Quantification and Spectral Curve of Acute Myocardial Infarction in Swine**

Zhang Zhang (Presenter): Nothing to Disclose, Jing Yu: Nothing to Disclose, Ningnanan Zhang PhD: Nothing to Disclose, Dong Li MD: Nothing to Disclose, Tielian Yu: Nothing to Disclose

**PURPOSE**

Spectral CT renewed the interest of myocardial perfusion evaluation in clinic application, such as image quality improvement by virtual monochromatic spectral (VMS) images, and iodine quantification by material decomposition. The current study was to investigate the ability of cardiac spectral CT for assessing myocardial infarction.

**METHOD AND MATERIALS**

A total of 12 swine underwent 90 minutes occlusion on distal segment of LAD by balloon angioplasty. After 4±1 days of successful acute myocardial infarction model establishment, spectral CT coronary angiogram (CTCA, Discovery CT750 HD CT FREEdom Edition scanner: GE Healthcare, Milwaukee, WI, USA) and late gadolinium-enhanced magnetic resonance (MR, Signa HDx 3.0 Tesla MR scanner, GE, Milwaukee, WI, USA) was performed to evaluate myocardial infarction. The differences of attenuation density (AD), iodine concentration, and spectral curve among different myocardial regions were observed. The infarction on late gadolinium-enhanced MR and CTCA were visually assessed for each myocardial segment on a binary classification. The differences of both AD and iodine concentration on CTCA were found among infarction, risk area and remote myocardium on all three types of image settings (70keV, high voltage, and iodine density images; p<0.05). There were also significant differences slopes of spectral curve among infarction, risk area and remote myocardium. The spectral CT and MR had almost perfect agreement (κ=0.821) in infarct segment differentiation. ROC curve showed high diagnostic accuracy of CTCA to differentiate myocardial infarct segments (sensitivity=0.813, specificity=0.989, positive predictive
CONCLUSION

The 70keV VMS with higher SNR, CNR and lower noise was preferable to assess acute myocardial infarction. AD and iodine concentration on spectral CTCA, which had a good agreement with the standard MR results, could be used to differentiate infarct myocardial segments.

CLINICAL RELEVANCE/APPLICATION

Spectral CTCA may have the potential ability to differentiate infarction, risk area and remote myocardium by using VMS, iodine quantification, and spectral curve in the clinics.

SSQ02-06 Correlation of Aortic Valve Calcium Score with Post-Transcatheter Aortic Valve Implantation Paravalvular Aortic Regurgitation

Bothaina Mohammed Abdulshakour (Presenter): Nothing to Disclose, Sophie Tan: Nothing to Disclose, Aileen Mae Bathan Iomarda MD: Nothing to Disclose, Foong Koon Cheah MBChB, FRCR: Nothing to Disclose, Swee Yaw Tan MBChB, MRCP: Nothing to Disclose

PURPOSE

In recent years, for patients with severe and symptomatic aortic stenosis, but are not suitable candidates for surgery, Transcatheter Aortic Valve Implantation (TAVI) has been recommended as a less invasive alternative to surgical aortic valve replacement (AVR). However, post-procedural paravalvular aortic regurgitation (PAR) is a common complication that can arise due to incomplete annular sealing or technical errors in valve sizing or positioning. PAR has been associated with an increase in long-term mortality post-TAVI. We would like to determine if the density distribution of calcium in the aortic valves and surrounding walls, as derived from a non-contrast CT, can predict if the patient is likely to have PAR post-TAVI.

METHOD AND MATERIALS

A total of 29 patients (12 men and 17 women; 77.2 ± 9.69 years) with severe or critical aortic stenosis by echocardiography had TAVI. They had pre-procedural assessment by non-enhanced 320 slice MDCT. The Aortic Valve Calcium (AVC) score was derived measuring the amount of calcium in the aortic valve and immediate surrounding aortic wall calculated using the Agatston schema on a Vitrea workstation. All cases are reviewed independently by a senior cardiologist and a radiologist, with final readings averaged. The degree of post-TAVI PAR was assessed using an invasive aortogram immediately after valve deployment.

RESULTS

Elevated AVC scores have a positive correlation with increasing possibility of PAR with an ROC of 0.82 (95% CI: 0.66, 0.97). Optimal corresponding sum of sensitivity and specificity to determine any grade of post TAVI paravalvular leak was an AVC score of 3000. 7 patients out of 29 had no PAR after implantation of the valve. None of these 7 patients had an AVC greater than 3000. All patients with an AVC score of 3000 and above had at least mild paravalvular leak. A cut off point of >3000 yielded a sensitivity of 0.68 and a specificity of 1.0. With a prevalence of 0.24, the PPV was 1.0 and the NPV was 0.9.

CONCLUSION

A high AVC score of more than 3000 predict moderate to severe PAR as complication of post TAVI procedure. Therefore, pre-operative scoring of aortic valve calcification by non-enhanced MDCT is highly recommended as predictor of PAR severity post TAVI procedure in which may support decision making for traditional surgical replacement of aortic valve.

CLINICAL RELEVANCE/APPLICATION

AVC can be determined using noncontrast CT and correlates with post TAVI PAR.

SSQ02-07 A Performance Comparison of all Different DECT Series for Assessment of Myocardial Blood Supply Using 13NH3 PET as the Reference Standard

Wenhuan Li MD (Presenter): Nothing to Disclose, Kuncheng Li MD: Nothing to Disclose, Xiaolian Zhu: Nothing to Disclose, Nan Chen MD: Nothing to Disclose, Qi Yang MD: Nothing to Disclose, Xiangying Du MD: Nothing to Disclose

PURPOSE

To identify the optimal dual energy computed tomography (DECT) series for detection of myocardial perfusion defects, by comparing all different DECT series (iodine mapping, monoenergetic series, non-linearly blended series, and 100kV series), using 13NH3 positron emission tomography (PET) as reference standard.

METHOD AND MATERIALS

This study was approved by the local ethics committee, and written informed consent was obtained from each patient. Nineteen prospectively enrolled patients, with known or high likelihood of coronary heart disease, underwent both cardiac DECT and 13NH3 PET acquisition at rest. The DECT data were reconstructed as iodine mapping, monoenergetic series, non-linearly blended series, linearly blended series, and 100kV series. The myocardial perfusion defects on all different DECT series were visually assessed by 2 observers, using standard 17-segment model. Per-segment agreement between modalities was investigated with kappa statistics. The comparison of all different DECT series vs. PET was mainly based on receiver operating characteristic (ROC) curve analysis.

RESULTS

A total of 323 segments (100%) of all 19 patients were analyzed. Iodine mapping showed the largest area under ROC curve (AUC) (0.897±0.021, p<0.001), best correlation with 13NH3 PET (K=0.777, p<0.001), and best diagnostic accuracy (96.7% sensitivity, 82.7% specificity, 98.1% positive predictive value, 95.0% negative predictive value, and 90.7% accuracy) among all different DECT series.

CONCLUSION

The 70keV VMS with higher SNR, CNR and lower noise was preferable to assess acute myocardial infarction. AD and iodine concentration on spectral CTCA, which had a good agreement with the standard MR results, could be used to differentiate infarct myocardial segments.

CLINICAL RELEVANCE/APPLICATION

Spectral CTCA may have the potential ability to differentiate infarction, risk area and remote myocardium by using VMS, iodine quantification, and spectral curve in the clinics.
Iodine mapping is superior to other DECT series for the visualization of myocardial perfusion defects.

**CLINICAL RELEVANCE/APPLICATION**

Iodine mapping is a powerful DECT series for detecting myocardial perfusion defects and is recommended in evaluation of myocardial blood supply.

**SSQ02-08**

**Coronary Artery Calcium Quantification Based on Virtual Non-contrast Dual Energy CT Data Sets**


**PURPOSE**

To evaluate the feasibility of using CT virtual non-contrast enhanced (VNC) series derived from dual-energy CT (DECT) imaging studies for coronary artery calcium quantification.

**METHOD AND MATERIALS**

The study was approved by the institutional review board; all patients provided written informed consent. In 60 patients, we prospectively underwent single energy non-contrast enhanced CT calcium scoring scan at 120 kV followed by coronary CT angiography performed in dual energy mode based on rapid kilovoltage switching between 80 and 140 kV, using 0.625 mm slice thickness. Both scans were carried out on a 128-slice DECT scanner (Discovery CT750 HD; GE Medical Systems). Material basis decomposition images were created for the iodine/water pair. Polychromatic images at 120 kV were generated from the material density images by thresholding water images above 1100 mg/cm3 to suppress iodine content with dedicated software which gave virtual non-contrast images in HU as a result. Both data sets were analyzed using dedicated calcium scoring software (Smart Score 4.0; GE Medical Systems). The AJ-130, the mass and the volume scores and the percentile rank for age and gender of each patient were calculated. Correlation between quantified calcium on VNC images and true non-contrast enhanced coronary artery calcium scoring images, and the percentile rank was performed by the Spearman rank order correlation coefficient.

**RESULTS**

There was excellent correlation between AJ-130, the mass score and the volume score on VNC images and the true non-contrast enhanced series (r= 0.95 (0.93 to 0.97), 0.95 (0.93 to 0.97), and 0.96 (0.94 to 0.98), respectively, p< 0.001) globally. There was also excellent agreement between Multiethnic Study of Atherosclerosis percentile ranks derived from predicted versus actual calcium scores and the percentile rankings, 0.88 (0.81 to 0.93).

**CONCLUSION**

The excellent correlation between the amounts of calcium measured on non-contrast enhanced CT calcium scoring images and VNC data derived from DECT provide an opportunity to avoid the need for a dedicated CT scan for calcium scoring.

**CLINICAL RELEVANCE/APPLICATION**

Coronary artery calcium scoring (CCS) has been shown to increase the predictive accuracy of established multivariate risk factor models and it is an independent predictor of cardiovascular events.

**SSQ03**

**Cardiac (Imaging)**

**SSQ03-01**

**Hepatic Triglyceride Content is Associated with Aortic Pulse Wave Velocity and Carotid Intima-Media Thickness: The NEO Study**

Ralph L. Widya MD (Presenter): Nothing to Disclose, Jos Westenberg PhD: Nothing to Disclose, Renee De Mutsert: Nothing to Disclose, Karin Gast: Nothing to Disclose, Martin den Heijer: Nothing to Disclose, Saskia In Cessie PhD: Nothing to Disclose, Jan W. A. Smit MD, PhD: Nothing to Disclose, Wouter J. Jukema MD: Research Grant, Astellas Group Research Grant, AstraZeneca PLC Research Grant, BIOTRONIK GmbH & Co KG Research Grant, Boston Scientific Corporation Research Grant, DAIICHI SANKYO Group Research Grant, Eli Lilly and Company Research Grant, sanofi-aventis Group Research Grant, Medtronic, Inc Research Grant, Merck & Co, Inc Research Grant, Pfizer Inc Research Grant, OrbusNeich Research Grant, Novartis AG Research Grant, F. Hoffmann-La Roche Ltd
SSQ03-02

Do Incidental Findings Discovered on Pre-procedural CT for Trans-catheter Aortic Valve Replacement Have an Impact on Decision to Treat Aortic Stenosis?

Elham Najafpour MD (Presenter): Nothing to Disclose, Sreevathsan Sridhar MD: Nothing to Disclose, Daniel Vargas MD: Nothing to Disclose, Saman Panahipour MD: Nothing to Disclose, Álvaro Zajarias MD: Nothing to Disclose, Cylen Javidan-Nejad MD: Nothing to Disclose

PURPOSE

Trans-catheter aortic valve replacement (TAVR) is increasingly performed to treat severe aortic stenosis. Pre-TAVR chest, abdomen and pelvis CT frequently yields incidental findings with a potential to impact surgical planning.

METHOD AND MATERIALS

Pre-procedural CT exams of 285 consecutive patients considered for TAVR were retrospectively reviewed. Incidental findings were categorized as: Group 1) acute incidental finding needing treatment (e.g. pneumonia); Group 2) comorbidity (e.g. cirrhosis); Group 3) non-acute incidental finding needing further work up or follow-up; Group 4) incidental finding of no consequence. Clinical notes were differentiated from those decided to not be treated due to other factors. Statistical analysis was performed using chi-squares.

RESULTS

6/285 CT exams revealed no incidental findings. Most CT studies showed multiple incidental findings falling into several groups. Group 1: 35 incidental findings, 60% were unknown, 50% patients had TAVR, 26% TS, 9% BV and 6% NT; Group 2: 16 incidental findings, 94% were unknown, 44% patients had TAVR, 6% TS, 13% BV and 25% NT; Group 3: 284 incidental findings, 29% were unknown, 45% patients had TAVR, 25% TS, 2% BV and 4% NT; Group 4: 166 incidental findings, 45% patients had TAVR, 18% TS, 3% BV, and 4% NT; Group 5: 372 incidental findings, 44% patients had TAVR, 24% TS, 3% BV, 3% NT. Statistical analysis revealed a higher association the incidental finding of cancer with a management of no repair (p 0.0085). All other correlations had a p value > 0.05.

CONCLUSION

Incidental findings are ubiquitous on pre-TAVR CT exams. Cancer is the only incidental finding demonstrating a significant association with the decision to not perform an interventional treatment. Comorbidities which may have precluded patients from open aortic valve replacement in the past now have no significant effect upon decision to treat by TAVR.

CLINICAL RELEVANCE/APPLICATION

This study can lead to establishment of standardized reporting of incidental findings in regards to a vascular procedure (Similar to Bi-RADS).
SSQ03-03

Characteristics of Vulnerable Human Coronary Atherosclerotic Plaque: Phase-Contrast Imaging
Sebastian Winklhofer MD (Presenter): Nothing to Disclose, Peter Silvia: Nothing to Disclose, Verena Tischler MD: Nothing to Disclose, Fabian Morsbach: Nothing to Disclose, Moritz Werdt, von: Nothing to Disclose, Sandra Berens MD: Nothing to Disclose, Peter Mordregger PhD: Nothing to Disclose, Holger Moch: Nothing to Disclose, Marco Stampannone PhD: Nothing to Disclose, Michael J. Thal MD: Nothing to Disclose, Hatem Alkadhi MD: Nothing to Disclose, Paul Stolzmann MD: Nothing to Disclose

PURPOSE

Purpose of the study was to investigate into X-ray grating interferometry phase-contrast (PC) imaging for the characterization of human coronary artery plaque.

METHOD AND MATERIALS

PC X-ray and absorption computed tomography (CT) imaging was performed ex vivo in this institutional review board-approved study in forty human coronary artery segments using a synchrotron radiation source. Two independent readers performed qualitative analyses of image quality, plaque components, and plaque classification according to the modified American Heart Association (AHA) criteria in 38 plaques detected by histopathology, the latter serving as the reference standard. Quantitative measurements of plaque components (i.e., collagen, lipid, smooth muscle, and calcification) were performed and compared among PC and absorption images using analysis of variances (ANOVA) for repeated-measures with a post hoc Bonferroni correction.

RESULTS

Image quality was superior in PC images as compared with absorption imaging (P<0.001). Plaque components weeg by PC imaging with knowledge-based iterative model reconstruction algorism, whereas absorption imaging detected calcifications without statistical differences only. Of the 38 detected coronary artery plaques, characterization was accurate in 33 plaques (87%) with PC; absorption imaging allowed for correct characterization of 7 plaques (13%, P<0.001). Hounsfield units (HU) of PC images were significantly different for all plaque components (pairwise P<0.05). Absorption images demonstrated significant differences (k=0.81, P<0.001) between calcification and other plaque components, but were similar for collagen, lipid, and smooth muscle (P=1.00).

CONCLUSION

PC imaging allows for accurate characterization of human coronary artery plaque and quantitative assessment of plaque components, thereby outperforming absorption imaging.

CLINICAL RELEVANCE/APPLICATION

Phase contrast imaging may not only allow for an improved understanding of the development of vulnerable plaque but for the identification of patients at risk for myocardial infarction.

SSQ03-04

Low Contrast- and Low Radiation Dose Protocol in Cardiac CT: Usefulness of Low Tube Voltage and Knowledge-based Iterative Model Reconstruction Algorism
Takeshi Nakaura MD (Presenter): Nothing to Disclose, Yuji Iyama MD: Nothing to Disclose, Shinichi Tokuyasu RT: Employee, Koninklijke Philips NV, Masafumi Kidoh: Nothing to Disclose, Kazunori Harada: Nothing to Disclose, Yasuyuki Yamashita MD: Consultant, DAIICHI SANKYO Group, Naritsugu Sakano: Nothing to Disclose, Seitaro Oda MD: Nothing to Disclose

PURPOSE

Low kilo-voltage (kVp) CT is well suited for low contrast and low radiation dose cardiac CT; however, increased image noise is a problem. The recent introduced knowledge-based iterative model reconstruction (IMR) dramatically reduces the image noise. We evaluated the feasibility of a low contrast-, low radiation dose protocol for cardiac CT using 80 kVp and IMR.

METHOD AND MATERIALS

This prospective study received institutional review board approval; prior informed consent to participate was obtained from all patients. Thirty patients underwent a low contrast-, low radiation dose protocol with 80 kVp, 923 mA and prospective ECG gating. A 40% reduced contrast dose (222 mgI/kg) was delivered during 12 sec. We also enrolled 30 patients who underwent our conventional protocol with 120kVp, 992 mA and prospective ECG gating. The 80-kVp images were reconstructed with FBP, hybrid iterative reconstruction (HIR) and IMR. We evaluated CT number, image noise and contrast to noise ratio (CNR) of ascending aorta between 120 kVp images and 80 kVp images reconstructed with FBP, HIR and IMR with the Dunnett test. We also compared noise reduction rate of HIR and IMR as compared with FBP reconstruction with the two tailed t-test. Two independent readers assessed image contrast, image noise, image sharpness, unfamiliar texture and overall image quality on a 4-point scale.

RESULTS

The estimated ED was 75% lower with the 80- than the 120 kVp protocol (1.3 mSv vs 5.3 mSv). The CT number of 80 kVp images was significantly higher than that of 120 kVp images (517.1 HU ± 64.8 vs 431.4 HU ± 51.6, p < 0.01). The noise reduction rate was significantly higher with IMR (76.2% ± 4.6) than with HIR (50.0% ± 1.5) (FBP: 119.0 HU ± 39.9; HIR: 59.4 HU ± 19.6; IMR: 27.4 HU ± 7.3) (p < 0.01). The CNR of 80 kVp images with IMR was significantly higher than that of 120 kVp images (19.8 ± 3.9 vs 13.3 ± 2.5, p < 0.01). There was no significant difference in the score of unfamiliar texture between 80-kVp images with IMR and 120-kVp images (p > 0.05).

CONCLUSION

The 80 kVp scans with the IMR yields higher image quality for cardiac CT with 75% decreased radiation dose and 40% decreased contrast dose as compared with the 120 kVp protocol with FBP reconstruction.

CLINICAL RELEVANCE/APPLICATION
The low tube voltage scan with IMR is well suited for a low contrast-, low radiation dose protocol for cardiac CT.

**SSQ03-05**

**3.0T Motion-corrected Single-shot Phase Sensitive Inversion Recovery (PSIR) Late Gadolinium Enhancement (LGE) in Free-breathing Patients Compared with Conventional Segmented Breath-held LGE**

Lu Lin MD (Presenter): Nothing to Disclose, Yining Wang MD: Nothing to Disclose, Jian Cao MD: Nothing to Disclose, Lingyan Kong MD: Nothing to Disclose, Zheng Yu Jin MD: Nothing to Disclose, Jing An: Research collaboration, Siemens AG, Tianjing Zhang: Nothing to Disclose

**PURPOSE**

To investigate the diagnostic value of 3.0T motion-corrected single-shot phase sensitive inversion recovery (PSIR) late gadolinium enhancement (moco-LGE) compared with the conventional segmented breath-held LGE (bh-LGE).

**METHOD AND MATERIALS**

In a consecutive cohort of 36 patients referred for clinical enhanced cardiac MR, bh-LGE and moco-LGE were collected contemporarily with identical image parameters using a 3.0T scanner. The moco-LGE was acquired just after the bh-LGE while the patients were asked to breathe freely. Images were randomized and scored for image quality (1-very poor and not analyzable, 2-poor, 3-acceptable, 4-good, 5-very good) and diagnostic confidence for myocardial LGE (1-low confidence, 2-some confidence, 3-high confidence) separately base on the American Heart Association 17-segmented model. In patients with diagnostic image quality and definite LGE, the myocardial LGE mass was quantified. Paired t test was used to compare the image quality, diagnostic confidence. Linear regression and correlation plots were used to compare LGE mass.

**RESULTS**

35 patients had regular heart rate (HR), the mean HR was 72±12 beats per minute (bpm). The other one patient had atrial fibrillation rhythm. In all the patients, the moco-LGE with free-breathing had similarly high image quality (4.6±0.9 vs 3.9±0.9, P=0.350), and diagnostic confidence (2.8±0.3 vs 2.4±0.4, P=0.893) compared with bh-LGE. A total of 9 patients with marked image artifacts in bh-LGE for arrhythmia or respiratory motion, moco-LGE had significantly higher image quality (3.8±0.8 vs 3.1±0.9, P=0.000) and confidence (2.8±0.2 vs 2.5±0.4, P=0.000). The myocardial LGE mass was quantified and compared in 12 patients, the results correlated highly (R2=0.95, P=0.000) without bias.

**CONCLUSION**

In general, moco-LGE and bh-LGE have similar image quality and myocardial LGE quantification. In vulnerable patients with marked artifacts of bh-LGE, moco-LGE probably has higher image quality and diagnostic confidence.

**CLINICAL RELEVANCE/APPLICATION**

Motion corrected single shot PSIR LGE is a promising clinical tool for detecting myocardial fibrosis, especially for vulnerable patients with arrhythmia or respiratory motions.

**SSQ03-06**

**Feasibility of High-resolution Modified Look-locker Inversion Recovery (HR-MOLLI) for Right Ventricular T1 Mapping at 3T and 1.5T in Healthy Volunteers**


**PURPOSE**

The purpose of this study is to evaluate an optimized high-resolution MOLLI (HR-MOLLI) technique at 3T and 1.5T for RV ECV calculation in healthy volunteers.

**METHOD AND MATERIALS**

25 healthy volunteers (16 men, 41±14.3yrs) were scanned at 3T (MAGNETOM Skyra, Siemens AG, Healthcare Sector, Erlangen, Germany) and 19 (12 men, 46.8±13.9yrs) were scanned at 1.5T (MAGNETOM, Aera). T1 mapping was performed in the axial orientation using a HR-MOLLI technique, with an in line motion correction algorithm with T1 and T1* parametric map generation using 0.5x0.5x8mm3 voxel. The MOLLI sequence was comprised of two inversion pulses sampling T1 recovery using a 5(3)3 scheme with single shot steady state diastolic readouts. Images were acquired before and 12-25 minutes after 0.2mmol/kg gadobenate dimeglumine (Multihance, Bracco Diagnostics, Monroe, NJ) infusion as a bolus. Two reviewers quantified basal and mid RV, interventricular septal, and lateral LV wall T1 values from T1 parametric maps. RV and LV ECV ranges were calculated as originally described by Jerosch-Harold et al assuming normal hematocrit values (women:0.38-0.46, men: 0.42-0.54). Global ECV values were compared using the students t-test. Intra and inter-observer variance was measured by the intraclass correlation coefficient (ICC).

**RESULTS**

One 3T volunteer and four 1.5T subjects were excluded due to motion blurring of the RV free wall. Table 1 shows RV and LV global ECV ranges by field strength and BP T1 estimation method. Global RV and LV ECV ranges were significantly different at 3T and 1.5T(p<0.001). Intraobserver variance for global RV and LV ECV was 0.78 and 0.92 for 3T and 0.83 and 0.79 for 1.5T respectively. Interobserver variance for global RV and LV ECV was 0.75 and 0.71 at 3T and 0.58 and 0.71 at 1.5T respectively.

**CONCLUSION**

This feasibility study demonstrates that HR-MOLLI can quantitate the global RV ECV fraction at both 1.5T and 3T with good intra and interobserver variance, also that blood pool T1 estimates without a look-locker
correction have a significant influence on the RV and LV ECV. We also found a field strength influence on RV and LV ECV values, highlighting the need to determine field strength specific values.

CLINICAL RELEVANCE/APPLICATION

Determination of the ECV by T1 estimation using MOLLI techniques enables quantitation of diffuse myocardial fibrosis and it may be feasible to measure in the RV.

Improving the Image Quality of Coronary CTA Using a Novel Non-rigid Registration Based Motion Correction Algorithm: In Comparison with Bi-sector Reconstruction

Meng Zhang (Presenter): Nothing to Disclose, Hong Zeng MD, PhD: Nothing to Disclose, Zhongwen Lv: Nothing to Disclose, Lin Liu MD, PhD: Nothing to Disclose

PURPOSE

A novel non-rigid registration based motion correction algorithm (Snap-Shot-Freeze, SSF) has been recently introduced for coronary CTA. The aim of this study was to evaluate the efficiency of SSF in coronary CTA, by comparing the image quality with that of single sector and multi-sector reconstructions.

METHOD AND MATERIALS

Coronary CTA was performed with a 64-row MDCT scanner (GE, Discovery HD750) on 123 patients with mean heart rates of 68 bpm (range:58-75 bpm). Both single sector and bisector multiphase reconstruction were performed to select the optimal cardiac phase for each reconstruction method. SSF reconstruction and motion correction was performed based on the optimal single sector reconstruction to generate the SSF images. The image quality was then evaluated by two blinded and independent observers on workstation using a 5-point scale(5=excellent to 1=non-diagnostic) and the image quality of the three reconstruction methods was compared.

RESULTS

Totally 984 segments of coronary artery from 123 patients were analyzed. There was good inter-observer agreement (k=0.85). The average scores of the groups with single sector (A), bi-sector (B) and SSF (C) were2.56±0.12,3.01±0.23 and 3.78±0.09, respectively. On segment based analysis, the percentage of acceptable image quality no less than score 3 was83.6%,89.4% and 93.4%, respectively, with significant difference between groups A and C(x2=5.24, p <0.05). One observer evaluated the SSF images as no-diagnostic in 10 segments.

CONCLUSION

SSF can effectively improve the image quality of coronary CTA in patients with high heart rates.

CLINICAL RELEVANCE/APPLICATION

As a new method to reduce the motion artifact of coronary artery, SSF will expand the use of ECG-gated coronary CTA.

Detecting Myocardial Structural Abnormalities in Patients with the WPW Syndrome with ECG-gated Multi-detector Cardiac CT

Kyu Ok Choe (Presenter): Nothing to Disclose, Hye-Jeong Lee MD: Nothing to Disclose, Young Joo Suh MD: Nothing to Disclose, Sae Rom Hong MD: Nothing to Disclose, Yoo Jin Hong MD: Nothing to Disclose, Young Jin Kim MD: Nothing to Disclose

PURPOSE

Myocardial dyskinesia in segments prematurely activated by accessory pathways has been well documented in echocardiographic studies for pediatric WPW syndrome patients. However, the long-term effects of dyskinesia to the myocardium have not been studied in depth. Therefore, our study goal was to evaluate myocardial structural abnormalities on cardiac CT in adult WPW syndrome patients.

METHOD AND MATERIALS

Institutional Review Board approval was obtained for this retrospective study and informed consent was waived. Of the 75 WPW syndrome patients who underwent cardiac CT from January 2006 to December 2013, 58 patients (mean age 51.8 ± 12.7 years, 62.1% male) were finally included after excluding combined cardiac disease. Clinical records including electrocardiography, electrophysiologic study, and echocardiography were evaluated. Two reviewers blindly and independently evaluated myocardial thickness and attenuation on cardiac CT retrospectively. The interobserver agreement about the presence of myocardial structural abnormality and the correspondence rate between the myocardial abnormality location and the accessory pathway location were evaluated.

RESULTS

For myocardial abnormality, excellent agreement (k=0.811) was obtained between the reviewers. After consensus, a total of 18 patients (31%) were found to have myocardial abnormalities; wall thinning in 17 patients, subendocardial fat attenuation in 10, and combined findings in 9. All findings were observed at the basal left ventricle. For the accessory pathways, 16 patients had the right free wall pathway, 11 had the septal pathway, and 31 had the left lateral pathway. No myocardial abnormality was observed at the right free wall pathway, and 6 patients with the septal pathway and 12 with the left lateral pathway showed myocardial abnormalities. All abnormalities (100%, 18/18) corresponded with the accessory pathway location.

CONCLUSION

A relatively high prevalence (31%) of myocardial structural abnormalities was observed on cardiac CT in adult WPW syndrome patients, and all abnormalities corresponded with the accessory pathway location.

CLINICAL RELEVANCE/APPLICATION

Wall thinning and subendocardial fat attenuation observed in WPW patients might reflect long term effects of dyskinesia and might suggest irreversible myocardial injury.
Can MRI Be Used to Assess Mechanical Dyssynchrony? The Features of Left Bundle Branch Block on MRI

Giselle Y. Revah MD (Presenter): Nothing to Disclose, Vincent Wu BS: Nothing to Disclose, James S. Babb PhD: Nothing to Disclose, Janice Chyou: Nothing to Disclose, Leon Axel MD, PhD: Nothing to Disclose

PURPOSE

There is scant information about MRI of mechanical features of left bundle branch block (LBBB). Several findings have been described in the echo literature, including: septal flash (SF), early inward motion followed by outward motion of the septum once the lateral wall begins to contract; apical rocking (AR), abnormal motion of the left ventricular (LV) apex perpendicular to the LV long axis; delayed opening of the aortic valve; and delayed lateral wall contraction. This study aims to assess the MRI features of LBBB.

METHOD AND MATERIALS

We retrospectively identified cardiac MRIs from 43 patients with LBBB on EKG and 43 age and gender matched controls. Two cardiac radiologists assessed the MRIs for the presence of SF, AR and timing of lateral wall contraction. Timing of aortic valve opening was assessed on phase-contrast velocity flow maps and three different conventional cine planes.

RESULTS

According to Fisher's exact test, LBBB was significantly associated with SF and AR (p<0.0001). Since SF and AR were seen exclusively in LBBB, they showed 100% specificities and PPVs for LBBB. Using logistic regression, the delayed timing of both the lateral wall contraction and the aortic valve opening as compared to controls were significant predictors of LBBB (p<0.0001). The timing of aortic valve opening assessed on phase-contrast images had the best sensitivity (86%) and specificity (100%) in predicting LBBB, compared to conventional cine images. Among LBBB patients, 79.1% (34/43) had SF. Ejection fraction (EF) was a significant predictor of SF (p=0.041, OR= 0.93) but QRS duration was not a significant predictor of SF (p=0.437). EF was also a significant predictor of delayed opening of the aortic valve (p=0.041), in patients with LBBB. Inter-reader agreement was assessed by kappa (κ) coefficients, which showed concordant opinions between the readers in identifying SF (κ=1.0) and AR (κ=0.55). There was good inter-reader agreement in timing measurements of delayed aortic valve opening on phase-contrast (ICC = 0.90) and 3 chamber cine SSFP (ICC =0.88).

CONCLUSION

MRI can be used as an adjunct to EKG to assess patients with mechanical dyssynchrony. SF, AR and delayed opening of the aortic valve are highly specific predictors of LBBB that can reliably be detected by MRI.

CLINICAL RELEVANCE/APPLICATION

MRI can act as an adjunct to EKG and identify patients with mechanical dyssynchrony (LBBB), who may benefit from resynchronization therapy.

SSQ04

ISP: Chest (Diffuse Lung Disease)

Scientific Papers

ARRT Category A+ Credits: 1.50
ARRT Category A+ Credits: 1.50

Thu, Dec 4 10:30 AM - 12:00 PM Location: E351

Participants

Moderator
Jeffrey P. Kanne MD: Research Consultant, Perceptive Informatics, Inc

Sub-Events

SSQ04-01 Chest Keynote Speaker: Picture Perfect—Where the HRCT Diagnosis Is Virtually Certain
Jeffrey P. Kanne MD (Presenter): Research Consultant, Perceptive Informatics, Inc

SSQ04-02 A Novel Computer Algorithm for the Textural Classification of Idiopathic Interstitial Pneumonia - A Prospective Cohort Study
Emma Jane Helm MBBS (Presenter): Nothing to Disclose, Abhir Bhalaria: Nothing to Disclose, Felix Woodhead: Nothing to Disclose, Rhian Hughes: Nothing to Disclose, Charles E. Hutchinson: Nothing to Disclose, David Parr: Nothing to Disclose

PURPOSE

To explore the use of a novel automated computerized method for textural analysis of the lung parenchyma in idiopathic interstitial pneumonia (IIP)

METHOD AND MATERIALS

A total of 50 patients were prospectively enrolled and assessed using full pulmonary function testing (PFTs), a health status questionnaire (St George’s Respiratory Questionnaire - STGQR) and volumetric CT in full inspiration. The CT data was automatically processed by a computerized method using texture features based on 3D Minkowski Functionals and a machine learning classification approach. The computer algorithm calculated total lung volume and the percentage of lung in the following radio-pathological categories: honeycombing, reticulation, indeterminate and normal. A total fibrosis score (TFS) was calculated by summing the honeycombing and reticulation categories and expressing this volume as a percentage of total lung volume. Initial analysis was performed on the first 21 patients to complete the
RESULTS

There was strong correlation between CT calculated volume and total lung capacity (TLC) ($r = 0.85^*$) and a strong negative correlation between TFS and DLco (DLco; $r = -0.76^*$). There was also a strong negative correlation between TFS and DLco/FVC ($r = -0.61^*$). There was a moderate negative correlation between TFS and FVC (percent predicted) ($r = -0.43$) and a moderate positive correlation between CT fibrosis score and STGRQ ($r = 0.41$). Asterisk indicates p-value < 0.05.

CONCLUSION

TFS was highly correlated with DLco and these preliminary results suggest that it may represent an objective, clinically meaningful measure of the severity of idiopathic interstitial pneumonia.

CLINICAL RELEVANCE/APPLICATION

Our textural analysis software based on Minkowski Functionals has been successfully used to analyze parenchymal disease in patients with idiopathic interstitial pneumonia and may offer an alternative outcome measure to lung function, particularly in those patients who are unable to perform physiologic tests.

SSQ04-03

HRCT Classification and Survival in a Large Population of Subjects Enrolled in Multicenter Studies of Idiopathic Pulmonary Fibrosis


PURPOSE

To identify the relationship between CT pattern and survival in a large population of subjects enrolled in multicenter studies of idiopathic pulmonary fibrosis.

METHOD AND MATERIALS

We retrospectively reviewed the HRCT findings in 538 participants in three studies sponsored by the IPFNET study network. CT appearances were classified by two thoracic radiologists according to ATS criteria as UIP, possible UIP, and inconsistent with UIP. Univariate and multivariate analysis with Cox proportional hazards regression models were used for the correlation between CT and physiological features and survival.

RESULTS

Of the 538 cases, 304 (56.5%) had a UIP pattern on HRCT, 113 (21%) had possible UIP, and 121 (22.5%) had pattern inconsistent with UIP. There were 38 deaths in the follow-up period. The UIP group was significantly older, more likely to be current or former smokers, had lower FVC% predicted, DLco% predicted, and a shorter six-minute walk test compared to the other two groups. On univariate analysis, the survival for the groups with possible UIP pattern and CT inconsistent with UIP with similar, but subjects with UIP had shorter survival than the other groups ($p = .032$) (median survival in months - 49.9, 49.1, and 44.3, respectively). The presence of honeycombing were significant predictors of survival (hazard ratios: 1.57, 1.51, and 2.58, respectively) ($p=0.015, 0.0005$, and $0.0185$, respectively). Younger age, lower Borg dyspnea index scores after a walk test, lower total score on St. George's Respiratory Questionnaire, and greater six-minute walk test distance were also significant predictors of survival (hazard ratios: $1.06$, $1.24$, $1.05$, and $0.99$, respectively) ($p=0.0044, 0.0083$).

CONCLUSION

In subjects enrolled in IPF clinical trials, survival of subjects with possible UIP pattern and findings inconsistent with UIP was similar, but subjects with UIP had shorter survival.

CLINICAL RELEVANCE/APPLICATION

Categorization of UIP by CT may influence prognosis.

SSQ04-04

Can Chest CT Prevent Unnecessary Biopsy in Patients with Interstitial Lung Disease (ILD)? The Effect of the ATS 2011 ILD Reporting Guidelines on Patient Management

Anna Rozenshtein MD (Presenter): Nothing to Disclose, Gregory D. N. Pearson MD, PhD : Nothing to Disclose, Beilinda D’Souza MD : Nothing to Disclose, Beth H. Leopold BA : Nothing to Disclose, David Ledderer MD, MS : Steering Committee, Gilead Sciences, Inc Advisory Board, Gilead Sciences, Inc Steering Committee, InterMune, Inc Advisory Board, InterMune, Inc

PURPOSE

We retrospectively evaluated the American Thoracic Society (ATS) 2011 criteria for Computed Tomography (CT) classification of Usual Interstitial Pneumonia (UIP) in a cohort of patients presenting to a tertiary referral center for evaluation of ILD.

METHOD AND MATERIALS

The records of patients presenting to ILD clinic between 2010 and 2012 were reviewed. 3 fellowship trained chest radiologists and a pulmonologist specializing in ILD independently reviewed CT scans in 187 patients, 86 of whom had pathology results available. Based on the ATS 2011 criteria (Raghu et. al. 2011 Am J Respir Crit Care Med 183:788-824), patients were classified as Definite UIP, Possible UIP, or Inconsistent with UIP. Consensus was defined as agreement by 3 or more readers. Interobserver agreement was perfomed with Kappa values.

RESULTS

Consensus CT diagnosis was reached independently in 163 of 187 (87%) of cases, and after discussion in
an additional 24 (13%) of cases. In 3 cases (2%) no consensus was reached. Interobserver agreement was moderate, with kappa value 0.49. Of the 86 patients with available pathology, 15 (17%) had UIP, 5 (6%) had mixed UIP and Nonspecific Interstitial Pneumonia (NSIP), 31 (36%) had NSIP, 12 (14%) had Hypersensitivity Pneumonia (HP), and 24 (28%) had other diagnoses (total>100%) due to multiple pathologic diagnoses in some biopsies. Sensitivity was low, with only 8 of 20 (40%) of patients with either pathologic UIP or combined UIP/NSIP having a consensus radiologic diagnosis of Definite UIP. Of the 15 patients with UIP on biopsy, 5 were classified on CT as Definite UIP, 4 Possible UIP, 5 Inconsistent, and 1 no consensus. Of the 5 patients with mixed UIP and NSIP on biopsy, 3 were classified on CT as Definite UIP, 1 Inconsistent, and 1 no consensus. Specificity, however, was high (98%), with only 1 of 66 patients without UIP on biopsy classified as Definite UIP on CT.

CONCLUSION

ATS 2011 criteria for UIP have poor sensitivity but excellent specificity for the diagnosis of UIP in our retrospective cohort. As such, if used to triage patients with ILD for biopsy 40% of patients with pathologic UIP would have avoided biopsy, while 2% of patients without UIP would have been triaged to no biopsy.

CLINICAL RELEVANCE/APPLICATION

In our cohort, ATS 2011 criteria were excellent for triaging patients without UIP to biopsy, but would not have prevented a biopsy recommendation in the majority of patients with pathologic UIP.

Shear Wave Imaging and ARFI Technique: Potential Tools for Analyzing Early Fibrotic Changes in the Sub Pleural Space - Experimental Data and First Clinical Results

Reinhard I. Kubale MD (Presenter): Nothing to Disclose, Jonas Stroeder MD : Nothing to Disclose, Heinrike Wilken : Nothing to Disclose, Arno Buecker MD : Consultant, Covidien AG Speaker, Covidien AG Co-founder, Aachen Resonance GmbH Research Grant, Siemens AG

PURPOSE

Elastography can provide information about tissue’s mechanical property. The new variant of shear wave imaging (SVI) enables a quick examination not only of breast tumours but also of tendons and liver stiffness. Purpose of this study is to evaluate its feasibility for depicting subpleural parenchymal lung disease and to evaluate influencing physical factors.

METHOD AND MATERIALS

In a group of 30 normal patients proved by HRCT shear wave images, ARFI measurements and displacement maps were analyzed for reproducibility and variation of displacement of lung structures in the subpleural space (Siemens S3000). The effect of frequency, depth of pleural structures and aperture of the scan heads were analyzed. In 25 patients with subpleural fibrotic changes proved by CT and in one sided lung transplant patients with fibrosis the displacement maps are are scored and compared with HRCT.

RESULTS

A good quality of the displacement map was seen in 28/30 of patients with normal lungs. 25/30 patients had a clear delineation between normal lung and pleura. Problems are seen in the basal area due to muscles and depth. 21/25 patients with fibrotic changes had a focal or general reduced displacement in
the subpleural space correlating with CT (fig. 1). False positive results are caused by sub pleural metastasis and pneumonia in 2 cases.

CONCLUSION

Although quantitative measurements of the shear wave velocity in the subpleural space showed a great variation, semiquantitative analysis of the displacement map of subpleural lung parenchyma could be a useful tool for diagnosis and noninvasive follow-up controls of early stages of lung fibrosis. Factors that should be standardized are - Frequency and aperture size of the scan head and its elements - compression and amount of inspiration

CLINICAL RELEVANCE/APPLICATION

Elastography of the subpleural space can be a useful tool for early depiction of sub pleural fibrosis.

A Computerized Score for the Automated Differentiation of Usual Interstitial Pneumonia from Regional Volumetric Texture Analysis

METHOD AND MATERIALS

CT examinations of 33 patients with biopsy proven UIP from -anonymous- were retrospectively reviewed in this study. Two thoracic radiologists with more than 15 years of experience worked in consensus to classify each patient (UIP 15 patients) versus the American Thoracic Society guidelines. The responses of 3-D wavelets are localized using a simple digital atlas of 36 subregions of the lungs. The decision function of support vector machines (SVM) trained in a feature space spanned by the regional texture features is used as a score to stratify patients with UIP into classic and atypical subtypes. Receiver operating characteristics (ROC) analysis was used to evaluate the ability of the score to discriminate between classic versus atypical UIP.

RESULTS

An area under the ROC curve (AUC) of 0.81 was obtained using a leave-one-patient-out cross-validation, with high specificity for classic UIP. We compared this performance with a global characterization of the volumetric texture properties of the lungs, which led to an AUC of 0.72. This highlighted the importance of localizing tissue texture properties, which is consistent with the medical knowledge.

CONCLUSION

We propose a novel computational method for the automated classification of classic versus atypical UIP based on regional volumetric texture analysis. Overall, the proposed approach successfully predicts UIP subtypes for more than 4 out of 5 patients (AUC=0.81) with high specificity for classic UIPs.

CLINICAL RELEVANCE/APPLICATION

With further validation, our system may be useful in the clinical setting for identifying patients with classic UIP for which an unnecessary surgical biopsy can be avoided.

The Effect of Different Levels of Iterative Reconstruction on Qualitative and Quantitative Assessment of Smoking Related Lung Disease

METHOD AND MATERIALS

52 patients undergoing clinically indicated low dose computed tomographic (CT) exams of the chest (100 kVp, and 65mAs), with reconstruction of data with different levels of blended ASIR (0, 40 and 100%) were consented. Qualitative assessment of CT datasets were performed by two thoracic trained radiologists blinded to clinical history, spirometry and quantitative data for presence of emphysema (%/lung zone) and degree of respiratory bronchiolitis (RB). Quantitative analysis was performed to assess emphysema and airway measures of COPD (Apollo, VIDA Diagnostics). IRB approval was obtained.

RESULTS

The application of ASIR results in alterations in both qualitative and quantitative assessment of smoking related lung disease. As levels of ASIR increased both readers scored more RB (p
disease both qualitatively and quantitatively needs to be utilized with caution.

**SSQ04-09**  
**Comparison of Fibrosis Extent on CT, Pulmonary Function Test, and Survival Rate between Usual Interstitial Pneumonia (UIP) and Combined Pulmonary Fibrosis and Emphysema (CPFE)**

Kum Ju Chae (Presenter): Nothing to Disclose, Hyunnyeong Jung MD: Nothing to Disclose, Gong Yong Jin MD, PhD: Nothing to Disclose, Young Sun Lee: Nothing to Disclose, Su Bin Chon: Nothing to Disclose, Keun-Sang Kwon: Nothing to Disclose, Young Min Han MD: Nothing to Disclose

**PURPOSE**

To compare CT findings, pulmonary function tests (PFT), and survival rate of usual interstitial pneumonia (UIP) with those of combined pulmonary fibrosis and emphysema (CPFE)

**METHOD AND MATERIALS**

This study was approved by the institutional review board and informed consent was waived. From January 2004 to December 2009, among 105 patients who underwent open lung biopsy due to interstitial lung disease, 55 patients diagnosed as UIP or CPFE pathologically were finally included in this study. We reviewed the CT findings and clinical characteristics including pulmonary function test of 55 patients; biopsy proven UIP with typical or probable UIP pattern in CT (n=38), biopsy proven UIP or CPFE with CPFE pattern in CT (n=17). The extent of honeycombing on CT was visually assessed using five point scale by two observers independently. Clinical characteristics including PFT were analyzed by Student t-test. Differences of 5-year survival rate according to extent of honeycombing on CT for each group were calculated from Kaplan-Meier analysis.

**RESULTS**

The five year survival rate between UIP and CPFE group was not significantly different (P=0.406). Also, physiologic variables such as FEV1, FVC, FEV1/FVC and DLCO in two groups were not independent risk factors to determine survival rate. The extent of honeycombing on CT between two groups wasn’t significantly different (P=0.140). However, the extent of honeycombing over 25% on CT was an important prognostic factor to determine survival rate (P=0.041, 95% CI; 1.032-4.456) regardless of UIP or CPFE patients; median survival rate of honeycomb extent over 25% (17.3 months), <25% (57.2 months).

**CONCLUSION**

The larger extent of honeycombing at CT is associated with poor prognosis of CPFE and UIP patients.

**CLINICAL RELEVANCE/APPLICATION**

1. Quantification of honeycombing extent on CT in UIP and CPFE patients is important for prognosis prediction. 2. CPFE patients proved to be have two pathologic patterns (UIP and CPFE).

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**SSQ05**  
**Chest (Miscellaneous)**

**Scientific Papers**

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**Thu, Dec 4 10:30 AM - 12:00 PM**  
**Location: S404CD**

**Participants**

Moderator

Satinder Pal Singh MD: Nothing to Disclose

Moderator

Sudhakar N. Pipavath MD: Nothing to Disclose

**Sub-Events**

**SSQ05-01**  
**Diffusion-weighted MR Imaging of the Thymus in Patients with Generalized Myasthenia Gravis: Usefulness of ADC Values in Distinguishing Lymphoid Hyperplasia, Normal Thymus, and Thymoma**

Adriano Massimiliano Priola MD (Presenter): Nothing to Disclose, Sandro Massimo Priola: Nothing to Disclose, Maria Teresa Giraudo: Nothing to Disclose, Dario Gned MD: Nothing to Disclose, Lorina Ducco: Nothing to Disclose, Federica Moretti: Nothing to Disclose, Andrea Veltri MD: Speakers Bureau, Eli Lilly and Company Speakers Bureau, Bayer AG

**PURPOSE**

To prospectively evaluate the efficacy of diffusion-weighted (DW) magnetic resonance imaging (MRI) in patients with myasthenia gravis (MG) for distinguishing thymic lymphoid hyperplasia (TLH), normal thymus (NT), and thymoma (THY) by using the apparent diffusion coefficient (ADC), in order to suitably select patients for surgery.

**METHOD AND MATERIALS**

The IRB approved the study, and informed consent was obtained. We evaluated 88 subjects (45 male, 43 female) with generalized MG and anti-AChR antibodies that underwent surgery. They were divided into a TLH/NT group (A, 64 patients; TLH, 49; NT, 15) and a THY group (B, 24 patients) by histological findings. DW-MRI was performed at b values of 0, 150, 500, and 800 s/mm². All measures were performed independently by two radiologists and inter-reader agreement was assessed by calculating the intraclass correlation coefficient (ICC). Discrimination abilities were individuated according
Differential Diagnosis of Benign and Malignant Pleural Effusion with Spectral CT

Zhang Xirong MMed (Presenter); Nothing to Disclose, Jia Yongjun MMed; Nothing to Disclose, Yang Chuangbo MMed; Nothing to Disclose, Ma Chunling MMed; Nothing to Disclose, Lu Shuanhong MMed; Nothing to Disclose

PURPOSE

To investigate the value of spectral CT in the differential diagnosis of benign pleural effusion and malignant pleural effusion.

METHOD AND MATERIALS

14 patients with benign pleural effusion (8 with pneumonia, 5 with pulmonary tuberculosis, and 1 with pneumocystosis) and 15 patients with malignant pleural effusion (5 with adenocarcinoma of lung, 4 with squamous cell carcinoma of lung, 2 with adenosquamous carcinoma of lung and 4 with transitivity carcinoma of lung) underwent non-contrast spectral CT imaging. These patients were later verified by pathology. Various parameters for the effusion were measured: CT values of the benign pleural effusion and malignant pleural effusion at both the monochromatic 40keV and 100keV; the material contents on the water-, fat- and blood-based material decomposition images, and the effective atomic number Z. These values from the benign and malignant pleural effusion were statistically compared with t test.

RESULTS

The CT values of benign and malignant pleural effusion from the conventional 140kVp images showed no difference (12.61±3.39 vs. 14.71±5.03, p=0.20). The water-density, fat-density and blood-density between benign pleural effusion and malignant pleural effusion also did not show difference (p=0.18, 0.39, 0.43, respectively). On the other hand, the CT values of the benign pleural effusion and malignant pleural effusion at both the monochromatic 40keV and 100keV spectral images were statistically different: 43.15±3.79 vs. 39.42±2.60 at 40keV (p=0.005) and 9.11±1.38 vs. 6.52±2.04 at 100keV (p<0.001). The effective atomic number values of benign pleural effusion was 7.87±0.08, statistically different from that of malignant pleural effusion (7.90±0.02) (p<0.05).

CONCLUSION

The spectral CT provides CT number measurements at both high and low energy levels and effective atomic number from a single scan to assist the differential diagnosis of benign pleural effusion from malignant pleural effusion.

CLINICAL RELEVANCE/APPLICATION

CT numbers at different energy levels from Spectral CT may be used to better differentiate benign pleural effusion from malignant pleural effusion.
attenuations at different energies. Metric $K_1$ was the ratio of the difference of $\mu_x$ at (120, 60) kVp and (70, 60) kVp - namely $[(\mu_{120kVp}-\mu_{60kVp})]=(\mu_{120kVp}-\mu_{60kVp})$ - independent of sample thickness $x$, similarly for $K_2$ and $K_3$. The 37 pleural samples were analyzed to determine the accuracy of using the metrics to discriminate between bloody or non-bloody fluids and the false positive rate (FPR) and true positive rate (TPR) were calculated for various thresholds to yield the receiver operating characteristic curves ROC.

**RESULTS**

The ROC was plotted for the 37 blinded pleural samples. The area under the operating curve (AUC) was 0.66, 0.67, and 0.56 for $K_1$, $K_2$, and $K_3$, respectively. Based on these results, $K_2$ was found to be most suitable for differentiating between bloody and non-bloody pleural effusions. Further work is required to evaluate clinical feasibility.

**CONCLUSION**

In this work, a novel metric based on the multispectral x-ray signal was defined and tested on 37 pleural effusion samples. This metric may provide a reasonable differentiation between bloody and non-bloody pleural effusions. Further work is required to evaluate clinical feasibility.

**CLINICAL RELEVANCE/APPLICATION**

We report initial results of a novel multi-spectral portable DR system, which may have the potential for discriminating between pleural effusions types (i.e., bloody from a non-bloody effusion).

**SSQ05-04 Computed Tomography Volumetry for Subtyping Chronic Lung Allograft Dysfunction**

**Presenter: Tomohito Saito**

Toshiba Corporation, Daisuke Nakajima: Nothing to Disclose

**Disclose**

Jo-Anne O. Shepard MD: Consultant, Agfa-Gevaert Group

Roberto Lo Gullo MD: Nothing to Disclose

Alexi Otrakji MD: Nothing to Disclose

**Purpose**

The long-term success of lung transplantation is challenged by the development of chronic lung allograft dysfunction (CLAD) and its distinct subtypes: bronchiolitis obliterans syndrome (BOS) and restrictive allograft syndrome (RAS). However, the current diagnostic criteria for subtyping CLAD subtypes that relies on total lung capacity (TLC) which is not always measured during routine post-transplant assessment. Our aim is to investigate the utility of 3D computed tomography (CT) lung volumetry for differentiating RAS from BOS.

**Method and Materials**

Retrospective evaluation of 103 patients following bilateral lung or heart-lung transplantation; including 44 patients without CLAD and 59 patients who developed CLAD of whom 41 had BOS and 18 RAS. All patients had complete PFT and CT data. Median duration of post-transplant follow-up was 47 months in BOS and 27 months in RAS. Median interval of CT volumetry timepoints was 11 months in both BOS and RAS. The changes in CT lung volume over time and the diagnostic accuracy of CT lung volume (measured as % of baseline) for differentiating RAS from BOS were investigated.

**Results**

The CT lung volumes varied over time; patients without CLAD experienced increase in lung volume ($p=0.001$); patients with BOS had no significant post-transplant change, whereas patients with RAS showed a significant decrease at disease onset compared to baseline ($p=0.0001$). The area under the receiver operating characteristic curve of CT lung volume for differentiating RAS from BOS was 0.958 (95% confidence interval, 0.908 to 1.00, $p<0.0001$) and the calculated accuracy was 0.932 at a threshold of 85%.

**Conclusion**

In patients with chronic lung allograft dysfunction, a decrease in CT lung volume to 85% of baseline differentiates lung transplant recipients who develop RAS from those who develop BOS.

**CLINICAL RELEVANCE/APPLICATION**

Computed tomography volumetry is useful tool for subtyping chronic lung allograft dysfunction. Restrictive allograft syndrome shows significant decrease in lung volume after lung transplantation.

**SSQ05-05 Trouble-shooting of Artifacts Related to Placement of Arms by the Side of the Chest during Dual Energy CT**

**Presenter: Alexi Otrakji**

Efren Jesus Flores MD: Nothing to Disclose

Robert Lo Gullo MD: Nothing to Disclose

Subba Rao Digumarthy MD: Nothing to Disclose

Jo-Anne O. Shepard MD: Consultant, Agfa-Gevaert Group

Mannudeep K. S. Kalra MD: Nothing to Disclose

Matthew David Gilman MD: Nothing to Disclose

**Purpose**

To evaluate the ability of single source dual energy (SS-DECT) to decrease the artifacts related to placing one or both arms by the side of chest using monenergetic 75 Kev images and iterative reconstruction technique.

**Method and Materials**

Our IRB approved study included 52 adult patients who underwent contrast enhanced chest CT.

Twenty-six patients underwent chest DECT (13 patients (M:F 7:6, mean age 66±17 years, mean weight 81±21kg) with one arm or both by the side of chest; 13 patients (M:F 7:6, mean age 61±12 years, mean weight 81±21 kg) with both arms placed up) and 26 weight-matched patients who underwent contrast enhanced chest with single energy CT (SECT) (13 patients (M:F 8:5, mean age 57±2 years, mean weight 83±23 kg) with one arm or both by the side of chest; 13 patients (M:F 8:5, mean age 57±2 years, mean weight 83±23 kg) with both arms placed up).
METHOD AND MATERIALS

To determine the optimal energy level for lung parenchyma analysis in spectral CT imaging.

RESULTS

Radiation dose for DECT chest (CTDI:8±0.6mGy,DLP: 288±32mGy.cm). The vascular enhancement in (Mono 75 keV ASIR70%) was rated as optimal or better in all patients (100%) for MPA and its lobar branches and in 69% (9/13 patients) for segmental and sub-segmental branches compared to just 85% and 54% for 60 keV images and 69% and 8% for 100 keV images. There was significant reduction in image noise and artifacts at the level of the tracheal carina and diaphragm with 75 keV images compared to the 60 and 100 keV images. There was a significant improvement in diagnostic quality with 75 keV compared to 60 and 75 keV images as well as SECT.

CONCLUSION

Conventional monoenergetic (60 and 100 keV) DECT images and SECT are substantially impaired when scanning is performed with one or both arms by the side. Monoenergetic 75 keV images with ASIR70% help increase the diagnostic quality, and decrease artifacts without compromising vascular enhancement.

CLINICAL RELEVANCE/APPLICATION

Appropriate modification to DECT of the chest can improve image quality in patients who can not place their arms above the shoulders.

SSQ05-06

Comparison of Filtered Back Projection (FBP), Adaptive Statistical Iterative Reconstruction (ASIR) and Model Based (MBIR) Iterative Reconstruction Techniques for Post Mortem Chest CT Acquired at Eight Different Dose Levels


PURPOSE

To assess diagnostic image quality in post mortem chest CT acquired at eight different dose levels and reconstructed with FBP, ASIR and MBIR techniques.

METHOD AND MATERIALS

In an IRB approved, post mortem chest CT was performed in 40 human cadavers (57±13years, body mass index 26±6, F:M 13:27) at eight different dose levels with mean CTDIvol of 3.7-15 mGy at 100-120 kV and 10-40 noise index (NI) on a 64 channel MDCT (GE Discovery CT750 HD). The remaining scan parameters were held constant at pitch of 0.984:1, rotation time of 0.5 second. Sinogram data at each dose level were reconstructed with FBP, ASIR (SS50, GE Healthcare) and MBIR (Veo, GE Healthcare) (n=8*3*40= 960 series). Radiologist performed independent and blinded comparison of one image series at a time for lesions detection, lesions conspicuity, and visibility of small structures. In addition, subjective image noise and artifacts were also assessed. Objective image noise was measured at each dose levels.

RESULTS

There were total 256 lesions detected on 15 mGy. In mediastinal window, at CTDIvol of 5.7 mGy lesions conspicuity was acceptable for 40/71 with FBP, 59/71 with ASIR, and 67/71 with MBIR. Similarity, visibility of small structures was acceptable in 8/40 with FBP, 23/40 with ASIR and 40/40 with MBIR. At CTDIvol of 3.7 mGy, lesion conspicuity was acceptable for 21/71 with FBP, 27/71 with ASIR, and 57/71 with MBIR. Visibility of small structures was acceptable in 1/40 with FBP, 1/40 with ASIR and 20/40 with MBIR. In lung window, at all dose levels, lesion conspicuity and visibility of small structures were equally seen on FBP, ASIR, and MBIR. At CTDIvol of 3.7 mGy, lesions conspicuity was acceptable for 50/57 with FBP, 49/57 with ASIR, and 50/57 with MBIR. Similarity, visibility of small structures was acceptable in 38/40 with FBP, 39/40 with ASIR and 39/40 with MBIR. For all dose levels, subjective image noise and artifact were lower with MBIR compared to FBP and ASIR. In addition, for all dose level, objective image noise was significantly lower for MBIR compared to FBP and ASIR (p<0.001).

CONCLUSION

MBIR improves the mediastinal lesion conspicuity and visibility of small structures in post mortem chest CT performed at CTDIvol down to 3.7 mGy when compared to ASIR and FBP.

CLINICAL RELEVANCE/APPLICATION

Mediastinal structures can be better seen with iterative reconstruction techniques at CTDIvol of 3.7 mGy, where FBP technique is suboptimal.

SSQ05-07


Mickael Ohana MD, MSc (Presenter): Nothing to Disclose, Aissam Labani MD: Nothing to Disclose, Aina Venkatasamy: Nothing to Disclose, Mi-Young Jeung MD: Nothing to Disclose, Catherine Roy MD: Nothing to Disclose

PURPOSE

To determine the optimal energy level for lung parenchyma analysis in spectral CT imaging.

METHOD AND MATERIALS

81±11kg) with one arm or both by side;13 patients (M:F 7:6, mean age 68±16years, mean weight 82±13kg) with both arms placed up). All chest CT exams were performed on a single source 64-row multidetector CT (GE 750HD Discovery). Additional 75 kev images at adaptive statistical iterative reconstruction (ASIR) were generated for 13 patients with one arm or both by their side. All image series were assessed qualitatively for image quality, level of enhancement, and artifacts. CT numbers and noise was measured in main pulmonary artery (MPA) for all series. CTDIvol and DLP were recorded as well.

RESULTS

There were total 256 lesions detected on 15 mGy. In mediastinal window, at CTDIvol of 5.7 mGy lesions conspicuity was acceptable for 40/71 with FBP, 59/71 with ASIR, and 67/71 with MBIR. Similarity, visibility of small structures was acceptable in 8/40 with FBP, 23/40 with ASIR and 40/40 with MBIR. At CTDIvol of 3.7 mGy, lesion conspicuity was acceptable for 21/71 with FBP, 27/71 with ASIR, and 57/71 with MBIR. Visibility of small structures was acceptable in 1/40 with FBP, 1/40 with ASIR and 20/40 with MBIR. In lung window, at all dose levels, lesion conspicuity and visibility of small structures were equally seen on FBP, ASIR, and MBIR. At CTDIvol of 3.7 mGy, lesions conspicuity was acceptable for 50/57 with FBP, 49/57 with ASIR, and 50/57 with MBIR. Similarity, visibility of small structures was acceptable in 38/40 with FBP, 39/40 with ASIR and 39/40 with MBIR. For all dose levels, subjective image noise and artifact were lower with MBIR compared to FBP and ASIR. In addition, for all dose level, objective image noise was significantly lower for MBIR compared to FBP and ASIR (p<0.001).

CONCLUSION

MBIR improves the mediastinal lesion conspicuity and visibility of small structures in post mortem chest CT performed at CTDIvol down to 3.7 mGy when compared to ASIR and FBP.
50 dual energy CT pulmonary angiography (DE-CTPA) from a previously published prospective study were used after Institutional Review Board approval. All patients (58% men, 64.8yo ±16) underwent a single source DE-CTPA with the following acquisition parameters: 80/140 kV, 0.6s rotation time, 275mA fixed tube current, 50% ASIR, automatic injection of 50mL of Iohexol 350mgI/mL. Monochromatic images in lung window reconstructed every 5keV from 40 to 140keV were independently assessed by two chest radiologists, based on overall image quality and the depiction of potential parenchymal lesions. Each reader had to eventually designate for every patient which keV provided the best diagnostic and image quality. A correlation between the preferred keV and the body mass index (BMI) of the patients was searched using a Pearson's product-moment correlation.

RESULTS

Mean radiation dose was 243mGy.cm ±33 and mean BMI of the participants was 25.6 ±4.5. Regarding the lung parenchyma, 28% of the examinations were normal, while the remaining 72% showed various lesions: nodule greater than 5mm (n=6), mass (n=3), alveolar consolidation (n=10), ground glass opacities (n=6), diffuse septal thickening (n=4), fibrosis (n=7), bronchiectasis (n=3) and emphysema (n=15). Reader 1 picked the 55keV monochromatic reconstruction in 52% of cases, the 50keV in 30% and the 60keV in the remaining 18%. For reader 2, the 50keV monochromatic reconstruction was preferred in 52% cases, the 55keV in 40%, the 60keV in 6% and the 40keV in 2%. The 55keV monochromatic reconstruction was chosen by at least one reader in 76% of patients, and the 50keV was preferred by at least one reader in 64% of all cases. There wasn't any correlation between the preferred keV and the BMI for both readers (ρ<0.05 with p>0.05).

CONCLUSION

The best image quality for lung parenchyma in spectral CT is obtained with 50-55keV monochromatic reconstructions.

CLINICAL RELEVANCE/APPLICATION

In dual energy chest CT, lung parenchyma is better analyzed using a 50-55keV monochromatic reconstruction.

Feasibility of Respiratory Gating in High-Pitch Spiral CT of the Chest

Matthias Stefan May (Presenter): Speakers Bureau, Siemens AG, Wolfgang Wust MD: Nothing to Disclose, Achim Eller MD: Nothing to Disclose, Michael Uder MD: Speakers Bureau, Bracco Group, Siemens AG, Siemens AG Research Grant, Siemens AG, Michael Marcus Lell MD: Research Grant, Siemens AG, Siemens AG Research Grant, Bayer AG, Speakers Bureau, Bayer AG, Research Consultant, Bracco Group

PURPOSE

Artifact free imaging of the chest remains difficult in non-compliant patients for breath-hold undergoing chest CT. Our aim was to establish a respiratory gated High-Pitch protocol using Dual-Source CT.

METHOD AND MATERIALS

21 patients were examined on a second generation Dual Source CT with a high-pitch scan mode (pitch = 3.4, 128 x 0.6 mm collimation, 0.28 s gantry rotation time, 150 ref.mAs per tube at 120kV) without breathing commands. Measurements from a respiratory gating system were used as trigger to obtain images in inspiration. Previous examinations on a single source CT system with regular breathing instructions were used as reference. Motion artifacts, delineation of pathologic findings and lung volumina were assessed for both, free-breathing and reference exams.

RESULTS

Delineation of the pathologic findings was good with both protocols. Significantly less motion artifacts were recorded with the high pitch mode compared to the reference (p=0.021). Main location of artifacts was the peripheral parts of the lower lobes in the study group and the central part of the left lower lobe in the reference. Average total lung volume was 4.3 ± 1.5 l in respiratory gated examinations and 5.8 ± 0.9 l in examinations with breath hold in inspiration.

CONCLUSION

High Pitch CT of the chest in inspiration is feasible by respiratory gating and minimizes motion artifacts in free breathing patients.

CLINICAL RELEVANCE/APPLICATION

Chest CT in patients that are unable to breath-hold should be performed using a High Pitch protocol with a respiratory gating device.

Thoracic Virtual Non-enhanced CT with Spectral CT: A Preliminary Study

He Taiping MMed (Presenter): Nothing to Disclose, Yu Yong MMed: Nothing to Disclose, Chen Xiaoxia MMed: Nothing to Disclose, Ma Guangming MMed: Nothing to Disclose, Jia Yongjun MMed: Nothing to Disclose, Yang Chuangbo MMed: Nothing to Disclose

PURPOSE

To compare the virtual non-enhanced chest CT (VNCT) generated from spectral CT with conventional non-enhanced chest CT in patients with lung disease in terms of CT number accuracy and image quality.

METHOD AND MATERIALS

A total of 30 patients with lung disease proved by pathology underwent the conventional non-enhanced thoracic CT and contrast enhanced CT with spectral imaging mode in arterial phase (AP) and venous phase.
The VNCT images were reconstructed based on the enhanced spectral CT imaging data. The mean CT number, signal to noise ratio (SNR) for the lesions and image quality score were obtained and compared between the true non-contrast CT (TNCT) and the VNCT (including AP and VP) with paired t test.

**RESULTS**

The mean ± standard deviation for CT Number were 38.74±5.17HU, 39.08±5.07HU and 38.96±5.18HU for TNCT, VNCT at AP and VNCT at VP, respectively, with no statistical difference (p>0.05). All 3 sets of images demonstrated acceptable image quality, even though there were statistically significant differences in the SNR value and image quality score. The mean ± standard deviation values for SNR were 4.74±0.42 with TNCT (figure 1#2), 3.79 ± 0.51 with VNCT at AP (figure 3) and 3.77 ± 0.39 with VNCT at VP (figure 4) (P<0.05), and the image quality scores were 5.00±0.00 with TNCT, 4.17±0.65 with VNCT at AP and 4.17±0.53 with VNCT at VP (p<0.05).

**CONCLUSION**

In patients with lung disease, the virtual non-enhanced CT images generated from spectral CT provide accurate CT numbers for lesions and acceptable image quality compared with the true non-contrast CT. VNCT may be used to replace TNCT to improve work flow and reduce radiation dose.

**CLINICAL RELEVANCE/APPLICATION**

Virtual non-enhanced images generated from spectral CT may be used to replace the true non-contrast CT for lung patients to improve work flow and reduce radiation dose.

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**SSQ06**

**Gastrointestinal (Oncology: Staging and Response)**

**Scientific Papers**

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

**Participants**

Moderator
- J. Louis Hinshaw MD : Stockholder, NeuWave Medical Inc Medical Advisory Board, NeuWave Medical Inc Stockholder,
- Cellectar Biosciences, Inc

Moderator
- Andrew Dennis Smith MD, PhD : Research Grant, Pfizer Inc President, Radiostics LLC President, Liver Nodularity LLC
- President, Color Enhanced Detection LLC Pending patent, Radiostics LLC Pending patent, Liver Nodularity LLC Pending patent, Color Enhanced Detection LLC

Moderator
- Keyanoosh Hosseinzadeh MD : Consultant, Bayer AG

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**Sub-Events**

**SSQ06-01**

**Different Approaches and Methodological Principles of Reporting in Chest/Abdominal CT with Oncologic Questioning by Residents and Radiology Specialists with Regard to Professional Experience: Results of a Clinical Investigation Using Eye-Tracking**

Sara Kammerer (Presenter): Nothing to Disclose, Anna Knauer : Nothing to Disclose, Christoph Schuelke : Nothing to Disclose, Walter Leonhard Heindel MD : Nothing to Disclose, Boris Buerke MD : Nothing to Disclose

**PURPOSE**

Contrast-enhanced thoracoabdominal CT is an established method in cancer staging. However, higher rates of missed pathologies in case of little work experience suggest that a methodical approach of detection of pathologies can be learned. Thus, aim of this study is to investigate differences in focussing of radiologic residents or specialists when screening CT for oncological findings to evaluate the efficiency of different methodological principles in analysis of CTs according to the professional experience.

**METHOD AND MATERIALS**

Thoracoabdominal MSCTs of 20 patients with the clinical indication of staging owing to known underlying oncological disease were included. CTs were presented to 4 radiologists with varying years of working experience and evaluated independently of one another. Meanwhile ocular fixation positions are recorded using an eye-tracking software tool (Tobi X2-60 EyeTracker), a commercially available software tool that is already perfectly established. CTs were retrospectively analysed with the issue of successful detection of all pathologies. Based on the eye-fixation patterns heat maps were created. Visual attention, dwell time of ocular fixation on clinically important or areas with pathologic findings, general search patterns and time efficiency was assessed. Statistical analysis was performed taking account to the individual stage of professional experience.

**RESULTS**

The analysis revealed that observer sensitivity depends on work experience due to a systematic order of inspection and a good known course of disease, e.g. of metastatic spread. Missed pathologies mostly included secondary findings or a lack of methodical approach of inspection. The dwell time of ocular fixation of unexperienced readers was significantly higher in salient findings whereas experienced readers more frequently fixated areas with less salient, but clinically important findings or clinically important regions.

**CONCLUSION**

Preliminary results suggest that experienced radiologic physicians reduce missed findings through looking more systematically upon CTs and a focus on clinically important regions regarding the individual primary disease. Visual attention was more targeted in the practiced physicians and less time was needed, however all experience stages seem to be able to improve their performance by analyzing CT images in systematic patterns.

**CLINICAL RELEVANCE/APPLICATION**

Contrast-enhanced thoracoabdominal CT is an established method in cancer staging. However, higher rates of missed pathologies in case of little work experience suggest that a methodical approach of detection of pathologies can be learned. Thus, aim of this study is to investigate differences in focussing of radiologic residents or specialists when screening CT for oncological findings to evaluate the efficiency of different methodological principles in analysis of CTs according to the professional experience.
SSQ06-02 Detection of Peritoneal Disease Using Multidetector CT in Upper Abdominal Malignancies: Diagnostic Performance in Experienced and Inexperienced Readers

Giuliano Scattolin MD (Presenter): Nothing to Disclose, Dow-Mu Koh MD, FRCP: Nothing to Disclose, Giovanni Morana MD: Nothing to Disclose, David Watkins MBBS, MRCP: Nothing to Disclose, Angela Mary Riddell MBBS: Nothing to Disclose

PURPOSE
Peritoneal disease contraindicates surgery in patients with gastroesophageal, gastric and pancreatic cancers, but the diagnostic performance of CT in this context is unknown. We compare the CT diagnostic performance between experienced and inexperienced radiologists for peritoneal disease detection in primary upper abdominal malignancies.

METHOD AND MATERIALS
In this IRB approved study, the pre-operative CT images of 110 patients with gastroesophageal (n=41), gastric (n=49) and pancreatic (n=10) cancers who underwent laparoscopy were retrospectively reviewed. Portovenous phase CT was performed within 3 weeks prior to laparoscopy using multichannel CT and 1.3 mm multiplanar image reconstruction. Images were reviewed by an expert (>10 years experience) and inexperienced radiologist for presence, size and location of peritoneal nodules; peritoneal stranding, peritoneal thickening, cystic disease and ascites. CT images were scored using set criteria on a 4-point scale for likelihood of peritoneal disease. Reader diagnostic performance was compared by ROC analysis and observer agreement by kappa statistics. CT features were compared between patients with and without peritoneal disease using Fisher’s exact test.

RESULTS
97 were laparoscopically negative for peritoneal disease and 13 positive. For experienced radiologist, CT score ≥ 2 showed 77% (95%CI: 46-95%) sensitivity and 56% (47-68%) specificity for detecting peritoneal disease. For inexperienced radiologist, there was 71% (42-92%) sensitivity and 52% (42-62%) specificity. By ROC analysis, there was no difference in diagnostic performance between readers (Az 0.69 vs 0.61, p=0.23) with moderate interobserver agreement (kappa = 0.47). For experienced reader, peritoneal nodules > 5 mm in gastrohepatic ligament were more frequently observed in patients with peritoneal disease (Fisher’s exact test p=0.005), but other CT features were non-discriminatory in both readers.

CONCLUSION
In patients with primary upper abdominal malignancies, reader experience shows little advantage for detecting peritoneal disease. The diagnostic performance of CT is modest in both experienced and inexperienced readers.

CLINICAL RELEVANCE/APPLICATION
Peritoneal disease detection in upper abdominal cancers is limited using CT and appears uninfluenced by reader experience. Other imaging techniques (e.g. DWI) should be investigated to improve diagnostic performance.

SSQ06-03 Use of Liver MRI Following Standard Staging Abdominopelvic CT to Evaluate Newly-diagnosed Colorectal Cancer Patients

Kichang Han MD (Presenter): Nothing to Disclose, Seong Ho Park MD: Research Grant, DONGKOOK Pharmaceutical Co, Ltd Research Grant, General Electric Company, Hyoung Jung Kim MD: Nothing to Disclose, Seung Soo Lee MD: Nothing to Disclose, Ah Young Kim MD: Nothing to Disclose, Hyun Kwon Ha MD: Nothing to Disclose

PURPOSE
No clear guidelines yet exist regarding how to use liver MRI in evaluating patients with newly-diagnosed colorectal cancer. This study was to investigate the clinical impact of liver MRI in staging evaluation of newly-diagnosed colorectal cancer patients, primarily focusing on those who demonstrate diminutive indeterminate hypoattenuating ('too-small-to-characterize' [TSTC]) focal hepatic lesions or metastasis-negative hepatic findings on standard staging CT.

METHOD AND MATERIALS
We included 863 consecutive adults who had newly-diagnosed colorectal cancer without concomitant malignancies and received portal-phase contrast-enhanced abdominopelvic CT. Patients who had TSTC hepatic lesions without other suspicious/indeterminate hepatic findings (TSTC-liver-on-CT), metastasis-negative hepatic findings (negative-liver-on-CT), and hepatic lesions suspicious or indeterminate for metastasis-negative lesions on CT were identified. Per-patient rate of hepatic metastasis unsuspected by CT for the entire cohort and the diagnostic yield of liver MRI for such lesions for those who had undergone liver MRI were assessed.

RESULTS
There were 261 TSTC-liver-on-CT patients, 464 negative-liver-on-CT patients, and 138 patients with suspicious hepatic findings on CT. Among TSTC-liver-on-CT patients, the rate of hepatic metastasis was 3.2% (5/150, excluding patients without follow-up) and the yield of liver MRI was 3% (3/96). Negative-liver-on-CT patients gave the MRI yield of 0% (0/94). Among negative-liver-on-CT patients, the rate of hepatic metastasis discovered within 6 months of curative surgery was 1.1% (4/350, excluding patients without follow-up) when the liver was cleared by negative CT alone and 2% (2/88, excluding patients without follow-up) when cleared also by negative MRI (P=0.347). Among the patients who had suspicious hepatic findings on CT, the MRI yield was 25% (19/77).

CONCLUSION
The diagnostic yield of liver MRI for hepatic metastasis was very low in newly-diagnosed colorectal cancer patients who showed TSTC hepatic lesions or metastasis-negative hepatic findings on CT. Staging liver MRI
Does the Gadoxetic Acid-enhanced Liver MRI Impact on the Treatment of Patients with Colorectal Cancer? Comparison Study with FDG-PET and Gadoxetic Acid-enhanced MRI

Ji Won Oh MD (Presenter): Nothing to Disclose, Seung Beak Lee: Nothing to Disclose, Soon Nam Oh MD: Nothing to Disclose, Sung Eun Rha MD: Nothing to Disclose, Seung Eun Jung MD: Nothing to Disclose, Joon Il Choi MD, PhD: Nothing to Disclose, Je Ryung Yoo: Nothing to Disclose, Jae Young Byun MD: Nothing to Disclose

PURPOSE

To evaluate the added value of Gadoxetic acid-enhanced liver MRI in preoperative staging of colorectal cancer, and to estimate the clinical impact of the liver MRI in management planning of liver metastasis.

METHOD AND MATERIALS

Among 140 Patients who underwent CT, FDG-PET, and consecutive Gadoxetic acid-enhanced liver MRI for preoperative evaluation of colorectal cancer, between January 2011 and December 2013, 41 patients with confirmed liver metastasis by subsequent surgery or follow-up imaging were included. Per patient sensitivity and specificity, and per-nodule sensitivity of FDG-PET and liver MRI at detecting metastatic nodules were evaluated according to the reading papers. The sensitivity for liver metastasis of FDG-PET and MRI were calculated in groups of tiny (<1cm), small (<2cm) and large (≥2cm) metastatic nodules. The newly detected metastatic nodules on liver MRI were analyzed, to assess the treatment change after performing liver MRI.

RESULTS

A total of 131 metastatic nodules (size 1.6 cm; range 0.4–8.2) were detected in 41 patients (mean age 65 years; range 37–81). The sensitivity and the specificity of FDG-PET and liver MRI did not differ significantly on per patient base. The nodule sensitivity of FDG-PET (68.7%) and liver MRI (96.2%) were significantly different (P = 0.0001), especially for small (<2 cm) nodules. The sensitivity of FDG-PET and MRI were 59.8%, 95.1%, for small nodules and 27.1%, 91.7% for tiny nodule, respectively. The mean diameter of metastatic nodules was significantly different between FDG-PET negative (0.76 cm) and FDG-PET positive (1.98 cm) nodules (P = 0.0001). At least one more metastatic nodule was newly detected on MRI in 16 (39%) patients. Among these, 6 (15%) patients showed significant change of the management plan after performing liver MRI.

CONCLUSION

Gadoxetic acid-enhanced liver MRI detected more metastatic nodules compared with FDG-PET, especially for small (<2 cm) nodules. Excellent small nodule detection of Gadoxetic acid-enhanced liver MRI is helpful for treatment planning of liver metastasis in colorectal cancer.

PETCT Derived Tumoural Heterogeneity and Glucose Uptake Predicts Survival in Primary Colorectal Cancer Patients


PURPOSE

We investigated the prognostic value of FDG PET and CT texture analysis for survival of colorectal cancer patients grouped by stage as a) stage I–III rectal cancer, b) stage I–III colonic cancer and c) metastatic stage IV.

METHOD AND MATERIALS

126 patients (79-males; 47-females; mean-age 66.2±10.6y) with primary colorectal cancer prospectively underwent FDG-PET/CT. Primary tumour heterogeneity was assessed on CT images using image filtration-histogram technique. FDG uptake (SUVmax) on PET was measured. Clinical stage was determined using surgical histology and clinical imaging data. Univariate Kaplan-Meier analysis assessed the ability of each imaging and clinical markers to predict survival. Cross-validation assessed the prognostic model via hazard ratio. Multivariate Cox’s regression was used to test the independence of significant model input factors. Institutional Review Board approval was obtained.

RESULTS

Median follow up for surviving patients was 47.9 months (minimum 12 months). For patients with stage I–III rectal cancer (n=42), CTTA (coarse skewness, p=0.011), SUVmax (p=0.012) and clinical stage (p=0.006) were
the best survival predictors. A significant interaction between skewness and clinical stage was the only independent predictor (p=0.003). For patients with stage I-II (n=28) and stage III (n=28) colon cancer, CTTA (unfiltered kurtosis, p=0.001) and T-stage respectively were the only significant survival predictors. CTTA (fine kurtosis) was the only significant survival predictor in stage IVb disease (n=11).

CONCLUSION

Tumour heterogeneity measured as CTTA and glucose uptake on PET were found to be survival predictors for colorectal cancer patients divided in a number of clinically relevant sub-populations.

CLINICAL RELEVANCE/APPLICATION

CT textural features and FDG signal has potential to predict survival and help refine management decision in colorectal cancer patients at staging, in a number of clinically relevant settings.

SSQ06-06

The Inferior Mesenteric Vein Sign: A New Sign for Diagnosis of Rectosigmoid Carcinoma on Contrast-enhanced CT

Ahmed-Emad Mahfouz MD (Presenter): Nothing to Disclose, Hanan Sherif MD: Nothing to Disclose, Ahmed El Sayed Sayedin MBBCh: Nothing to Disclose, Moamena Ahmed El-Matbouly MBBCh: Nothing to Disclose, Rashad Alfkey MD: Nothing to Disclose

PURPOSE

Diagnosis of rectosigmoid carcinoma on contrast-enhanced CT relies on demonstration of thickening and enhancement of the rectosigmoid wall and enlarged lymph nodes. Rectal wall thickening may be the only sign seen in early carcinoma and may be mimicked by spasm or adherent fecal matter. Angiogenesis and arteriovenous shunting within the carcinoma may result in earlier venous return in the draining inferior mesenteric vein (IMV) compared to the superior mesenteric vein (SMV). The purpose of this study is to evaluate fast venous return of intravenous contrast agent in IMV compared to SMV (the IMV sign) as a diagnostic sign for rectosigmoid carcinoma.

METHOD AND MATERIALS

Contrast-enhanced CT of the abdomen and pelvis of 35 patients with rectosigmoid carcinoma and 50 patients free of colorectal disease as a control group have been randomized and reviewed in consensus by two experienced radiologists, blinded to the diagnosis. In the first session transverse CT sections of the pelvis were reviewed for rectosigmoid wall thickening and lymph nodes. In the second session, only 3-D reconstructions of the arterial and venous-phase CT were reviewed to note whether contrast agent appeared earlier in IMV compared to SMV (positive IMV sign). The diameter of IMV and the IMV/SMV enhancement ratio have been measured and compared in the two groups by the Student’s T-test.

RESULTS

Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of IMV sign for diagnosis of carcinoma have been 83, 100, 100, 89, and 93% as compared to 100, 84, 81, 100, and 91% for wall thickening and 40, 98, 93, 70, and 74 % for nodal enlargement respectively. IMV/SMV enhancement ratio on arterial phase has been significantly higher in the carcinoma group (1.38±0.42) compared to control group (0.68±0.25) (p<0.05), denoting faster venous return in IMV, while the difference was not statistically significant in the venous phase. There has been no statistically significant difference of IMV diameter between the carcinoma (5.8±1.1 mm) and the control group (4.3±1.2 mm).

CONCLUSION

The IMV sign is a useful sign for the diagnosis of rectosigmoid carcinoma on contrast-enhanced CT.

CLINICAL RELEVANCE/APPLICATION

IMV sign is specific for rectosigmoid carcinoma. Rectosigmoid wall thickening should not be interpreted as a spasm if associated with the positive IMV sign.

SSQ06-07

The Prognostic Significance of Macroscopic Extramural Vascular Invasion on MRI in Patients with Locally-advanced Rectal Cancer

James Franklin MA, MBBS : Nothing to Disclose, Fergus Vincent Gleeson MBBS : Alliance Medical Ltd Consultant, Ewan Mark Anderson MBBCh (Presenter): Nothing to Disclose

PURPOSE

Macroscopic extramural vascular invasion (mEMVI) can be detected on staging MRI for rectal carcinoma and mEMVI has been associated with synchronous metastatic disease. The aim of this study was to assess the prognostic significance of mEMVI on subsequent metastatic relapse at 3 years.

METHOD AND MATERIALS

30 patients with locally advanced rectal cancer were recruited into this prospective study and underwent staging MRI including an axial small field of view (sFOV) T2W (MRI (TR/TE 3620/85ms, 20cm FOV with a matrix of 384x256, slice thickness 3mm, spacing 0.3mm) at 1.5T (GE Signa, GE Healthcare, Milwaukee, US). Patients with synchronous metastatic disease at presentation or metastasis-free follow-up for less than 3 years were excluded from the analysis. The presence of distant metastatic disease at 3 years was based on all available follow-up imaging including contrast-enhanced CT and MRI and FDG-PET/CT where available. The presence or absence of mEMVI was recorded, in addition to T- and N-staging, depth of invasion into the mesorectal fat (subdivided into >5mm and <5mm) and peritoneal invasion. Chi-squared tests were used to test the association of each feature with metastasis-free survival (MFS) at 3 years.

RESULTS

8 patients were excluded from the analysis. 22 patients formed the study group, in whom 11 (50%, 95%
CI 31-69%) developed metastatic disease at 3 years. 17 (77% CI 57-90%) patients had evidence of mEMVI on staging MRI. 0/5 of those without mEMVI and 11/17 with mEMVI developed metastatic disease at 3 years (0% vs 64.7%, p=0.011). The other features were not associated with MFS.

CONCLUSION

The presence of EMVI on staging pelvic MRI for rectal cancer is associated with a significantly higher risk of metastatic relapse at 3 years.

CLINICAL RELEVANCE/APPLICATION

The presence of adverse imaging features for metastatic relapse may be used to stratify patients with rectal cancer who will benefit from adjuvant systemic therapy.

Pancreatic Cancer Staging: Comparison of Whole-body Hybrid PET/MR and PET/CT Imaging


PURPOSE

To compare the staging performance of whole-body PET/MR with PET/CT in patients with pancreatic cancer.

METHOD AND MATERIALS

In this retrospective IRB approved study, 24 consecutive patients affected by pancreatic cancer underwent whole-body hybrid FDG-PET/CT (Gemini TF, Philips) and same day FDG-PET/MR (Biograph mMR, Siemens). PET/CT and PET/MR studies were independently evaluated by two readers. TNM staging according to PET/MR and PET/CT was compared.

RESULTS

PET/MR imaging quality was deemed adequate for diagnostic purposes in all. 14/24 pancreatic cancer patients showed avid FDG lesions. In 15/24 staging between PET/MR and PET/CT was concordant. In the remaining 9/24, PET/MR up-staged 5: In 1 PET negative lymph nodes were DWI positive and had supportive MR morphologic criteria, In 1 PET negative liver metastasis demonstrated pathologic enhancement on MR, In 2 negative PET/CT, PET/MR demonstrated locally resectable cancer. In 1 a questionable pancreatic lesion on PET/CT was definitively diagnosed as resectable pancreatic cancer on PET/MR. PET/MR down-staged 3 positive PET/CT demonstrating: In 1 focal pancreatitis, In 1 post-electroboretic inflammatory changes In 1 benign post surgical bowel loop changes. Moreover it demonstrated focal pancreatitis in 1 negative case on PET/CT, referred to us for a suspicious pancreatic cancer on ultrasound.

CONCLUSION

PET/MR imaging provides all the diagnostic benefits of PET/CT in the assessment of pancreatic cancer patients, with the benefits of superior local, hepatic and nodal staging and accuracy in comparison to PET/CT.

CLINICAL RELEVANCE/APPLICATION

PET/MR might represent a very promising and innovative technique for accurate staging and follow up of pancreatic cancer patients.

Desmoplastic Small Round Cell Tumor: A Comprehensive, Single-institution Study of 94 Cases


PURPOSE

To evaluate clinico-pathological and multi-modality, cross-sectional imaging features of a cohort of 94 cases of desmoplasic small round cell tumor (DSRCT).

METHOD AND MATERIALS

An IRB-approved, HIPAA-compliant, retrospective study of patients with DSRCT treated at a tertiary cancer center between 2001 and 2013 yielded 94 cases. Epidemiological, clinical and pathological data as well as imaging findings were recorded. Tumor size, location, morphology, and distribution pattern of metastases at the time of presentation, were analyzed.

RESULTS

DSRCT occurred in young patients with a median age of 21.5 years (age range 5-53 years) and a marked male predilection (M:F= 86:8). 89 were white (Caucasian or Hispanic), 4 were African-American, and 1 of Asian descent. Most patients were symptomatic with abdominal pain being the most common symptom. At initial presentation, 85 patients showed multifocal, nodular and/or diffuse omental and peritoneal disease. 38 patients had diaphragmatic involvement. In addition, 32 patients had liver metastases, 2 cases had pancreatic involvement, and 1 had renal involvement. 49 patients had retroperitoneal involvement in the form of implants, tumoral extension or nodal involvement. In the thorax, 33 had nodal disease, 17 had pleural effusion, and only 2 cases had lung metastases at presentation. 1 patient had intracranial metastasis and 2 had bony metastases at presentation. 12 patients showed calcific lesions.

CONCLUSION.
CONCLUSION

DSRCT is a rare, multifocal peritoneal malignancy with frequently disseminated abdominal disease at presentation. In the abdomen, the disease most commonly involves the omentum and peritoneum, followed by the retroperitoneum. Liver is the most common solid visceral metastatic site. A substantial number of patients have diaphragmatic involvement. In the thorax, nodal and pleural involvement is more common than lung parenchymal involvement. About 13% of cases showed calcifications.

CLINICAL RELEVANCE/APPLICATION

Desmoplastic small round cell tumor (DSRCT) is a rare, biologically aggressive, multifocal primary peritoneal sarcoma that should be considered in the differential diagnosis of solitary or multiple peritoneal masses in a young white male. The characteristic t(11;22)(p13;q12) translocation involving fusion of EWS and WT1 genes and unique pathological findings are important diagnostic features of this tumor.
colopathy (PHC) and its relation with various clinical features.

METHOD AND MATERIALS

We retrospectively reviewed 163 consecutive patients with clinical diagnosis of liver cirrhosis who underwent contrast enhanced CT and blood examination within a 24 hour interval between January 2012 to January 2013 (median age: 69.0 years, range: 41-89, male103, female 60). Two board-certified radiologists with 22 and 6 years of experience in abdominal imaging reviewed the CT images. The presence and location of PHC, which was defined as submucosal thickening greater than 10 mm, was assessed. Associated CT findings including the followings were also evaluated: Gastroesophageal varices, gall bladder wall edema, splenomegaly, ascites, the diameter of main portal vein, and modified Caudate-right lobe ratio (C/RL-m). The relationship between presence of PHC, clinical findings including Child-Pugh score and the associated CT findings was statistically assessed. Univariate statistics including chi-squared test, Student’s t-test, and Mann-Whitney U test were used as appropriate.

RESULTS

PHC was found in 39 out of 162 patients (29.3%). The location of PHC was the ascending colon in 34/39 patients (87.2%), the transverse colon in 18/39 patients (46.2 %), the descending colon in 11/39 patients (28.2%), the sigmoid colon in 9/39 patients (23.1%) and the rectum in 9/39 patients (23.1%). The presence of edema was significantly associated with higher Child-Pugh score (10.3%, 41.0% and 48.7% for Child-Pugh score A, B and C, respectively, p

CONCLUSION

The presence of PHC is significantly associated with cirrhosis severity and is more frequently observed in the ascending colon and the transverse colon. It is important to recognize PHC as it is sometimes mistaken for colitis.

CLINICAL RELEVANCE/APPLICATION

Portal hypertensive colopathy (PHC) is a colonoscopic finding and the radiological feature is not fully understood. We found the characteristic distribution and relation with the clinical condition.

SSQ07-04

Comparison of Diagnostic Performance of 99mTc-Labeled RBC Scintigraphy and CT with GI Bleed Protocol in Detecting and Localizing Source of Acute Lower Gastrointestinal Bleeding Using Conventional Angiography as Gold Standard

Muhammad Awais MBBS (Presenter):  Nothing to Disclose , Tanveer Ul Haq MBBS :  Nothing to Disclose , Zishan Haider MBBS, FRCR :  Nothing to Disclose , Abdul Rehman MBBS :  Nothing to Disclose , Maseeh Uz Zaman MBBS :  Nothing to Disclose

PURPOSE

Acute lower gastrointestinal bleeding (LGIB) is a medical and surgical emergency, which despite recent advances in diagnosis and treatment, still remains a diagnostic and therapeutic challenge causing significant morbidity and mortality. In this study, we assessed the diagnostic performance of RBC scintigraphy and CT with GI bleed protocol for the detection and localization of the LGIB.

METHOD AND MATERIALS

Seventy six patients had undergone either RBC scintigraphy, CT with GI bleed protocol or both, followed within 24 hours by conventional angiography for the evaluation of LGIB between Jan 2010 and Feb 2014. All scintigraphic and CT examinations were performed according to standard departmental protocol. CT
with GI protocol comprised of an initial unenhanced CT, followed by arterial, portovenous and delayed phases at 15, 60 and 180 seconds post intravenous contrast administration, respectively. Data was retrospectively reviewed for evaluating sensitivity, specificity and accuracy of these two modalities for the detection and localization of LGIB using conventional angiography as gold standard. Statistical analysis was performed on Statistical Analysis Software (SAS) version 9.1.3 and Fisher exact test was used to compare the sensitivity, specificity and overall accuracy of the two modalities. A p-value of less than 0.05 was considered statistically significant.

RESULTS
Fifty one (51) patients had undergone RBC Scintigraphy alone, 20 had CT with GI bleed protocol alone and 5 had undergone both the modalities. Fourteen (14) out of 25 patients in CT with GI bleed group had angiographic evidence of active bleed compared to 32 out of 56 patients in the RBC scintigraphy group. CT with GI bleed protocol had significantly higher specificity (90.9%) as compared to 33.3% for RBC scintigraphy. (p=0.0027) CT with GI bleed also had a higher sensitivity (100%) as compared RBC scintigraphy. (p=0.09) Overall accuracy of CT with GI bleed protocol (90.5%) was significantly higher as compared to 60.7% for RBC scintigraphy. (p=0.0006)

CONCLUSION
CT with GI bleed protocol was significantly more accurate in detecting and localizing lower GI bleed in comparison to RBC scintigraphy.

CLINICAL RELEVANCE/APPLICATION
Patients with LGIB should undergo CT with GI bleed rather than RBC scintigraphy for detecting and localizing source of LGIB as it is more accurate and less time consuming.

SSQ07-05
Comparison between MR Defecography and X-ray Defecography in Patients with Obstructed Defecation Syndrome
Zhiyang Zhou PhD : Nothing to Disclose, Yanbang Lian (Presenter): Nothing to Disclose, Zhong-Ping Zhang MMedSc : Nothing to Disclose, Zhicheng He : Nothing to Disclose, Wuteng CAO : Nothing to Disclose, Jiaying Gong : Nothing to Disclose

PURPOSE
To compare the diagnostic capability of magnetic resonance defecography with conventional X-ray defecography in obstructed defecation syndrome (ODS).

METHOD AND MATERIALS
Thirty-two consecutive patients diagnosed as ODS were enrolled and underwent both MR defecography and conventional X-ray defecography of the ano-rectal region (ARA) within 10 days. T2- weighted fast spin-echo sequences in sagittal, coronal and axial slices and a single sagittal dynamic sequence of fast imaging employing steady state acquisition (FIESTA) for rest, and defecation phase were acquired on MR system, respectively. The antero-posterior position for rest and post-defecation phase, lateral position for rest, lift and defecation phase were acquired using X-ray defecography. The obtained data sets from both methods regarding to the condition of ODS and its complication were evaluated using the pubococcygeal line (PCL) as the reference line, and the results were compared using a two-tailed McNemar's test with p<0.05.

RESULTS
No significant difference was observed regarding to the evacuation phase between MR defecography and X-ray defecography (p>0.05) in the presence of rectocele (13 vs 15), puborectalis dyssynergia (5 vs 6), enterocele (1 vs 3), sigmoidocele (2 vs 4). Although MR defecography was inferior (p < 0.05) to X-ray defecography in the assessment of rectal mucosal prolapse (12 vs 22), intrarectal invagination (3 vs 18) and descending perineum (8 vs 21), it demonstrated more complications of the anterior and middle compartment of the pelvic cavity such as cystoptosis and hysteroptosis, and other lesions of the pelvic cavity or pelvic floor. Meanwhile, MR defecography demonstrated better superiority in demonstrating the detailed pelvic anatomy.

CONCLUSION
MR defecography and X-ray defecography exhibit different advantages in evaluating ODS. MR defecography provides both morphological and functional information for the pelvic floor and plays a significant role in a better evaluation of the entire pelvic anatomy and pelvic organ interaction.

CLINICAL RELEVANCE/APPLICATION
MR defecography provides significant information on the morphology and function of the pelvic floor to ensure an approach in the evaluation of the entire pelvic anatomy and pelvic organ interaction.

SSQ07-06
Temporal Variations in Presentation for MDCT for Suspected Acute Appendicitis in Adults
Bryan Dustin Pooler MD (Presenter): Nothing to Disclose, Joshua Suhonen : Nothing to Disclose, Edward Malnor Lawrence BS : Nothing to Disclose, Perry J. Pickhardt MD : Co-founder, VirtuoCTC, LLC Stockholder, Cellectar Biosciences, Inc

PURPOSE
To evaluate temporal (hourly, daily, monthly, seasonal) variations in presentation for MDCT for the evaluation of suspected acute appendicitis in adults.

METHOD AND MATERIALS
Over a ten year period, 2,844 consecutive adults (mean age 38.8 years) underwent MDCT for suspected...
Accuracy and Radiation Dose Reduction of a Limited Abdominopelvic CT in the Diagnosis of Acute Appendicitis.

Melanie Chang MD (Presenter): Nothing to Disclose, Michael Thomas Corwin MD : Nothing to Disclose, Ghanem Fananapazir MD : Nothing to Disclose, J. Anthony Seibert PhD : Nothing to Disclose, Ramit Lamba MD : Nothing to Disclose

PURPOSE
To determine the accuracy and radiation dose reduction of a limited abdominopelvic CT from the bottom of the T10 vertebral body to the top of the pubic symphysis in patients with suspected acute appendicitis.

METHOD AND MATERIALS
This was a retrospective review of patients greater than 18 years of age who underwent CT abdomen and pelvis for suspected acute appendicitis. Scout line mode was used to correlate axial images with the CT localizer radiographs to define the limited range CT from the bottom of the T10 vertebral body to the top of the pubic symphysis. The original scan was prescribed from the lung bases to the ischial tuberosities. The Z-axis lengths of the full and theoretical limited scans were recorded. Radiation dose estimates were made using a commercial software package that estimates effective dose using an anthropomorphic phantom and Monte Carlo methods. All images were reviewed to determine if the appendix or entire cecum (in cases where the appendix was not visualized) would be visualized with the limited scan. The
images were reviewed to determine if any cases of appendicitis or alternative diagnoses would be missed with the limited scan.

RESULTS

235 patients (89 male, mean age 44.6 years) were included. The limited scan resulted in a mean Z-axis length reduction of 5.1 cm superiorly, 6.1 cm inferiorly, and a total reduction of 111.7 cm (24.1%). The mean whole body effective dose was 11.8 mSv and 9.1 mSv for the original and limited scans respectively (21.2% reduction). In females, the mean breast equivalent dose was 6.4 mSv and 0.9 mSv for the full and limited scans respectively (85.4% reduction). The entire appendix or cecum was visualized in all cases. Appendicitis was present in 24 cases and an alternative diagnosis was made in 75 cases with urolithiasis the most common alternative finding (n = 22). No cases of appendicitis or alternative diagnoses would have been missed using the limited scan.

CONCLUSION

A limited range CT from the bottom of T10 to the top of the pubic symphysis is as accurate as full abdominopelvic CT in evaluating patients with suspected acute appendicitis and results in approximately 20% dose reduction.

CLINICAL RELEVANCE/APPLICATION

A limited range CT is an effective technique to reduce radiation dose in patients undergoing MDCT for suspected acute appendicitis.

SSQ07-09

CT Following US for Possible Appendicitis: Anatomic Coverage

Martin E. O'Malley MD (Presenter): Nothing to Disclose, Fawaz Saud Alharbi MBBS, MD : Nothing to Disclose, Tanya Punita Chawla MBBS : Nothing to Disclose, Hadas Moshonov PhD : Nothing to Disclose

PURPOSE

To determine appropriate anatomic coverage for CT following inconclusive or nondiagnostic US for possible appendicitis.

METHOD AND MATERIALS

This retrospective study included 99 patients with possible appendicitis with inconclusive or nondiagnostic US followed by CT. Two radiologists reviewed the CT scans and determined superior and inferior anatomic coverage required to diagnose or exclude appendicitis and diagnose alternative causes. This “targeted” coverage was used to estimate potential reduction in anatomic coverage compared to standard abdominopelvic CT.

RESULTS

Study group included 99 patients; 83 women, 16 men; mean age 32 (median, 29; range 18-73) years. On CT, each reviewer identified normal appendix, no alternative diagnosis in 47 (48%) and 45 (45%); appendix not seen, no alternative diagnosis in 7 (7%) and 5 (5%); equivocal appendicitis in 5 (5%) and 2 (2%); appendicitis in 19 (19%) and 22 (22%); and alternative diagnosis in 21 (21%) and 25 (25%) patients, respectively (Kappa coefficient 0.675, substantial agreement). To confidently diagnose or exclude appendicitis or identify an alternative diagnosis, anatomic coverage would be from superior border of L2 to superior border of pubic symphysis for both reviewers. If this targeted rather than standard coverage was used, the anatomic coverage would be reduced by 30-55% (mean 39%, median 40%) with a similar reduction in dose.

CONCLUSION

When CT is performed for appendicitis following inconclusive or nondiagnostic US, targeted anatomic coverage should be from superior border of L2 to superior border of pubic symphysis. Targeted anatomic coverage would result in a significant reduction in exposure to ionizing radiation compared to standard CT.

CLINICAL RELEVANCE/APPLICATION

When CT is performed for appendicitis following inconclusive or nondiagnostic US, targeted anatomic coverage rather than standard anatomic coverage can be used resulting in a significant reduction in exposure to ionizing radiation.

SSQ08

Gastrointestinal (MR Technique)

Scientific Papers

ARRT Category A+ Credits: 1.50
Thu, Dec 4 10:30 AM - 12:00 PM  Location: E353C

Participants

Moderator
David John Lomas MD : Nothing to Disclose
Mahmoud Mouhamad Al-Hawary MD : Nothing to Disclose
Alvin C. Silva MD : Nothing to Disclose

Sub-Events

SSQ08-01 Feasibility of 10-min Delayed MR Imaging with 30° Flip Angle in Gd-EOB-DTPA-enhanced MR
Imaging for the Detection of Liver Metastases, Compared with 20-min Delayed MR Imaging with Standard 10° Flip Angle

Seungbo Lee (Presenter): Nothing to Disclose, Eun-Suk Cho: Nothing to Disclose, Dahye Lee: Nothing to Disclose, Jeong-Sik Yu MD: Nothing to Disclose, Joo Hee Kim: Nothing to Disclose, Jae-Joon Chung MD: Nothing to Disclose

PURPOSE
10-min delayed hepatocyte phase imaging (HPI) provided satisfactory information for detection of focal hepatic lesion (FHL) in Gd-EOB-DTPA-enhanced liver MRI. However, lesion-to-liver contrast-to-noise ratio (CNR) was significantly lower than 20-min delayed HPI. Increasing the flip angle (FA) from 10° to 30° in HPI improves lesion-to-liver CNR since the higher FA increases T1-weighting. The purpose of the study was to compare the lesion-to-liver CNR and FHL detection sensitivity between 10-min delayed HPI with a 30° FA (10min-FA30) and 20-min delayed HPI with a 10° FA (20min-FA10) in patients with liver metastases. In addition, to determine whether 10min-FA30 could replace 20min-FA10, thus saving time of 10 minutes in acquiring HPI.

METHOD AND MATERIALS
51 patients with 197 liver metastases underwent Gd-EOB-DTPA-enhanced MRI with 10min-FA30 and 20min-FA10 using 3D T1-weighted gradient echo sequence. Lesion-to-liver CNRs on both HPI sets were calculated. Two radiologists assessed independently the presence of FHLs using a four-point scale. The values were compared with paired t-test and Wilcoxon signed-rank test.

RESULTS
The mean CNR for metastases on 10min-FA30 (268.5 ± 91.9) was significantly higher than that of 20min-FA10 (202.1 ± 71.3). There was no significant difference on detection sensitivity for liver metastases between the two HPI sets for both readers (98.1% sensitivity at 10min-FA30 and 97.8% at 20min-FA10).

CONCLUSION
10min-FA30 in Gd-EOB-DTPA-enhanced MRI had higher lesion-to-liver CNR with no difference in lesion detection sensitivity, compared to the 20min-FA10. This result indicates that 10min-FA30 could replace 20min-FA10 with a better diagnostic performance for detection of liver metastases and also allows 10 minutes of time-saving.

CLINICAL RELEVANCE/APPLICATION
Using a 30° flip angle, 10-min delayed hepatocyte phase imaging in gadobetic acid-enhanced MRI can replace 20-min delayed imaging with 10° flip angle with a better diagnostic performance for detection of liver metastases and also allows 10 min of time-saving.

Feasibility of Arterial Spin Label to Differentiate Solid and Cystic Focal Liver Lesions

Antonio Luna MD (Presenter): Nothing to Disclose, Teodoro Martin MD : Nothing to Disclose, Lidia Alcala Mata MD : Nothing to Disclose, Jordi Broncano MD : Nothing to Disclose, Javier Sanchez MD, PhD : Research Consultant, Koninklijke Philips NV, Jorge A. Soto MD : Nothing to Disclose

PURPOSE
Analyze if FAIR-ASL is feasible in the liver
Check if FAIR-ASL is able to differentiate cystic and solid liver lesions in comparison to DCE-MRI

METHOD AND MATERIALS
20 patients with 28 focal liver lesions (n=18 solid and n=10 of cystic nature) were submitted to our 3T magnet for further characterization. Solid lesions included 6 metastasis, 4 hepatocellular carcinoma, 6 hemangioma, 1 dysplastic nodule and 1 FNH and cystic lesions correspond to 7 simple cysts, 1 hydatid cyst, 1 postsurgical collection and 1 treated HCC. ASL-FAIR sequence was performed as part of the MRI protocol, which also include chemical-shift imaging, axial TSE T2-weighted sequence and DCE-MRI. Two radiologist independently reviewed all MRI studies in 2 different session blinded to any clinical information. In the first session, they read all MR sequences including the DCE-MRI, except the ASL. They classified all focal liver lesion over 8 mm as solid or cystic. Criteria for solid lesions were presence of internal flow in ASL sequence or enhancement in the DCE-MRI sequence. DCE-MRI was considered as the gold-standard. The ASL-FAIR is a breath-hold balanced TFE sequence: flip angle: 35, TR: 3.6 ms, TE: 1.7 ms, SENSE factor: 2, Tag delay: 1500 ms, image resolution: 4x4x10 mm3, acquisition time: 14s.

RESULTS
Interreader agreement for both ASL and DCE-MRI was excellent (κ=1; p<0.001). A statistically significant correlation was demonstrated between DCE-MRI and ASL (r=0.85; p<0.001). Sensitivity, specificity, and positive and negative predictive values were of 100%, 80%, 90% and 100%, respectively for both readers. The two false positive in ASL reading corresponded to a postsurgical collection and a simple cyst.

CONCLUSION
FAIR-ASL was feasible in all patients, and as part of a liver MRI protocol. ASL can show accurately the presence or absence of flow in solid and cystic liver lesions, respectively.

CLINICAL RELEVANCE/APPLICATION
ASL is feasible in the liver. ASL can be used as an alternative non-contrast technique to DCE-MRI in the differentiation between benign and malignant focal liver lesion.

Surrogate Arterial Phase Imaging Using Long-duration Free-breathing Fat-suppressed Radial 3D Gradient-Recalled Echo Sequence: An Alternative Approach in Patients Unable to Breath-hold

Mamdoh ALObaidy MD (Presenter): Nothing to Disclose, Miguel Ramalho MD : Nothing to Disclose, Kiran Kumar Reddy Busireddy MD : Nothing to Disclose, Brian M. Dale PhD : Employee, Siemens AG, Ersan Altun MD : Nothing to Disclose, Lauren Marie Brubaker Burke MD : Consultant, Amgen Inc.
Effect of Intravenous Gadoxetic Acid and Flip Angle on Hepatic Proton Density Fat Fraction (PDFF) Estimation with Magnitude Multi-echo Gradient-echo MR Imaging at 3T


PURPOSE
To compare hepatic proton density fat fraction (PDFF) accuracy using low- and high-flip angle (FA) 6-echo magnitude-based magnetic resonance imaging (MRI), before and after administration of gadoxetic acid (Gx), using pre-contrast magnetic resonance spectroscopy (MRS) as reference.

METHOD AND MATERIALS
This prospective, cross-sectional, observational single-center study was IRB approved and HIPAA complaint. Adults with or suspected non-alcoholic fatty liver disease (NAFLD) undergoing 3T clinical Gx-enhanced liver MRI were enrolled. Magnitude-based MRI at low-FA (10°) and high-FA (50°) was obtained pre-Gx and during the hepatobiliary phase to estimate PDFF, with FAs in random order to eliminate time-point bias. Pre- and post-Gx advanced MRS (using multiple TRs and TEs, to measure T1) was obtained from a voxel in the right hepatic lobe. Accuracy of MRI PDFF, co-localized to the MRS voxel location, was assessed by regression analysis using pre-Gx MRS as reference. Pre- and post-Gx hepatic water and fat T1 values were estimated from MRS.

RESULTS
Twenty-eight adult subjects were enrolled after obtaining written informed consent. Linear regression slope, intercept, and R2 of MRI-PDFF as a function of MRS-PDFF were, respectively: 1.06, 0.90%, and 0.98 pre-Gx at FA 10°; 1.05, 0.92%, and 0.99 post-Gx at FA 10°; 0.73, 0.06%, and 0.98 pre-Gx at FA 50°; and 1.04, 0.37%, and 0.99 post-Gx at FA 50°. Mean hepatic water and fat T1 values by MRS were 927 and 356 msec pre-Gx, and 361 and 347 msec post-Gx, respectively.

CONCLUSION
Low-FA magnitude multi-echo gradient-echo MRI estimates hepatic PDFF pre- and post-Gx accurately. High-FA magnitude MRI overestimates PDFF pre-Gx due to T1 bias from fat protons having shorter T1 values than water protons, but accurately estimates PDFF post-Gx because Gx preferentially relaxes water protons, causing T1 values of both water and fat to be similar, thus reducing T1 bias.

CLINICAL RELEVANCE/APPLICATION
Post-Gx MRI at high FA allows accurate PDFF estimation with improved signal-to-noise, and higher resolution which may enable detection and characterization of fatty or fat-sparing focal liver lesions.
**SSQ08-05**

**Combined Multiple Short Echo of Gradient Echo (CMSGRE) Imaging for Accurate Measurement of Severe Iron Accumulation in the Liver**

Xianfu Luo (Presenter): Nothing to Disclose, Fuhua Yan: Nothing to Disclose, Wei-Min Chai: Nothing to Disclose, Huan Zhang: Nothing to Disclose, Huanhuan Liu: Nothing to Disclose, Xiao Zhu, Lin MD: Nothing to Disclose

**PURPOSE**

To assess the accuracy of combined multiple short echo of gradient echo (CMSGRE) imaging for noninvasive quantification severe iron accumulation in the liver.

**METHOD AND MATERIALS**

Forty-two patients with elevated ferritin and suspected of iron overload were included in our study. MR was then performed for liver iron quantification on 1.5T GE Healthcare Signa Twin speed systems. First, a routine multiple gradient echo (RMGRE) imaging was acquired 10 echoes in a sequence with first echo time (TE) of 1.5ms and an echo spacing of 1.2ms. And then a group of combined multiple short echo of gradient echo (CMSGRE) technique was used in 10 separately sequence with the first TE of 1ms and an echo spacing of 0.2ms. The gradient echo sequences were run all with repetition time (TR) of 50ms, a flip angle of 20°and a readout bandwidth of 83.3 KHz. Frequency fat suppression was used for each single sequence. R2* of the liver was calculated with the function of R2* on ADW4.3 workstation. 3 parameter fitting model was used to calculate R2*. Two radiologists measured R2* with three region of interest (ROI) for each patient. The accuracy of two group for R2* quantification was judged by curve fitting analysis. R Square and residual sum of squares of regressions from two groups were compared in severe iron accumulation patients (R2*>585Hz).

**RESULTS**

For all 42 patients the R2* was 335.47± 58.34Hz and ranged from 34.13Hz to 1503.10Hz. 11 of 42 patients with chronic liver disease had normal R2* liver.10 patients were with severe iron accumulation (R2*>585Hz). The R2* of severe iron accumulation patients was 1035.56±101.99 Hz ranging from 665.91Hz to 1721.87Hz determined by CMSGRE. The R Square of CMSGRE and RMRGE was 0.98 and 0.39 respectively. And the residual sum of squares for CMSGRE and RMRGE was 0.04 and 71.39, respectively. CMSGRE was more accurate than SMGRE in quantification of severe iron accumulation in the liver.

**CONCLUSION**

Combined multiple short echo of gradient echo imaging will give more accuracy for quantitation of liver iron concentrate in severe iron accumulation patients.

**CLINICAL RELEVANCE/APPLICATION**

With combined multiple short echo of gradient echo imaging for quantification graveness iron accumulation, MRI might provide more accuracy information for chelation therapy in the clinical practice in the future.

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**SSQ08-06**

**DWI of Liver Lesions: IVIM Model with Different Combination of 11 b Values**

Giovanni Morana MD (Presenter): Nothing to Disclose, Giuliano Scattolin MD: Nothing to Disclose, Riccardo Zanato: Nothing to Disclose, Federica De Leo: Nothing to Disclose, Alex Faccinetto: Nothing to Disclose, Michele Fusaro: Nothing to Disclose, Dow-Mu Koh MD, FRCR: Nothing to Disclose

**PURPOSE**

We investigate diffusion coefficients, evaluated with intravoxel incoherent motion (IVIM) model, in both hypervascular and hypovascular liver lesions (HCC, FNH and colorectal metastases). We evaluated how IVIM parameters change according to the number of b values utilized in their analysis.

**METHOD AND MATERIALS**

Retrospective study of 96 patients with different diagnosis: HCC (n=28; path proof) FHN (n=44; Liver specific CM uptake and follow up) CCM (colorectal carcinoma metastasis: n=24; path proof). MR: Siemens Avanto, 1.5 T with quantum gradients. DWI sequence: EPI (WIP511c; TR/TE=4361/54ms) with 11 b values: 0, 10, 20, 30, 50, 70, 100, 150, 200, 400, 800 sec/ mm². Using Matlab, the estimations of D, D* and f were carried out for different combination of b-values: C1 (11 values: 0, 10, 20, 30, 50, 70, 100, 150, 200, 400, 800 sec/ mm²); C2 (9 values: 0, 20, 30, 50, 70, 100, 200, 400, 800 sec/ mm²); C3 (7 values: 0, 50, 100, 150, 200, 400, 800 sec/ mm²). Statistics Analysis: box plots and scatter plot; 2 sample t test; Kruskal-Wallis and Wilcoxon test.

**RESULTS**

With 11 b values: - ADC and D were not significantly different between lesions. - HCC vs FHN: D* and f were not significantly different between HCC and FNH; both were significantly higher than in CCM. - Perfusion fraction (%f) was significantly higher in HCC and FHN versus CCM. With lesser b values (C2, C3): - D* shows a significant (p< 0.05) decrease in HCC, not significantly decrease in FNH and in CCM. Not statistically difference between lesions - ADC shows a significant (p< 0.05) decrease for ALL lesion (C1 vs C3). Not statistically difference between lesions - D does not change - %f does not show a significantly decrease in the above groups, thus maintaining the statistical difference (HCC/FNH >> CCM).

**CONCLUSION**

DWI and IVIM parameters are dependent on number of b values, with the exception of %f and D. Higher b values are more helpful for dd. Quantitative analysis is highly dependent on the sequence. There is a need for standardization of sequences.

**CLINICAL RELEVANCE/APPLICATION**

Perfusion fraction is independent from the number of b values and is a useful indicator for differential diagnosis.
Novel Dynamic Hepatic MR Imaging Strategy Using Advanced Parallel Acquisition, Rhythmic Breathhold Technique, and Gadoxetate Disodium Enhancement

**METHOD AND MATERIALS**

With institutional-review-board approval and consent, twenty-seven patients (21 males, mean age 57.3 years) underwent 3D gradient-echo imaging at 3 Tesla using controlled-aliasing-for-image-reconstruction (CAIPIRINHA, spatial resolution 1.2×1.2×3.0mm, acquisition time 10.4 seconds) for preoperative imaging. Sequence was repeated over three minutes at eight fixed timepoints after contrast injection. Image quality was evaluated on a five-point scale (1=excellent; 5=non-diagnostic). Dynamic sequences were classified according to perfusion phases. Contrast characteristics and artifacts were analyzed. The liver position in z-axis was evaluated to monitor breathhold robustness.

**RESULTS**

Overall image quality was scored 1.44 (95%CI: 1.18-1.71). Contrast in central and peripheral vessels was excellent in 25/27 and 22/27 patients, respectively. Adequate arterial phase was acquired in 21/27 patients, classification was "early arterial" in 3/21 and "late arterial" in 18/21 patients. In two patients, 1st dynamic acquisition was classified "too early" and 2nd acquisition "portal", and in four patients timing was too late (1st dynamic classified "portal"). Artifacts were observed in 21/27 patients, rated as mild in 19/21. Compromised quality was due to receiver-coil-related artifacts (17/29), parallel-imaging-related artifacts (6/29), breathing artifacts (3/29), and other (3/29). The position of the liver throughout the dynamic phases was highly constant with maximal mean shifting of +2.2mm and -2.1mm during 1st and 2nd dynamic acquisitions.

**CONCLUSION**

Advanced parallel acquisition with rhythmic breathholding leads to very high and robust image quality without individual timing in preoperative gadoxetate disodium-enhanced liver MR imaging.

**CLINICAL RELEVANCE/APPLICATION**

Acquisition time of about 10 seconds combined with a rhythmic breathholding strategy guarantees for high quality of gadoxetate disodium-enhanced hepatic MR imaging and avoids non-diagnostic dynamic phases caused by breathing artifacts.

CAIPIRINHA-Dixon-TWIST (CDT)-volume-Interpolated Breath-hold Examination (VIBE) for Abdominal Imaging: Comparison of Gadoterate Meglumine, Gadobutrol and Gadoxetic Acid

**PURPOSE**

CAIPIRINHA-Dixon-TWIST (CDT)-VIBE is a robust method for abdominal magnetic resonance imaging providing both high spatial and high temporal resolution. The purpose of this study was to examine the influence of different gadolinium based contrast agents (GBCA) on image quality (IQ) with CDT-VIBE.

**METHOD AND MATERIALS**

In this IRB-approved, retrospective, inter-individual comparison study, 86 patients scanned at 3T were included. Within 28 seconds, 14 high-resolution 3D datasets were acquired using CDT-VIBE. 37 patients received 0.1 mmol/kg gadoterate meglumine, 28 patients 0.1 mmol/kg gadobutrol, and 19 patients 0.1ml/kg gadoxetic acid. Two blinded, board-certified radiologists assessed the image quality on a 5 point scale (1=excellent; 5=non-diagnostic), as well as the number of hepatic arterial dominant (HAD) phases.

**RESULTS**

Regardless of the used GBCA, CDT-VIBE provided good results in terms of best IQ achieved among all 14 datasets (gadobutrol 4.3, gadoterate meglumine 3.9, gadoxetic acid 3.7). With respect to worst IQ, the three groups showed statistically significant differences with gadobutrol receiving the highest (3.6), gadoxetic acid the lowest (2.4) rating. No statistically significant differences were found regarding the number of HAD phases.

**CONCLUSION**

Applying a CDT-VIBE technique, different classes of gadolinium-based contrast agents can be utilized for dynamic liver imaging with good image quality.

**CLINICAL RELEVANCE/APPLICATION**

Advanced parallel acquisition with rhythmic breathholding leads to very high and robust image quality without individual timing in preoperative gadoxetate disodium-enhanced liver MR imaging.
As CDT-VIBE provides good image quality regardless of the applied contrast agent, it can be beneficial in various imaging settings, e.g. by combining its high spatial and temporal resolution with advantages of hepatocyte specific contrast agents.

SSQ08-09  
**Hepatocellular Carcinoma Perfusion Quantification with Tofts vs. Two-Compartment Shutter-speed Models. Initial Experience**

**Guido Hugo Jajamovich PhD**: Nothing to Disclose  
**Wei Huang**: Nothing to Disclose  
**Cecilia Besa MD**: Nothing to Disclose  
**Xin Li**: Nothing to Disclose  
**Aneela Afzal**: Nothing to Disclose  
**Bachir Taouli MD (Presenter)**: Research Grant, General Electric Company Consultant, Bayer AG

**PURPOSE**

DCE-MRI can be used to quantify liver tumor perfusion parameters with the use of pharmacokinetic models, such as the Tofts model (TM) and two-compartment Shutter-Speed model (SSM). The TM assumes infinitely fast equilibrium inter-compartmental water exchange kinetics, while the SSM introduces the mean intracellular water molecule lifetime, ti, to account for the transcytolemmal exchange. In this study, the TM and SSM are applied to estimate perfusion parameters of liver parenchyma and hepatocellular carcinoma (HCC).

**METHOD AND MATERIALS**

In this prospective IRB approved study, 9 cirrhotic patients with 12 HCC lesions (mean size 6.4 cm, range 1-13 cm) underwent DCE-MRI. 5 patients were scanned twice for test-retest evaluation. Data was acquired using axial 3D-FLASH sequence covering the whole liver (temporal resolution 1.9-2.5s, 100 volumes acquired) before and after injection of 0.05 mmol/kg of Gd-BOPTA. Liver, portal vein, abdominal aorta and HCCs mean concentrations time-courses were obtained by placing ROIs. Liver and HCC parameters Ktrans, ve and kep for TM and SSM and ti for SSM were compared using Wilcoxon test. Reproducibility was assessed by computing the coefficient of variation (CV).

**RESULTS**

Ktrans, ve and kep for TM and Ktrans and ti for SSM showed significant differences between liver and HCC (p <0.03). Ktrans, ve and kep for TM were significantly different when compared with their SSM counterparts (p <0.005). Parameter reproducibilities were better in liver parenchyma (CV range 17.4-32.3) compared to HCC (range 37.7-62.6) for both models, while TM demonstrated generally better reproducibility than SSM.

**CONCLUSION**

Initial data shows different perfusion parameters when computed with the TM and SSM, with differences observed for Ktrans and ti between liver and HCC for the SSM. The SSM showed worse reproducibility than TM.

**CLINICAL RELEVANCE/APPLICATION**

Substantial differences in ti (mean intracellular water molecule lifetime) were observed between liver parenchyma and HCC which may reflect differences in metabolic activities, suggesting potential utility for HCC characterization.

SSQ09  
**ISP: Genitourinary (Functional and Vascular Imaging of the Kidneys)**

**Sub-Events**

**SSQ09-01**  
**Genitourinary Keynote Speaker: Renal CTA and MRA—When and How?**

**Ruth P. Lim MBBS, MMed (Presenter)**: Nothing to Disclose

**SSQ09-02**  
**Cortical and Medulla Oxygenation Evaluation of Kidneys with Renal Artery Stenosis by BOLD MRI Comparing with Healthy Volunteers**

**Zhao Long (Presenter)**: Nothing to Disclose  
**Jiayi Liu**: Nothing to Disclose  
**Zhanming Fan**: Nothing to Disclose

**PURPOSE**

The purpose of this study was to compare R2* value of renal artery stenosis (RAS) patients with the degree of RAS of its own and R2* value of control group respectively, and therefore evaluate different levels of renal hypoxia by BOLD MRI.

**METHOD AND MATERIALS**
We compared 51 renal arteriosclerosis kidneys with 32 healthy kidneys of volunteers. We also compared 4 subgroups of renal arteriosclerosis kidneys, 16 without obvious RAS, 6 with mild RAS, 9 with moderate RAS and 20 with severe RAS. BOLD signal was measured in the cortex and medulla by a 3.0T MR scanner. The severity of vascular occlusion was determined by intervention.

RESULTS
For all groups, medulla R2* values, reflecting the deoxyhemoglobin, were higher than cortex R2* values. Both cortex and medulla R2* values of renal arteriosclerosis kidneys (21.14±4.90/s, 36.25±8.04/s) were higher than corresponding R2* values of control group (18.23±1.77/s, 29.61±2.26/s) (P<0.05), and a more sensitive change was found in medulla. For RAS subgroups, medulla R2* values for severe RAS (44.20±6.01/s) elevated as compared with unobstructed, mild, moderate stenosis subgroups (29.87±3.92/s, 33.15±2.42/s, 31.98±4.28/s) (P>0.05), but cortex R2* values for severe RAS(24.06±5.94/s) were found no significant difference from mild, moderate stenosis subgroups(20.20±2.01/s, 19.14±1.86/s) while it was higher than unobstructed subgroup(18.96±3.62/s) (P<0.05). Besides, combining mild and moderate RAS as one group, both cortex and medulla R2* values of this group (19.56±1.92/s, 32.44±3.93/s) elevated as compared with control group (P<0.05).

CONCLUSION
This study shows that BOLD MR can noninvasively detect different levels of renal hypoxia induced by RAS with different severities of vascular occlusion. It can play an important role in estimation of kidney oxygenation changes when vascular occlusion overwhelms the capacity of the kidney to adapt to reduced blood flow. R2* value may become an index to identify the severity of renal hypoxia and parenchymal injury.

CLINICAL RELEVANCE/APPLICATION
BOLD MRI is an effective and noninvasive method to evaluate the oxygenation state of kidney. It can play an important role in estimation of kidney oxygenation changes when RAS exists. BOLD MRI is a sensitive tool which can be used to detect ischemia and anoxia of medulla of kidney.

SSQ09-03
The Comparative Study on Image Quality of Renal Artery CT Angiography by Iterative Reconstructions and Filtered Back Projection

PURPOSE
The purpose of this study was to evaluate the image quality and image noise of artery CT angiography with iterative reconstructions which based on the original data from dual-source dual-energy CT.

METHOD AND MATERIALS
Fourteen consecutive patients underwent dual-energy (DE) renal artery CTA examination [Somatom Definition FLASH, (Siemens Healthcare, Germany)] were analyzed retrospectively. Tube voltage 80 kV and Sn140kV; tube current 250mAs and 106mAs; collimation 128×0.6mm. Data sets were reconstructed with Sinogram Affirmed Iterative Reconstruction (SAFIRE) and filtered back projection (FBP) base on original data.CTDIvol and SSDE were recorded and calculated. Image quality was evaluated by two experienced radiologists. For qualitative assessment, the whole quality of imaging, detail quality of imaging (sharpness of main renal artery and segmental vessels, segmental vessels displayed in MPR and MIP) were evaluated with 5 scale method (1=poor to 5=excellent). For quantitative assessment, attenuation values were measured in the vascular lumen of aorta, renal arteries and erector spinae major at almost same level, and contrast-to-noise ratio (CNR), signal-to-noise ratio (SNR) were calculated.

RESULTS
The mean value of CTDIvol and SSDE of renal CTA were (10.15±2.32) mGy and (12.93±1.82) mGy. There was significant difference in the whole imaging quality between 2 groups (Z=-3.61, P<0.05). There was no significant difference in the sharpness of vessels between the 2 groups(Z=-2.00, P>0.05). Whereas the segmental vessels displayed in MPR and MIP were not statistically different(Z=-0.00, P>0.05; Z=-0.00, P>0.05), respectively. The attenuation values of abdominal aorta and renal artery in two groups were [(211±34) HU vs. (213±34) HU, P>0.05] and [(196±38) HU vs. (193±36) HU, P>0.05]. The CNR and SNR in two groups were (14±6 vs. 9±4, P

CONCLUSION
Compared with standard FBP reconstruction, SAFIRE improve image quality and has the potential to decrease radiation dose.

CLINICAL RELEVANCE/APPLICATION
Compare with FBP, SAFIRE reconstruction can achieve better image quality, which help its clinical diagnosis and treatment.

SSQ09-04
Non Invasive Evaluation of Elasticity of Renal Parenchyma by Acoustic Radiation Force Impulse Imaging
Vivek Kishor Pargaoankar MBBS (Presenter): Nothing to Disclose, Sudhakar K: Nothing to Disclose

PURPOSE
Prospective evaluation of diagnostic efficacy of acoustic radiation force impulse(ARFI) imaging to test the elasticity of renal parenchyma by measuring the shear wave velocity(SWV) which might be used to detect chronic kidney disease(CKD).

METHOD AND MATERIALS
Fifty patients(age range 18-78yrs)with CKD were enrolled. Seventy three subjects(age range 18-71 yrs)
Radiation Dose and Contrast Reduction during UFE Using 3D MRA Guidance versus Conventional 2D Technique

Nishad Nadkarni MD (Presenter): Nothing to Disclose, Vikram S. Dravid MD: Nothing to Disclose, Anil Syal MD: Nothing to Disclose, Atul Gupta MD: Nothing to Disclose

**PURPOSE**
To compare physician dose, patient dose, procedure time, contrast and fluoro time using the conventional 2D technique for uterine fibroid embolization (UFE) versus a novel 3D MRA guided UFE technique.

**METHOD AND MATERIALS**
Ten UFE procedures were performed at 2 hospitals in the same health system by 2 interventional radiologists, each with over 10 years of experience using the same imaging equipment and protocols. 5 of these cases were performed using the conventional 2D guidance technique and 5 were performed using a novel 3D MRA guidance technique, which allows real time fusion of a preexisting MRA with the live fluoroscopy stream to create a visual roadmap during UFE. The physician dose (Sv), patient dose (DAP), procedure time (min), non-embolic contrast (mL), and fluoro time (min) were compared.

**RESULTS**
There was a 94% reduction in average physician dose using 3D MRA guidance (18.6 Sv) versus the conventional 2D technique (308.6 Sv). There was an 83% reduction in average patient radiation dose using 3D MRA guidance (68.5 Gy.cm2) versus 2D technique (401.6 Gy.cm2). A 49% reduction in procedure time was noted using 3D MRA guidance (40 min) versus 2D technique (76 min). A 55% reduction was noted in non-embolic contrast utilized using 3D MRA technique (39 ml) versus 2D technique (86 ml). There was a 57% reduction in fluoroscopy time using 3D MRA guidance (10.8 min) versus 2D technique (24.9 min).

**CONCLUSION**
There is a notable and statistically significant reduction (p < 0.05) in physician and patient radiation dose, procedure time, non-embolic contrast utilized and fluororo time using 3D MRA guidance for UFE.

**CLINICAL RELEVANCE/APPLICATION**
Radiation exposure not only to patient, but also to physician is of great concern. The Novel 3D MRA guidance technique not only reduces radiation to physician and patient, but also reduces procedure time, contrast utilized and fluororo time.
Bosniak 3 and 8% remained as Bosniak 2F. 16% (n=12) were CT graded as Bosniak 3 on CT. 60% contained features consistent with Bosniak III. 20% were upgraded to Bosniak IV (confirmed with histology) and 20% were downgraded to Bosniak II. All CEUS graded Bosniak 4 lesions were confirmed to be malignant on histology. Of the solid, malignant appearing lesions examined with CEUS, 94% were confirmed as such with histology.

CONCLUSION

CEUS offers improved contrast resolution relative to CT or MRI and plays an important role in the characterisation of renal lesions by • Helping to visualise vascularity in solid lesions or in solid components of cystic lesions with borderline or difficult to assess enhancement on CT or MRI • Upgrading or downgrading lesion as a consequence of the improved contrast resolution which therefore allows better visualisation of lesion vascularity

CLINICAL RELEVANCE/APPLICATION

• Virtually abolishing the Bosniak 2F category • Allowing assessment or follow up of renal lesions, particularly in patients with impaired renal function or allergy to iodinated contrast medium, and also to avoid excessive radiation in patients requiring longer term follow up.

Perfusion-CT as a Potential Predictor for Response to Antiangiogenic Therapy with Multikinase Inhibitors in Patients with Metastatic Renal Cell Cancer: Preliminary Results of a Pilot Study

Alexander Sterzik (Presenter): Nothing to Disclose, Michael Staehler MD: Nothing to Disclose, Jozefina Casuscelli: Nothing to Disclose, Martina Karpitschka MD: Nothing to Disclose, Florian Schwarz MD: Nothing to Disclose, Maximilian F. Reiser MD: Nothing to Disclose, Anno Graser MD: Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Pfizer Inc Consultant, Bayer AG Grant, Bayer AG

PURPOSE

To evaluate the role of dynamic contrast-enhanced computertomography (DCE-CT, perfusion CT) as a potential biomarker in predicting response to antiangiogenic therapy with multikinase inhibitors (MKI) in patients with metastatic renal cell carcinoma (mRCC).

METHOD AND MATERIALS

48 mRCC patients were prospectively enrolled of which 38 were included in the current study. CT perfusion imaging of representative metastatic lesions was performed before and 8 weeks after start of treatment with Sunitinib (n=28) or Pazopanib (n=10). The DCE-CT protocol included a targeted dynamic acquisition starting 4 - 8 s after injection of 50 ml of contrast media at 6 ml/s using a 4D spiral mode technique (10 cm z-axis coverage, scan duration 44sec, 100 kVp (abdomen), 80 kVp (chest), 100 mAs) on a dual source scanner (Siemens Somatom Definition Flash). Blood flow (BF), blood volume (BV) and permeability-surface area product (PS) were calculated for the entire tumor volume. DCE-CT results were correlated with Response Evaluation Criteria in Solid Tumors response (RECIST) and with progression-free interval (PFI) using Spearman rank correlation, Wilcoxon test, Mann-Whitney U test and Kaplan-Meier statistics.

RESULTS

Responders (n=14) - defined by their best overall response according to RECIST - showed significantly higher baseline values of BF and BV as well as a significantly higher reduction of BF/BV parameters after 8 weeks of AAT than those with stable disease (n = 21) or progressive disease (n=4), (all p-values <0.05).

A definition of >50% reduction of BF and BV after 8 weeks of antiangiogenic therapy as a cut-off value was identified to optimally discriminate patients with favorable outcome (median PFI of 10 months) from those with early progression (median PFI of 4 months) and enabled with a sensitivity and specificity of 75%, respectively 90% identification of poor responders with a PFI of < 7 months.

CONCLUSION

In patients with mRCC relative changes of tumor BF and BV assessed with CTP after 8 weeks of antiangiogenic MKI-treatment may allow prognostic estimations of early therapy failure.

CLINICAL RELEVANCE/APPLICATION

Perfusion-CT predicts response to MKI-therapy in patients with mRCC allowing identification of poor responders with early therapy failure and therefore might help to optimize oncologic treatment in this tumor entity.

Analysis of 4-years Experience of Renal Transplant Colour Flow Ultrasonography (CFUS) and Renal Arterial Resistive Index (RI) Measurement to Determine the Optimum Post-operative Renal Transplant Imaging Protocol

Christopher Beirne MBBCh, MRCS (Presenter): Nothing to Disclose, Aisling Courtney MRCP, MBBCh: Nothing to Disclose, John Trevor Lawson MD : Nothing to Disclose

PURPOSE

Ultrasonography is routinely performed following renal transplantation to assess for early complications including acute tubular necrosis, accelerated rejection, obstruction or collections and renal vein/renal artery thrombosis. The schedule of scans has been historical practice and many patients have multiple scans. The resistive index, which is a measure of pulsatile flow affected by vascular resistance, heart rate and pulse pressure, is measured in all patients however its predictive relationship to post-operative complications has been debated and we have also assessed the value of routine RI measurement.

METHOD AND MATERIALS

Data from a prospectively maintained transplant surgery database was analysed and correlated with the ultrasound scan findings over a 4-year period January 2010 to December 2012. This was used to identify potential areas for service improvement. This included a review of the referral pattern and development of an optimal schedule for imaging as well as issues such as patient transportation and service provision in the out-of-hours setting. These factors were subsequently addressed by a prospective audit performed immediately over the following 4 month period. As a consequence of this second audit, a protocol was
then introduced to optimise service provision for all renal transplant patients. All subsequent transplant patients up until December 2013 were prospectively audited to ensure protocol safety. The timing of renal transplant ultrasonography (by post-operative day), CFUS, R.I. and significant renal and extra-renal findings were recorded. The R.I. of patients requiring post-operative biopsy, post-operative haemodialysis or prolonged sonographic investigation (>5 days) were also analysed for significance.

RESULTS
Total number of patients (n=324), Mean age = 44 years (range 3-73 years). Living related/unrelated donor (n=204) versus cadaveric donor (n=120). Within the initial audit period January 2010 -December 2013: Transplant cases, n = 223. Mean number of ultrasound exams performed per patient, n=6.1 (4 - 14). Number of acute transplant rejections (n=3, 1.6%), R.I > 1 (n=2). There was no significant difference in R.I within surviving grafts (live or cadaveric donor) assessed at days 1, 3, 4 or 5 (p=0.69, 0.5, 0.71 or 0.83 respectively). RI was not significantly different in patients requiring biopsy or post-operative haemodialysis (p=0.71, 0.82). During the first prospective audit January 2013 - April 2013: Transplant cases, n = 36. Mean number of ultrasound exams performed per patient, n=4.19 (2 - 9). Number of acute transplant rejections (n=0), R.I > 1 (n=1). With the protocol implemented during May 2013 - December 2013: Transplant cases, n = 65. Mean number of ultrasound exams performed per patient, n = 3.4 (2 - 12). Number of acute transplant rejections (n = 1, 1.5%), R.I. >1 (n=0). During both the re-audit and protocol implemented period the R.I was not found to be significantly different between patients who had a satisfactory post-transplant course and those patients who were not progressing satisfactorily and required biopsy or post-operative haemodialysis (p=0.64, 0.5). There was also a marked reduction in examinations performed within both the re-audit and protocol period, when the patients were imaged according to an agreed schedule and directed referral pattern.

CONCLUSION
Renal transplant patients in the immediate post-operative period do not routinely require multiple CFUS with R.I calculation. RI does not reliably predict patients requiring biopsy or prolonged post-operative dialysis. Patients with elevated R.I’s (>1) have an increased association with acute rejection, and a low threshold for performing ultrasound is indicated when graft rejection is suspected. In those patients who have undergone uncomplicated surgical and who have a smooth post-operative course we have successfully introduced within our institution to perform CFUS on Day 1 and 2 (living donor) and Day 1, 3 and 5 (cadaveric donor). This enables a more efficient use of the ultrasound department and our out of hours service with no detriment to patient care. Those patients who are at increased risk are also better identified as the request forms have been re-designed to ensure that all relevant clinical details are available to the radiologist. An additional benefit is a significant cost saving (annual reduction in CFUS examinations of approximately 2.7 scans per patient with approximately 100 transplants per year), with much of the reduction being in out of hours scanning.

SSQ09-09
BMI-based Tube Kilovolt Selection Combined with Iodixanol (270 mg I/mL) and Iohexol (350 mg I/mL) in Achieving Coherent Vascular Enhancement in Renal Artery CT Angiography

Yan: Liang MMed (Presenter): Nothing to Disclose, Zhiren Chen MD: Nothing to Disclose, Chuang Yi: Research Grant, General Electric Company, Bin 00617875. Li: Nothing to Disclose, Dongbin Shi: Nothing to Disclose, Yongfang Yin: Nothing to Disclose

PURPOSE
To compare vascular enhancement between a low-kilovoltage renal artery CT angiography (CTA) protocol using a low-concentration iodixanol (270 mg I/mL) and protocol 120 kV protocol with high-concentration iohexol (350 mg I/mL) contrast medium.

METHOD AND MATERIALS
30 patients (body mass index, ≤ 23 kg/m(2)) with suspected renal artery stenosis underwent renal artery CTA with a 64-MDCT scanner using a tube voltage of 80 kV. Patients were received 70 mL of iodixanol (270 mg I/mL) injected at a rate of 5 mL/s. And 32 patients (BMI>23 kg/m(2)) were administered an equal volume of iomeprol (350 mg I/mL) at a delivery rate of 5 mL/s. Images of 80kVp group were post-processed with adaptive statistical iterative algorithm(50%ASiR). For both groups, the CT values and SD values of aorta, subcutaneous fat and the erector spine muscle were measured, and the averaged SD value was calculated as the image noise. The signal-noise-ratio (SNR) and contrast-noise-ratio (CNR) for aorta, artery and left renal artery and right renal artery were calculated respectively.

RESULTS
For low-kV with ASiR group, the enhancement of aorta, artery and left renal artery and right renal artery (223.4±23.8, 261.0±32.2 and 267.2±31.0) were compatible with those in routine120 kV group (271.3±30.4, 223.9±25.6 and 256.3±32.1)(each p>0.05). The CNR of aorta, artery and left renal artery and right renal artery (32.1±4.7, 32.4±6.7 and 31.8±4.7) in low-kVCTA group was slightly higher than those in conventional CTA group (28.6±6.4, 29.9±6.1 and 29.3±9.4)(each p>0.05). Enhancement homogeneity was good with both contrast agents, with no statistically significant difference between them (p>0.05).

CONCLUSION
In 80-kV renal artery CTA of lean patients, higher intravascular enhancement can be achieved with iodixanol (270 mg I/mL), with good vessel conspicuity down to the sub-segmental level.

CLINICAL RELEVANCE/APPLICATION
In patients of BMI<23 with reduced contrast medium, low-kV (80kV) renal artery CTA provides compatible image quality with conventional (120kV) renal artery CTA.
On the basis of a power analysis, 11 patients with biopsy proven focal T2 prostate cancer were enrolled. MR-TULSA was performed for whole-gland prostate ablation using the PAD-105 (Profound Medical Inc., Canada) and a 3T MRI (Siemens, Germany). One treatment session was delivered under general anaesthesia and 3D active MR-thermometry feedback control. Thermal coagulation was confirmed on CE-MRI immediately after MR-TULSA and at 12 months.

RESULTS
MR-TULSA was well-tolerated by all patients. There were no intraoperative complications. Normal micturition resumed after catheter removal. Median (range) treatment time and prostate volume were 36 (24-61) min and 44 (21-95) ml, respectively. Maximum temperature measured during treatment depicted a continuous region of heating shaped accurately to the prostate to within 0.1 ± 1.3 mm, with average over- and under-targeted volumes of 0.8 and 1.0 ml, respectively. Immediate post-treatment cell kill, visualized by the peripheral region of enhancement surrounding the non-perfused volume, correlated well with the acute cell kill regions on MR-thermometry. Successful treatment was further indicated by a median PSA decrease from 5.8 to 0.7 ng/ml at 1 month (n=24), remaining stable to 0.7 ng/ml at 6 months (n=12).

CONCLUSION
MRI-guidance enables accurate treatment planning, real-time dosimetry and control of the thermal ablation volume. The Phase I clinical trial showed that whole-gland ablation of the prostate for localized PCa is feasible, safe, and accurate using MR-TULSA.

CLINICAL RELEVANCE/APPLICATION
Whole-gland ablation can be safely and accurately achieved using MR-TULSA, which represents a minimally-invasive treatment option for organ-confined prostate cancer.

Non-invasive Focal Therapy of Organ Confined Prostate Cancer: Phase I Study Using Magnetic Resonance Guided Focused Ultrasound Technology and Excision Pathology for Efficacy Assessment

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

METHOD AND MATERIALS
On the basis of a power analysis, 11 patients with biopsy proven focal T2 prostate cancer were enrolled. MR-TULSA was performed for whole-gland prostate ablation using the PAD-105 (Profound Medical Inc., Canada) and a 3T MRI (Siemens, Germany). One treatment session was delivered under general anaesthesia and 3D active MR-thermometry feedback control. Thermal coagulation was confirmed on CE-MRI immediately after MR-TULSA and at 12 months.
After cryoablation for the first two years, and then yearly. was repeated also 1 week after the treatment. Reference standard was MRI/CT performed every 6 months after the ablation. In patients with persistent lesion vascularity at early follow-up CEUS the test underwent percutaneous cryoablation between August 2011 and July 2013. All tumors were treated with Twenty-six patients with 31 renal tumors (20 men, 6 women; mean age, 69 years; range, 52-81 years) residual tumor after cryoablation. To evaluate the diagnostic accuracy of contrast enhanced ultrasound (CEUS) in the early detection of 

**RESULTS**

No significant complications were observed in all subjects during or immediately after the procedure. Procedure was validated by pathologist, that demonstrated extensive coagulative necrosis at the site of sonication surrounded by normal prostatic tissue with inflammatory changes; these features positively compared with immediate post-ablative MRI scan and NPV. At histology 10 patients were free of residual viable tumor within the treated area; in the remaining patient, 10% of residual tumor was observed within the NPV. There was a variable amount of isolated cancer tissue (Gleason max 7, 3+4) within the non-treated parenchyma that was neither identifiable at MRI nor at biopsy.

**CONCLUSION**

Results of our Phase I study suggest MR guided Focused Ultrasound as a safe and effective modality to determine >90% necrosis of identifiable prostate cancer; other prospective studies are needed to extend success rate in larger cohort.

**CLINICAL RELEVANCE/APPLICATION**

MR guided Focused Ultrasound is a safe and effective modality to determine >90% necrosis of identifiable prostate cancer.

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**SSQ10-05**

**Cryotherapy for Renal-cell Cancer: Evaluation of the Efficacy of the Treatment with Contrast-Enhanced Ultrasonography (CEUS)**

Michele Bertolotto MD (Presenter): Nothing to Disclose, Fulvio Stacul MD: Nothing to Disclose, Calogero Cicero: Nothing to Disclose, Francesca Cacciato: Nothing to Disclose, Salvatore Siracusano MD: Nothing to Disclose, Maria Assunta Cova MD: Nothing to Disclose, Matilde Cazzagon: Nothing to Disclose, Antonio Celia: Nothing to Disclose

**PURPOSE**

To evaluate the diagnostic accuracy of contrast enhanced ultrasound (CEUS) in the early detection of residual tumor after cryoablation.

**METHOD AND MATERIALS**

Twenty-six patients with 31 renal tumors (20 men, 6 women; mean age, 69 years; range, 52-81 years) underwent percutaneous cryoablation between August 2011 and July 2013. All tumors were treated with CT guidance. Patients underwent CEUS before, within 1 day (early follow-up CEUS), 1 month and 3 months after the ablation. In persistent patients with persistent lesion vascularity at early follow-up CEUS the test was repeated also 1 week after the treatment. Reference standard was MRI/CT performed every 6 months after cryoablation for the first two years, and then yearly.
RESULTS
The mean tumor size was 20 mm (range, 6-37 mm). One patient was lost to follow up. Twenty-five patients with 30 renal tumors were followed-up for at least 6 months and all underwent CEUS. MRI was performed in 21 patients, CT in 4 patients who had contraindications to MR scanning. The mean follow-up period was 15 months (range, 6-24 months). Early CEUS follow-up displayed a completely avascular lesion in 24/30 renal lesions. Minimum to mild perilesional enhancement was present in 4 cases, which disappeared progressively during the follow-up. One type IV cystic tumor had two intrarenal vegetations (10 and 20 mm, respectively), which were still vascularized early after cryoablation and during the follow-up and were categorized as residual tumor. Severe comorbidities precluded from repeated cryoablation. Two lesions were vascularized in the early CEUS follow-up while the CEUS investigation repeated 1 week and 1 month after the treatment documented progressive devascularization of the mass.

CONCLUSION
CEUS is an effective alternative to CT and MRI for the early diagnosis of residual tumor after renal percutaneous cryoablation. Care should be taken, however, in interpreting persistent vascularity in the early CEUS follow-up as residual tumor. Repeated CEUS investigations allow to differentiate between a late devascularization of a successfully ablated tumor and persistent disease.

CLINICAL RELEVANCE/APPLICATION
CEUS is able to monitor the result of cryoablation of renal tumors. Early features after the treatment, however, should be interpreted with caution to avoid misdiagnosis of persistent disease.

CT-guided Biopsy for the Entirely Endophytic Small Renal Mass: Comparison of Diagnostic Rate and Complication between Standard-dose and Low-dose Protocol Group

Mi-Hyun Kim (Presenter): Nothing to Disclose, Jeong Kon Kim MD: Nothing to Disclose, Myung-Won You MD: Nothing to Disclose, Hyuck Jae Choi MD: Nothing to Disclose, Kyoung-Sik Cho MD: Nothing to Disclose

PURPOSE
To compare the diagnostic rate and complication between standard-dose and low-dose protocol group in the CT-guided biopsy for the entirely endophytic small renal masses (SRM)

METHOD AND MATERIALS
A total of 56 patients underwent CT-guided biopsy for the entirely endophytic SRM (≤ 4 cm) from May 2011 to March 2014. Biopsy was performed with standard-dose protocol (reference mAs, 210) in 37 patients and low-dose protocol (reference mAs range, 40-80; mean±standard deviation, 43±9.5) in 19 patients. The diagnostic rate, histologic finding, radiation dose, complication rate, and procedure time were assessed from the retrospective chart and image reviews and compared between two groups.

RESULTS
In the low-dose protocol group, all 19 patients had diagnostic results (14 renal cell carcinomas, 2 metastases, 1 urothelial carcinoma, 1 oncocyctic neoplasm, and 1 angiomyolipoma). In the standard-dose protocol group, 36 (97%) patients had diagnostic results (24 renal cell carcinomas, 2 metastases, 1 lymphoma, 4 angiomyolipomas, 4 inflammations, and 1 cyst) and one patient had non-diagnostic result. No serious complication such as active bleeding was occurred in two groups. The standard-dose protocol group had statistically greater value of the dose length product (DLP) than low-dose protocol group (560±221 vs. 180±61 mGy*cm, P < .05). Mean procedure time was equally 21 minutes in two groups.

CONCLUSION
Low-dose protocol CT-guided biopsy for the entirely endophytic SRM has comparable diagnostic result to the standard-dose protocol group without increasing complication rate or procedure time.

Ultrasound-guided Transvaginal Core Biopsy of Pelvic Masses: Feasibility, Safety and Short-term Follow-up

Jung Jae Park MD (Presenter): Nothing to Disclose, Chan Kyo Kim MD, PhD: Nothing to Disclose, Byung Kwan Park MD: Nothing to Disclose

PURPOSE
Although several previous studies reported the utility of transvaginal approach for endometrial biopsy or fine needle aspiration of pelvic lesions, few studies have demonstrated the feasibility of transvaginal technique for biopsy of pelvic masses. The aim of our study was to evaluate the diagnostic accuracy and safety of ultrasound (US)-guided transvaginal core biopsy for pelvic masses.

METHOD AND MATERIALS
Forty-nine pelvic masses (mean size, 4.2 ± 2.8 cm) in 49 women (median age, 59 ± 12.7 years) who received US-guided transvaginal core biopsy between 2009 and 2013 were enrolled in this retrospective study. On pre-biopsy CT or MR imaging, the lesions were identified in vaginal stump (n = 25), rectovaginal or vesicovaginal pouch (n = 11), adnexa (n = 8), or distal ureter (n = 5). The biopsy was performed using a probe equipped with a guide and an 18 gauge Tru-cut needle with an automatic biopsy gun (Ace-cut) after local anesthesia. We evaluated the diagnostic accuracy and complication rate of the procedure.

RESULTS
All acquired specimens were adequate and sufficient for pathologic analysis. Overall diagnostic accuracy of US-guided transvaginal core biopsy was 91.8% (45/49 patients). Of these, 39 lesions were diagnosed as
innovative image-guided therapy. The remaining one lesion was diagnosed as ovarian sex cord-stromal tumor. Of the four non-diagnostic lesions, two were identified as fibrothecoma and recurrent leiomyosarcoma after surgery, respectively and the remaining two were clinically regarded as recurrent ovarian and endometrial cancer due to increases in size on follow-up imaging, respectively. None of these biopsies resulted in major complications, vaginal complications, vaginal bleeding immediately after the biopsy and gross hematuria were found in 10 patients (20.4%) and three patients (6.1%), respectively, but these complications were stopped spontaneously in all 13 patients without further treatment or transfusion.

CONCLUSION
US-guided transvaginal core biopsy appears to be reliable and safe procedure for the histologic diagnosis in patients with pelvic masses.

CLINICAL RELEVANCE/APPLICATION
As a reliable and safe technique, US-guided transvaginal core biopsy can be used for clinical decision making and selecting optimal treatment strategies in patients with pelvic masses.

SSQ10-08
Retrospective Study of Uterine Fibroid Treatment Using MRgFUS: Correlations between Age, Recurrence Rate and Clinical Outcomes
Fabiana Ferrari MD (Presenter): Nothing to Disclose, Anna Miccoli MD : Nothing to Disclose, Francesco Arrigoni : Nothing to Disclose, Eva Fascetti MD : Nothing to Disclose, Antonio Barile MD : Nothing to Disclose

PURPOSE
To evaluate the efficacy of MRgFUS in the uterine fibroids treatment analysing the recurrence rate after 12 months from the treatment. This study correlates the age of patients to the clinical and imaging results.

METHOD AND MATERIALS
38 patients, with symptomatic uterine fibroids were treated using MRgFUS from September 2011 to December 2012. Twenty-two of them were aged between 40 and 50 (group 1), 10 patients between 30 and 40 (group 2) and 6 patients between 20 and 30 (group 3). Single fibroids were found in 13 patients while 25 patients presented multiple fibroids. Patients were submitted to one treatment alone. We submitted the patients to c.e. MRI respectively before treatment, after 10 days, 3 months, 6 months and 12 months. We made a morphological analysis of the images, an evaluation of the treated volume extension and the possible recurrence of the pathology in the area of the treatment. Clinical evaluation was performed by SSS-questionnaire, comparing the pre-treatment score to the one obtained after 12 months.

RESULTS
All patients had a non-perfused-volume mean value of 91.5 %. Thirty-four women belonging to Group 1, Group 2 and Group 3 (89.5% of patients) showed a complete reabsorption of the necrotic area without any fibrotic tissue in the treatment area after 12 months. Four younger women (10.5 % of patients) belonging to Group 3, aged between 24 and 30 years, showed hypointense tissue in the peripheral part of the treated area after 3-6 months from the treatment. One of them, who underwent myomectomy, showed a mixed tissue made of necrotic cells and fibrotic tissue. Clinically, after 12 months from the treatment, Group 1, Group 2, and Group 3 showed a SSS-Q mean value of 7.8, 8.1, and 6.4, respectively. We did not appreciate clinical differences of statistical relevance between the groups.

CONCLUSION
MRgFUS is an effective technique in younger and older women. We found excellent morphological results and clinical outcomes. Patients belonging to group 1 and 2. In Group 3, the excellect clinical response was not associated to significant morphological results, this however not impairing the final response to the treatment.

CLINICAL RELEVANCE/APPLICATION
We evaluate the efficacy of the uterine fibroid treatment using MRgFUS correlating the morphological and clinical results in younger and older women obtaining in both groups good therapeutic results.

SSQ10-09
Genitourinary Keynote Speaker: Oncologic Applications of HIFU in 2014—Current State-of-the-Art and Future Directions
Aradhana Mukherjea Venkatesan MD (Presenter): Institutional research agreement, Koninklijke Philips NV

Abstract
High intensity focused ultrasound (HIFU), also known as focused ultrasound (FUS) is a non-invasive image-guided therapy which has been primarily employed in the clinical realm for non-invasive thermal ablation of benign and malignant neoplasms. Real time imaging guidance, treatment monitoring and therapy control is achieved with ultrasound (US) or magnetic resonance imaging (MRI) guidance. Clinical experience in the GU tract has been described in the treatment of leiomyomata, adenomyosis, prostate and renal tumors, although, to date, widespread adoption of HIFU thermoablation remains limited. Ongoing technical challenges include the feasibility of treating large tumors within a finite treatment time, treating targets prone to motion or those for which the acoustic window is restricted by intervening anatomy. A range of provocative bio-effects of therapeutic ultrasound beyond thermoablation also have the potential to be leveraged in the care of the oncology patient. Hyperthermic effects can potentiate the release of thermostensitive drugs, enhance the permeability and retention of chemotherapeutic agents, and potentially enable gene delivery within tumors. Mechanical effects of HIFU, including stable and inertial cavitation play a role in heat sensitive drug and gene delivery and have the potential to be employed as adjuvant effects for more efficient ablation of large tumors. Ongoing and promising oncologic research is directed toward optimization of HIFU’s thermoablative capabilities and greater elucidation of its non-thermal effects. This keynote presentation will describe the principles governing oncologic applications of HIFU and present current state-of-the-art and future GU interventional applications of this innovative image-guided therapy.
An Evaluation of Automated RadLex Encoding of Free Text Pediatric Orthopedic Medical Imaging Reports

Robyn Alexandra Cairns MD, FRCP(C) (Presenter): Consultant, McKesson Corporation, Thomas Rosenal MSC, MD: Nothing to Disclose, Francis Y. Lau MSC, PhD: Nothing to Disclose

CONCLUSION

The performance of the NCBO Annotator for correctly extracting all clinically relevant terms and excluding irrelevant terms is limited but RadLex encoding of correctly extracted terms is more accurate. The NCBO Annotator shows promise as a viable alternative to time intensive manual processing for simply identifying and encoding existing RadLex preferred concepts in free text radiology documents.

Background

Content from narrative medical imaging (MI) reports could be more efficiently applied to clinical decision support and other applications in electronic health records if coded relevant terms were generated from MI reports. The National Center for Biomedical Ontology (NCBO) Annotator is an open source ontology-based web service that automatically identifies and returns codified terms. The objective of this study was to determine if domain relevant terms can be accurately extracted and encoded from free text paediatric orthopaedic MI reports using the NCBO annotator with RadLex, a terminology for radiology, applied as the reference ontology.
Evaluation
The NCBO annotator results for extraction and RadLex encoding of retrospectively collected free text pediatric orthopaedic MI reports were evaluated separately for 51 reports. The overall extraction performance, recall (sensitivity) and precision (positive predictive value), of the NCBO Annotator was evaluated by comparing the automated extracted terms to a "gold standard list" of relevant terms manually generated for each report by a pediatric musculoskeletal radiologist. The contextual correctness of coding of the relevant NCBO Annotator extracted terms was also assessed by comparing the NCBO Annotator RadLex encoding results with manual RadLex encoding results.

Discussion
A comparison of 1055 NCBO extracted terms with the 711 manually identified terms included in the 51 gold standard extraction lists demonstrated a recall rate of 50% and precision of 34% for the NCBO Annotator. Analysis of the encoding of the relevant NCBO extracted terms (n=353) found that 98% of the terms were RadLex exact match terms and these terms were encoded in correct clinical context 88% of the time.

SSQ11-04
EXTraction of Numerical Data (EXTND): A Novel Tool to EXTEND Clinical Radiology Research Using Automated Numerical Data Collection
Tianrun Cai MD (Presenter): Nothing to Disclose, Kanako Kunishima Kumamaru MD, PhD: Nothing to Disclose, Amir Imanzadeh MD: Nothing to Disclose, Elizabeth George MD: Nothing to Disclose, Ruth M. Dunne MBBCh: Nothing to Disclose, Frank John Rybicki MD, PhD: Research Grant, Toshiba Corporation, Carlos J. Gonzalez Quesada MD: Nothing to Disclose, Zoha Hussain: Nothing to Disclose, Andelita Rotilla: Nothing to Disclose, Arash Bedayat MD: Nothing to Disclose, Rani S. Sewatkar MBBS: Nothing to Disclose

PURPOSE
Numerical data (eg, blood pressure, heart rate) recorded in the Electronic Medical Record (EMR) are important information in radiology clinical outcomes research. The purpose of the study was to develop and validate EXTND, a novel tool that automatically collects important numerical data through the processing medical reports.

METHOD AND MATERIALS
Software design
EXTND was written in-house using Python. Pattern matching, word segmentation, and lexical analysis were the main technologies used.
1: Standardize report format
2: Build a list of abbreviations by using Unified Medical Language System
3: Process a medical report using the module of Natural Language Toolkit and search relevant key words
4: Extract numerical data following the key words and send them to a set of functions to perform validity testing in terms of normal ranges, value structures, and units
5: Collect validated numerical values

RESULTS
104 patients (45 males; 59 females) participated in the study (832 total evaluations). The mean level of report comprehension was 2.53 (1-5 scale) with "unclear or technical language" (59.6% of evaluations) and "too long" (10.2% of evaluations) being the most commonly cited problems. An explanation of the report in lay terms (20.1% of evaluations) was the most common request in the free-text portion. There was an inverse relationship between report length and patient comprehension (r²=0.69, p=0.01, df=6). Longer reports were also correlated with a higher number of patient-identified problems (r²=0.72, p=0.008, df=6). Patients who had prior experience with their own radiology reports indicated a greater correlation between the patients’ educational status and report comprehension (mean=2.26; p=0.0006). No correlation between the reports' educational status and report comprehension was identified (r²=0.005, p=0.91, df=3).

CONCLUSION
Radiology reports are not well understood by patients, who identified the technical language and long length of reports as the most common problems. Longer reports tended to be less well understood and have more patient-identified problems. Radiologists should consider this structured feedback from patients when attempting to establish a more patient-centered practice.

CLINICAL RELEVANCE/APPLICATION
Structured feedback from patients on actual radiology reports is a feasible and patient-centered approach to improving reporting practices which has not been previously described.
Software application
A total of 69,406 free-text medical records in the hospital EMR database for the 2070 consecutive patients (08/2003-05/2010) with acute pulmonary embolism diagnosed with CT pulmonary angiography at a single, large, teaching hospital were evaluated using EXTND. Heart rate, blood pressure, temperature, respiratory rate, and oxygen saturation measured at the time closest to the CT acquisition were collected for all patients.

Software validation
Manual review of 285 documents (from the 69,406 above) from a randomly selected sub-cohort of 149 patients was performed. The accuracy of EXTND was assessed using the manual EMR review as reference standard.

RESULTS
For all 2070 patients, EXTND rapidly and effectively acquired the data elements. Using the manual data as reference standard, the positive predictive value (PPV) and sensitivity (with standard errors) were as follows: PPV Sensitivity Heart rate 0.953 (0.016) 0.970 (0.013) Blood pressure 0.911 (0.022) 1.000 (0) Temperature 0.942 (0.021) 0.991 (0.009) Respiratory rate 0.988 (0.021) 0.991 (0.009) Oxygen saturation 0.938 (0.018) 0.943 (0.008)

CONCLUSION
EXTND is a novel tool with high accuracy in acquiring clinical numerical parameters that are important in pulmonary embolism outcomes research.

CLINICAL RELEVANCE/APPLICATION
EXTraction of Numerical Data (EXTND) that was developed to extract key numerical metrics for pulmonary embolism research can potentially be applied to other clinical radiology research.

SSQ11-05
The Impact of a Structured Design and a Computer-aided Diagnosis Tool on the Quality of Prostate Multiparametric MRI Reports
Patricia Silveira MD (Presenter): Nothing to Disclose, Ruth M. Dunne MBBCh : Nothing to Disclose , Nisha Sainani MD : Nothing to Disclose , Stuart G. Silverman MD : Author, Wolters Kluwer nv , Clare M. C. Tempay-Afdhal MD : Research Grant, InSightec Ltd Research Consultant, ProFound Medical Inc , Ramin Khorasani MD : Consultant, Medicalis Corp , Ronilda Lacson MD, PhD : Nothing to Disclose

PURPOSE
Assess the impact of implementing a structured design and a computer-aided diagnosis (CAD) tool on the quality of prostate multiparametric MRI (mp-MRI) reports.

METHOD AND MATERIALS
Institutional review board approval was obtained for this HIPAA-compliant pre-/post-interventional study performed at a 793-bed, quaternary care, academic medical center. We randomly sampled prostate mp-MRI reports finalized between August 1, 2012 and July 31, 2013. An intervention consisting of a structured design and a CAD tool integrated into PACS workstations was implemented on February 1, 2013; and was accompanied by a 1-hour targeted instructional program for radiology faculty and trainees. Primary outcome measure was quality of prostate mp-MRI reports, classified as sub-standard, standard and optimal quality using report quality metrics derived by institutional abdominal radiologists’ consensus. Following manual report review, chi-square or Student t-tests were used to compare report quality six months pre- and post-intervention. Logistic regression analysis was performed to control for confounders and determine factors associated with standard quality reports.

RESULTS
A total 312 prostate mp-MRI reports were analyzed. Post-intervention, optimal quality reports and standard reports increased significantly from 0/156 [0%] to 21/156 [13.5%] (p<0.001), and from 47/156 [30.1%] to 69/156 [57.1%] (p<0.001), respectively. When controlling for confounding factors, use of either structured design or CAD increased the likelihood of a standard quality report (OR=2.8; p=0.011 and OR=3.4; p=0.002, respectively).

CONCLUSION
Implementing a structured design and a CAD tool significantly improved the quality of prostate mp-MRI reports, but documentation of quality metrics on prostate mp-MRI reports still needs additional improvement. Potential next steps are automated monitoring of report content through the use of natural language processing tools, feedback to radiologists using quality dashboards, education targeting quality metrics awareness, financial incentives for adherence, and mandatory use of the new technologies.

CLINICAL RELEVANCE/APPLICATION
Documentation of quality metrics might improve referring physicians’ management decision-making process and, therefore, patient care.

SSQ11-06
Important Non-urgent Radiology Findings. A Novel Solution Using a Voice Dictation Macro and the TIBCO Application Integrated within the Soarian EMR (Siemens Medical) to Prevent These Findings from Falling through the Cracks
Jonathan S. Movson MBBCh (Presenter): Nothing to Disclose , Timothy Paul : Nothing to Disclose , Cynthia M. Cobb : Nothing to Disclose , Daniel M. Golding MD : Nothing to Disclose , Andrew Karn : Nothing to Disclose

PURPOSE
It is well known that non-urgent but important findings “fall through the cracks” of patient care. This is particularly likely to happen in the emergency room setting. To ensure that these results are always communicated either to the patient’s primary care physician or to the patient, our radiology department worked with our IT group to develop a solution to identify and communicate these findings.
METHOD AND MATERIALS
When a radiologists makes a finding that is considered to be important to patient care but not immediately life-threatening, they insert a macro at the end of the report using our voice dictation system (Nuance:PowerScribe). Specific characters in the macro designated by a radiology report category system (RADCAT) are recognized by the Cloverleaf interface engine and a copy of the report is sent to the TIBCO Process (The Information Bus Company) application. The TIBCO iProcess has a web based front end that is used by dedicated personnel at three affiliated hospitals to review and process these reports. They contact the patient’s primary care physician or if necessary the patient, and document that communication of the finding has taken place. A copy of the ‘closed report’ is sent to the EMR for reference and medico-legal reasons.

RESULTS
We are able to audit the TIBCO system to determine how often the communication loops is closed. Results: Between June 2012 and August 2013, 3956 radiology reports were noted by our radiologists to contain important non-urgent findings. We have documented that 99.5% of these findings were successfully communicated to physicians and/or their patients. The 0.5% of patients whom we were unable to contact generally are either homeless or provided false information at the time of registration.

CONCLUSION
The system we created was rapidly adopted by our radiologists due to its ease of use. The web front end of the TIBCO application allows for the efficient use of the human resources in a multi-facility institution like ours. We believe that we have virtually eliminated the risk of failure to communicate important but non-urgent findings at our institution.

CLINICAL RELEVANCE/APPLICATION
Using the combination of an interface engine and an application like TIBCO, it is possible to create novel solutions to complex patient care problems without disrupting the workflow of the radiologists.

**Clinical Trial Management and Analysis Utilizing Multimedia Structured Reporting**


CONCLUSION
Multimedia structured reporting provides a means to automate and improve the efficiency of clinical trial management and analysis.

Background
Clinical trials are dependent upon radiologists for efficient tumor assessment. We have developed a multimedia structured reporting system that facilitates this task by aggregating structured data from cohorts to automate the management and analysis of clinical trial data.

Evaluation
We developed a structured reporting system that captures key images, metrics and voice descriptions during a radiologist’s interpretative session of oncological studies using any vendor’s image display system, and then assembles the data in a multimedia structured report. Our software provides a means to link image findings from serial examinations to generate graphical disease timelines which show progression of disease at individual anatomical sites. Specific image findings can be designated as “target lesions” from which the calculation of the response criteria can be performed, such as that prescribed by the Response Evaluation Criteria in Solid Tumors (RECIST). Our system then aggregates structured data from cohorts in real-time to automate the management and analysis of clinical trial data, including the generation of Waterfall plots, Progression Free Survival (PFS) and Overall Survival (OS) rates, Kaplan-Meier survival curves.

Discussion
Improving the efficiency of clinical trials could significantly reduce the costs associated with developing new therapies. We have created a multimedia structured reporting solution that is capable of aggregating structured data from cohorts of patients in order to achieve this aim.

**An Automatic Bone Mineral Density Reporting System**

**I-Ta Tsai MD (Presenter):** Nothing to Disclose, Meng-Yuan Tsai: Nothing to Disclose, Ming-Ting Wu MD: Nothing to Disclose, Kuen-Huang Chen MD: Nothing to Disclose

CONCLUSION
We constructed an efficient and reliable AR web application of BMD. It prevented human errors from technicians, typists and radiologists. It facilitates current clinical service and has potential academic applications.

Background
The reports of bone mineral density (BMD) are based on a diagnostic algorithm on the numeric data. In retyping these data manually, a few mistakes might be made, and the process is time-consuming. We constructed an AR web application using Ruby on Rails, a open source web application framework. By importing the data generated by a dual-energy x-ray absorptiometry (DXA) scanner, the web application can automatically generate structure reports integrated with the electronic medical records.

Evaluation
For comparison of reporting speed, in Jan 2014, 500 examinations were randomized into Automatic Group (AG) and Manual Group (MG). With 25 examinations per test unit, the average time spent of report generation in AG and in MG (dictation and check) was 264 seconds and 1,452 seconds, respectively (p < 0.001). For evaluation of the accuracy, 5,120 examinations during Jan 2013 and Dec 2013 were enrolled.
retrospectively. With an AutoHotKey script, the context of automatically generated reports (AR) were compared with the formal manual reports (MR). There were 383 discrepant reports. The accuracy of calculation of T and Z scores in AR is 100%. The errors in AR were key-in errors by technicians (0.64%, 33/5120) and need of additional judgements (0.57%, 29/5120); in MR, there were misreading of T or Z score (2.32%, 119/5120), mis-assignment of hip level (2.17%, 111/5120), dictation error (1.21%, 62/5120) and data omission (0.57%, 29/5120). The overall accuracy of AR and MR is 98.8% and 93.7%, respectively (P < 0.001). The mis-categorization of BMD in AR and MR is 0.039% (2/5120) and 0.273% (14/5120), respectively (P = 0.17).

Discussion
Ancillary radiological comments such as degenerative change of spine with relative high T scores in MR were not generated in current AR. Revised algorithm would give a warning message in the future AR. The structured database could be integrated for epidemiological statistics such as normal range of our population.

SSQ11-09  
Teaching a Machine to Annotate Radiology Text
Eamon Johnson MS (Presenter): Nothing to Disclose, Michael D. Torno DSc: Nothing to Disclose, William Christopher Baughman MD: Nothing to Disclose

CONCLUSION
The involvement of expert annotators is critical when we encounter new data and metadata, yet expert involvement can be decreased when the data conform to prior patterns. This work uses additional metadata to provide a partial solution to reducing the need for expert involvement in the text annotation process.

Background
Ideally, the data analysis revolution would aid physicians in making diagnoses and offer an automated secondary analysis. Training machines to provide this functionality generally requires data sets vetted by experts as a starting point. However, the lack of annotated text corpora for training computational models is a perennial problem in medical informatics. The cost of creating annotated corpora is high, because informaticists must design annotation schemes and train physicians to make the annotations, and physicians must invest effort in making annotations. Even then, expert physicians are not necessarily expert- or willing-annotators. This project analyzes methods for leveraging existing clinical annotations to build richly annotated data sets automatically.

Evaluation
The source data consist of 700,000 diagnostic radiology text reports, each of which contains physician name, full interpretation text, modality, body area, and an ICD-9-CM code reflecting the initial diagnosis. An NLP pipeline based on cTAKES was used to extract medical concepts from the interpretation text, and a correlation between the codes and the concepts extracted from the reports was constructed.

Discussion
The output of the analysis is a ranked evaluation of concept correlation with 448 ICD-9-CM codes, with discussion of underlying factors, sources of noise, and sources of bias. For a portion of codes with low-noise and low-bias characteristics, strategies for automatic annotation of records are presented.
to the external domain of prostate specific membrane antigen (PSMA), an enzyme with high expression in PCAs. We conducted an open-label, multicenter study (NCT01667536). The primary endpoint was the ability of trofolastat to detect PCAs within the prostate gland (PG). Secondary endpoints included detection in PLNs and comparison to MRI.

METHOD AND MATERIALS
Patients (pts) with PCa scheduled for RP with ePLND at high risk (≥cT3 or Godoy nomogram score ≥130) for PLN involvement were eligible. Within 30 days of screening, pts required a bone scan and pelvic MRI. Enrolled pts received trofolastat and SPECT/CT imaging 3-6 hrs later, 3 SPECT/CT readers and one MRI reader, blinded to clinical information, evaluated all available image data. Results were compared to on-site histopathology assessments of RP and ePLN surgical specimens using a common anatomic template. Target to background (T:B) ratio within the PG was measured on the SPECT/CT and compared to Gleason Score (GS).

RESULTS
Enrollment has been completed and data is available for the first 54 of 105 pts. A majority of SPECT/CT readers correctly identified the presence of primary PCas in 49/54 (91%) evaluable pts. In 47 pts who had both MR as well as trofolastat scans, readers correctly identified PCas in 40/47 (85%) and 42/47 (89%), respectively. In 37 pts with no prior hormone therapy, GS following RP ranged from 3+4 to 5+5 and significantly correlated with maximum T:B values (r=0.54 p<0.001). In 17 pts treated with neoadjuvant hormonal therapy, T:B was lower than untreated pts (p<0.005).

CONCLUSION
Trofolastat SPECT/CT detected PCas within the PG in 49 of the first 54 (91%) of evaluable high-risk pts prior to surgery. Uptake of trofolastat correlated significantly with GS obtained from post-RP histopathology in untreated pts and may provide information regarding disease aggressiveness using a non-invasive technique in high-risk pts prior to surgery. Final results, analyses of secondary endpoints, pelvic lymph nodes, and comparative performance vs. MRI from this study will be presented.

CLINICAL RELEVANCE/APPLICATION
Accurate detection and characterization of prostate cancer should enhance optimal delivery of therapy. Tc-99m trofolastat has shown clinical relevance in studies to date.

A Novel Phase Transition-activatable Multi-Modomal Imaging Agent for Prostate Cancer
Shadi A. Esfahani MD, MPH (Presenter): Nothing to Disclose, Pedram Heidari MD: Nothing to Disclose, Nazife S. Turker: Nothing to Disclose, Umar Mahmood MD, PhD: Research Grant, Sabik Medical Inc

PURPOSE
We assessed the ability of a novel phosphatase activatable agent, selective for Prostate Specific Acid Phosphatase (PAP) for the detection of prostate cancer (PCa). Cleavage by PAP results in increased fluorescence and radioactive signal due to a local phase change at sites overexpressing the enzyme.

METHOD AND MATERIALS
In vitro, 3 PCa cell lines (AT3-B, LNCaP and PC-3) were incubated with 0.1 mg/ml of the soluble probe 2-(2'-phosphoryloxyphenyl)-6-iodo-4-(3H)-quinazolinone (127IQ2-P). Dephosphorylation and extracellular precipitation of the probe was assessed using confocal microscope over 24 hrs. PC-3 cells were implanted in 16 nu/nu mice. Epifluorescence imaging (excitation/emission, 480/530 nm) was performed 1 and 24 hrs after IV injection of the probe with concentrations of 1 and 0.1 mg/ml (n=8 each). Signal intensity in xenografts, and tumor to background ratio (TBR) were measured. Biodistribution and histopathologic studies were performed at each time point.

RESULTS
In vitro incubation of the probe with all PAP-overexpressing cell lines resulted in phase transition and formation of the corresponding water-insoluble compound in the extracellular space over 24 hrs. In vivo, rapid hydrolysis of the probe within the tumor resulted in peak fluorescence signal intensity and high TBR 1 hr post injection, with non-significant difference between the mean TBR using 2 different probe concentrations (TBR with 0.1mg/ml: 4.12±0.2 at 1hr vs. 2.45±0.12 at 24 hrs) and (TBR 1mg/ml: 3.44±0.12 in 1 hr, vs. 2.42±0.08 in 24 hrs). Biodistribution studies showed rapid probe accumulation in xenografts, fast probe clearance from the background tissues and its excretion through the kidneys.

CONCLUSION
Rapid activation, multimodal detection, and high TBR suggest that this phase transition PAP-activatable probe is promising for imaging PCa. This multimodal probe may be employed in early detection of primary and metastatic prostate cancers, treatment response evaluations, and selective image-guided interventions.

CLINICAL RELEVANCE/APPLICATION
The phase-transition activatable probe has the potential in early detection and treatment response evaluation of prostate cancer by targeting the diagnostic marker prostate specific acid phosphatase.

First Demonstration of Hypofractionated Volumetric Modulated Arc Therapy Dose Painting with Unflattened Beams for Bone Metastases Using 18F–NaF PET/CT scan
Yu Kuang PhD (Presenter): Nothing to Disclose, Lili Wu MS: Nothing to Disclose, Mei Li MD: Nothing to Disclose, Xia Li PhD: Nothing to Disclose

PURPOSE
Higher radiotherapy (RT) doses delivered to bone metastases would result in a higher local control rate. However, such a high dose is impossible to achieve without an unacceptably high risk of severe toxicity. In this study, we propose, for the first time, to utilize 18F–NaF PET/CT to identify regions within the conventional bone metastasis target volumes that may have different biology and thus allowing RT dose escalation (i.e. dose painting) to attain tumor control.
Recurrent Prostate Cancer Detection with Anti-3-[18F]FACBC PET-CT: Comparison with CT

**METHOD AND MATERIALS**

Nine patients with bone metastases from prostate cancer who had 18F-NaF PET/CT scan prior to treatment were retrospectively included in this study. Two gross tumor volumes (GTVs) were generated for each patient: GTVreg was delineated according to the regular tumor boundary shown in PET/CT images; GTV60% was contoured on 60% of the planning target volumes (PTVs) as defined in Table 1. The GTVreg volume contributed 43% to the PTV60% volume. The planning target volumes (PTVs) were outlined using a 3-mm margin around the GTVs identified as suspicious for recurrent disease. Two hypofractionated Volumetric Modulated Arc Therapy (VMAT) plans with 6 MV flattened filter free (FFF) beams (1400MU/min) were generated for each patient based on PTVreg and PTV60%, respectively. The standard plan (Planreg) included a dose of 24 Gy prescribed to PTVreg. The dose escalation plan (Plan60%) consisted of a dose of 24 Gy prescribed to PTVreg and a boost dose of 30 Gy prescribed to the PTV60%. TCP and the NTCP were also compared between the plans.

**RESULTS**

In all 18 VMAT plans generated, the target volume objectives and the organs-at-risk (OARs) dose constraints were met. The use of pre-treatment 18F-NaF PET/CT led to a better estimate of the dominant lesion areas within routine GTV, which translated into an advantageous escalation of target dose while maintaining normal tissue sparing.

**CONCLUSION**

This study demonstrates the technical feasibility of 18F-NaF PET/CT-based dose painting for hypofractionated VMAT with FFF beams in patients with bone metastases from prostate cancer.

**CLINICAL RELEVANCE/APPLICATION**

This molecular image guided VMAT approach, with exquisite tumor metabolic activity arising from 18F-NaF PET, would offer therapeutic insight impossible with the current design. Given the higher dose responsive nature in cancer and the facts that the proposed method requires only minimal protocol modification in routine care, it could have major therapeutic value for the clinical outcome in the long term patient care in the future.

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** SSQ12-06 **

**Detection of Intra-pelvic vs Extra-pelvic Lesions with Carbon-11 Acetate Positron Emission Tomography/Computed Tomography Imaging in the Evaluation of Recurrent Prostate Cancer: Interim Results from the AMIC-AC-001 Clinical Study**

Fabio Almeida MD (Presenter): Nothing to Disclose, Steven Eric Finkelstein MD: Nothing to Disclose, Mark Scholz MD: Nothing to Disclose, Richard Lam MD: Nothing to Disclose, Jeffrey Turner MD: Nothing to Disclose, Elisa Blackwell: Nothing to Disclose
**Comparison of [18F]DCFBC PET/CT to Conventional Imaging Modalities in the Detection of Metastatic Prostate Cancer**

Steven Patrick Rowe MD, PhD (Presenter): Nothing to Disclose, Katarzyna J. Macura MD, PhD: Nothing to Disclose, Anthony Ciarallo MD, MSc: Nothing to Disclose, Esther Mena: Nothing to Disclose, Amanda Bidge: Nothing to Disclose, Daniel Holt PhD: Nothing to Disclose, Ronnie Mease PhD: Nothing to Disclose, Robert F. Dannals MD: Nothing to Disclose, Martin Gilbert Pomper MD, PhD: Grant, Eisai Co, Ltd Grant, Eli Lily and Company Founder, Cancer Targeting Systems, Inc Board of Directors, Cancer Targeting Systems, Inc Founder, Theraly Pharmaceuticals Inc, Steve Cho MD: Nothing to Disclose

**PURPOSE**

A rising PSA after definitive therapy possess a significant problem, as it represents a large group of prostate cancer (PCa) patients. These patients often have the absence of sufficiently detectable disease on standard imaging studies, thereby limiting treatment options.

**METHOD AND MATERIALS**

373 C11-Acetate (CA) PET/CT studies were reviewed in an ongoing single site FDA/IND clinical study. Male patients with histologically proven PCa and biochemical recurrence (BCR) were imaged. Imaging was performed from vertex - thighs on an integrated PET/CT scanner with imaging 3 to 7 minutes post injection. Detected lesions were defined as moderate-intense focal areas of increased metabolic activity over background in the prostate, bed, nodes and bone.

**RESULTS**

PSA ranged from 0.2 - 148 ng/mL (mean 6.3, median 2.7). The overall detection rate was 87%. At various PSA subgroups the detection rates were: 0.2-0.4 = 50%, 0.41 - 1.0 = 77%, >1.1 90%. True positive (TP) studies were defined as those with positive biopsy, confirmatory imaging or where radiotherapy (RT) was directed at the detected site with a resultant drop in PSA. 145 patients have thus far met criteria for TP analysis, with a PPV of 94%. Focal lesions were detected only in the prostate or bed in 28% (post prostatectomy (RP): 32%, post RT: 31%, post RP-RT: 11%). In 24% of studies, only focal pelvic nodal lesions were detected (RP:32%, RT-13%, RP-RT: 41%). Lesions where detected in both the prostate/bed and pelvic nodes in 7%. Metabolic lesions were detected in both the pelvis and abdomen in 7% and isolated to abdominal nodes in 3%. Bone lesions were found in 28% of the studies (71% in bone only and 29% with soft tissue lesions). In 3%, lesions were detected in the other areas such as the lungs, mediastinal nodes or in supraclavicular nodes (particularly on the left).

**CONCLUSION**

In patients with BCR of PCa, CA PET/CT imaging demonstrates a high detection rate and PPV for the site(s) of recurrence/metastasis. Particularly evident is the high detection of locally recurrent and intra-gelical nodal disease (59%), which may be amenable to focal therapy with a curative intent. CA PET/CT was also able to better identify those with distant metastases, whom would most benefit from systemic therapy.

**CLINICAL RELEVANCE/APPLICATION**

Conventional imaging is of limited value in BCR PCa and CA PET imaging appears to help differentiate those with local-regional disease from distant metastasis.

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**Comparison of [18F]DCFBC PET/CT to Conventional Imaging Modalities in the Detection of Metastatic Prostate Cancer**

A rising PSA after definitive therapy possess a significant problem, as it represents a large group of prostate cancer (PCa) patients. These patients often have the absence of sufficiently detectable disease on standard imaging studies, thereby limiting treatment options.

**METHOD AND MATERIALS**

14 patients with recurrent (PCa) and imaging findings diagnostic of and/or indeterminate for radiographic recurrence were imaged with [18F]DCFBC PET/CT and CIM. Central review was performed with lesion-by-lesion analysis of the PET and CIM. Lesions were scored as positive, equivocal, or negative on each modality. GEE intercept-only regression models that accounted for intra-patient correlation of multiple lesions were used to estimate proportion of agreement in lesion detection between [18F]DCFBC PET/CT and CIM.

**RESULTS**

673 lesions were identified on at least one modality. Of those lesions that were positive with PET, 45% (95% CI, 28-65%) were negative or equivocal with CIM. This includes 89% (71-96%) of identified lymph node lesions, 24% (13-39%) of bone lesions, and 39% (14-71%) of visceral lesions (though only 24 such lesions were identified).

Of those lesions that were positive on CIM, only 6% (2-14%) were negative or equivocal on PET. This includes 8% (1-42%) of lymph node lesions, 8% (3-17%) of bone lesions, and no identified visceral lesions.

**CONCLUSION**

[18F]DCFBC PET/CT identified more potential sites of metastatic PCa than CIM. The majority of lymph node lesions with PET uptake were negative or equivocal with CIM, often due to size <1 cm and hence not deemed definitely pathologic by CT size criteria. Some bone lesions with PET uptake were also not identified on CIM, apparently as a result of lack of significant associated sclerosis. Planned analyses will include clinical and imaging follow-up to diagnose all sites of true PCa metastases definitively in these patients to further assess the utility of this new PET radiotracer.

**CLINICAL RELEVANCE/APPLICATION**

[18F]DCFBC is a novel PET imaging agent that promises to be more sensitive than CIM for detection of metastatic disease in patients with prostate cancer.
SSQ12-08 Optimization of Fluorescence Detection Improves Sentinel Node Localization in Prostate Cancer Patients

Nynke S. Van Den Berg MSc (Presenter): Nothing to Disclose, Gijs Kleijnan MD: Nothing to Disclose, Oscar Brouwer: Nothing to Disclose, Cenk Acar: Nothing to Disclose, Esther Wit: Nothing to Disclose, Erik Vegt: Nothing to Disclose, Henk G. Van Der Poel: Nothing to Disclose, Florian Sterzing MD: Nothing to Disclose, Ali Afshar-Oromieh: Nothing to Disclose, Renato Valdes Olmos: Nothing to Disclose, Fijs Wilton, Bernard van Leeuwen PhD: Nothing to Disclose, Hanna Fiedler: Nothing to Disclose, Gijs Kleinjan MD: Nothing to Disclose, Henk G. Van Der Poel: Nothing to Disclose

PURPOSE
In 2011 the hybrid tracer indocyanine green (ICG)-99mTc-nanocolloid was introduced for sentinel node (SN) biopsy in prostate cancer patients. This tracer, being both radioactive and fluorescent, the radioguided approach was complemented with fluorescence guidance towards the SN(s). The current study evaluated how intraoperative fluorescence guidance during the hybrid SN procedure could be further optimized, by improving the tracer and by upgrading the fluorescence imaging hardware.

METHOD AND MATERIALS
40 patients with >10% risk of lymph node metastasis (based on Briganti nomogram) were included for a combined SN, extended pelvic lymph node dissection (ePLND) and robot-assisted radical prostatectomy procedure. The hybrid tracer was injected into the peripheral zone of the prostate under transrectal ultrasound guidance. Following preoperative SN mapping (lymphoscintigraphy and SPECT/CT), intraoperative SN identification (ICG fluorescence) was achieved using radiotracing and fluorescence imaging. Three patient groups were evaluated: In group 1 (n=11) the "old" tracer formulation was used for injection combined with the intraoperative use of the Tricam SL II + D-light C system (KARL STORZ Endoskope). In group 2 (n=13), an increased particle concentration of the hybrid tracer was injected with reduced volume. In group 3 (n=16) the fluorescence laparoscope was upgraded to an Image HUB 1 HD + D-light P system (KARL STORZ).

RESULTS
Fluorescence-based SN identification increased from 64% in group 1 to 85% in group 2 and 93% in group 3 (p-value=0.004). On follow-up, there were fewer N0 patients with a R0 margin with biochemical recurrence (PSA>0.1 ng/mL) in group 3 (Fig. 1).

CONCLUSION
By introducing a new tracer formulation and new fluorescence imaging hardware, intraoperative fluorescence SN detection improved significantly. This contributes to the refinement of the SN procedure, which in turn may improve regional staging in prostate cancer patients.

CLINICAL RELEVANCE/APPLICATION
Improved intraoperative SN identification may lead to improved regional lymph node staging prostate cancer patients, resulting in better patient-tailored therapy planning and possibly improved survival.

SSQ12-09 Impact of 68Ga-PSMA PET/CT in Staging of Prostate Cancer Patients prior to Radiotherapy

Frederik Lars Giesel MD, MBA (Presenter): Nothing to Disclose, Hannes Fiedler : Nothing to Disclose, Clemens Krayenbühl MD: Nothing to Disclose, Ali Afshar-Oromieh : Nothing to Disclose, Uwe Haberkorn MD: Nothing to Disclose, Florian Sterzing MD: Nothing to Disclose, Renato Valdes Olmos: Nothing to Disclose, Hanna Fiedler: Nothing to Disclose, Gijs Kleinjan MD: Nothing to Disclose, Henk G. Van Der Poel: Nothing to Disclose

PURPOSE
Prostate cancer risk stratification is based on PSA, T-stage and Gleason score and results in improved therapeutic decision-making. The purpose of this retrospective investigation is to evaluate the impact of 68Ga-PSMA PET as a novel pre-treatment staging method prior to radiotherapy.

METHOD AND MATERIALS
56 patients with prostate cancer were retrospectively analyzed with conventional CT and 68Ga-PSMA PET/CT imaging. 15 patients presented at diagnosis, while 41 patients presented with recurrence after combined SN, extended pelvic lymph node dissection (ePLND) and robot-assisted radical prostatectomy (RARP). 71% had high risk and 29% intermediate risk cancer according to the d'Amico criteria. On conventional CT, lymph nodes were regarded as pathologically involved if their short axis diameter was ≥10mm. Lymph node involvement in 68Ga-PSMA PET was diagnosed when a node on CT matching the diameter was ≥10mm. Lymph node involvement in 68Ga-PSMA PET was diagnosed when a node on CT matching the diameter was ≥10mm. On follow-up, there were fewer N0 patients with a R0 margin with biochemical recurrence (PSA>0.1 ng/mL) in group 3 (Fig. 1).

RESULTS
26 of 56 (46.4%) patients were changed after 68Ga-PSMA PET imaging. This included 8 patients with changes at initial diagnosis and 18 patients at the time of recurrence. 13/26 patients (50%) with recurrence were changed from N0 to N1. 9 patients (24.6%) were changed from M0 to M1a, 4 patients (15.4%) were changed from M0 to M1b and 1 patient (3.8%) was changed from Tx to T2a. In 7/15 patients (46.6%) at initial diagnosis no metastases were detected in 68Ga-PSMA PET/CT. Among the 26 patients in whom 68Ga-PSMA PET upstaged their therapy, Nodal upstaging resulted in individualized simultaneous integrated boost IMRT. Detection of distant metastases, patient management was changed from local radiotherapy to systemic therapy.

CONCLUSION
These results suggest that 68Ga-PSMA PET/CT can more accurately stage patients with prostate cancer than conventional CT leading to changes in therapy. This agent could therefore, become important for more precise treatment of patients with primary or recurrent prostate cancer.

CLINICAL RELEVANCE/APPLICATION
68Ga-PSMA PET/CT can more accurately stage patients with prostate cancer than conventional imaging modalities resulting in changes of the treatment regime.
**SSQ13**

**Musculoskeletal (Advanced Imaging Bone Structure and Tumor Characterization)**

*Scientific Papers*

**SSQ13-01**

**Finite Element Analysis Applied to High-Resolution 3 T MR Imaging of Proximal Femur, Microarchitecture Detects Lower Bone Strength in Subjects with Fragility Fractures, Compared with Controls who Do not Differ by Bone Mineral Density**

*METHOD AND MATERIALS*

This prospective study was institutional review board approved and HIPAA compliant. Written informed consent was obtained from postmenopausal women (n = 22) and without (n = 22) fragility fractures were matched for age and body mass index. All subjects underwent standard dual-energy x-ray absorptiometry. Images of proximal femur microarchitecture were obtained by using a high-resolution three-dimensional fast low-angle shot sequence at 3 T. Finite element analysis was applied to compute elastic modulus as a measure of strength in the femoral head and neck, Ward's triangle, greater trochanter, and intertrochanteric region. The Mann-Whitney test was used to compare bone mineral density T scores and elastic moduli between the groups. The relationship (R2) between elastic moduli and bone mineral density T scores was assessed.

**RESULTS**

Patients with fractures showed lower elastic modulus than did control subjects in all proximal femur regions (femoral head, 8.51-8.73 GPa vs 9.32-9.67 GPa; p = 0.04; femoral neck, 3.11-3.72 GPa vs 4.39-4.82 GPa; p = 0.04; Ward's triangle, 1.85-2.21 GPa vs 3.98-4.13 GPa; p = 0.04; intertrochanteric region, 1.62-2.18 GPa vs 3.86-4.47 GPa; p = 0.006-0.007; greater trochanter, 0.65-1.21 GPa vs 1.96-2.62 GPa; p = 0.01-0.02), but no differences in bone mineral density T scores. There were weak relationships between the elastic moduli and bone mineral density T scores in patients with fractures (R2 = 0.25-0.31, P = 0.02-0.04), but not in control subjects.

**CONCLUSION**

Finite element analysis applied to high-resolution 3-T MR images of proximal femur microarchitecture can allow detection of lower elastic moduli, a marker of bone strength, in subjects with fragility fractures compared with controls without fracture. Assessment of proximal femur strength may provide information about bone quality that is not captured by dual-energy x-ray absorptiometry.

**CLINICAL RELEVANCE/APPLICATION**

MR imaging computation of markers of proximal femur strength could be used as an adjunct clinical care tool for detection of skeletal fragility and assessment of fracture risk, which would help physicians make treatment decisions.

**SSQ13-02**

**Trabecular Bone Microstructure Assessed by Low-dose MDCT and Iterative Reconstruction Predicts Vertebral Bone Strength**

*METHOD AND MATERIALS*

High-resolution multi-detector computed tomography (MDCT) based trabecular bone microstructure analysis has improved the prediction of bone strength beyond bone mineral density (BMD) measurements in the context of osteoporosis. However, the clinical application of this method is currently limited due to the relatively high radiation exposure. Therefore, the purpose of our study was to investigate the effects of low-dose MDCT and iterative reconstruction algorithms on trabecular bone microstructure parameters.

**RESULTS**

Twelve thoracic vertebrae were harvested from three fresh human cadavers. MDCT imaging of each vertebra was performed in a water bath to simulate the soft tissue environment. Images were obtained by using a clinical 64-row MDCT scanner with a tube load and current of 120kV and 220mAs (full-dose protocol, FD) and 120kV and 70mAs (low-dose protocol, LD), respectively. Voxel size and slice thickness amounted to 300x300µm² and 60µm in both protocols. Images were reconstructed by using standard filtered back-projection (FBP) and in-house developed fully iterative reconstruction (IR) algorithms. BMD and trabecular bone microstructure parameters (histomorphometric parameters and fractal dimension) were determined in the MDCT images and correlated with failure load (FL) as assessed by destructive biomechanical testing of the vertebrae.
RESULTS

BMD significantly correlated with FL ($r=0.92$; $p<0.05$). Trabecular bone microstructure parameters showed correlations with FL in the range of $r=0.84-0.94$ (FD-FBP), $r=0.80-0.94$ (FD-IR), $r=0.84-0.89$ (LD-FBP), and $r=0.80-0.96$ (LD-IR) ($p<0.05$). The correlation coefficients were not significantly different ($p>0.05$). However, the absolute values of the trabecular bone microstructure parameters as assessed in FD-FBP, FD-IR, LD-FBP, and LD-IR were significantly different ($p<0.05$).

CONCLUSION

Trabecular bone microstructure parameters as assessed by low-dose MDCT and iterative reconstruction algorithms adequately predicted vertebral bone strength. However, absolute values of the microstructure parameters were dependent on the used protocol and reconstruction algorithm.

CLINICAL RELEVANCE/APPLICATION

Low-dose protocols and iterative reconstruction algorithms may allow the clinical use of MDCT based trabecular bone microstructure analysis in the spine with an acceptable radiation exposure to improve fracture risk prediction and therapy monitoring in the context of osteoporosis.

SSQ13-03

Predicting Pathologic Spine Fracture in Multiple Myeloma Patients Using Trabecular Microarchitecture and CT-based Finite Element Analysis: A Longitudinal Study

Miyuki Takasu MD (Presenter): Nothing to Disclose, Yoko Kaichi: Nothing to Disclose, Chihiro Tani MD: Nothing to Disclose, Shuji Date: Nothing to Disclose, Masao Kiguchi RT: Nothing to Disclose, Kazuo Awai MD: Research Grant, Toshiba Corporation Research Grant, Hitachi Ltd Research Grant, Bayer AG Research Consultant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd, Yoshihiko Kuroda: Nothing to Disclose, Akira Sakai: Nothing to Disclose

PURPOSE

Sixty percent of myeloma patients develop pathologic fractures, with the majority occurring in the spine or ribs. Determining the nature of a spine fracture in myeloma patients may be difficult due to the presence of concomitant osteoporosis. The purpose of this study was to determine whether trabecular microstructural analysis can be used to predict new pathologic spine fractures in myeloma patients.

METHOD AND MATERIALS

A total of 22 vertebral bodies from 14 patients with multiple myeloma (4 males; mean age, 64.3±4.1 years; 10 females; mean age, 61.2±7.9 years) were examined by 64-detector row computed tomography prior to follow-up CT (mean period: 10.9 months) which showed new pathologic spine fractures. Using a bone mineral calibration phantom and a 3-dimensional image analysis system, bone mineral density (BMD), trabecular parameters, and mechanical properties were calculated for three vertebrae comprising a vertebra that would become fractured and the two adjacent vertebrae. Areas of lytic lesions were also obtained using manually drawn regions of interest in the axial images containing the largest lytic lesions. Trabecular microstructural indices were expressed as ratios to mean values from the three vertebrae. For data analysis, univariate analysis was used to compare indices between vertebrae that would develop fracture and those that would not. Multivariate logistic regression analyses and receiver operating characteristic curves were also used. Values of $P < .05$ were considered significant.

RESULTS

Univariate analysis demonstrated that area of lytic lesion, trabecular spacing, structure model index, volumetric BMD (vBMD), failure load, and stiffness were significantly associated with occurrence of pathologic fracture. Multivariate analysis identified area of lytic lesion, vBMD, and failure load as significant predictors of pathologic fracture. Area under the curve was 0.779 for failure load, 0.741 for vBMD, and 0.632 for area of lytic lesion.

CONCLUSION

Trabecular microstructural analysis and finite element modeling can be used to predict new pathologic fractures in myeloma patients. Failure load and vBMD predict pathologic fracture better than existence of a lytic lesion in a vertebra.

CLINICAL RELEVANCE/APPLICATION

Factors predicting pathologic fracture in myeloma include BMD and bone strength estimated by CT-based FEM. Trabecular structural analysis can be used to predict pathologic fracture in vertebrae.

SSQ13-04

Improving Bone Strength Prediction in Proximal Femur Specimens through Quantitative Characterization of Trabecular Micro-architecture with Minkowski Functionals and Support Vector Regression


PURPOSE

Biomechanical bone strength prediction in the proximal femur is a key component of osteoporosis diagnosis and associated fracture risk estimation. Our study proposes to use advanced integral geometry texture features derived from Minkowski Functionals for purposes of characterizing trabecular bone structure on multi-detector computed tomography (MDCT) images of femur specimens. Such novel topological feature vectors are subsequently compared with conventional measures of bone mineral density (BMD) in their ability to predict bone strength, which is achieved through support vector regression (SVR).
METHOD AND MATERIALS

Axial MDCT images were acquired from 146 proximal femur specimens using a 16-row scanner and a calibration phantom. Spherical volumes of interest (VOI) were annotated in the femoral head (Huber et al., Radiology 2008) for BMD conversion and image analysis. VOIs of these BMD images were characterized through statistical moments as well as topological texture features derived from Minkowski Functionals. The specimens were then biomechanically tested by simulating a lateral fall on the greater trochanter, and failure load was recorded. All features were analyzed with multi-regression and SVR for predicting bone strength. The performance of different feature sets was compared using root-mean-square error (RMSE) and coefficient of determination ($R^2$). A Wilcoxon signed-rank test was used to compare two RMSE distributions and test for statistically significant differences in performance.

RESULTS

The best prediction performance was observed with Minkowski Functional surface ($RMSE = 0.939 \pm 0.345$, $R^2 = 0.544 \pm 0.262$) when analyzed with SVR, which was significantly lower than using mean BMD in conjunction with standard multi-regression analysis ($RMSE = 1.075 \pm 0.279$, $R^2 = 0.417 \pm 0.228$) ($p < 0.005$).

CONCLUSION

Our results suggest that biomechanical strength prediction in the proximal femur can be significantly improved through topological characterization of trabecular bone micro-architecture, when used in conjunction with advanced machine learning techniques, such as support vector regression.

CLINICAL RELEVANCE/APPLICATION

Complementing BMD characterization on MDCT images with advanced topological features and machine learning can contribute to improved diagnosis and disease progression monitoring in patients with osteoporosis.

SSQ13-06

Validation of a Mechanical Competence Parameter for the Trabecular Bone Characterization from 3T-MR

Angel Alberich Bayarri (Presenter): Nothing to Disclose, Waldir L. Roque: Nothing to Disclose, Maria Angeles Perez: Nothing to Disclose, Luis Marti-Bonmati MD, PhD: Nothing to Disclose

PURPOSE

High resolution 3T MR imaging can be used in the postprocessing and quantification of trabecular bone imaging biomarkers. However, its interpretation is intricate due to intrinsic heterogeneity. The aim of this work was to validate a bone mechanical competence parameter (MCP) for in vivo MR by combining.
morphology, connectivity, tortuosity and mechanical characteristics measured by comparison against microcomputed tomography (μCT).

**METHOD AND MATERIALS**

A total of 103 subjects (75 healthy, 28 osteoporosis) were included in the MR study. For the μCT evaluation, a different dataset of 15 in vitro cadaveric samples from human radius was considered. The MR images from distal radius metaphysis were acquired in a 3T system (Philips, The Netherlands) with an isotropic resolution of 180μm. μCT spatial resolution was 34μm (Scanco, Switzerland). The MR sequence was a 3D T1 gradient echo (TE/TR/α=5ms/16ms/25). Images were properly processed and finally binarized to obtain 3D reconstructions. Morphology algorithms were applied to calculate bone-volume/total-volume (BV/TV) ratio, trabecular thickness (Tb.Th) and trabecular separation (Tb.Sp). The Euler-Poincaré Characteristic (EPC) to assess structure connectivity and trabecular tortuosity (τ) were also analyzed. The 3D volumes were converted to Finite Element meshes to simulate uniaxial compression and calculate the elastic modulus (Eapp[X,Y,Z]). The correlations and variance of the biomarkers calculated for MR and μCT were analyzed by principal components analysis (PCA) in order to extract the relevant parameters in each modality and define the MCP.

**RESULTS**

A first principal component was found explaining 95% of the variance, both in MR and μCT data. The first component had the same parameters and almost the same weights for MR (MCP_CMR = 0.53·BV/TV-0.50·EPC+0.51·EappZ+0.45·τ) than for μCT (MCP_CμCT = 0.52·BV/TV-0.49·EPC+0.51·EappZ+0.48·τ), which was considered as the reference.

**CONCLUSION**

The results of this study validate the importance of the bone percentage, the connectivity, tortuosity and Z elastic modulus in explaining bone properties, showing almost the same weighting in MR-derived measurements than in the reference μCT using different samples. This justifies the use of MR for a complete quantitative bone characterization in Osteoporosis.

**CLINICAL RELEVANCE/APPLICATION**

Quantification of trabecular bone properties from MR can be used for the early evaluation of microstructural alterations in osteoporosis.

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**SSQ13-07**

**Differentialiation of Skeletal Multiple Myeloma and Metastases Using Additive Axial Diffusion-weighted Imaging to Standard MR Imaging:** Use of ADCmean, ADCminimum, and ADCvolume at 3.0 T

Ga-Eun Park MD (Presenter): Nothing to Disclose, Won-Hee Lee MD: Nothing to Disclose, So-Yeon Lee MD: Nothing to Disclose, Jin-Kyeong Sung MD: Nothing to Disclose, Robert Grimm, Employee, Siemens AG, Kee-Yong Ha: Nothing to Disclose, Joon-Yong Jung MD: Nothing to Disclose

**PURPOSE**

To retrospectively determine the value of adding axial diffusion-weighted imaging (DWI) to standard magnetic resonance imaging (MRI) to differentiate between skeletal multiple myeloma from metastases at 3.0 T, using mean ADC (ADCmean), minimum ADC (ADCmin), and volume ADC (ADCvolume).

**METHOD AND MATERIALS**

The institutional review board approved this HIPAA-compliant study, and informed consent was waived. The authors retrospectively analyzed 3.0 T MRI including DWI with high b value in 43 patients with treatment-naïve bone metastases or multiple myeloma. Two radiologists independently interpreted MR images for the presence of multiple myeloma by using standard MRI alone and standard MRI and axial DWI combined. ADCmean, ADCmin, and ADCvolume from ADC histograms on volume of interests were measured by two independent reviewers. Mann-Whitney U test was performed. Area under the Receiver operating characteristic curve (AUC) was obtained for the differentiation of multiple myeloma from metastases.

**RESULTS**

There were 25 patients with bone metastases and 18 patients with multiple myeloma: 38 metastases and 36 multiple myeloma lesions. ADCmean, ADCmin and ADCvolume of multiple myeloma were significantly lower than those of metastases; 752 µm²/sec (interquartile range, 619, 849), 704 (587, 773) and 747 (636, 860) for multiple myeloma; 1081 µm²/sec (813, 1248), 835 (709, 1089) and 933 (718, 1322) for metastases (P < .05). With standard MRI alone, the sensitivity, specificity and accuracy were 61%, 88%, and 77%, respectively for reader 1, and 61%, 96%, and 81% for reader 2. With standard MRI and DWI combined, the sensitivity, specificity and accuracy were 100%, 92%, and 95% for reader 1, and 94%, 96%, and 95% for reader 2. Diagnostic performance of both readers improved significantly after additional review of DWI: AUCs improved from 0.762 to 0.953 and from 0.706 to 0.950 (P < .005) for two readers. AUC of ADCvolume (0.668) was significantly lower than those of ADCmean and ADCmin (P < .005). Interobserver agreements were fair to good for ADCmean (ICC = 0.741) and excellent for ADCmin (ICC = 0.821).

**CONCLUSION**

The addition of axial DWI to a standard MRI improved the diagnostic accuracy in the differentiation of skeletal multiple myeloma from metastases, particularly using ADCmean and ADCmin.

**CLINICAL RELEVANCE/APPLICATION**

DWI should be added to standard MRI in clinical routine to help differentiate between skeletal multiple myeloma and metastases.

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**SSQ13-08**

**Evaluation of Vertebræ Marrow Health Based on MR Findings: IDEAL IQ Superior to MRS**

Huiying Chen (Presenter): Nothing to Disclose, Ziheng Zhang: Nothing to Disclose, Huishu Yuan MD: Nothing to Disclose

**PURPOSE**

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To evaluate the practicability of IDEAL IQ and magnetic resonance spectroscopy (MRS) for the quantification of vertebrae marrow fat, a significant indicator of vertebrae marrow health.

METHOD AND MATERIALS

19 healthy volunteers (F:M=6:13, age range: 23 - 66 years old) were recruited in this study with written informal consent obtained. All the attendees were performed MRI exams on a 3.0T MR scanner (GE MR750, Waukesha, WI) including routine T1WI, T2WI and single-voxel point resolved spectral selection (PRESS) MRS and IDEAL IQ. The L3 vertebrae of all the objects were scanned with the key parameters set as, for PRESS: TR/TE=2000/36ms, spectral width = 5000 Hz, NEX = 16, voxel size =20×20×18 mm3, with scan time = 2 min 24s, and for IDEAL IQ: TR/TE=8.4/1.2ms, echo train length=3, slice thickness=3mm FOV=35×35cm2, matrix=288×256, with scan time=61s. The original images from both acquisitions were post-processed automatically on GE host with the resultant spectrum and maps of fat fraction, R2*, fat and water obtained. The average fat fraction (FF) of the vertebrae marrow from IDEAL IQ was obtained by drawing a 20×20mm2 region of interest (ROI) on each of 6 successive slices, well corresponding to the voxel size of MRS. The relevance of the FFs from IDEAL IQ and MRS was evaluated through Pearson correlation analysis.

RESULTS

Due to the potential T2 and T2* effect of MRS, a certain bias of accuracy on MRS was expected. IDEAL IQ, however, was more accurate than MRS because of the application of the T2*-correction and fatty spectral modeling. As a result, IDEAL IQ FF exhibited a relatively high positive correlation with MRS FF (R2=0.88, P<0.01). In addition, the general distribution of vertebrae marrow fat was unfolded by IDEAL IQ, showing different variations along the vertebrae axial by individual. Practically, one third acquisition time of IDEAL IQ versus PRESS would contribute greatly to the throughput of patients.

CONCLUSION

Comparing with MRS, IDEAL IQ provided a rapid and accurate FF and a quasi-3D evaluation of the adipose tissue, more comprehensive in reflecting the health condition of vertebrae marrow.

CLINICAL RELEVANCE/APPLICATION

IDEAL IQ can fulfill the clinical needs on multi-vertebrae FF examination valuable in assessing vertebral marrow health, such as in predicting vertebral fracture.
PURPOSE
The cerebral metabolic rate of oxygen (CMRO2) and the oxygen extraction fraction (OEF) are important markers of neuronal function, particularly for managing ischemic stroke. In MRI, changes in local R2* or phase induced by the deoxyhemoglobin (dHb) magnetic field have been used to estimate CMRO2. However, R2* and phase images are contaminated by blooming artifacts and highly dependent on imaging parameters. Quantitative susceptibility mapping (QSM) by deconvolving MRI signal has been developed recently and can be used to accurately quantify dHb. The purpose of this study is to demonstrate the feasibility of using QSM to map CMRO2 in the healthy human brains when combined with cerebral perfusion measurements.

METHOD AND MATERIALS
Healthy volunteers (n=13) were recruited in this IRB approved MRI study using 3D gradient echo (GRE) and 3D arterial spin labeling (ASL) sequences on a 3T MRI system. dHb and Ferritin contributions to voxel susceptibility measured by QSM are resolved by performing two iso-CMRO2 measurements before and 25 minutes after an oral bolus of 200 mg caffeine. Pre- and post-caffeine QSM and CBF maps were used to generate CMRO2 and OEF maps maps using mass conservation and the assumption of iso-CMRO2 pre- and post-caffeine.

RESULTS
A statistically significant decrease in both susceptibility (-4.6 ± 1.8 ppb, p<0.01) and CBF (-23.1 ± 6.4 ml/100g/min, p<0.01) were measured in the cortical grey matter (GM) at 25 min post-caffeine compared to the pre-caffeine values. Consistent with the decrease in CBF after the caffeine challenge, OEF significantly increased from 22.5 ± 4.1% to 36.7 ± 5.3% (p<0.01) at 25 min post-caffeine. Mean CMRO2 in the cortical GM was 129 ± 21 μmol/100g/min.

CONCLUSION
QSM can be used in conjunction with cerebral perfusion measurements before and after a caffeine challenge to map CMRO2 and OEF in human brains.

CLINICAL RELEVANCE/APPLICATION
CMRO2 and OEF maps generated from QSM and ASL have the potential to provide important markers of neuronal function in ischemic stroke and tumor.
Our observations show that TBSS pipeline based on FA values derived from the NLLS method is able to identify a much higher proportion of true changes than the conventional LLS-based method.

**CLINICAL RELEVANCE/APPLICATION**

The challenges with DT fitting in obtaining an anatomically reliable FA map presents a significant confounder in TBSS. Our work indicates that NLLS can improve the reliability of TBSS analysis.

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**SSQ14-03 Fronto-Parietal Cortical Parcellation Using High Resolution Inversion Recovery MRI**

**Eyal Lotan** MD, MSc (Presenter): Nothing to Disclose, **Daniel Barazany** PhD: Nothing to Disclose, **Ido Tavor**: Nothing to Disclose, **Shani Ben-Amitai**: Nothing to Disclose, **Gahl Greenberg**: Nothing to Disclose, **Galia Tsarfaty** MPH: Nothing to Disclose, **Chen Chaim Hoffmann** MD: Nothing to Disclose, **David Tanne** MD: Nothing to Disclose, **Yaniv Assaf**: Nothing to Disclose

**PURPOSE**

We have recently showed that inversion recovery (IR) MRI can be used to segment the cortex into laminar shape clusters that represent cortical layers (i.e., IR-layers) in vivo and in 3D. The separation to clusters was done based on their T1 characteristics. In this study, we investigated whether the fronto-parietal neuroanatomical areas can be distinguished based on their IR-layer composition.

**METHOD AND MATERIALS**

On a 3.0T-MRI, healthy subjects (n=15) underwent high resolution multiple IR-MRI scans in the axial plane covering the fronto-parietal cortex. The inversion time was varied as following: 230, 432, 575, 665, 760, 920 and 1080ms. An anatomical SPGR image was acquired 1mm isotropically covering the whole brain. SPGR was analyzed using Freesurfer framework, to define the brain neuroanatomical areas. Overall 22 fronto-parietal cortical areas were selected based on their representation of the IR-MRI coverage (11 areas in each hemisphere, minimum of 10000 voxels in each area). The IR-MRI data was analyzed by Hierarchical Clustering Analysis (HCA), where a dendrogram of the IR layers among all cortical areas was computed using correlation metric scheme to quantify their similarity.

**RESULTS**

The multi IR-MRI images were analyzed using a multi-spectral clustering framework revealing distinct laminar shape clusters across the cortex. The analysis was able to define 5 significant similar and consistent IR layers. The dendrogram plot showed that the IR layer composition of homologous areas (i.e., matched areas of the left and right hemispheres), were the most similar. In addition, several areas were found to have shared IR-layer composition.

**CONCLUSION**

The IR-layer reflects the tissue microstructure, and therefore can be used as a tool for brain segmentation. We found that homologous areas in both hemispheres have similar compositions, different from other neuroanatomical areas that show distinct composition.

**CLINICAL RELEVANCE/APPLICATION**

IR-MRI is a powerful tool that should be combined with traditional measurements for discrimination of cyto-architectonic areas.

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**SSQ14-04 Atlas of Human Brain Gray Matter Connectivity**

**Anna Varentsova** BS (Presenter): Nothing to Disclose, **Shengwei Zhang** BS, BEng: Nothing to Disclose, **Konstantinos Arfanakis** PhD: Nothing to Disclose

**PURPOSE**

The purpose of this study was to develop a probabilistic atlas of gray matter (GM) connectivity through probabilistic white matter (WM) fiber tractography on an artifact-free high angular resolution diffusion-imaging (HARDI) template.

**METHOD AND MATERIALS**

HARDI template: Turboprop DTI data were acquired on 72 human subjects using a 3T MRI scanner. Diffusion tensors from all subjects were transformed to ICBM152 space using deformable registration with explicit orientation optimization (DTI-TK, PICSL, PA). Resulting transformations were applied to the raw diffusion-weighted (DW) and non-DW data of corresponding subjects. Due to differences in spatial transformations, each voxel of the combined dataset contained DW signals for 864 unique diffusion directions. Fiber orientation distribution functions (FOD) were produced using constrained spherical deconvolution. Tractography: Probabilistic tractography was performed on the resulting HARDI template using MRtrix, with seeds placed at the WM-GM interface. Gray matter atlas: The raw T1-weighted data from all subjects were segmented into 42 cortical and subcortical GM regions per hemisphere using FreeSurfer. The GM labels from all subjects were then transformed to ICBM-152 space using the transformations generated above. Each GM voxel in ICBM-152 space was labeled with a multi-atlas approach using the transformed labels from all subjects and a vote-rule. HARDI template and GM atlas used in the study are parts of IIT Human Brain Atlas project (https://www.nitrc.org/projects/iit2).

**RESULTS**

For each pair of GM labels, the generated atlas contains a map of the probability a WM voxel belongs to the connection of the two labels. The resulting maps of connectivity are in general agreement with known brain anatomy.

**CONCLUSION**

This work has generated a digital atlas of human brain GM connectivity based on probabilistic tractography on an artifact-free HARDI template.

**CLINICAL RELEVANCE/APPLICATION**

The new atlas can be used for atlas-based segmentation in ROI studies, as a reference for spatial
Multiband pulse sequence design is a recent research tool that facilitates simultaneous acquisition of multiple slices for diffusion or functional MRI. This can be used to accelerate MRI acquisitions for user-specified temporal, spatial or angular resolutions. We investigated the potential of this new multiband technology to accelerate routine diffusion MRI acquisitions in clinical patients.

**METHOD AND MATERIALS**

We obtained both routine and multiband 2-slice acceleration of a diffusion MRI sequence for 25 consecutive clinical outpatients (mean age 46 ± 21 yrs, 18 female). This typical cohort for our practice included patients with normal MRI except for white matter changes (7), multiple sclerosis (4), vascular malformations (2) and postsurgical follow-up brain tumors (7). The routine diffusion MRI sequence at 3-T with a 20 channel head and neck coil had 1.5-mm in-plane resolution and 5-mm slices (3 directions, 2 averages, b-values = 500 and 1000 s/mm2). Diffusion trace images for both techniques were randomized and anonymized, then compared side-by-side by 3 board-certified neuroradiologists for diagnostic quality, artifacts and signal-to-noise ratios (SNR). Quantitation of the apparent diffusion coefficient (ADC) for frontal horn CSF and the centrum semiovale also were compared.

**RESULTS**

In all 25 patients, the multiband diffusion MRI acquisition was successfully acquired, free of major artifacts and considered of equivalent diagnostic quality. Multiband 2-slice acceleration reduced diffusion MRI sequence relaxation time to 3.9 sec and reduced overall scan time by 38% to 81 sec. The gray-white contrast in trace diffusion images was unchanged suggesting increased T1-weighting was negligible. There was a subtle mild decrease in SNR for the posterior fossa that did not compromise perceived image quality. There was no significant difference for the ADC of the centrum semiovale (unpaired t-test, P > 0.05) and CSF ADC differed by only 2%.

**CONCLUSION**

Multiband sequences can be used to reduce routine diffusion MRI acquisitions in clinical patients by 38% without compromising image quality. This novel research technology should greatly facilitate translation of multiple diffusion-based brain mapping techniques to real patients.

**CLINICAL RELEVANCE/APPLICATION**

Multiband sequence acceleration may accelerate clinical MRI acquisitions and finally allow translation of time-intensive diffusion-based brain mapping techniques to real clinical patients.
We implemented a shortened sequence without compromising accuracy of volumetric analysis.

**CLINICAL RELEVANCE/APPLICATION**
From quantitative brain imaging, easily implemented into clinical practice for application in memory-impaired patients who might benefit from reducing the scan time of brain volumetric 3D IR-TFE sequence by 45% from 9 min to 5 min. This can be achieved by applying SENSE factor of 2 and increasing the slice-oversampling factor by 10%, which allows us to maintain high correlation for brain volumetric (ρ=0.9977) as well as asymmetric index (ρ =0.9257). (Graph 1).

**CONCLUSION**
The volume of brain structures was very similar between 9 min and 5 min scans. Average difference in brain volume of brain structures was 0.32 cc, ranging from 0.0 cc to 2.34 cc. Spearman's nonparametric correlation shows extremely high correlation for brain volumetric (ρ=0.9977) as well as asymmetric index (ρ =0.9257). (Graph 1).

**METHOD AND MATERIALS**
All MR data was acquired on a 3T wide-bore whole-body scanner. Volumes of 12 automatically segmented (NeuroQuant) brain structures in each side of brain (total of 24 structures per subject), asymmetric index (R vs. L) of the 12 brain structures, and age adjusted percentile of hippocampal volume were recorded in each of the 12 brain structures, and age adjusted percentile of hippocampal volume were recorded in all four subjects. Both MR acquisition protocols are exactly the same except for application of SENSE factor 2 in R-L direction and an increase in slice oversampling factor from 1.28 to 1.4 for 5 min scan. Spearman's correlation was used for the analysis of asymmetric index and actual volume measurements of the anatomic brain structures.

**RESULTS**
The volume of brain structures was very similar between 9 min and 5 min scans. Average difference in brain volume of brain structures was 0.32 cc, ranging from 0.0 cc to 2.34 cc. Spearman's nonparametric correlation shows extremely high correlation for brain volumetric (ρ=0.9977) as well as asymmetric index (ρ =0.9257). (Graph 1).

**CONCLUSION**
By applying SENSE factor of 2 and increasing the slice-oversampling factor by 10%, we were able to reduce the scan time of brain volumetric 3D IR-TFE sequence by 45% from 9 min to 5 min. This can be easily implemented into clinical practice for application in memory-impaired patients who might benefit from quantitative brain imaging.

**CLINICAL RELEVANCE/APPLICATION**
Volumetric brain analysis can provide valuable information for characterizing neurodegenerative disease. We implemented a shortened sequence without compromising accuracy of volumetric analysis.
Preliminary Study of Distribution and Age-related Changes of Brain Iron Deposition in Healthy Subjects by Susceptibility Mapping

chai chao MD (Presenter): Nothing to Disclose, Shuo Yan MD: Nothing to Disclose, Shuang Xia MD: Nothing to Disclose, Wen Shen: Nothing to Disclose

PURPOSE
To evaluate the distribution and age-related changes of brain iron deposition in healthy people using MR susceptibility mapping (SM).

METHOD AND MATERIALS
63 healthy right-handed volunteers (male 24, female 39, age 20~63 years, mean 37±13 years) underwent the SWI scan to get the unfiltered phase and magnitude images, SM was reconstructed from the unfiltered phase and magnitude images by Susceptibility Mapping and Phase Artifacts Removal Toolbox (SMART) software. The regions of interest of bilateral frontal white matter and deep gray matter nuclei were outlined manually and the susceptibility was measured by Signal Processing in Nuclear Magnetic Resonance (SPIN). The correlation between the susceptibility and iron concentration cited from Hallgren and Sourander’s post-mortem brain study was calculated. Wilcoxon test was applied to compare susceptibility of bilateral frontal white matter and deep gray matter nuclei. Spearman correlation analysis between the susceptibility of frontal white matter and deep gray matter nuclei and age was calculated.

RESULTS
There is a strong positive correlation between the susceptibility and iron concentration ($r=0.905$, $p=0.002$): (1) The susceptibility of globus pallidus was highest, the second was substantia nigra, the least susceptibility was seen in frontal white matter, which is same with the post-mortem brain study; (2) There was significant difference in the susceptibility of bilateral caudate head, substantia nigra, red nucleus and dentate nucleus ($p<0.05$); (3) The gender-related differences in susceptibility of bilateral globus pallidus between male and female subjects were statistically significant, the left $p=0.024$, the right $p=0.016$; (4) There were positive correlations between age and susceptibility of bilateral caudate head, putamen, red nucleus and dentate nucleus ($p<0.05$); the mean susceptibility values of these nuclei also had positive correlations with age ($p<0.05$).

CONCLUSION
SM can accurately evaluate the brain iron content, which is correlated with the post-mortem brain study and iron deposition of bilateral caudate head, putamen, red nucleus and dentate nucleus increase with aging.

CLINICAL RELEVANCE/APPLICATION
Abnormal brain iron deposition has been implicated in the pathogenesis of some neurodegenerative diseases. To know the normal brain iron changes with aging is helpful to diagnose the disease, understand the pathologic mechanism and guide the clinical therapy.

SSQ15
ISP: Nuclear Medicine (Cardiovascular Imaging)

SSQ15-01 Nuclear Medicine Keynote Speaker: New PET Cardiovascular Biomarkers—Beyond Perfusion and Viability
Robert J. Gropler MD (Presenter): Advisory Board, Bracco Group Advisory Board, GlaxoSmithKline plc Advisory Board, Pfizer Inc Advisory Board, Bayer AG Research grant, GlaxoSmithKline plc Research grant, Pfizer Inc Research grant, Clinical Data, Inc Research grant, Lantheus Medical Imaging, Inc

SSQ15-03 Comparison in Diagnostic Performance between Single Semi-supine Acquisition and 2-position (Upright and Supine) Acquisition in Myocardial Perfusion Imaging with a Solid State Dedicated Cardiac Scanner
KA CHUN YIP (Presenter): Nothing to Disclose, YU CHING LAU: Nothing to Disclose, Sirong Chen: Nothing to Disclose, William Cheung: Nothing to Disclose, Chi Lai Ho: Nothing to Disclose

PURPOSE
Upright (U) and supine (S) positions for myocardial perfusion imaging (MPI) are routinely performed on a CZT solid state cardiac scanner with variable angle capacity. It is based on the assumption that diaphragmatic attenuation artifacts are normalized or shifted in location at different positions to differentiate from true perfusion defects. We aim to evaluate if a single semi-supine (SS) position with lumbar support could minimize these artifacts and have a diagnostic accuracy comparable to a UandS MPI.

METHOD AND MATERIALS
36 patients (M=32, mean age=65±12y, mean BMI=25.3±4.1) suspected of coronary artery disease (CAD) underwent same day Tc-99m tetrofosmin rest-stress MPI on a CZT solid state cardiac scanner (D-SPECT, Spectrum Dynamics) in 3 positions: U, S and SS (40° with lumbar support, detector head reclining), all with 1 M left ventricular cored counts. Reconstructed images by standard algorithms were individually interpreted by 2 experienced NM physicians in consensus for discriminating perfusion abnormalities from inferoapical (IA) or inferior wall (IW) artifacts. All patients had invasive coronary angiography (ICA) within 3 months after MPI, with >70% luminal stenosis as positive.

RESULTS

ICA confirmed 34 patients with CAD. The patient-based sensitivity and accuracy of SS MPI were 85% (29/34) and 89% (30/36), respectively, similar to those for combined UandS MPI (sensitivity 85%, accuracy 86%), 12/36 (33%) patients had IA artifacts on U MPI but all were partially or completely normalized on SS images. 7/36 (19%) large patients with BMI 25.4 - 44.8 showed fixed and mild IW artifacts on SS MPI significantly less severe than those on S MPI.

CONCLUSION

Single SS MPI with lumbar support could minimize IA and IW artifacts commonly appeared on U and S MPI. It has sensitivity and accuracy comparable to a 2-position UandS MPI for detection of CAD by D-SPECT.

CLINICAL RELEVANCE/APPLICATION

Pre-acquisition optimization to improve raw data signal reception is as important as post-acquisition data processing. This may also improve imaging time and patient through-put.

SSQ15-04

Characterization of the Difference in Appearance between Supine and Prone Myocardial Perfusion Imaging on a High-efficiency Pinhole SPECT System

Brandon Augustus Howard MD (Presenter): Nothing to Disclose, Jorge Daniel Oldan MD: Nothing to Disclose, Robert Pagnanelli RT: Nothing to Disclose, Salvador Borges-Neto MD: Speakers Bureau, General Electric Company

PURPOSE

Cadmium-zinc telluride (CZT) detectors promise improved resolution, scan times, and radiation dose in myocardial perfusion imaging (MPI). Traditional Anger cameras suffer from attenuation artifact, which in men is seen in the inferior wall. Specificity for CAD reportedly improves when prone imaging is added to supine imaging, and this practice has become commonplace. However, a systematic study of the difference in uptake between prone and supine imaging has not been undertaken.

METHOD AND MATERIALS

Twenty patients referred for MPI underwent rest (supine and prone) and stress (supine and prone) Tc-99m tetrofosmin imaging on a CZT camera (GE Discovery NM 530c) between Oct. and Nov. 2013. One patient was excluded due to bowel uptake. Patient were 18 males and 1 female, with ages 35-76 (mean 60). Thirteen had known CAD and 6 had cardiac risk factors. Two board certified nuclear medicine physicians who were blinded to the clinical information, stress test results, and gated study scored perfusion using the 17 segment model and five point scale. Mean perfusion score (MPS) was computed for each segment and summed rest and stress scores (SRS, SSS) for each of the four conditions. Student’s T test with Bonferroni correction was used for statistical analysis.

RESULTS

SSS significantly decreased from supine to prone (SP) (p=0.00622). Perfusion in the basal inferior wall significantly increased from supine to prone at rest (p=0.0013) and at stress (p=0.000000103). Removal of the basal inferior segment abolished the difference in SSS. Trends from SP not meeting cut-off for significance (p=0.00147) were as follows: rest perfusion increased in the mid- inferior segment (p=0.00592); stress perfusion increased in the basal inferoseptal, mid- inferoseptal, and mid- inferior segments (p=0.00447, p=0.00231, and p=0.00325, respectively). No other significant differences were noted.

CONCLUSION

Prone imaging results in an overall decrease in summed stress score (SSS) compared to supine, and this difference is solely due to increased tracer uptake in the basal inferior segment, Prone perfusion in the basal inferior segment is also significantly greater on prone than supine imaging at rest, with no significant difference in SRS.

CLINICAL RELEVANCE/APPLICATION

Prone imaging results in increased tracer uptake in the basal inferior wall at stress and rest versus supine, and decreases overall summed stress score. Further study of prognostic and gender-specific effects is needed.

SSQ15-05

Feasibility Study of a Novel 6 Receiver Channel PET-optimized MR Coil for Hybrid Imaging of the Carotids


PURPOSE

Recently, hybrid PET/MR imaging of atherosclerosis was compared to conventional PET/CT imaging concluding potentially an enhanced applicability of PET/MR carotids imaging in patients with no overt atherosclerosis. Regarding the higher soft tissue contrast of MR imaging simultaneous PET/MR imaging of the carotid artery wall and particularly imaging of carotid artery atherosclerosis is appealing. Thus, we present an evaluation of a PET-optimized MR-carotids coil for advanced imaging of atherosclerosis.

METHOD AND MATERIALS
A novel 6 receiver channel coil for simultaneous PET/MR imaging of the carotids was developed. To examine the overall performance, signal-to-noise ratio (SNR) and image quality was evaluated in phantoms and volunteers (N=5, using a T1 - TSE-darkblood-, a T2-fat saturated, a DCE-test- and a 3D MP-RAGE – sequence as well as 10 min PET acquisitions). The MR-image quality was assessed by a blinded diagnostic evaluation against the clinical standardized procedure using images. Using the same clinical protocols the PET performance was assessed using homogeneous phantoms (FDG, 80- 100MBq).

RESULTS
MR image quality for the novel PET/MR carotids coil showed significant advantages over the clinical standard imaging using a dedicated MR-only coil. The quantitative validation for the PET performance showed that the average attenuation in homogeneous phantoms in the volume affected by the two coil elements (VOI: 8cm diameter by 12cm length) varibaf the new PET-optimized MR coil (mean ± SD = 0,82 ± 0,005 SUV) is only a little lower than using a conventional MR-only coil (mean ± SD = 0,80 ± 0,02 SUV). However, regarding the mean variation the variability of a conventional coil (min. value – max. value = 0,78-0,86 SUV) being three times higher than the newly developed PET/MR carotids coil (min. value - max. value = 0,81-0,83 SUV).

CONCLUSION
Considering the small VOI for imaging atherosclerosis in the carotids the novel PET-optimized 6 receiver channel coil is capable of simultaneous hybrid PET/MR imaging with excellent MR-image quality and homogeneous PET tracer attenuation for improved tracer uptake quantification.

CLINICAL RELEVANCE/APPLICATION
Simultaneous hybrid PET/MR imaging of carotids using the newly developed coil is able to advance diagnostic evaluation of atherosclerosis.

SSQ15-06

Limitations of the Most Diseased Segment for Use in 18FDG Vascular Imaging of the Aorta

Mark Allan Ahlman MD (Presenter): Nothing to Disclose , Veit Sandfort MD : Nothing to Disclose , Davis M. Vigneault BS : Nothing to Disclose , Nehal Mehta : Nothing to Disclose , David A. Bluemke MD, PhD : Research support, Siemens AG

PURPOSE
Changes in FDG arterial activity within the most diseased segment target to background ratio (MDS TBR) has been used to measure response to treatment. MDS TBR is calculated by averaging the maximum arterial activity of arterial axial slices centered atherosclerotic plaque (SUV), divided by the mean venous activity. For a normal adult patient population, we evaluate the MDS value and location using differing image reconstruction algorithms and methods for calculation.

METHOD AND MATERIALS
FDG PET-CT images were obtained at 2 hrs uptake time with a Siemens Biograph 128 mCT. Transaxial reconstruction of the descending aorta at 1.5mm slice thickness resulted in 200-300 images covering the descending aorta (D Ao) from the arch to the bifurcation. PET-CT images were obtained in 17 hyperlipidemic subjects (age 56.8 ± 12.8, 59% female). Image reconstruction (256x256 matrix) was performed using both high definition (HD) and time-of-flight (TOF) algorithms. For either reconstruction, aortic MDS TBR was identified and the corresponding MDS TBR at the same slice location was measured in the second reconstruction. Any difference in MDS slice location was recorded. The MDS TBR was measured on both reconstructions using both 3- and 5- contiguous slices for comparison.

RESULTS
MDS was located on the same slice between HD and TOF volumes in only 2/17 (11%) of subjects, and was 7.4 ± 6.6 cm apart on average. There was no difference in MDS TBR between HD and TOF when the same slice measurement was used (e.g. 3-slice HD vs 3-slice TOF). However, there was a higher value of 3-slice MDS TOF compared to 5-slice methods for either reconstruction (p<0.01). Specific to location where TOF MDS TBR was found for 3- and 5-slice methods, the reference HD MDS TBR was lower (p<0.001 and p<0.001, respectively). Similarly, where found on HD images, the reference MDS TBR on the TOF reconstruction was lower (p<0.001 and p<0.01, respectively).

CONCLUSION
MDS location and value is highly dependent on reconstruction algorithm. Independent of MDS TBR length, values will regress to a lower value on the same slice on alternate PET reconstructions evaluated.

CLINICAL RELEVANCE/APPLICATION
Designed to quantify changes in FDG PET arterial inflammation in research as well as for clinical application for cardiovascular risk stratification, we evaluate the MDS TBR with different reconstruction algorithms and methods for calculation.

SSQ15-07

Cardiovascular Consequences of Liver Cirrhosis: Diagnosis of Portal Hypertension and Prediction of Pulmonary Consequences on Equilibrium Radionuclide Ventriculography

Laurent Dercle MD (Presenter): Nothing to Disclose , Thomas Cognet : Nothing to Disclose , Olivier Lairez : Nothing to Disclose , Camille Christol : Nothing to Disclose , Mania Duisai : Nothing to Disclose , Marie-Angele Robic : Nothing to Disclose , Isabelle Berry : Nothing to Disclose , Christophe Bureau : Nothing to Disclose

PURPOSE
Liver cirrhosis leads to portal hypertension and hyperdynamic circulation that are responsible for hepato-pulmonary syndrome and portopulmonary hypertension. The aim of this study was to determine if gated blood pool SPECT could become a one-stop-shop procedure in order to predict the cardiovascular complications of liver cirrhosis.

METHOD AND MATERIALS
100 patients referred for gated blood pool SPECT were prospectively included: 16 cirrhotic patients and a control group (n=84). The parameters of the function of both ventricles were measured: global, regional, systolic, diastolic, synchrony and Spleno-Hepatic Score (SHS). The SHS is a new score of the severity of complications of liver cirrhosis.
the vascular redistribution from liver to spleen due to the portal hypertension and is calculated according to the formula: \( SHS = \frac{S25 \times LSD}{H25 \times LHD} \). LSD: longest splenic diameter, LHD: longest hepatic diameter, H25 (S25): mean activity per pixel at the center of the right liver (spleen) in a 25 pixel ROI. The gold standard for the measurement of the portal pressure and of the mean pulmonary arterial pressure were catheter measurement.

**RESULTS**

Clinical parameters were not statistically different in the two groups. Biological parameters related to liver cirrhosis were statistically different. Concerning the treatment, the proportion of diuretics and inhibitors of angiotensin converting enzyme was significantly higher in the cirrhotic group. By multivariate regression analysis, two parameters were independent predictors of liver cirrhosis: SHS and LVEF. Odds Ratio were: 3.7 for SHS (95Cl: 1.4-9.6) and 1.2 for LVEF (95Cl: 1.0-1.4). According to ROC curve analysis, the best thresholds were SHS>0.73 (AUC:0.97 (95CI: 0.94-1.00), Sensitivity 88%, Specificity 95%) and LVEF>76% (AUC: 0.90 (95CI: 0.81-0.99), Sensitivity 80%, Specificity 83%). In the liver cirrhosis group, the strongest correlation with the mean pulmonary arterial pressure was for SHS (r=0.56).

**CONCLUSION**

Gated blood pool SPECT is efficient to predict the cardiovascular complications of liver cirrhosis. SHS and LVEF are two independent parameters that assess the severity of the vascular redistribution and the hyperdynamic circulation. An increased SHS could be considered as a predictor of an increased pulmonary arterial pressure.

**CLINICAL RELEVANCE/APPLICATION**

Gated blood pool SPECT could become a one-stop-shop procedure in liver cirrhosis and predict portal hypertension and hyperdynamic circulation.

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**SSQ15-08**

The Redirection of Outpatient Radionuclide Myocardial Perfusion Imaging (MPI) from Offices to Hospital Facilities as a Result of Code Bundling – Cost Implications

David C. Levin MD (Presenter): Consultant, HealthHelp, LLC Board of Directors, Outpatient Imaging Affiliates, LLC, Bhavik Patel MD : Nothing to Disclose, Laurence Parker PhD : Nothing to Disclose, Vijay Madan Rao MD : Nothing to Disclose

**PURPOSE**

In 2010, the CPT codes for MPI, LV wall motion, and LV ejection fraction were bundled together into a single new code that sharply reduced reimbursement. Other policy decisions in recent years have adversely affected reimbursement. As a result, many cardiology office practices migrated into hospital employment. Our purpose was to see if this led to a noticeable shift in place-of-service of these exams from offices to hospital outpatient departments (HOPDs). This would lead to higher costs, since outpatient imaging reimbursements to hospitals are considerably higher than those to offices.

**METHOD AND MATERIALS**

The nationwide Medicare Part B databases for 2002 to 2012 were the data sources. The primary CPT codes for MPI were selected and utilization rates per 1000 beneficiaries were calculated for outpatients. Medicare's place-of-service codes were used to identify elective outpatient studies done either in private offices or HOPDs. Specialty codes identified those exams done by radiologists (including nuclear medicine physicians), cardiologists, and other physicians. Trends were analyzed over the study period.

**RESULTS**

The private office MPI utilization rate per 1000 rose from 37.8 in 2002 to a peak of 57.3 in 2008 (+52%). It dropped slightly in 2009, then began a steady and steeper decline, dropping to 35.0 in 2012 (-39% vs peak). In HOPDs, the rate dropped somewhat from 18.8 in 2002 to 15.6 in 2008 and 2009 (-17%), but then increased to 20.6 in 2012 (+32% vs nadir). Most outpatient MPI scans are done by cardiologists and their utilization trends generally mirrored the trends for total MPIs by all specialists as a group. On the other hand, radiologists' use of MPI has declined steadily in both venues in recent years.

**CONCLUSION**

In recent years, outpatient MPI use has declined sharply in offices. This is likely due to lower reimbursement - principally resulting from code bundling - which has led many cardiologists to close their offices and become hospital employees. At the same time, MPI use in HOPDs has begun to increase. This shift is an unfavorable result of code bundling. Costs will rise because Medicare pays HOPDs more than it does private offices for the scans. In addition, the role of cardiologists and nuclear medicine physicians has been diminished.

**CLINICAL RELEVANCE/APPLICATION**

not applicable
**RESULTS**

The independent samples t-test (p < 0.05) shows a statistically significant difference between the averages of BWI coefficient (R) was calculated. Scores were also correlated with forced expiratory volume in one second (FEV1). Both scores were reproducible (R = 0.85 to 0.88 for HBS and 0.85 to 0.90 for MRS). The scores correlated significantly with FEV1 (HBS: R = -0.50 to -0.58 and MRS: -0.51 to -0.63, P<0.001). The highest value in the category “centrilobular nodules” was added. To evaluate interobserver reliability Pearson’s correlation coefficient (R) was calculated. Scores were also correlated with forced expiratory volume in one second (FEV1). The paired t-test (p < 0.05) showed a statistically significant difference between the averages of IVIM coefficients between the first and second examination in the “exacerbation” group while not showing a statistically significant difference in the “stable” group.

**CONCLUSION**

MR is a feasible tool to follow CF patients with exacerbation.

**CLINICAL RELEVANCE/APPLICATION**

MR is able to distinguish reversible lung changes from irreversible with DWI. It can enhance the management of CF patients with exacerbation.

**RESULTS**

Both scores were reproducible (R = 0.85 to 0.88 for HBS and 0.85 to 0.90 for MRS). The scores correlated significantly with FEV1 (HBS: R = -0.50 to -0.58 and MRS: -0.51 to -0.63, P<0.001). The highest value in both scores was achieved by reader 1. With a baseline FEV1 of 50% to 100% 7/30 patients showed a statistically significant decrease (>3%/year) over period of 2 years. Instead for the DWI score, the independent samples t-test (p < 0.05) showed a statistically significant difference between the averages of DWI score between the exacerbation group and the stable group at the first examination but not at the second examination. The independent samples t-test (p < 0.05) showed a statistically significant difference between the averages of IVIM coefficients between the first and second examination in the “exacerbation” group, while not showing a statistically significant difference in the “stable” group.

**CONCLUSION**

The results indicate that both scores are reproducible and clinical useful. The MRS may have the higher prognostic performance.
SSQ16-04

Humidifier Disinfectant-associated Children’s Interstitial Lung Disease: CT Features, Histopathologic Correlation between Survivor and Non-survivor

Hee Mang Yoon MD (Presenter): Nothing to Disclose, Eun Lee: Nothing to Disclose, Jin Seong Lee MD: Nothing to Disclose, Kyung-Hyun Do MD: Nothing to Disclose, Soo-Jong Hong: Nothing to Disclose, Young Ah Cho: Nothing to Disclose

PURPOSE

From 2006, epidemics of a fatal lung injury associated with humidifier disinfectant (DI) in children were observed. The aim of this study was to report radiologic findings with pathologic correlation of the disease and to compare the CT findings between survivors and non-survivors.

METHOD AND MATERIALS

Forty seven children were hospitalized with acute lung injury associated with DI inhalation (mean age=27.4±12.4 months) and divided into two groups: survivors (n=25) and non-survivors (n=22). CT findings including the presence and extent of consolidation and centrilobular ground-glass opacity (cGGO) were evaluated for hazard ratio (HR) in each group. Histopathologic correlation was performed in 25 patients.

RESULTS

CT scans showed the characteristic features according to the stage of disease progression. The early stage was characterized by patchy consolidation in bilateral basal lungs. In advanced stage, it evolved into cGGO involving the entire lung. In resolving stage, cGGO was resolved and slowly changed into the faint centrilobular nodules. Pathologic review revealed, in early stage, predominant denuded bronchiolar epithelium with bronchocentric fibroblast proliferation and intra-alveolar exudate. In advanced state, bronchial damage with fibroblastic proliferation was more profound. CT showing resolving stage does not exist in non-survivors. The time interval between the presentation of initial symptom and CT scan showing early stage was significantly shorter in non-survivors than in survivors (9days and 14days respectively, p=0.021). Consolidation over 30% of lung volume was the predictor of poor prognosis (p=0.014, HR=2.932) while cGGO over 30% of the lung was that of good prognosis (p<0.001, HR=0.124).

CONCLUSION

The distinctive CT feature was chronological changes from early consolidation to cGGO. In survivors, lesions eventually changed into the faint centrilobular nodules. It was correlated with histopathology. Wide area of consolidation in early stage results in the poor prognosis of disease.

CLINICAL RELEVANCE/APPLICATION

This series of patients showed the inhalation injury caused by one kind of chemicals. Radiological understanding plays a pivotal role in management and prediction of outcome in chemical pneumonitis.

SSQ16-05

Pulmonary MRI in the NICU: Initial Experience Imaging BPD and CDH with a Small-Footprint Scanner

Laura Walkup PhD (Presenter): Nothing to Disclose, Jean A. Tkach PhD : Nothing to Disclose, Robert Thomen: Nothing to Disclose, Stephanie Merhar: Nothing to Disclose, Raouf S. Amin MD : Nothing to Disclose, Paul Kingma: Nothing to Disclose, Jason C. Woods PhD: Nothing to Disclose

PURPOSE

Neonatal pulmonary imaging poses difficulties because of small size, respiratory motion, and the delicate nature of moving infants and from the NICU. While CT is the current clinical gold standard for diagnostic pulmonary imaging, it is not routine for the longitudinal evaluation of most neonatal pulmonary abnormalities within the NICU. Our goal was to use our institution’s one-of-a-kind NICU MRI scanner to investigate the feasibility of performing pulmonary MRI in conditions that are present in our NICU (bronchopulmonary dysplasia [BPD] and congenital diaphragmatic hernia [CDH]), since they are poorly understood both physiologically and radiologically.

METHOD AND MATERIALS

Pulmonary MRI was performed on a small-footprint 1.5T MRI scanner developed for orthopedic use (marketed as GE Optima MR430s) that was modified and adapted for use in our institution’s NICU. Free-breathing FrFSE (TE/TR 3000/11.8, ETL=5 or 11) and FGRE (TE/TR 1.9/6.8, 7-10° FA) images were obtained for a small group of non-sedated NICU patients (1 BPD, 2 CDH, 3 control). Images were evaluated qualitatively and a quantitative assessment of approximate lung density obtained by normalizing the lung signal to nearby soft tissues.

RESULTS

Both FrFSE and GRE images were generally of high (diagnostic) quality and demonstrated very few motion artifacts for quietly-breathing babies, with parenchymal SNR of around 5. Pulmonary abnormalities were visually apparent in many cases: pleural effusion, multiple local areas of atelectasis, alveolar simplification, and parenchymal opacities were all observed, with quantitative results that matched visual inspection. MR images for one CDH patient revealed regions of air-trapping undetected in chest x-ray.

CONCLUSION

We have demonstrated that free-breathing pulmonary MRI in the NICU is feasible and can produce diagnostic-quality images that may be used in detection and longitudinal assessment of various pulmonary abnormalities, including BPD and CDH. The MR images obtained were of diagnostic-quality, compared well to CT in the opinion of our clinical radiologist, and did not require sedation.

CLINICAL RELEVANCE/APPLICATION

Application on thoracic/pulmonal MRI in patient suffering from cystic fibrosis for follow up and therapy monitoring. Detection and evaluation of the severity of pulmonal findings in cystic fibrosis and other pulmonary diseases.
MR Lung Perfusion in 2-year old Children After Congenital Diaphragmatic Hernia — Comparison of Children after ECMO-therapy and Children without ECMO-requirement

Meike Weidner (Presenter): Nothing to Disclose, Frank G. Zoellner : Nothing to Disclose, Claudia Hagelstein MD : Nothing to Disclose, Stefan Oswald Schoenberg MD, PhD : Institutional research agreement, Siemens AG, Katrin Zahn : Nothing to Disclose, Thomas Schaible : Nothing to Disclose, Wolfgang Neff MD, PhD : Nothing to Disclose

PURPOSE

In severe cases of congenital diaphragmatic hernia (CDH), extracorporeal membrane oxygenation (ECMO) therapy is required. Later on, lung morbidity defines development. Lung function measurement is therefore crucial but limited in 2-year old children. With MRI, lung perfusion can be measured and is known to be reduced on the ipsilateral side after CDH. In this study we investigated if 2-year old children after ECMO-therapy show reduced MR-perfusion values as a sign of more severe lung hypoplasia in comparison to children without ECMO-requirement.

METHOD AND MATERIALS

DCE-MRI was performed in 38 children (24.3±1.8 month; 15 with ECMO-therapy; 23 without ECMO-therapy) after CDH repair using a 3D TWIST sequence (temporal resolution 1.5 sec ; voxel size: 2x2x2 mmCubed). 0.05 mmol/kg body weight of contrast agent (Dotarem, Guerbet, France) was administered. Pulmonary blood flow (PBF), pulmonary blood volume (PBV) and mean transit time (MTT) were calculated for both lung sides by placing 6 cylindrical regions of interest (ROI) in the apical, middle and basal lung respectively. Additionally, the ratio of contralateral to ipsilateral lung was calculated for all parameters.

RESULTS

15 of 38 children (39%) required ECMO-therapy as neonates. In all children, PBF and PBV were significantly reduced on the ipsilateral side in comparison to the contralateral side (p always

CONCLUSION

2-year old children after ECMO-requirement as neonates show significantly reduced MR perfusion values on the ipsilateral lung in comparison to children without ECMO-requirement. Perfusion values of the contralateral lung are not significantly different. MR perfusion measurements therefore reflect the severity of lung hypoplasia and are helpful in follow-up investigations.

CLINICAL RELEVANCE/APPLICATION

MR-perfusion values reflect the severity of lung hypoplasia after CDH as children after ECMO-therapy show more reduced values. Therefore, MR-perfusion measurements are advisable for follow-up.

Validation of a Novel Parameter for the Evaluation of Pectus Excavatum: The Correction Index

Javier Vallejos MD, MBA (Presenter): Nothing to Disclose, Maria Eugenia Maccarone MD : Nothing to Disclose, Carlos Capunay MD : Nothing to Disclose, Marcelo Martinez Ferro : Nothing to Disclose, Patricia M. Carrascosa MD : Research Consultant, General Electric Company

PURPOSE

To validate the new correction index (CI) to determine severity in patients with pectus excavatum and discriminate from normal patients.

METHOD AND MATERIALS

Retrospective analysis of prospectively collected chest computed tomographic data in PE (N=87) and controls (N=24). We calculated HI in a standard fashion. For the CI, we drew a horizontal line across the anterior spine and measured two distances: the minimum distance between the posterior sternum and the anterior spine (D1) and the maximum distance between the line placed on the anterior spine and the inner margin of the most anterior portion of the chest (D2). The difference between these two lines (D1 and D2) is the amount of defect the patient has in their chest. KCI formula was as follows: D2-D1/D2*100.

RESULTS

The mean age did not vary between both groups (19.5±9.3 years for PE and 22±2.9 for controls, p=0.92). In the table, we illustrate the HI and CI values from our study and St. Peters et al. In our study, 10/87 (11.4%) patients with PE had overlapped with controls (area under the ROC curve 0.48, p=0.67) compared to 47% in St. Peters et al. Using the CI, only 2/87 (2.3%) patients overlapped (area under ROC curve 0.99, p<0.001), while no overlap was reported.

CONCLUSION

The use of CI resulted in less overlap than with HI in both studies; however, overlap between PE and controls with HI depended on the baseline severity of the PE population.

CLINICAL RELEVANCE/APPLICATION

The Haller index (HI) is the most commonly used parameter to determine surgical candidacy in patients with pectus excavatum (PE). However, the use of the HI cannot discriminate between PE and normal patients. This new correction index expresses the percentage of thoracic depression represented by the sternal defect, demonstrating optimum discrimination between PE and controls.

High Resolution, Contrast Enhanced MR Angiography as the Sole Test for Evaluation of Broncho-Vascular Anatomy in Pediatric Patients with Suspected Vascular Rings

Elena Karavaeva MD (Presenter): Nothing to Disclose, M. Ines Boechat MD : Nothing to Disclose, Simon Gabriel MD : Nothing to Disclose, J. Paul Finn MD : Research Grant, Siemens AG Research Grant, Bracco Group

PURPOSE

To assess the feasibility of high resolution, 3D contrast enhanced MR Angiography (CEMRA) as a single test
for complete evaluation of detailed vascular and proximal 3-dimensional airway anatomy in pediatric patients with suspected vascular rings.

**METHOD AND MATERIALS**

Forty-two consecutive pediatric patients (25 male, 17 female; mean age, 6.14 +/- 4.07 years, range 1m to 13 y) with a clinical suspicion of vascular rings underwent multiphase, high spatial resolution CEMRA at 3.0T (31 patients) or 1.5T (15 patients) with gadolinium-based contrast medium (Multihance, Bracco Diagnostics, N=38, 0.2 mmol /kg, or Ablavar, Lantheus Medical, N=3, 0.06 mmol /kg). Using a standardized scoring system 2 independent, board certified radiologists scored the studies for image quality, artifacts, the visibility of upper airways that were divided into 5 segments: trachea, right main stem bronchus, left main stem bronchus, right upper lobe bronchus and bronchus intermedius. Additionally, all studies were evaluated for the presence of pathology, including vascular rings and trachea-bronchial compression, by the same two radiologists and a third independent board certified radiologist. Correlation with chest X-ray findings was available in all patients and with chest CT in 12 patients.

**RESULTS**

All scans were scored as highly diagnostic with good or excellent image quality. Visualization of the trachea and bronchi was assessed as confident and very confident, the interobserver agreement was considered as 'good' and 'excellent' (Cohen's kappa ranged from 0.607 to 0.846 depending on scored segment). A total of 10 vascular rings with tracheobronchial compression were detected with excellent interobserver agreement (Fleiss' kappa = 1). The mean difference between MR and CT measurements of trachea diameter at 3 different levels was 0.45 +/- 0.3 mm.

**CONCLUSION**

High resolution CE MRA allowed for confident assessment of both vascular anatomy and relevant 3-dimensional trachea-bronchial anatomy in pediatric patients with suspected vascular rings. The complementary 3-D visualization of vascular and airway anatomy with CEMRA may make supplemental CT imaging unnecessary in appropriate patient groups.

**CLINICAL RELEVANCE/APPLICATION**

High resolution CEMRA can evaluate 3D vascular anatomy and relevant 3D airway anatomy in children suspected of tracheobronchial compression, obviating the need for CT scanning and radiation exposure.

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**Is It Worth Improving Temporal Resolution (TR) in Paediatric Chest CT?**

**Alexandre Bridoux**: Nothing to Disclose, Jean-Baptiste Faivre MD: Nothing to Disclose, Julien Pagniez: Nothing to Disclose, Antoine Hutt MD (Presenter): Nothing to Disclose, Jacques Remy MD: Research Consultant, Siemens AG, Martine J. Remy-Jardin MD, PhD: Research Grant, Siemens AG

**PURPOSE**

To evaluate the influence of optimized temporal resolution (TR) in pediatric standard chest CT imaging.

**METHOD AND MATERIALS**

93 consecutive children less than 4 years of age (mean age: 1 yr, mean weight: 7.73 kg) underwent a chest CT angiographic examination for non-cardiac indications on a dual-source CT system. No sedation was performed and no β-blocker used. The examinations were obtained with a non-ECG-gated dual-source, single-energy mode using the following parameters: collimation: 64x2x0.6 mm; rotation time: 0.28 s; 70 kVp and 80 mAs; pitch: 2.0. From each dataset, two series of images were systematically reconstructed on a prototype workstation: images with a TR of 140 ms (i.e., standard TR) (Group 1) and images with a TR of 75 ms (i.e., optimized TR) (Group 2). Using a 5-point scale, two radiologists independently analyzed the detection and sharpness of proximal and mid segments of the right (RCA) and left (LCA) coronary arteries (total number of coronary segments examined: n= 651). These anatomical structures, highly sensitive to motion artifacts in otherwise uncooperative patients, were chosen to analyze the impact of an optimized TR.

**RESULTS**

Interobserver agreement for coronary artery analyzability was excellent (Group 1: kappa=0.86 [95% CI: 0.82-0.89]) (Group 2: kappa=0.86 [95% CI: 0.83-0.90]). The mean rate of detection and grade of analyzability of all coronary segments were significantly higher in Group 2 than in Group 1 (p<0.001). The rate of detection of the proximal RCA (26/93; 28% versus 18/93; 19.35% p=0.0114) and left main (LM) artery (60/93; 64,52% versus 54/93 ;58,06% p=0,0339) were significantly higher in Group 2 than in Group 1. Group 2 images provided the best image quality for 64,52% of LM (60/93) and 35,48% of proximal RCA (33/93) whereas Group 1 images were found to be the best reconstruction for only 5,38% of LM (5/93) and 1,08% (1/93) proximal RCA.

**CONCLUSION**

Optimized TR improves image quality in standard paediatric chest CT, still perfectible at 75 ms.

**CLINICAL RELEVANCE/APPLICATION**

Optimization of TR improves image quality of standard chest examinations in children.
SSQ17-01

**Qualitative and Quantitative Evaluation of the Effectiveness of Rigid and Deformable Motion-correction Algorithms Using Dual-energy CT-images in View of Application to CT-perfusion Measurements in Abdominal Organs Affected by Breathing Motion**

- **Stephan Skornitzke** (Presenter): Nothing to Disclose
- **Franziska Fritz**: Nothing to Disclose
- **Miriam Klaus**: Nothing to Disclose
- **Gregor Pahn**: DIPLPHYS
- **Joseph Hansen**: Nothing to Disclose
- **Lars Grenacher**: Nothing to Disclose
- **Hans-Ulrich Kauczor**: Research Grant, Boehringer Ingelheim GmbH Research Grant, Siemens AG Research Grant, Bayer AG Speakers Bureau, Boehringer Ingelheim GMBH Speakers Bureau, Siemens AG Speakers Bureau, Novartis
- **Wolfram Stiller**: DIPLPHYS
- **Nothing to Disclose**

**PURPOSE**

Breathing motion necessitates motion-correction for CT-perfusion measurements in abdominal organs. Six different scenarios were compared for assessing the impact of rigid and deformable motion-correction, as well as Dual-energy (DE) post-processing, on CT-perfusion measurements.

**METHOD AND MATERIALS**

For 12 patients with suspected recurrent pancreatic carcinoma, DE CT-perfusion sequences were dynamically acquired over 51s (34 acq.). Three algorithms for motion-correction of image data were evaluated: rigid (RR) and non-rigid (NR) registration of commercially available CT-perfusion software (BodyPCT/syngo.via Body Perfusion, Siemens Healthcare, Forchheim, Germany), custom deformable registration (DR, demons algorithm), and a control group (CG) without motion-correction. All algorithms used 30kBP images, additionally DR was applied to DE-blended (DR-DE) and virtual non-contrast images (DR-VNC). After motion-correction, perfusion maps were calculated using a combined Maximum-Slope/Patankar-model. For quantitative evaluation relative changes in metric values of the motion-corrected images, RR and residuals of the perfusion model fits were calculated. For qualitative evaluation three blinded, experienced radiologists rated motion-correction quality and resulting perfusion maps on a 4-point Likert-Scale (1=worst, 4=best). A significance level of p=0.05 was used.

**RESULTS**

For the motion-corrected images mean ratings differed significantly (DR and DR-DE 3.1, NR 2.9, DR-VNC 2.7, CG 2.6), with the exception of comparing DR to DR-DE, and RR to the control group. DR and DR-DE achieved the highest reduction in metric values (DR 48.5%, DR-DE 45.6%, NR 29.2%, DR-VNC 22.8%, RR 0.6%, CG 0%, p<0.05 for all). Regarding perfusion maps, DR and DR-DE were rated highest (2.8/2.8, p<0.05 for all) and had significantly higher R2 and lower residuals. NR (2.5) was rated significantly higher than RR (2.1) or the CG (2.2; DR-VNC 2.4), with significantly higher R2 and lower residuals.

**CONCLUSION**

Deformable motion-correction improves the spatial alignment of the target region and the fit of CT-perfusion models. The use of DE-blended images and DE-VNC images for deformable registration offers no significant improvement.

**CLINICAL RELEVANCE/APPLICATION**

CT-perfusion is a valuable tool for detecting isodense tumors, and the evaluated deformable algorithms for correction of breathing-induced abdominal organ motion allow for more accurate measurements.

SSQ17-02

**Quantification of Iodine Enhancement Using Dual Energy CT: Internal Normalization Minimizes Physiologic Variation Between Patients**

- **Jeremy Robert Wortman** MD (Presenter): Nothing to Disclose
- **Urvi Pravin Fulwadhva** MD: Nothing to Disclose
- **Gregory Aaron Bonci** MD: Nothing to Disclose
- **Andrew Primak** PhD: Employee, Siemens AG
- **Heidi Miracle MPH, MS**: Nothing to Disclose
- **Aaron D. Sodickson** MD, PhD: Research Grant, Siemens AG

**PURPOSE**

The enhancement of normal anatomic structures varies substantially between individuals, confounding efforts to accurately detect pathology on quantitative grounds. Dual energy (DE) CT uniquely allows users to quantify tissue iodine content in a single acquisition. We aimed to evaluate variability of iodine enhancement of abdominal organs using DECT, and to select optimal reference tissues that minimize variability between individuals in normalized enhancement ratios.

**METHOD AND MATERIALS**

76 consecutive portal-venous phase contrast-enhanced abdominal DE CT examinations (Siemens Definition Flash) were post-processed, and DE regions of interest (ROI) placed in iodine overlay images within parenchyma of the renal cortex, liver, adrenal gland, and spleen, as well as vascular structures including the portal vein, supra-renal IVC, and main portal vein (MPV). Each ROI yielded the attenuation due to iodine enhancement, which was divided by the organ distribution mean to re-scale the tissue enhancement (ENH) distribution to a mean of 1. For each organ, variances were calculated for the raw ENH distribution, and compared with the variances of the normalized ratios obtained by dividing organ ENH by each vascular reference ENH value. The Pitman-Morgan test for differences in variance in paired data was used to compare non-normalized values and normalized ratios.

**RESULTS**

There was substantial variation in organ enhancement (renal ENH example in Figure 1). For all organs, the variance was significantly reduced through normalization. The best vascular normalizer was found to be the MPV for all organs. Relative reductions in variance were: kidney 38.3% (p<0.0001); liver 17.9%.
CONCLUSION

Normalization of DE iodine enhancement values using internal controls significantly reduces the observed variation between patients in enhancement of the abdominal organs. This will support future efforts to more accurately differentiate pathology from normal tissues on quantitative grounds.

CLINICAL RELEVANCE/APPLICATION

We demonstrate a method to normalize iodine enhancement from DE CT that reduces physiologic variability between patients and may help to better differentiate pathologic from normal tissue enhancement.

In situ Assessment Reveals Skeletal-wide Heterogeneity of Human Cancellous Bone

PURPOSE

Since biologically important skeletal heterogeneity has only recently been recognized, skeletal-wide characterization of metabolically active regions has never been attempted. We aimed to characterize the distribution of cancellous bone across the skeleton using noninvasive whole-body dual energy computed tomography (DECT) imaging.

METHOD AND MATERIALS

20 adult female cadavers, ages 40-80 (mean = 63) years, were imaged using a dual source (80kVp and 140kVp) scanner. 23 cancellous bone skeletal sites, from head to foot, were assessed for volumetric bone mineral density (BMD) (mg/cm^3) using single energy (140kVp) quantitative computed tomography, and marrow-corrected BMD (mcBMD) using a dual energy decomposition method. McBMD at 23 skeletal sites was examined and their inter-correlations were obtained for control and cancer treated groups.

RESULTS

DECT provided a unique marrow correction for each skeletal site BMD. Although average correlation was high (r = 0.99), larger corrections were seen in the limbs. A highly heterogeneous BMD distribution was observed with a maximum at the posterior skull and minimum in the proximal humerus (580mg/cm^3 and 15mg/cm^3, respectively). Average correlation for all skeletal sites was higher in controls than in the cancer treated group (r = 0.61 and 0.33, respectively).

CONCLUSION

In addition to commonly measured sites (spine, hip), mcBMD of cancellous bone is heterogeneously distributed throughout the entire skeleton. Heterogeneity may be further affected in the cancer patient. Further studies will be required to validate site specific correlations in larger populations and to utilize it for predicting BMD for unknown sites from sites that are scanned for clinical reasons.

CLINICAL RELEVANCE/APPLICATION

These findings suggest potential for developing a skeletal heterogeneity model in further prospective studies, which could identify abnormalities in patients who deviate from the model.

Impact of Acquisition, Detection, and Reconstruction Techniques on the Accuracy of Iodine Quantification Using a Second-generation Dual-source Dual-energy MDCT

PURPOSE

To assess the impact of patient habitus, acquisition parameters, detector efficiencies, and reconstruction techniques on the accuracy of iodine quantification using dual-source dual-energy CT (DECT).

METHOD AND MATERIALS

Two phantoms simulating small and large patients were developed. Phantoms contained 20 iodine solutions mimicking vascular and parenchymal enhancement (ranging from 0 to 400 HU) and 30 iodine solutions simulating enhancement of the urinary collecting system (400 to 2000 HU). DECT acquisition was performed using two second-generation dual-source DECT scanners equipped with standard and integrated electronics detector technologies. DECT was performed with 80/140 kVp and 100/140 kVp dual-energy pairs. DECT raw datasets were reconstructed using filtered backprojection (FBP), and iterative reconstruction at two different levels (SAFIRE I and V). Accuracy of iodine quantification was assessed as absolute percentage error (APE) and evaluated by ANOVA. A univariate GLM analysis was performed to assess the presence of synergistic effects between DECT parameter combinations.

RESULTS

Accuracy for iodine quantification was significantly higher for the small compared to the large phantoms...
In a second-generation dual-source DECT system, the accuracy of iodine quantification can be dramatically improved by an optimal choice and combination of acquisition parameters, detector efficiency, and reconstruction techniques.

**CLINICAL RELEVANCE/APPLICATION**

Improvements in iodine quantification using DECT may allow detection of subtle variations in parenchymal blood supply, which may be clinically relevant for oncologic and cardiovascular imaging applications.
CONCLUSION

For reconstructions made with each vendors best performing MAR method the RMSEMA of reconstructions made by vendor A and C were 7% and 47% higher than the RMSEMA of reconstructions made by vendor B.

CLINICAL RELEVANCE/APPLICATION

Efficiency of metal artifact reduction algorithms differ in computed tomography systems from different vendors, which may have an impact on the clinical outcome.

METHOD AND MATERIALS

A Pioneer Method to Validate Non-invasive Multimodality Assessment of Marrow Fat Using Human Bone Samples


PURPOSE

Due to a heterogeneous distribution of bone mineral density and marrow composition throughout the body, invasive biopsies of the iliac crest do not truly represent the complete physiological status. Therefore, we aim to provide verification for an in vivo imaging technique using co-registered histologic examinations for assessment of marrow adiposity.

METHOD AND MATERIALS

The abdomen of 3 recently expired (i.e. < 24 hours) human cadavers were scanned with a dual source CT (DECT) scanner. These donors were also imaged to get marrow fat (MF) measurements using Water Fat MRI (WFMRI). The three lumbar spines were then excised and the superior and inferior aspects of 13 vertebral sections were removed. The remaining center section was processed for histological examination to find the ratio of adipocyte volume to total volume.

RESULTS

Marrow fat estimation using DECT and WFMRI had a high correlation (r = 0.948). Adiposity measured by histology of the 13 vertebral sections ranged from 17.8% to 74.8% with a Mean (SD) of 35.9% (18.3%). Marrow adiposity as assessed by histology had a reliability of r > 0.987. Correlation between the adiposity ratio was slightly higher for DECT-derived MF than when compared to WFMRI (r = 0.802 and 0.772, respectively).

CONCLUSION

The adipocyte ratio can be an accurate means of assessing the marrow fat concentration in cancellous bone. A high variation of the adipocyte ratio was seen among the 3 individuals imaged. Both DECT and WFMRI have a good correlation with the adipocyte ratio and can be used to estimate the concentration of MF.

CLINICAL RELEVANCE/APPLICATION

The ability to quickly and non-invasively monitor marrow fat expansion may help provide a more skeletal-wide assessment of bone health and identify areas of concern, especially in the cancer survivor.

Subvoxel Accurate Airway Wall Measurements Using an Intensity Integration Approach: Comparative Study Using the COPDGene Phantom

Michael Schmidt MSc: Nothing to Disclose, Eva Marjolein Van Rikxoort PhD (Presenter): Stockholder, Thirona BV Co-founder, Thirona BV, Jan-Martin Kühnigk PhD, MS: Stockholder, MeVis Medical Solutions AG, Philip F. Judy PhD: Nothing to Disclose, Bram Van Ginneken PhD: Stockholder, Thirona BV Co-founder, Thirona BV Research Grant, MeVis Medical Solutions AG Research Grant, Canon Inc Research Grant, Toshiba Corporation Research Grant, Riverain Technologies, LLC

PURPOSE

Accurate quantification of airway wall thickness in thoracic CT is a key technique for the extraction of imaging biomarkers in obstructive pulmonary disease. We present an intensity integration approach that allows measurements of airway wall thickness with an accuracy higher than the resolution of the CT data.

METHOD AND MATERIALS

For most airways visible on CT, wall thickness is less than the resolution of the image data and partial volume effects hamper accurate measurement. By making appropriate assumptions about the density of air, airway wall and lung parenchyma, it is possible to fit a model to an array of line profiles perpendicular to the airway wall and thus measure the wall thickness precisely. This intensity integration approach was compared with two established methods: Full-Width-at-Half-Maximum (FWHM) and Phase Congruency (PC). We used the improved COPDGene phantom with 7 polycarbonate tubes with varying sizes (lumen diameter: 2.5/3/3/6/6/6/6 mm, wall thickness: 0.4/0.6/0.6/0.9/1.2/1.2/1.5 mm) and orientations (tubes 3 and 6 at 30° angle from scanner z-axis, all others in z-axis direction). The intensity integration and FWHM method were implemented by the authors, PC measurements were obtained using the open source software Airway Inspector. We measured each tube at five positions and calculated the average measurement. Accuracy of each method was determined by calculating the minimum, mean and maximum signed as well as mean unsigned measurement errors for each method. Additionally, linear regression was used to determine each method’s ability to detect changes in wall thickness regardless of constant measurement bias.
RESULTS

The smallest minimum/mean/maximum signed errors were obtained for intensity integration: -0.07/-0.01/0.05 mm versus 0.39/0.74/1.04 mm (FWHM) and -0.26/0.13/0.57 mm (PC). Intensity integration also gave the lowest mean absolute errors: 0.05 mm versus 0.74 mm (FWHM) and 0.27 mm (PC). Correlation was very high for intensity integration and FWHM (r=0.997 and r=0.972, both p<0.001) and only high for PC (r=0.746, p=0.054).

CONCLUSION

Intensity integration yielded the superior results in terms of overall error and measurement consistency. FWHM significantly overestimates thin walls but provides consistent measurements. PC is unreliable for measuring small airways.

CLINICAL RELEVANCE/APPLICATION

Airway wall thickness measurements are best performed with an intensity integration quantification algorithm.

SSQ17-09

Computational Fluid Dynamics Analysis of Pressure Drop Alteration in the Coronary Artery Stenosis Based on Patient-specific Computed Tomographic Images

Kuan-Yu Lin (Presenter): Nothing to Disclose, Tzu-Ching Shih: Nothing to Disclose

CONCLUSION

We can provide a non-invasive method that cardiac surgeon could use for CFD analysis to evaluate the pressure drop alteration in the coronary artery based on patient CT images.

Background

Coronary artery disease (CAD) is the most common type of heart disease and cause of heart attacks. The Doppler echocardiography was used to measure the averaged blood flow velocity in the left ventricular outflow tract. The aim of this study was to simulate the blood flow in the stenosis of a coronary artery and to calculate the pressure gradient in the artery using the patient-specific computed tomography (CT) images and the measured blood flow velocity by a Doppler echocardiography.

Evaluation

The patient CT images was acquired by a helical CT scanner. The thickness of the image slice was 3 mm and the pixel size was 0.62*0.62 mm. A 3D surface reconstruction was created on the workstation. The three-dimensional geometry of the coronary artery was created by the Amira and volume mesh was generated by the ANSYS ICEM-CFD. The blood velocity of the left ventricular outflow tract was measured by the Doppler ultrasound echocardiography machine. The measured blood velocity was about 62 cm/s in the coronary artery diagnosed with 50% stenosis. The inlet velocities were 62 cm/s (LVOT) and 80 cm/s.

Discussion

In numerical simulation, the two blood velocities (62 cm/s and 80 cm/s) were used to simulate the blood flow in the coronary artery and to calculate the pressure drop across the stenosis of the artery. Computer simulation results showed that for the inlet blood velocity of 62 cm/s, the pressure drop over the stenosis of the coronary artery was about 153.063 cm/s. For a higher inlet velocity of 80 cm/s, the pressure drop in the artery was 192.154 cm/s. The increment ratio of the pressure drop was about 71% when the inlet velocity form 62 to 80 cm/s. Furthermore, the increment ratio of maximum velocity in the stenosis was around 25%. It shows that higher blood flow velocity results in larger pressure drop in the stenosis of the coronary artery.
approach for intra-individual comparison of three acquisition protocols at different radiation dose levels.

**METHOD AND MATERIALS**

An abdominal phantom representing an 80kg male was imaged using DSCT (Somatom Definition, Siemens Healthcare) at three radiation dose levels (RDL) with 120kVp and different tube currents (low, standard, high mAs). For each RDL, raw data was obtained once in single source mode using x-ray tube A only and in dual source mode using 5 different ratios for tube current of x-ray tube A and B (same total radiation dose; A/B: 90/10%, 80/20%, 70/30%, 60/40%, 50/50%). For each RDL, one standard (SSS-CT) and five virtual single source image datasets (VSS-CT50 - 90) were reconstructed. To compare SSS-CT and VSS-CT datasets, image quality was assessed in terms of high and low contrast performance by calculating the modulation transfer function (MTF), image noise, noise power spectrum (NPS) and for low contrast lesion detectability the modified multiscale structural similarity index (MS-SSIM*). A maximum decrease of Δ=5% of image quality compared to SSS-CT was defined as acceptable and a non-inferiority analysis with Δ was performed.

**RESULTS**

For MTF, non-inferiority was observed for all VSS-CT datasets and RDL (P<0.05). Image noise demonstrated an acceptable increase (<3.2%, P<0.05) for each RDL and NPS showed only minor differences in the mid frequency range. The MS-SSIM* index demonstrated for the high RDL protocol a minor decrease for VSS-CT datasets (<2%, P<0.05). For the standard and low RDL the relative differences of MS-SSIM* index increased and were only in one case above Δ (standard RDL, mean VSS-CT60 5.1%, P>0.05).

**CONCLUSION**

Image quality obtained by VSS-CT and SSS-CT using equivalent total radiation exposure to the patient showed only negligible differences in image quality. Therefore, this technique might allow an iterative, task dependent radiation dose reduction in CT.

**CLINICAL RELEVANCE/APPLICATION**

Radiation dose-splitting with DSCT may enable an iterative, task dependent radiation dose reduction in CT.

**SSQ18-02**

The Master CT Protocol Concept in Practice: How a Small Set of Optimized Protocols Can Be Used to Create Acquisition Parameters for a Wide Range of Clinical Indications

Timothy Peter Szczyputowicz PhD (Presenter): Equipment support, General Electric Company Research Grant. Myron Andrew Pozniak MD : Stockholder, Cellectar Biosciences, Inc , Frank N. Ranallo PhD : Grant, General Electric Company

**CONCLUSION**

The framework presented in this paper makes complying with ACR and AAPM recommendations easier; as well as creating new protocols. IT solutions to capturing tube output information and radiologist quality assurance information was vital to using this method.

**Background**

Maintaining a set of CT protocols specific to indication, patient size, body region, and scanner can be a daunting task; ideally hundreds of protocols are required to cover this range. This work proposes two concepts to aid this process: (1) basing all protocols within a given body region from a single basis protocol and (2) using graphical/spreadsheet tools to manage and develop protocols.

**Discussion**

Use of the master protocol concept enabled our institution to reduce the number of unique scan protocols by 37.5% for the body section. A case of an image quality issue for one protocol that triggered preventive action to be taken for all protocols using the same master protocol was implemented. Use of optimized master protocols allowed for easy creation of a new HCC liver and an organ donor protocol at our institution.

**Evaluation**

Acquisition parameters from the body section (114 protocols in total) at our institution were put into a spreadsheet program. After combining similar scan parameters, only 33 master protocols were needed to span all 114 clinical protocols. All 34 master protocols were based off a single basis protocols using mathematical relationships between acquisition parameters. These relationships were used to model protocol changes in order to optimize parameters like rotation time, pitch, tube current limits, etc. All of the changes were based on having a validated basis protocol in which the mA ranges required by individual scanners were recorded as a function of patient size. Graphical depictions of acquisition parameters were created from the master protocols and used to visually identify and confirm trends in protocol optimization (e.g. increase in kV with patient size).

**SSQ18-03**

Lens Dose in Routine Head CT: Comparison of Different Optimization Methods with Anthropomorphic Phantoms

Ulla Nikupaavo BSC (Presenter): Nothing to Disclose , Touko Kaasalainen : Nothing to Disclose , Vappu Reijonen PhD : Nothing to Disclose , Sanna-Mari Ahonen PhD : Nothing to Disclose , Mika Karel Kortesniemi PhD : Nothing to Disclose

**PURPOSE**

To study different optimization methods for reducing lens dose in computed tomography (CT) head scanning.

**METHOD AND MATERIALS**
Two tissue-equivalent anthropomorphic phantoms were scanned with a routine head CT protocol of the brain using bismuth shielding, gantry tilting, organ-based tube-current modulation (OBTCM), or their combinations. High sensitivity MOSFET dosimeters were used to measure local equivalent doses in the head region. The relative changes in image noise and contrast were determined using ROI analysis.

RESULTS

The mean absorbed lens dose varied from 4.9 mGy to 19.7 mGy, and from 10.8 mGy to 16.9 mGy in the two phantoms. The most efficient method for reducing lens dose was gantry tilting leaving lenses outside the primary radiation beam, resulting in approximately 75% decrease in the lens dose. The image noise decreased especially in the anterior part of the brain. The use of OBTCM resulted in an approximately 30% decrease in the lens dose. On the other hand, image noise increased by up to 30% in the posterior and central parts of the brain. With bismuth shields, it was possible to reduce lens dose by up to 25%. Measurements with the two different phantoms showed how patient geometry affects the optimization.

CONCLUSION

Gantry tilt is an effective method to reduce the exposure of the eye lenses in the CT scanning of the brain without compromising image quality. When lenses can only partially be cropped outside the primary beam, the OBTCM or bismuth shields could also be useful in lens dose reduction.

CLINICAL RELEVANCE/APPLICATION

The patient lens dose in head CT can be efficiently reduced by optimal use of different techniques without compromising clinical image quality.

SSQ18-05

Comparisons of Lung Nodule Detection Capability on Ultra-low and Low-dose CTs among Newly Developed Full Iterative Reconstruction (FIR), clinically Available Adaptive Iterative Dose Reduction (AIDR 3D) and Filter Back Projection Techniques in Chest Phantom Study

Hisanobu Koyama MD, PhD (Presenter): Nothing to Disclose, Yoshiharu Ohno MD, PhD : Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd Research Grant, Terumo Corporation Research Grant, Fuji Yakuhin Co, Ltd Research Grant, FUJIFILM Holdings Corporation Research Grant, Guerbet SA, Shinichiro Seki : Nothing to Disclose, Mizuho Nishio MD, PhD : Research Grant, Toshiba Corporation, Hiroyasu Inokawa : Employee, Toshiba Corporation, Naoki Sugihara MENG : Employee, Toshiba Corporation, Noriyuki Negi RT : Nothing to Disclose, Tohru Murakami : Nothing to Disclose, Takeshi Yoshikawa MD : Research Grant, Toshiba Corporation, Sumiaki Matsumoto MD, PhD : Research Grant, Toshiba Corporation Research Grant, Koninklijke Philips NV Research Grant, Bayer AG Research Grant, Eisai Co, Ltd Research Grant, DAIICHI SANKYO Group

PURPOSE

To compare lung nodule detection capability of ultra-low-dose and low-dose CTs among newly developed full iterative reconstruction techniques (FIR), clinically available iterative reconstruction (i.e. adaptive iterative dose reduction using three dimensional processing <AIDR 3D>) and filter back projection (FBP) techniques in chest phantom study.
METHOD AND MATERIALS
A chest CT phantom including simulated GGOs (-800HU) and part solid nodules (-630HU), was scanned on area-detector CT at standard-dose CT (SDCT: 270mA), low-dose CT (LDCT: 50mA) and ultra-low-dose CT (ULDCT: 10mA) protocols. Then, all CT data sets were reconstructed with FIR, AIDR 3D and/ or FBP. For quantitative image quality assessment, image noise at each protocol was assessed by ROI measurements. To determine the capability of nodule identification on each protocol, two chest radiologists independently evaluated lesion conspicuity at each nodule by means of 5-point scoring system, and final scores were made by consensus of two readers. Image noise was compared each other by Tukey’s HSD test at each tube current. Then, ROC analyses were performed to compare identification capability among all techniques at each tube current, between SDCT and each LDCT, and between SDCT and each ULDCT.

RESULTS
Image noises of FBP were significantly higher than that of others at each tube current (p<0.05). In addition, image noise of FIR was the lowest at both tube currents. When compared identification capability, area under the curves (Az) of LDCT and ULDCT reconstructed with FIR (LDCT: Az=0.94, ULDCT: Az=0.90) and those with AIDR 3D (LDCT: Az=0.94, ULDCT: Az=0.90) were significantly higher than those with FBP (LDCT: Az=0.91, p<0.05; ULDCT: Az=0.70, p<0.05). When compared with SDCT (Az=0.95), identification capability of ULDCT with each method was significantly lower than that of SDCT (p<0.05) in this setting.

CONCLUSION
Newly developed FIR algorithm as well as AIDR 3D is useful for LDCT and ULDCT, and can improve image quality and nodule identification as compared with FBP at each tube current level.

CLINICAL RELEVANCE/APPLICATION
On low- and ultra-low-dose CT, newly developed full iterative reconstruction algorithm as well as commercially available iterative reconstruction technique is useful than filter back projection for improving image quality and nodule identification.

SSQ18-06
Radiation Exposure Reduction on Multiphase Dual Energy CT Exams: How Virtual Non-Contrast Combined with Iterative Reconstruction Cut Doses in Half
Les Roger Folio DO, MPH (Presenter): Nothing to Disclose, Peter L. Choyke MD : Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura

PURPOSE
To minimize radiation dose on multiphase CT exams while maintaining diagnostic quality by 1) eliminating the pre-contrast pass and 2) reducing mAs and 3. applying iterative reconstruction. We also share a streamlined workflow, processing Virtual Non Contrast (VNC) across vendors.

METHOD AND MATERIALS
We compared radiation exposures of 22 consecutive multiphase chest, abdomen and pelvis CTs in patients with Von Hippel Lindau (VHL), to determine amount of total DLP reduction relative to prior exams. Tube current reduction (from 240mA to 150 mAs) effects were compensated for noise using iterative reconstruction (SAFIRE, Siemens Medical, Malvern, PA) with an iterative strength of 2 (of 5 strengths available).

The reduced exposure exams were performed on Siemens Flash in Dual Energy mode while the VNC was processed on Siemens PACS (Syngo.via) then pushed to our PACS (Carestream Health, Rochester, NY). Radiologists and referring clinicians compared the quality of mAs reduced exams and VNC series to prior actual non-contrast series and overall scan quality.

RESULTS
Eliminating the non-contrast scan and applying iterative reconstruction resulted in an average exposure reduction of more than 50% (avg 59.9%) while maintaining diagnostic quality. VNC was limited in larger patients (FOV of 80 kVp tube is only 33 cm), causing incomplete analysis of a small portion of one kidney in one patient. Workflow was streamlined by co-locating a PACS node next to the CT console.

CONCLUSION
Significant dose savings on multiphase CT exams were achieved by replacing the non-contrast phase with a VNC exam, reducing tube current and compensating for noise with iterative reconstruction. This resulted in greater than 50% exposure reduction when compared to previous exams in the same patients, while maintaining image quality.

CLINICAL RELEVANCE/APPLICATION
Multiphase exams are of clinical importance, however, expose patients to higher doses of radiation. Replacing the non-contrast images with a VNC, while using tube current reductions/iterative reconstruction can provide substantial dose savings; especially in patients that receive frequent surveillance exams.

SSQ18-07
256-slice Coronary Computed Tomography Angiography Using Low Voltage 100kV
Bhoj Raj Sharma MBBS, MD (Presenter): Nothing to Disclose, Madhu Gupta MBBS : Nothing to Disclose, Yuan Qing Hai MD, PhD : Nothing to Disclose

CONCLUSION
The protocol of low tube voltage CCTA using 100 kV/1000mAs retrospective ECG-gated shows significant reduction of the radiation dose without disturbing the subjective image quality of CCTA.

Background
SSQ18-08  
**A Comparison of Three Methods for Measuring Patient Positioning from Localizer Imaging in CT: Which Correlates Best with Optimal Image Quality?**  

**Purpose**  
Patient positioning in CT is critical for obtaining the lowest possible imaging dose and minimizing artifact level. Traditionally, CT technologists are instructed to align the geometric center of patients with the scanner’s isocenter. We propose an alternative positioning and evaluate three metrics for position determination.

**Method and Materials**  
Localizer images were taken from 184 clinical abdominal patients and one anthropomorphic phantom at our institution and three centering determination metrics were applied to each. The optimality of the metrics was based on which correlated best with positioning resulting in good noise uniformity and low beam hardening artifact level determined using the anthropomorphic phantom. The first metric uses the “center of mass” of the profile from the localizer image. For each detector row, the profile is extracted, thresholded, and the center of mass is calculated. The second method thresholds each line of the localizer image and the edges of the remaining profile are extracted and used to determine the geometric center of the patient. The third method calculates the center of mass of the highest 3% of the projection values within the localizer.

**Results**  
On average, the geometric center metric provided the most “anterior” offcentering measurement, followed by the “center of mass” (0.2 cm lower relative to the geometric center) and then the COM of the highest 3% of the attenuation profile (1.7 cm lower relative to the geometric center). The third approach may be the most clinically relevant approach because it is directly correlated with how well the most attenuating part of the patient is positioned relative to iso-center. Having the most attenuating part of the patient aligned with isocenter in most cases ensures the lowest level of image noise non-uniformity and beam hardening.

**Conclusion**  
Due to patient tissue inhomogeneity, patient positioning determination metrics based on the geometric center of the patient will not accurately provide information on optimal patient positioning. Tissue inhomogeneity within patients must be taken into account in order for position metrics to act as surrogates for optimal patient positioning.

**Clinical Relevance/Application**  
Dose monitoring companies are offering tools to aide in determining proper patient positioning, however, these tools may not be surrogates for optimal positioning due to patient tissue inhomogeneity.

SSQ18-09  
**Efficient Mapping of Protocol Selection Targets across Different CT Scanners Using Channelized Hotelling Observer Based Image Quality Metric**  

**Purpose**  
CT Protocol recommendation tools used to determine tube potential and tube current based on the specific clinical indication independently for two scanner types were developed indicating a time-consuming, manual process. The purpose of this work was to determine the utility of a comprehensive quantitative image quality metric based on Channelized Hotelling Model Observer (CHO) to more efficiently predict patient size-dose curves for a new CT scanner platform based on existing curves for a different scanner.

**Method and Materials**
Previously validated CT scanner-specific protocol recommendation tools are used in daily clinical practice to determine optimal tube potential and tube current settings based on patient size for the evaluation of thoracic aortic disease with CT. Patient size (water equivalent diameter \(D_w\)) and dose (CTDIvol) were determined for patients from each of two scanners (256-slice Philips Brilliance iCT [Scanner 1] and 64-slice Philips Brilliance 64 [Scanner 2]). Both scanners were evaluated for image quality using a phantom containing three sections \(D_w = 12, 25, 32\) cm, at five dose levels. Each section contains a region with three 5 mm and 2 mm low contrast rods, a uniform region, and a region to measure rod contrasts in the image (Plexar Imaging phantom). This characterization incorporates a CHO based image quality metric and generates an Image Index curve for the scanners across a wide range of body sizes and dose levels. Using the size-dose curve determined from patient scanning on Scanner 1 and the Image Index curve determined from phantom scanning on both scanners, the required size-dose curve for Scanner 2 was predicted.

**RESULTS**

93 patients (\(D_w\) range: 20-37 cm) were included in the study. The predicted size-dose curve for Scanner 2 closely fit the actual curve across the patient size range (Figure).

**CONCLUSION**

Scanner characterization using the ConvergeCT phantom and the Image Index metric enables the automated development of scanner and indication-specific protocol recommendation tools for new scanner platforms based on established practices.

**CLINICAL RELEVANCE/APPLICATION**

Scanner characterization using a dedicated phantom and quality metric provides an objective, automated process for adjusting proven protocols for new CT scanner platforms.

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**Vascular/Interventional (IR: Non-hepatic Tumor Ablation)**

**Scientific Papers**

**SSQ19**

**Interim Results of Phase II Clinical Trial for Evaluation of MRI-guided Laser Induced Interstitial Thermal Therapy (LIIT) for Low-to-Intermediate Risk Prostate Cancer**

Aytekin Oto MD (Presenter): Research Grant, Koninklijke Philips NV Consultant, Guerbet SA, Ambereen Yousuf MBBS : Nothing to Disclose, Shiyang Wang PhD : Grant, Koninklijke Philips NV, Tatjana Antic : Nothing to Disclose, Gregory Stanislaus Karczmar PhD : Nothing to Disclose, Scott Eggener : Research Grant, Visualase, Inc Speakers Bureau, Johnson & Johnson

**PURPOSE**

To assess the oncologic efficacy and safety of MRI-guided laser-induced interstitial thermal therapy of biopsy confirmed and MR-visible prostate cancer.

**METHOD AND MATERIALS**

17 patients with biopsy proven low-to-intermediate risk prostate cancer underwent MRI guided laser ablation of the cancer using Visualase laser ablation device. All patients had a pre-procedure endorectal MRI which showed suspicious foci concomitant with the positive sextant on TRUS guided biopsy. The area of interest was targeted transperineally using 1.5 T Philips MRI scanner and Visualase ablation device. Ablation was monitored by real time MR thermometry using Visualase MRI thermometry software. Perioperative, early and late complications and adverse events were recorded. Follow-up was performed with 3-month MRI examination and MR-guided biopsy and validated quality of life questionnaires to assess urinary and sexual function.

**RESULTS**

MRI guided laser ablation of prostate cancer was successfully performed in all 17 patients without significant peri-procedural complications. All patients were discharged home the same day. Average duration of the procedure was 3 hours 39 minutes and average duration of a single laser ablation was 1 minute 21 seconds. Total number of ablations per patient ranged from 2-7, with a median of 4. The treatment created an identifiable hypovascular defect in all cases. Post procedure complications were minor and included urinary symptoms, perineal bruising and erectile dysfunction, all of which self-resolved. MR-guided biopsy of the ablation zone performed at the 3-month time point showed no cancer in all patients. Validated quality of life urinary and sexual questionnaires obtained before and 3 months after the procedure did not reveal any significant differences (\(p \geq 0.05\)).

**CONCLUSION**

Very early results of MRI-guided focal laser ablation for treatment of clinically localized, low-to-intermediate risk prostate cancer appear promising. It may offer a minimally invasive procedure for selected patients that does not appreciably alter sexual or urinary function.
CLINICAL RELEVANCE/APPLICATION
Interim results of our phase II trial show that MRI-guided focal laser ablation can be a safe and feasible option for treatment of low-to-intermediate risk prostate cancer.

SSQ19-02
Lung Nodule Treatment with Cryoablation versus Radiofrequency Ablation versus Stereotactic Ablative Radiotherapy: A Survival Study
George Mikhail MD (Presenter): Nothing to Disclose, Ammar Ahmed Chaudhry MD : Nothing to Disclose, Jung Hwoon Edward Yoon MD : Nothing to Disclose, Thomas Bilfinger MD : Nothing to Disclose, William Henry Moore MD : Research Grant, Edda Technology, Inc Medical Board, Edda Technology, Inc Research Grant, Galil Medical Ltd Research Grant, Endo Health Solutions Inc

PURPOSE
Compare frequency of recurrence and major complications in patients with lung nodules treated with cryoablation, radiofrequency ablation (RFA) or Stereotactic Ablative Radiotherapy (SABR).

METHOD AND MATERIALS
A retrospective IRB-approved analysis of patients who underwent cryoablation, RFA or SABR for primary stage 1 lung cancer performed from January 2007 to March 2013 was performed in this study. All procedures were performed using general anesthesia and CT guidance. Follow-up imaging with CT of the chest was obtained at 1, 3, 6, 12, 24, 36, 48 and 60 months post-procedure to evaluate the ablated lung nodule. Nodule surface area, density (in Hounsfield units) and size of cavitations were recorded. Degree of nodule enhancement was also recorded.

RESULTS
80 patients underwent SABR out of which 6 had disease recurrence as evidenced by metastatic disease within first six months, 1 within 6 to 12 months, 3 within 12 to 24 months, 1 after 24 months. 49 patients underwent cryoablation, of which 2 had disease recurrence in the first 6 months, 1 between 6 to 12 months, 1 between 12 to 24 months and 1 after 24 months. 9 patients underwent RFA out of which 1 patient had disease recurrence which recurred between 12 to 24 months. There were no recurrences in the 0-6 month period, 6-12 month period, or greater than 24 months period. In terms of major complications, 67/80 patients in the SABR group went on to develop radiation fibrosis in the ablation zone. None of the patients required hospitalization post SABR. 1/9 patients developed respiratory distress post RFA, requiring greater than 48 hour hospitalization. 1/49 patients develop large pulmonary hemorrhage requiring ICU admission.

CONCLUSION
Our study shows that patients who underwent cryoablation had a lower frequency of metastatic disease recurrence (10.2%) as compared to RFA (11.1%), and SABR (13.75%).

SSQ19-03
Thoracic Cryoablation Is Safe and Effective for Multiple Tumors per Procedure
Peter John Littrup MD (Presenter): Founder, Cryomedix, LLC Research Grant, Galil Medical Ltd Research Grant, Endo Health Solutions Inc Officer, Delphinus Medical Technologies, Inc, Hussein D. Aoun MD : Nothing to Disclose, Brian Faustino, MD : Nothing to Disclose, Barbara A. Adam : Nothing to Disclose, Mark J. Krycia : Nothing to Disclose, Matthew Prus : Nothing to Disclose

PURPOSE
To assess efficacy and complication outcomes for cryoablation of primary and metastatic thoracic tumors based on location. Tumor and ablation size, complications, and location were also assessed for single vs. multiple tumors per procedure.

METHOD AND MATERIALS
CT fluoroscopic-guided percutaneous cryoablation was performed on 384 tumors in 283 procedures in 169 patients, noting tumor and ablation volumes, location, abutting vessels >3mm, recurrences, complications, and tumor type. In procedures with treatment of a single tumor, locations were designated as chest wall/pleural-based (n=113), pulmonary (n=53), and central (N=39). In addition, there were 179 tumors in procedures where multiple tumors were targeted in the same lung and outcomes noted separately. Complications were graded by the National Institutes of Health, Common Terminology of Complications and Adverse Events (CTCAE).

RESULTS
All patients required only conscious sedation. Overall tumor and ablation mean size was 2.6cm and 4.8cm, respectively. Total major complication rates were low at 5.3% (15/283). Tumor mean size was significantly larger in procedures with major complications (5.2cm) compared to those without (2.5cm, p<0.001). No significant difference in major complications was noted between locations for the 3 groups of single tumor ablation, as well as no difference between the combined single tumor ablation (5.9%, 12/205) compared to the multiple tumor ablation group (3.8%, 3/78; p>0.05). Total local tumor recurrence rates were low at 6.2% (20/384) and were not dependent upon tumor size or location, vessel proximity, or between single or multiple ablations per procedure.

CONCLUSION
CT guided thoracic cryoablation provides a low morbidity alternative for complex patients, particularly for central and chest wall/pleural-based tumors. Major complication rate was significantly higher for larger tumors, but there was no significant difference based on location or treatment of multiple tumors.
Recurrence rates were not dependent upon any assessed factors.

CLINICAL RELEVANCE/APPLICATION
Thoracic cryoablation has low recurrence and complication rates, even for multiple tumors in the same lung. Larger tumors may have lower complications if done in more than one session.

SSQ19-04
Transpulmonary Chemoembolization (TPCE) and Transarterial Chemoperfusion (TACP) in the Intervventional Treatment of Primary and Secondary Lung Cancer
Thomas Josef Vogl MD, PhD (Presenter): Nothing to Disclose, Sonja Frewert: Nothing to Disclose, Nagy Naguib Naeem Naguib MD, MSc: Nothing to Disclose

PURPOSE
To evaluate tumor response after treating primary and secondary lung cancer with transpulmonary chemoembolization (TPCE) or transarterial chemoperfusion (TACP) in a curative, neoadjuvant, palliative or symptomatic intention.

METHOD AND MATERIALS
From 2005 to 2013, 417 patients (202 males/215 females) were treated with a mean of 5.29 (range:1-25) TPCE or TACP sessions in 4-week intervals. Patients suffered from primary lung tumors (small cell carcinoma (n=9), non-small cell carcinoma (n=62), bronchial carcinoma with unknown histology (n=34) and lung metastases from different primaries (colorectal carcinoma (n=117), breast cancer (n=40), renal cellular carcinoma (n=17), and others (n=138)). In case of embolization the femoral vein was punctured and tumor-supplying pulmonary arteries were explored. A combination of different chemotherapeutic drugs, lipiodol and microspheres were applied via balloon protection. In case of perfusion the femoral artery was punctured and the catheter was placed in the thoracic aorta above the tumor feeding bronchial and intercostal arteries which were identified with DSA and C-arm CT. Chemotherapeutic drugs were applied manually with a speed of injection according to patient pain level.

RESULTS
Treatment was well tolerated in all patients without any major complications. After evaluation of the tumor volume partial response (PR) was achieved in 17.75% (n=74), stable disease (SD) in 33.09% (n=138) and progressive disease (PD) was found in 49.16% (n=205) according to the RECIST criteria. 1.68% (n=7) of all patients were treated in a curative intention, 42.86% of who had PR (n=3) or SD (n=3), 14.29% (n=1) PD. Of the patients treated in neoadjuvant intention (n=26; 6.24%) 46.15% (n=12) had PR, 34.62% (n=9) SD and 19.23% (n=5) PD. Of the 36 patients (8.63%) treated in a symptomatic intention 2 patients showed PR (5.52%), 27.78% (n=10) had SD and 66.67% (n=24) PD.

CONCLUSION
TPCE and TACP are well-tolerated treatment options for patients with primary and secondary lung tumors, especially in palliative and symptomatic intentions. Even in neoadjuvant and curative intentions they seem to be a proper preparation for tumor downsizing for following thermal ablation.

CLINICAL RELEVANCE/APPLICATION
TPCE and TACP provide good treatment option in patients with primary and secondary lung cancer.

SSQ19-05
False-positive Tumor Enhancement after Cryoablation in Renal Cell Carcinoma: A Prospective Study
Haruyuki Takaki MD (Presenter): Nothing to Disclose, Koichiro Yamakado MD, PhD: Nothing to Disclose, Atsuhiro Nakatsuka MD: Nothing to Disclose, Francois Cornelis MD: Nothing to Disclose, Junji Uraki MD: Nothing to Disclose, Takashi Yamanaka MD: Nothing to Disclose, Masashi Fujimori MD: Nothing to Disclose, Takaaki Hasegawa: Nothing to Disclose, Kiminobu Arima: Nothing to Disclose, Yoshiki Sugimura: Nothing to Disclose, Hajime Sakuma MD: Research Grant, Siemens AG Research Grant, Koninklijke Philips NV Research Grant, General Electric Company Research Grant, Bayer AG Research Grant, Guerbet SA

PURPOSE
To prospectively evaluate the frequency and duration of false positive tumor enhancement after cryoablation in patients with renal cell carcinoma (RCC).

METHOD AND MATERIALS
Thirty-three patients who underwent cryoablation for the treatment of RCCs smaller than 7 cm were enrolled in this IRB-approved prospective study after a written informed consent was obtained from each of them. Contrast-enhanced MR studies were performed at 6 different time point (3 days, 7 days, 1, 3, 6, 12 months) after cryoablation. The false-positive rates to detect residual tumors were evaluated at each time point. Factors affecting false-positive tumor enhancement was evaluated.

RESULTS
A planned MR protocol was completed in 30 patients (90.9, 30/33). Residual tumor was histologically proven in 5 patients (16.7%). False-positive rates at each time points were 60.0% (12/25) at 3 days, 52.0% (13/25) at 7 days, 40.0% (1/25) at 1 month, 0% (0/25) at 3 months, 0% (0/25) at 6 months, and 0% at 12 months, respectively. The false-positive tumor enhancement rate at 7 days was significantly higher in patients with RCC with clear cell carcinoma (63.2%, 12/19) than those with other histology (16.7%, 1/6) (p=0.0469). Either tumor size or tumor geometry did not affect false positive tumor enhancement.
CONCLUSION

Tumor enhancement frequency remains even in completely ablated RCCs up to one month after cryoablation, in particular in clear cell carcinoma.

CLINICAL RELEVANCE/APPLICATION

Residual tumor enhancement is frequently observed within one month after cryoablation for RCC, and this finding is more common in clear cell carcinoma.

SSQ19-06

Cryoablation of Pelvic Masses: A Low Morbidity Alternative in Selected Patients

Hussein D. Aoun MD (Presenter): Nothing to Disclose, Peter John Littrup MD : Founder, CryoMedix, LLC Research Grant, Galil Medical Ltd Research Grant, Endo Health Solutions Inc Officer, Delphinus Medical Technologies, Inc , Barbara A. Adam MSN : Nothing to Disclose, Mohamed M. Jaber MD : Nothing to Disclose, Brian Faustino Baigorri MD : Nothing to Disclose, Matthew Prus BS : Nothing to Disclose, Evan N. Fletcher MS, BA : Nothing to Disclose, Mark J. Krycia BS : Nothing to Disclose

PURPOSE

To assess the technical feasibility and complication rates of percutaneous pelvic mass cryoablation with respect to tumor size and location. Despite the difficulties of adjacent bowel and lower extremity nerves, we hypothesized that cryoablation could contribute to local tumor control in select patients.

METHOD AND MATERIALS

CT and/or CT-US fluoroscopic-guided percutaneous cryoablation was performed in 69 procedures on 82 tumors in 50 patients. Tumor and ablation volumes, location, recurrences, and major complication rates (CTCAE) were collected. Locations were noted as sub-cutaneous, bone, intraperitoneal or retroperitoneal. Patients were excluded if any bowel appeared adherent or motor nerves couldn't be avoided by ablation zone. Hydrodissection, balloon displacement of intraperitoneal bowel and urethral warming balloon for a prostate case were used for tissue protection as needed.

RESULTS

All patients required only conscious sedation. Median tumor and ablation diameter was 3.6 cm and 5.6 cm, respectively. Of the 82 of tumors, 35 were in the subcutaneous region, 8 intraperitoneal, 28 retroperitoneal and 11 within bone. There was 1 urachal tumor and 81 metastases which were from sarcoma (16), colorectal (14), ovarian (11), melanoma (9), renal (9) or miscellaneous (22). Of the 69 total procedures, 12 procedures had more than 1 tumor ablated. The low total tumor recurrence rate of 9.8% (8/82) as not significantly affected by tumor size or location with an average followup time of 1.2 yrs.

Total major complication rate as low at 5.8% (4/69), despite some tumors initially abutting vital structures that could be adequately protected (ie: sciatic/femoral nerve, urinary bladder and bowel.) Of the complications, 2 were fistulas, 2 were anticipated neurological changes in non-operative patients.

CONCLUSION

CT guided percutaneous cryoablation of pelvic tumors provides an effective and low morbidity alternative to surgery or radiation, particularly for patients who may require exenteration for local tumor control.

CLINICAL RELEVANCE/APPLICATION

Cryoablation of pelvic tumors has low recurrence and complication rates even for deep locations. Oligometastatic tumor control may avoid morbid pelvic surgeries in selected patients.

SSQ19-07

Percutaneous Adrenal Cryoablation: A Safe, Well Visualized and Effective Treatment

Hussein D. Aoun MD (Presenter): Nothing to Disclose, Peter John Littrup MD : Founder, CryoMedix, LLC Research Grant, Galil Medical Ltd Research Grant, Endo Health Solutions Inc Officer, Delphinus Medical Technologies, Inc , Barbara A. Adam MSN : Nothing to Disclose, Mohamed M. Jaber MD : Nothing to Disclose, Brian Faustino Baigorri MD : Nothing to Disclose, Matthew Prus BS : Nothing to Disclose, Evan N. Fletcher MS, BA : Nothing to Disclose, Mark J. Krycia BS : Nothing to Disclose

PURPOSE

To assess the technical feasibility, efficacy and complication rates of CT guided percutaneous cryoablation of adrenal masses.

METHOD AND MATERIALS

27 Ct fluoroscopic-guided percutaneous cryoablations were performed on 28 metastatic tumors, in 22 patients, noting tumor size and type, abutting vessels >3mm, recurrences, complications, need for hydrodissection of surrounding vital structures and anesthesia-managed hypertension monitoring by arterial catheter. Complications followed the grading system of the National Institutes of Health, Common Terminology of Complications and Adverse Events (CTCAE). Local tumor recurrence and involution was monitored over time with 1, 3, 6, 12 month and annual scans thereafter.

RESULTS

All patients required only conscious sedation. Average tumor and ablation size was 4.0 cm and 5.7 cm respectively. Of the 28 tumors, tumor origin was non-small cell lung (11), renal (11), sarcoma (3) ovarian cancer (1), colorectal (1) and small cell lung (1). Multiple tumors were ablated in 2 of total 24 procedures. Local recurrence rate was 17.9% (5/28) for an average followup time of 1.6 yrs. Other than 1 patient with leiomyosarcoma of the inferior vena cava having 2 re-treatments for local recurrence vasculature did not appear to effect recurrence rate. The major complication (> grade 3) rate was 3.7% (1/27), with 0 major complications attributable to the ablation procedure. Transient severe hypertension (>260/120) was noted in 3 cases which was rapidly managed by labetalol and nitroglycerin drips with no sequelas.

CONCLUSION
CT guided percutaneous cryoablation is a safe, effective and low morbidity alternative for patients with adrenal tumors. Transient hypertension is related only to residual viable adrenal tissue but can be safely managed.

CLINICAL RELEVANCE/APPLICATION

Oligometastatic disease is becoming more common with improved systemic treatments. Adrenal cryoablation contributes to improved local control for many tumor types, with greater probe density required near major vasculature.

SSQ19-08

MR Imaging-guided Brain Metastases Cryoablation: Initial Experience in 6 Patients
Chengli Li MD, PhD (Presenter): Nothing to Disclose

PURPOSE

Evaluate the feasibility and effective of our initial experience with MRI-guided cryoablation of metastatic brain tumors.

METHOD AND MATERIALS

With approval from the local ethics committee and patient consent. Between Sept.2008 - Jan. 2012, 7 brain mets in 6 consecutive patients (5 women, 1 men, mean age 53 years) were treated using cryoablation under conscious sedation. A 0.23T open MRI device mounted with optical tracking system was used for procedural imaging and instrument guidance. Once planning the intervention route, a 2-3mm burr-hole was drilled under sterile conditions and local anesthesia out of the 5 gauss line. Cryoablation was performed by using an MR-compatible, argon-based cryoablation system with 1.47mm probes according to the size of tumor. Multi-sites or multi-angles were performed if necessary to make the ice ball engulf the tumor and arrive to conformal ablation. For cystic lesions, aspirating fluid was performed first, then advancing the biopsy needle to acquire pathology specimen prior to the cryoablation. Two freeze-thaw cycles (10-minute freeze, 5-minute thaw, 10-minute interval) were performed for each site.

RESULTS

In 7 sessions, seven tumors in six patients were treated with 11 cryoablations. The ice around the probe tip was continuously and clearly visible as an ellipsoid-like signal-free area in MR images. one patient was died of pneumonia and high fever at the 12 days after cryoablation. Two patients had symptoms possibly related to intracranial hypertension. The mean operative time was 120 minutes.

CONCLUSION

MRI-guidance and monitoring cryoablation is safe, feasible, and effective for certain brain metastases patients. MRI-guided cryoablation can be used to substitute more invasive procedures in selected patient groups.

CLINICAL RELEVANCE/APPLICATION

Excellent MR Guidance and Visualization. Generally, technically feasible and effective treatment option of brain metastases. Decrease viable tumour.

SSQ19-09

New Intravascular Elution Device for the Interventional Radiological Treatment of Pancreatic Neoplasms. In vitro an in vivo First Results
Ruben Lopez-Benitez MD (Presenter): Nothing to Disclose , Levent Kara MD : Nothing to Disclose , Gregory Cruise : Nothing to Disclose

PURPOSE

To characterize gemcitabine loaded hydrogel elution devices (GLH-elution devices) using in vitro and in vivo methods as first intravascular prototypes for local treatment in pancreatic tumors.

METHOD AND MATERIALS

To determine the in vitro elution, the GLH-elution devices were placed in 0.9% saline at 37 °C. Periodically, the saline was collected and analyzed for gemcitabine content using liquid chromatography. To determine the in vivo elution of gemcitabine a10 cm, 35-system gemcitabine-loaded hydrogel device was placed into the gastroduodenal artery of every pig. Blood samples were collected periodically for gemcitabine and 2',2'-difluoro-2'-deoxyuridine quantitation using liquid chromatography/mass spectroscopy. Follow-up angiography was performed at 30 days post-embolization. Harvested tissues were evaluated histologically.

RESULTS

All the evaluated devices demonstrated a certain degree of gemcitabine elution, in vitro as in vivo. The in vitro elution of gemcitabine from the embolic device was rapid, as elution ceased after 2 hours. All 6 pigs were successfully embolized and survived the 30-day period. Similar to the in vitro elution, the plasma levels of gemcitabine spiked within 15 minutes of embolization and returned to baseline levels by 1 week post-embolization. As expected, the plasma levels of 2',2'-difluoro-2'-deoxyuridine peaked later than gemcitabine, between 1 and 3 hours post-embolization. Histologically, no evidence of inflammatory changes were observed.

CONCLUSION

The first local elution devices designed for a porcine model with possible future applications in cases of pancreatic neoplasms showed during the first experimental phase positive local drug elution.
CLINICAL RELEVANCE/APPLICATION

With this model, it will be feasible to deliver a targeted therapy nearby pancreatic tumoral areas, with sustained local drug release.

MSRT54

ASRT®RSNA 2014: Advanced Radiographic Practice in Adult Chest Imaging

Multisession Courses

AMA PRA Category 1 Credits™: 1.00
ARRT Category A+ Credit: 1.00
Thu, Dec 4 11:45 AM - 12:45 PM Location: N230AB

Participants

Nick Woznitza BSC (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Consider the role of the advanced radiographer practitioner in the United Kingdom.
2) Recognise the contribution that advanced radiographer practitioners make to patients, clinicians and radiologists, using anonymised real case scenarios.
3) Review the current evidence base which supports advanced radiographer practice, including radiographer reporting of adult chest x-rays

ABSTRACT

Increasing cost and activity pressures on health systems worldwide has led to advanced radiographer practice models developing internationally. In the United Kingdom, radiographer reporting has evolved from the reporting of trauma skeletal x-rays by trained radiographers to include the interpretation of adult chest x-rays, CT head, MRI knee and lumbar spine, mammography, ultrasound and gastrointestinal examinations.

Advanced radiographer practice encompasses the entire spectrum of imaging, from justification of the referral, obtaining high quality images, initial image review and the provision of a definitive clinical report. The contribution that advanced practitioner radiographers make at patient, departmental and hospital levels will be highlighted. The positive influence on improved patient care and the service provided to referring clinicians will be illustrated through real case scenarios. Departmental and hospital benefits of radiographer role extension will be explored through presentation of a service review.

The Royal College of Radiologists and the College of Radiographers are united in their position that all radiographers who expand their scope of practice must perform at a level comparable to a consultant radiologist. The growing body of evidence supporting adult chest x-ray interpretation by trained radiographers will be explored, including performance at the end of accredited postgraduate training, audit of radiographer chest x-ray reporting in clinical practice and agreement between expert consultant chest radiologists and clinical reports; both radiologist and radiographer.

URL’s

http://create.canterbury.ac.uk/12642/

Handout: Nick Woznitza

http://media.rsna.org/media/abstract/2014/14000945/Advanced Radiographic Practice in Adult Chest Imaging.pdf

BRS-THA

Breast Thursday Poster Discussions

Scientific Posters

AMA PRA Category 1 Credits™: .50
Thu, Dec 4 12:15 PM - 12:45 PM Location: BR Community, Learning Center

Participants

Moderator
Sarah Haefer Friedewald MD: Consultant, Hologic, Inc Research Grant, Hologic, Inc

Sub-Events

BRS285 Fully Automated Quantitative Analysis at Breast MR Imaging and Breast Cancer Risk (Station #1)


PURPOSE

The purpose of this study is to evaluate breast cancer risk with fully automated quantitative analysis of three indices with breast magnetic resonance images (MRI), i.e. amount of fibroglandular tissue (FGT), background parenchymal enhancement (BPE), and background parenchymal enhancement intensity (BPEI), and find thresholds associated with breast cancer risk.

METHOD AND MATERIALS

Among 14033 women who underwent breast MR examination among October 2009 and December 2012, we selected 101 identified breast carcinoma cases, and normal and benign control cases were selected in pairs with each breast cancer case on the basis of age and menstrual status. We used a fully automated quantitative analysis method to calculate three indices of FGT, BPE, and BPEI (BPEI=Glands signal
RESULTS

In premenopausal women, BPE have high correlation with breast cancer risk (AUC = 0.610, p = 0.034), and its corresponding threshold associated with breast cancer risk is 24.85% (sensitivity = 70.21%, specificity = 59.57%). In postmenopausal women, both BPE and BPEI have high correlation with breast cancer risk (AUC = 0.651, p = 0.002 for BPE; AUC = 0.614, p = 0.018 for BPEI), and their corresponding thresholds associated with breast cancer risk are 13.30% (sensitivity = 72.22%, specificity = 50.00%) and 27.35% (sensitivity = 44.44%, specificity = 80.55%), respectively. FGT is not significantly correlated with breast cancer risk (AUC = 0.530, p = 0.564 for premenopausal cases; AUC = 0.550, p = 0.299 for postmenopausal cases).

CONCLUSION

BPE have high correlation with breast cancer risk in both premenopausal and postmenopausal women, and BPEI have high correlation with breast cancer risk in postmenopausal women.

CLINICAL RELEVANCE/APPLICATION

The determination of thresholds associated with breast cancer risk could be helpful for accurate assessment of breast cancer risk.

**BRS286**

Fibroadenoma Transformation and Upgrade to Phylloides Tumors Post Core-Biopsy: A Longitudinal Review of Fibroepithelial Spectrum Lesions (Station #2)

Jaron Chong MD (Presenter): Nothing to Disclose, Shaza Alsharif MD: Nothing to Disclose, Sarkis Meterissian: Nothing to Disclose, Benoit Delphin Mesurolle MD: Nothing to Disclose

PURPOSE

The purpose of this study was to evaluate the longitudinal follow-up patterns of core-biopsy diagnosed fibroadenomas and to conduct a cost-effectiveness utility analysis of post-biopsy ultrasound examinations.

METHOD AND MATERIALS

Core-biopsy diagnosed fibroadenomas from ultrasound and stereotactic guided breast biopsies performed over a 6-year period (2008-2013) were identified. The complete clinical records of these patients was retrospectively analyzed to assess for the occurrence of lesion upgrade or transformation to a fibroepithelial or phylloides lesion. Analysis of follow-up practice behaviour was also performed to characterize the burden of post-biopsy follow-up examinations.

RESULTS

Of 754 core-biopsy diagnosed fibroadenomas, 125 (16.6%) demonstrated atypical characteristics involving hypercellularity, microcalcifications or adenosis, with 6 (0.8%) final diagnosis upgrade events identified. 5 typical fibroadenomas were upgraded to a benign phylloides and 1 atypical fibroadenoma was upgraded to a benign phylloides. For these lesions, the interval between fibroadenoma core-biopsy and full-excision diagnosis of a phylloides tumor was 39 - 479 days (mean 221.3 days). The final excisional size of upgraded lesions ranged from 1.5 - 4.6 cm (mean 2.9cm) and was not significantly different from non-upgraded lesions. Increase in size from previous was noted on 3 of the 6 lesions. Of the 748 non-upgraded lesions, 458 underwent a follow-up breast examination, and over 399 (53.3%) underwent a subsequent follow-up ultrasound, with the number of follow-up ultrasounds ranging from 1 to 8 (mean 2.1 examinations; total 829 examinations). Cost analysis of these post-biopsy ultrasound examinations, incurred potential estimated total costs of $82,900.

CONCLUSION

Upgraded re-classification of a fibroadenoma to a phylloides tumor post core-biopsy was a rare event. When upgrades did occur, suspicion due to growth was clinically evident or had atypia initially warranting aggressive investigation. In our case series, not performing lesion follow-up post core-biopsy diagnosis of fibroadenoma would have resulted in 6 missed diagnosis upgrades to benign phylloides out of 754 biopsies.

CLINICAL RELEVANCE/APPLICATION

Long-term follow-up of core biopsy proven fibroadenomas yielded rare upgraded diagnoses or transformations. Further investigation into the role for limited follow-up guidelines post core-biopsy is warranted.

**BRS287**

Preliminary Assessment of the Potential Clinical use of Three-dimensional Mammographic Density (Quantra) for Risk Management in an Asian Screening Cohort (Station #3)

Jeon-Hor Chen MD (Presenter): Nothing to Disclose, Tsung-Lung Yang MD: Nothing to Disclose, Chen-Pin Chiu MD: Research funded, Hologic, Inc, Huei-Lung Liang: Nothing to Disclose, Jer-Shyung Huang MD: Nothing to Disclose, Min-Ying Su PhD: Nothing to Disclose, Huay-Ben Pan MD: Support, Hologic, Inc

PURPOSE

Limitations of 2D area-based measures of breast density have led to the development of volumetric measures of breast density. Despite of the development of these new analysis tools, still it is not known how the acquired density results from the four views of the mammography should be interpreted. The purpose of this study was to evaluate the volumetric density data and explore how the density results can be used for future risk management.
METHOD AND MATERIALS

In a period of 7 months, a total of 2450 women who received mammographic screening and had complete four views (CC and MLO from bilateral breasts) studies were analyzed. The breast density assessment was based on a three dimensional (3D) volumetric tool (Quantra, Hologic), which provides an objective estimate of the total volume of fibroglandular tissue as well as the total volume of the breast. The 3D volume density (Vbd) acquired in the four views in each subject were compared.

RESULTS

The mean absolute and percent difference of Vbd between CC and MLO views was 2.8±3.0% and 23.8±22.8%, in the left breast, and 2.9±3.2% 24.7±23.9% in the right breast. A good correlation existed between the two views in each breast (r=0.84 for the left breast and r=0.83 for the right breast). The Vbd was also well correlated between LCC vs. RCC (r=0.86) and LMLO vs. RMLO (r=0.84).

Remarkable discrepancy of Vbd between CC and MLO views was, however, noted, in 11.9% of subjects in the right breast, and 11.2% of subjects in the left breast, showing >50% difference of Vbd, and in 28.9% of subjects in the right breast, and 28.5% of subjects in the left breast, showing >30% difference of Vbd. Percentage of discrepancy decreased remarkably for subjects with dense breast (Vbd >20%).

CONCLUSION

Our preliminary analysis showed that despite Vbd was well-correlated between CC and MLO views of each breast, and the left and right breasts in general, many women did show high discrepancy of intra-subject density results.

CLINICAL RELEVANCE/APPLICATION

Volumetric density analysis tools are increasingly being used for quantification of breast density. Before the 3D density tools can be applied for risk prediction or management, there is an urgent need to investigate the factors accounting for the inconsistent measurements among the four views of the same subject.
RESULTS
Median age at diagnosis was 53 years for SCA and 50 years for IC. IC were not associated with any risk factor or tumor subtype (p=0.36). Mean size of invasive cancers was 0.8 cm for SCA and 0.7 cm for IC. SCA were highly associated with invasive cancers (SCA: 87/120, 73%, IC: 18/48, 37%, p

CONCLUSION
Screening MRI preferentially detects invasive cancers and intermediate and high grade DCIS. Most IC after a negative MRI are detected as mammographic calcifications, representing low to intermediate grade DCIS. No clinical or histopathologic features are associated with the development of IC.

CLINICAL RELEVANCE/APPLICATION
Tumor biology of MRI SCA differ from IC. Women undergoing breast cancer screening with mammography and MRI may benefit from alternating screening at 6 month intervals, regardless of BRCA status.

BRE158
Beyond Gynecomastia: Less Common Entities in Male Breast Disease— A Pictorial Review
(Station #6)
Lilian Wang MD (Presenter): Nothing to Disclose

TEACHING POINTS
The aim of this exhibit is to review the clinical presentation, imaging features, and management of less common entities in male breast disease.

TABLE OF CONTENTS/OUTLINE
Review anatomy of the male breast. Briefly discuss diagnostic evaluation of the symptomatic male patient and more common entities of gynecomastia and male breast cancer. Multimodality pictorial review with pathologic correlation for less common entities in male breast disease: diabetic mastopathy, myofibroblastoma, epidermal inclusion cyst, Poland syndrome, lipoma edema, secondary to ESRD, papillary carcinoma, DCIS, metastatic melanoma. Review current literature on epidemiology, imaging findings, and management for each entity.

BRE129
Diagnostic Breast Tomosynthesis: Should We Dispense of Conventional Diagnostic Mammography Views? (Station #7)
Deanna Lynn Lane MD (Presenter): Nothing to Disclose, Monica Liwen Huang MD: Nothing to Disclose, Marion Elizabeth Scoggins MD: Nothing to Disclose, Beatriz E. Adrada MD: Nothing to Disclose, Basak Erguvan Dogan MD: Nothing to Disclose

TEACHING POINTS
Tomosynthesis helps characterize lesion margins and may increase diagnostic accuracy for noncalcified masses, distortions, and asymmetries. Lesions may appear to resolve on conventional spot compression views, but can be identified as true lesions on tomosynthesis. Tomosynthesis can define the accurate location of lesions seen on only a single conventional mammographic view. In some cases, tomosynthesis may obviate the need for multiple mammographic images obtained during conventional diagnostic workup and result in radiation dose-reduction. Diagnostic tomosynthesis may resolve pseudolesions on BIRADS-0 screening callbacks and obviate the need for sonography in some cases.

TABLE OF CONTENTS/OUTLINE
Review basic principles of digital breast tomosynthesis. Case-based presentation to illustrate the use of tomosynthesis in the diagnostic setting. Case examples will include: Tomosynthesis for diagnostic workup of BIRADS 0 screen callback cases, particularly for architectural distortions, noncalcified masses, and focal asymmetries. Lesions visualized on tomosynthesis, but occult or less conspicuous on conventional spot compression. Imaging features of these lesions will be reviewed, and pathologic correlation will be included. Lesions seen in a single mammographic view, but accurately localized by tomosynthesis.

BRE148
Interpretation of Breast MRI Utilizing the BI-RADS 5th Edition Lexicon: How Are We Doing and Where Are We Headed? (Station #8)
Kyuungmin Shin MD (Presenter): Nothing to Disclose, Kanchan Phalak MD: Nothing to Disclose, Anthony Sam Hamame MD: Nothing to Disclose, Mahdieh Parizi MD: Nothing to Disclose

TEACHING POINTS
1. Understanding the role of breast MRI (i.e. screening, diagnosis, and problem solving)
2. Review the new BI-RADS 5th edition lexicon for breast MRI with pictorial examples
3. Review the changes and new descriptors from the BI-RADS 4th edition to the 5th edition
4. To understand how appropriate utilization of BI-RADS 5th edition lexicon could help with interpretation of breast MRI and its clinical application

TABLE OF CONTENTS/OUTLINE
Role of breast MRI • high risk screening • problem solving • extent of disease evaluation • implant evaluation • others BI-RADS 5th edition lexicon for breast MRI with pictorial examples • Amount of tissue and background enhancement • Focus • Mass • Non-mass enhancement • Non-enhancing findings • Fat containing lesions • Skin and glandular changes • Intramammary lymph node • Associated features • Kinetic curve assessment • Implants Changes in lexicon from the BI-RADS 4th to the 5th edition and what is new on the 5th edition Current and future directions of breast MRI and summary Brief quiz for reinforcement of appropriate use of the BI-RADS 5th edition lexicon for breast MRI
Cardiovascular Magnetic Resonance in Chagas Disease: Differences by Clinical Stages and its Impact (Station #1)

Jorge Ignacio Magana MD (Presenter): Nothing to Disclose, Gabriela Melendez MD: Nothing to Disclose, Aloha Meave: Nothing to Disclose, Leyli C Velasquez MD: Nothing to Disclose, Cynthia Romero-Aragonés MD: Nothing to Disclose

PURPOSE
To assess the characteristics in cardiac magnetic resonance (CMR) of Chagas disease according to the clinical stage.

METHOD AND MATERIALS
We analyzed forty-eight patients with positive anti-T. cruzi antibodies that underwent CMR for evaluation of late enhancement and functional ventricular parameters. Patients were divided according to the clinical stage: indeterminate (7 patients), subclinical (5 patients) and Chagas cardiomyopathy (36 patients). Chagas cardiomyopathy (CC) patients were divided according to their clinical presentation 18 patients in heart failure (HF) and 18 ventricular tachycardia (VT) patients.

RESULTS
Progressive increase in measurements, global LV volumes and myocardial segments with late enhancement (LE), as well as a decrease in LVEF as the clinical stage progresses was found. There was an inverse relationship between the number of segments with LE and LVEF. Patients with VT had higher LVEF and lower ventricular volumes compared with patients with HF (LVEF 38.3% vs 21.9%, p = 0.000). There was a significant decrease in the number of segments with LE and a significant decrease in LVEF (0.7% vs 0.11%, p = 0.0005)

CONCLUSION
A progressive increase in segments with LE and decrease in LVEF as the clinical stage progresses. Patients with VT had higher LVEF and lower EDV compared to patients with HF.

CLINICAL RELEVANCE/APPLICATION
Chagas disease is widely distributed in developing latin american countries. The clinical scenarios of the disease between Mexico and other countries are different, but both share fatal ventricular arrhythmias and progression to congestive heart failure. Cardiac magnetic resonance (CMR) is an excellent method that may help to establish these different scenarios and detect those at higher risk and worst outcome.

Utility of Computed Tomography Coronary Angiography in Patients with Hypertrophic Cardiomyopathy Presenting with Chest Pain or Angina-equivalent Symptoms (Station #2)

Masoud Shariat MD (Presenter): Nothing to Disclose, Paaladinesh Thavendiranathan MD: Nothing to Disclose, Elsie Nguyen MD: Nothing to Disclose, Bernd J. Wintersperger MD: Speakers Bureau, Bayer AG Speakers Bureau, Siemens AG, Narinder S. Paul MD: Research funded, Toshiba Corporation, Harry Rakowski: Nothing to Disclose, Andrew Michael Dominic Crean MD: Nothing to Disclose

PURPOSE
Assess the utility of CTA in the assessment of patients with HCM and anginal symptoms and compare the incidence of epicardial CAD to an age and gender matched control group.

METHOD AND MATERIALS
Consecutive patients with HCM referred for CTA over a 3 year period due to anginal symptoms (chest pain or shortness of breath) were identified retrospectively. Age and gender matched patients without HCM referred for CTA over a 6 months period due to similar symptoms were used as controls. Data on CAD risk factors was collected in both groups. All patients had CTA using an Aquilion One 320 scanner. The coronary arteries were evaluated independently by 2 blinded observers and any luminal narrowing scored quantitatively as follows: > 70% = severe; 50-70% = moderate; < 50% = mild; and none. For the HCM group, results of SPECT or CMR perfusion studies as well as catheter angiograms were recorded where available.

RESULTS
Total of 91 patients with HCM and 91 controls were included. No significance difference in cardiac risk factors was present between two groups. The CTA was of diagnostic quality in all patients. The median (inter-quartile range) calcium score was lower in patients with HCM (0 [0-50] Hu versus 2[0-189] Hu) but did not reach statistical significance (p=0.23). The incidence of moderate to severe CAD was significantly lower in patients with HCM than in controls (6.6% versus 33.0%, p = 0.000). The incidence of moderate to severe CAD was significantly lower in our HCM patients compared to our control group. Given the high incidence of false positive findings on perfusion stress studies we propose that CTA may be a useful gatekeeper to coronary angiography in the HCM patient with anginal symptoms.

CONCLUSION
We demonstrate the use of CTA for assessment of anginal symptoms in patients with HCM. The incidence of moderate to severe CAD was significantly lower in our HCM patients compared to our control group. Given the high incidence of false positive findings on perfusion stress studies we propose that CTA may be a useful gatekeeper to coronary angiography in the HCM patient with anginal symptoms.

Study of Clinico-Epidemiological Characteristics and Analysis of the Image Findings in
Cardio-MR of Cardiomyopathy for a Period of 2 Years (Station #3)

Carmen de la Torre Valdivia MD (Presenter): Nothing to Disclose, Miguel Angel Ramirez: Nothing to Disclose, Rocio Rodriguez Ortega PhD: Nothing to Disclose, Maria Isabel Padin-Martin MD: Nothing to Disclose

PURPOSE

To describe the characteristics of cardiomyopathy and to show the main radiology findings in cardio-MR, specially those important to make a differential diagnosis.

To analyze our results.

METHOD AND MATERIALS

We have reviewed all cardio-MRI studies conducted in our center in the period between January 2012 and January 2014. The studies were performed on a General Electric® 1.5-Tesla Magnetic Resonance. Sequences performed in the study were Spin Echo single-shot secuences (HASTE), EST T1 and T2-weighted, cine-MR gradient-echo and cine-MR steady state free precession (Fiesta). Images postprocessing was performed by General Electric® Report Card. We used microsoft® excel 2010 for the statistical analysis of the obtained data.

RESULTS

During the period of our study (from January 2012 to January 2014), 201 cardiac-MRI studies were performed in our center. Most of the studies were conducted in the male gender (60.7 %), and the average age was 44 ± 19.4 years (range 9-79). 52% of these studies were made by clinical suspicion of cardiomyopathy. Hypertrophic cardiomyopathy was the most frequent diagnosis followed by dilated cardiomyopathy. Other diagnosis were restrictive cardiomyopathy, myocarditis and non-compaction cardiomyopathy.

CONCLUSION

Cardiomyopathy is a frequent entity in our environment. Cardio-MR study plays an important role in the early diagnosis and treatment of patients with cardiomyopathy.

CLINICAL RELEVANCE/APPLICATION

Cardio-MR is currently considered the gold standard in the study of cardiomyopathy and cardiac motility, being particularly useful in patients with little window that difficult the valuation of the myocardium by ultrasound.

CAS228

Evaluation of Image Quality and Diagnostic Accuracy of Coronary CT Angiography in Patients with Various Body Mass Index (BMI): Comparison of Iterative and Filtered Back Projection Image Reconstruction (Station #4)

Young Jun Cho MD (Presenter): Nothing to Disclose, Keum Won Kim MD: Nothing to Disclose, Cheol Mog Hwang MD: Nothing to Disclose, Kyu Ok Choe: Nothing to Disclose, Jung Han Hwang: Nothing to Disclose

PURPOSE

To compare traditional filtered back projection (FBP) and sonogram affirmed iterative reconstruction (SAFIRE) for the evaluation of coronary CT image quality and diagnostic accuracy in patients with various body mass indexes (BMI).

METHOD AND MATERIALS

One hundred nine consecutive patients (56 men, 53 women; mean age, 57.4 ± 11; range, 20-79) with various BMI underwent both coronary CTA and coronary catheterization. The study population was divided into three groups according to BMI: normal was defined as a BMI of 18.50 to 24.99 kg/m², overweight as a BMI of 25.00 to 29.99 kg/m², and obese as a BMI ≥ 30.00 kg/m². Image data were reconstructed with both FBP and SAFIRE. With two reconstruction techniques, we evaluated subjective image noise of each coronary segmental artery using a five-point scale according to the noise severity. We also evaluated objective image quality with two reconstruction techniques by measuring CT attenuation, image noise, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) as objective parameters. Diagnostic accuracies of FBP and SAFIRE were independently evaluated by significant coronary stenosis (≥50%) in comparison of coronary catheterization as the reference standard.

RESULTS

With both reconstruction techniques, the mean subjective image quality scores in all BMI groups were significantly higher with SAFIRE image than FBP image (p = 0.000). In obese and overweight patients, the number of assessable coronary segments was increased with SAFIRE. Image noise, SNR, and CNR were also significantly improved in all BMI groups when using SAFIRE, compared with FBP. In obese and overweight patients, specificity, PPV and accuracy of each SAFIRE for the detection of significant stenosis were significantly better than those of each FBP (p = 0.001, respectively).

CONCLUSION

Compare with traditional FBP image, the SAFIRE image in obese and overweight patients seems better suited by improvement of image quality and help to decreases the requirements of coronary catheterization by decreasing the number of false positive patient.

CLINICAL RELEVANCE/APPLICATION

The SAFIRE image in obese and overweight patients seems better suited by improvement of image quality and help to decreases the requirements of coronary catheterization by decreasing the number of false positive patient.

CAS229

“Heart of Brightness” – Delayed Enhancement Detection using Motion Corrected (MOCO) Phase
Therefore, a correction factor should be used for CCS of heavy patients, or image acquisition protocols that account for body size. This multivendor phantom study showed that CCS is underestimated up to 86% at a larger body size.

**CONCLUSION**

Scores increased for Philips to 4 (4-6) and decreased for the other vendors to 2 (2-4), 8 (7-8) and 10 (8-13) mg, respectively. Adding the extension ring resulted in reduced Agatston scores for all vendors (17-86%) and mass scores for three vendors (11-86%). Median mass scores increased for Philips to 9 (5-10), 18 (14-21), 5 (2-7) and 20 (17-24) mg, respectively. Routine acquisition protocols for both medium and heavy patients were evaluated with and without an extension ring using routine protocols of state-of-the-art CT systems.

**RESULTS**

FB MOCO SSFP had higher image quality and diagnostic confidence and less artifact than both FB single shot SSFP and BH TF. It detected more DE than FB single shot SSFP and BH TF detected the most DE but with the lowest image quality and diagnostic confidence. The advantage that non-ischemic cardiomyopathy, FB MOCO SSFP is overall superior to FB single shot SSFP and superior to BH TF in the large number of cases where BH TF images are poor.

**CONCLUSION**

FB MOCO SSFP had higher image quality and diagnostic confidence and less artifact than both FB single shot SSFP and BH TF. It detected more DE than FB single shot SSFP. BH TF detected the most DE but with the lowest image quality and diagnostic confidence. This suggests that in non-ischemic cardiomyopathy, FB MOCO SSFP is overall superior to FB single shot SSFP and superior to BH TF in the large number of cases where BH TF images are poor.

**CLINICAL RELEVANCE/APPLICATION**

As increasingly sicker patients undergo cardiac MRI, robust motion corrected images are needed to combat poor breathholding and fast or irregular rhythms. This sequence provides this and will be increasingly important over time.

**RESULTS**

The medium sized phantom resulted in median (interquartiles) Agatston scores of 10 (9-35), 113 (72-133), 34 (30-37) and 87 (85-89) for Philips, GE, Siemens and Toshiba, respectively. Mass scores were 4 (3-9), 18 (14-21), 8 (8-9) and 20 (20-20) mg, respectively. Adding the extension ring resulted in reduced Agatston scores for all vendors (17-86%) and mass scores for three vendors (11-86%). Median Agatston scores decreased to 9 (5-10), 16 (15-20), 27 (24-32) and 45 (29-53) units, and median mass scores increased for Philips to 4 (4-6) and decreased for the other vendors to 2 (2-4), 8 (7-8) and 10 (8-13) mg, respectively.

**CONCLUSION**

This multivendor phantom study showed that CCS is underestimated up to 86% at a larger body size.
Therefore, a correction factor should be used for CCS of heavy patients, or image acquisition protocols should be standardized across platforms of different vendors.

**CLINICAL RELEVANCE/APPLICATION**

Body size is an important determinant of the coronary calcium score and may impact perceived risk for future cardiovascular events.

**CAS227 Reduction of Beam Hardening Artifacts for Coronary Stent by using the Cardiac Spectral Imaging at Various Heart Rates: An In Vitro Study (Station #7)**

**PURPOSE**

Detection of in-stent re-stenosis using cardiac CTA is still challenging. One important obstacle is the beam hardening artifact from the high density stent, which may decrease the positive predictive value or even fail the examination. The cardiac gemstone spectral imaging (GSI) allows the synthesis of virtual monochromatic spectral (VMS) images, which may reduce the beam hardening artifact. The purpose of this study was to explore the reductions of beam hardening artifacts by using different energy levels of VMS at various heart rates.

**METHOD AND MATERIALS**

Totally 5 different types of coronary stents (internal diameter: 3.10±0.55mm; strut thickness: 0.12±0.04mm) were placed in a pulsating cardiac phantom (ALPHA 1-VT PC, Fuyo Corporation, Japan). The cardiac GSI scans were acquired on a single-source dual-energy spectral CT scanner (Discovery CT750 HD CT FREEdom Edition scanner, GE Healthcare, Milwaukee, WI, USA). All the spectral imaging data were analyzed with GSI viewer to reconstruct the VMS images (40~140keV). The Artifact Index (AI) was measured for each keV level data set.

**RESULTS**

On stationary condition, the AI of the polychromatic axial scan with standard reconstruction was 115.92 ± 34.86, while the AIs of VMS were 62.07 ± 18.67, 42.29 ± 12.72, 35.33 ± 10.62, 27.95 ± 8.41, 17.87 ± 5.37, 8.12 ± 2.44, 5.73 ± 1.72 on 40~100keV by interval of 10 keV, respectively (p<0.001). There were significant differences of AIs between the VMS and polychromatic images (ps<0.001). AIs above 80keV decreased significantly than the others (ps<0.005). Similar results were also found in the other heart rates (AI in 60bpm: 81.46 ± 24.46 for polychromatic images, 54.12 ± 16.29 in 40keV, 13.68 ± 4.11 in 80keV; AI in 70bpm: 19.34 ± 5.92 for polychromatic images, 59.55 ± 17.93 in 40keV, 6.33 ± 1.92 in 80keV).

**CONCLUSION**

VMS images with high energy level (i.e., >80keV) can apparently reduce the beam hardening artifacts for coronary stent in various heart rates.

**CLINICAL RELEVANCE/APPLICATION**

The spectral CTA could effectively reduce the artifact, and may have the potential to show a clear inner-lumen for the patient with coronary stent in clinic.

**CAE112 Applicability and Benefits of an In-house Rapid Prototyping 3D Printer in Cardiac Imaging Departments (Station #8)**

**TEACHING POINTS**

Commercially available Rapid Prototyping (RP) printers, such as Makerbot (Brooklyn, NY) Replicator 2X used in this study, produce accurate 3D analogs The use of a RP printer in-house has several potential benefits such as fast turnaround time (aortic root with coronaries:<12hrs, entire aorta:<20hrs vs. at least >24 hours from third party vendors), cost efficient, and protection of patient data from third parties 3D models of both normal and diseased cardiac structures can be used as teaching tools for patients, technologists, trainees, and other healthcare workers

**TABLE OF CONTENTS/OUTLINE**

**CHS274**

**Normal Right Hemidiaphragmatic Motion Measured with M-Mode Ultrasonography in a Large Healthy Population (Station #1)**

June-Sik Cho MD : Nothing to Disclose, Jeong Eun Lee : Nothing to Disclose, Kyung-Sook Shin MD : Nothing to Disclose, Borahm Lee (Presenter) : Nothing to Disclose, Won Hong Park MD : Nothing to Disclose

**PURPOSE**

To establish the reference value for normal right hemidiaphragmatic motion measured by M-mode ultrasonography in a large healthy population.

**METHOD AND MATERIALS**

From May 2013 to January 2014, a total of 288 adult subjects (140 men and 148 women) who had regular checkup liver ultrasound scans underwent M-mode ultrasonography for evaluation of right hemidiaphragmatic motion. Examinations were performed three times: during quiet breathing, deep breathing, and voluntary sniffing. Diaphragmatic excursion was determined as median value of the three measurements during each examination. Relationships between diaphragmatic motion and different variables [sex, age groups (≤30, 31-60, ≥61), and BMI groups (<18.5, 18.5-23, >23)] were assessed.

**RESULTS**

Right hemidiaphragmatic motion was successfully evaluated in all 288 subjects during quiet breathing, deep breathing, and voluntary sniffing. The median values of diaphragmatic excursions of quiet breathing, deep breathing, and voluntary sniffing were 1.9 cm (range, 0.9-4.2; mean ±SD, 2.0±0.5), 4.9 cm (range, 1.2-8.6; mean ±SD, 4.9±1.2), and 2.6 cm (range, 1.2-5.5; mean ±SD, 2.7±0.8). There was no significant difference in diaphragmatic motion between sex and age groups, respectively, during quiet breathing, deep breathing, and voluntary sniffing (p > .05 in all examinations). In BMI groups, there was no significant difference in diaphragmatic motion during quiet breathing and voluntary sniffing (p=0.626 and 0.137, respectively); however, there was significant difference during deep breathing (P< .05).

**CONCLUSION**

The results of this study suggest a reference value of normal right hemidiaphragmatic motion.

**CLINICAL RELEVANCE/APPLICATION**

The reference value of normal right hemidiaphragmatic motion can be used in study of diaphragmatic movement disorders such as diaphragmatic paralysis.

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**CHS275**

**Clinical Value of Spectral CT Imaging for the Assessment of Interface between Atelectasis and Lung Tumor (Station #2)**

Ying Guo (Presenter): Nothing to Disclose

**PURPOSE**

To evaluate the utility of spectral CT images for the visualization of the interface between atelectasis and lung tumor.

**METHOD AND MATERIALS**

The study consist of 24 patients pathologically confirmed of lung cancer with atelectasis underwent spectral CT imaging in artery and venous phase. The optimal monochromatic and iodine-based material decomposition images were obtained. Images were assessed by two radiologists for the display of interface between atelectasis and lung tumor. The iodine concentrations between tumour and atelectasis was compared by paired t test. The grades of the interfaces were evaluated by using a 4-point scale (0-poor to 3-excellent) and compared between artery phase and venous phase.

**RESULTS**

The optimal energy level was in the range of 50-65keV (median 54.99 keV) for displaying tumour-atelectasis interface at venous phase. CNR and image score of interface between tumour and atelectasis in venous phase was significant higher than that of in artery phase (p<0.05). Interface could be defined in 2(8%) and 21(87.5%) patients in artery phase and venous phase, respectively. The iodine concentrations of atelectasis was statistical higher than that of tumor in venous phase, but there was no statistical difference in artery phase (P>0.05).

**CONCLUSION**

Spectral CT imaging could improve contrast between atelectasis and tumor in central lung cancer with the optimized CNR. Monochromatic images from spectral CT enable better visualization of the interface between tumor and atelectasis.

**CLINICAL RELEVANCE/APPLICATION**

Spectral CT characteristic measurements is promising for differentiating benign and malignant findings.

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**CHS276**

**Differentiating Lung Cancer from Inflammatory Lesions Using Spectral CT Imaging (Station #3)**

Yun Liu MD (Presenter): Nothing to Disclose, Xuemei Wang : Nothing to Disclose, Xingjuan Wang : Nothing to Disclose, Xiaolu Ren : Nothing to Disclose, Hua I. Shi MD : Nothing to Disclose, Lulu Yang MD : Nothing to Disclose, Shaoning Yan : Nothing to Disclose
PURPOSE
To investigate the feasibility of differentiating lung cancer from inflammatory lesions by using spectral CT imaging.

METHOD AND MATERIALS
82 patients with pulmonary focal lesions (57 patients with lung cancer and 25 patients with inflammatory lesions) underwent plain and enhanced CT scans with spectral imaging mode. Spectral CT imaging related parameters for lesions such as calcium concentration in the plain CT phase and normalized iodine concentration (NIC, to that of aorta) and spectral HU curve in the enhanced CT phase were obtained. The slope k of the spectral HU curve was calculated as k=(HU(40keV)-HU(90keV))/50. All results were analyzed with independent samples t test. Receiver operating characteristic (ROC) curves were generated to determine threshold parameters for optimizing sensitivity and specificity in differentiating lung cancer and inflammatory lesions.

RESULTS
(1) In the plain CT: The calcium concentrations of lung cancer and inflammatory lesions were (3.41±1.48mg/ml) and (4.59±2.65mg/ml), respectively with significant differences between the two groups (t=-2.09, p=0.045). (2) In the enhanced CT: The slope k and NIC were (1.60±0.35, 0.12±0.02) and (1.94±0.62, 0.15±0.04) for lung cancer and inflammatory lesions, respectively, with statistical differences between the two groups (all p<0.05). (3) With value of 1.80, the slope in the enhanced CT provided relatively high sensitivity (72%) and specificity (76%) in differentiating lung cancer from inflammatory lesions, and the area under curve was 0.75.

CONCLUSION
Spectral CT imaging provides additional parameters (slope of spectral curve and NIC) than conventional CT to provide relatively high sensitivity and specificity for differentiating lung cancer from inflammatory lesions.

CLINICAL RELEVANCE/APPLICATION
With additional information, Spectral CT may provide better solution for differentiating lung cancer from inflammatory lesions than conventional CT.

CHS277

Drug-related Pneumonitis during mTOR Inhibitor Therapy in Patients with Waldenstrom Macroglobulinemia (Station #4)

Mizuki Nishino MD (Presenter): Consultant, Bristol-Myers Squibb Company, Erica N. Boswell: Nothing to Disclose, Hiroto Hatabu MD, PhD : Research Grant, Toshiba Corporation Research Grant, Aze, Ltd Research Grant, Canon Inc, Irene M. Gobrial MD : Nothing to Disclose, Nikhil H. Ramaiya MD : Nothing to Disclose

PURPOSE
To determine the frequency of drug-related pneumonitis during mTOR inhibitor therapy in Waldenstrom macroglobulinemia (WM) patients, and investigate the imaging characteristics and patterns of pneumonitis.

METHOD AND MATERIALS
Forty patients (23 males and 17 females, age:43-84) with WM treated in 2 trials of mTOR inhibitor, everolimus, who had baseline and at least one follow-up chest CT available for review were retrospectively studied. All chest CT scans were reviewed for abnormalities suspicious for drug-related pneumonitis by consensus of 3 radiologists, evaluating 1) extent in upper, middle and lower lungs (none, <5%, 5-25%, 25-50%, >50%), 2) distributions (peripheral, diffuse, central or mixed; and upper, lower, diffuse, multifocal or focal), and 3) specific CT findings. The cases with definite or probable drug-related pneumonitis were classified using ATS/ERS classification of interstitial pneumonia based on CT features.

RESULTS
Drug-related pneumonitis was noted in 23 patients (58%)(definite in 19; probable in 4). Median time between therapy initiation and the onset of pneumonitis was 5.5 months. Lower lungs were involved in all 23 patients, with higher extent than other zones (median extent: upper:<5%; middle:5-25%; lower:25-50%; p<0.001). The distribution was most commonly peripheral and lower in 11 (48%), and mixed and multifocal in 10 patients (44%). Findings were bilateral in 20 (87%). GGOs and reticular opacities were present in all 23 patients, with consolidation in 12, traction bronchiectasis in 2 and centrilobular nodularity in 1 patient. The pattern of pneumonitis was classified as COP in 16 and NSIP in 7, while overlapping features of COP and NSIP were noted in 7 patients (5 in COP group and 2 in NSIP group). No significant differences were noted in clinical characteristics between patients with and without pneumonitis (p>0.34).

CONCLUSION
Drug-related pneumonitis was noted on CT in 58% of WM patients treated with mTOR inhibitor. Most common findings were bilateral GGOs and reticular opacities, with or without consolidation, in peripheral and lower lungs. Patterns of CT findings simulate COP and NSIP.

CLINICAL RELEVANCE/APPLICATION
Awareness of the high incidence and characteristic imaging features of drug-related pneumonitis during mTOR inhibitor therapy contribute to accurate radiologic interpretation and patient management.

CHS279

Female Asthmatics Show a BMI Dependent Change in their Deltalumen: SARP Cohort Data Shows that Females are More at Risk than Males for Bronchial Collapse with an Increase in Weight (Station #6)

Sung Shin Shim (Presenter): Nothing to Disclose, Sean B. Fain PhD : Research Grant, General Electric Company Research Consultant, Marvel Medtech, LLC, Ronald L. Sorkness : Nothing to Disclose,

PURPOSE
To investigate the feasibility of differentiating lung cancer from inflammatory lesions by using spectral CT imaging.

METHOD AND MATERIALS
82 patients with pulmonary focal lesions (57 patients with lung cancer and 25 patients with inflammatory lesions) underwent plain and enhanced CT scans with spectral imaging mode. Spectral CT imaging related parameters for lesions such as calcium concentration in the plain CT phase and normalized iodine concentration (NIC, to that of aorta) and spectral HU curve in the enhanced CT phase were obtained. The slope k of the spectral HU curve was calculated as k=(HU(40keV)-HU(90keV))/50. All results were analyzed with independent samples t test. Receiver operating characteristic (ROC) curves were generated to determine threshold parameters for optimizing sensitivity and specificity in differentiating lung cancer and inflammatory lesions.
PURPOSE
The aim of this study was to assess airway luminal change found on post processing of HRCT images in asthma patients and to determine if there was any correlation with their respective clinical indices and BMI.

METHOD AND MATERIALS
We prospectively enrolled a total of 152 severe asthma research program (SARP) subjects. The airway deltalumen was defined as the ratio of difference between airway lumen area found at HRCT during total lung capacity (TLC) and functional residual capacity (FRC) / airway lumen area at TLC. Deltalumen of all 1st - 6th generation airways was measured using VIDATM software, and the mean values for each subject were calculated. Correlations were made between mean value of deltalumen and age, sex, duration of asthma, severity, spirometry parameters including baseline FEV1 percentage predicted (PP), baseline FEF25-75 PP, and body mass index (BMI). SPSS package was used to test for any statistical significance for each of the variables measured in the asthmatics (Spearman rank correlation coefficient and multivariate regression).

RESULTS
We found that deltalumen showed the positive correlation with BMI (r=0.274, p=0.001), baseline FEV1 pp.(r=0.163, p=0.045) and FEF25-75 pp. (r=0.182, p=0.028) and multivariate regression analysis of deltalumen in asthmatics was independently determined by BMI (P<0.001). By gender, BMI in females was also found to be positively correlated with deltalumen (r=0.391, p<0.001) but, this was not found for male subjects (r=0.023, p=0.860). This association was also different in non-severe and severe asthma groups. BMI was found to be significantly correlated with deltalumen for the non-severe asthmatics (r=0.417, p=0.001), but not for severe asthmatics (r=0.180, p=0.095).

CONCLUSION
Deltalumen was found to be positively associated with lung function and BMI. BMI was most highly correlated with deltalumen in the female non-severe asthmatic group.

CLINICAL RELEVANCE/APPLICATION
Weight control in female non-severe asthmatics may prove to be important for their lung function. As this group gains weight they are more likely to have collapse of their airways.

ERS-THA
Emergency Radiology Thursday Poster Discussion

Revised Criteria for Ultrasound Diagnosis of Appendicitis: Importance of Hyperechoic Fat in Adult and Pediatric Patients with Appendices Measuring 6-8 mm in Diameter (Station #1)

Stephanie T. Chang MD (Presenter): Nothing to Disclose, R. Brooke Jeffrey MD: Research Consultant, InnerVision Ultrasound, Jarrett Rosenberg PhD: Nothing to Disclose, Eric West Olcott MD: Nothing to Disclose

PURPOSE
To determine whether the ultrasound (US) presence of hyperechoic fat, hyperemia or an abnormal submucosal layer (SML) may be additionally predictive with appendiceal diameter in diagnosing acute appendicitis among pediatric and adult patients.

METHOD AND MATERIALS
A total of 381 patients (292 pediatric patients and 89 adults defined as greater than 18 years in age) between the ages of 2-40 years undergoing US evaluation for appendicitis between December 2011-January 2013 with visualized appendices were included. US cases were retrospectively reviewed by two independent readers for the presence of hyperechoic fat (absent, unilateral, or circumferential), loss of the SML, or increased Doppler blood flow. Acute appendicitis was ascertained by surgery or clinical follow-up.

RESULTS
In a multivariate model including sex, age, maximum anterior-posterior diameter, fat, SML loss, and Doppler flow, only appendical diameter (OR 2.7, p<0.001), unilateral fat (OR 4.1, p=0.039), and circumferential fat (OR 7.7, p<0.001) demonstrated significant independent predictive value for diagnosing acute appendicitis in a population of adult and pediatric patients. Specifically, for borderline appendices measuring between 6-8 mm in diameter, the presence of circumferential fat significantly increased the likelihood of appendicitis (OR 9.0, p=0.006).

CONCLUSION
The US presence of hyperechoic fat, particularly circumferential fat, is the most important secondary finding to appendiceal diameter for diagnosing appendicitis in both pediatric and adult patients.
The presence or absence of hyperechoic fat on US evaluation for appendicitis is the most important finding for improving sensitivity and specificity in appendices between 6-8 mm in diameter.

**ERS234**

**Imaging of Postcoital Pelvic Pain and/or Vaginal Bleeding (Station #2)**

**Ajay K. Singh** MD (Presenter): Nothing to Disclose, **Hani H. Abujudeh** MD, MBA: Research Grant, Bracco Group Consultant, **RCG HealthCare Consulting Author**, **Oxford University Press**

**PURPOSE**

The aim of the study was to study the evaluate features of female patient's presenting with postcoital acute or subacute pelvic pain and/or bleeding

**METHOD AND MATERIALS**

248 patients (17-74 years; Avg 35.2 years) with history of pelvic pain and/or bleeding after coitus were included in this study. There were 246 ultrasound, eight CT and oneMR studies were performed in the 247 patients. There were 80 patients with vaginal bleeding (40 with pelvic pain and 40 without pelvic pain). Rest of the patient's (n = 167) presented with pelvic pain without bleeding. 32 patient had history of intrauterine device insertion in the past.

**RESULTS**

Out of the 168 patients who were imaged for postcoital pain, 80 (47.6%) patients had a positive imaging study. In this group 24 had uterine fibroids, and 32 had an ovarian cyst measuring at least 2.5 cm in diameter. The other findings in the patients included 1 hydronephrosis, 1 hematomata, 1 malpositioned IUD, 7 adenomyosis (one with fibroid), 4 hemoperitoneum, 1 pelvic inflammation, 3 polycystic ovarian disease, 2 polyps, and 4 suspected adenomyosis. In the 40 patients with pain and vaginal bleeding 40% of the patients had a positive imaging finding, while in patients with vaginal bleeding only 47.5% (19/40) patients had a positive imaging finding. Amongst the 247 patients, there were 4 patients with significant hemoperitoneum, 1 patient with vaginal perforation and 2 patients with ovarian neoplasm.

**CONCLUSION**

Pelvic imaging for postcoital pain and/or bleeding has a high rate of positive results which justify its use in patient management. Findings of postcoital pain and/or vaginal bleeding are uterine fibroids and functional ovarian cysts, the most clinically significant result which can potentially require emergent intervention is intraperitoneal bleeding and vaginal vault perforation.

**CLINICAL RELEVANCE/APPLICATION**

The study justifies the use of pelvic imaging for postcoital pain and/or bleeding based on high positivity rate. The study concludes that the most common findings of postcoital pain and/or vaginal bleeding are uterine fibroids and functional ovarian cysts, which do not require emergency surgery. It enumerates the serious causes which need urgent management..

**ERS235**

**Performance of Automated 3D-rendering of Ribs in Polytrauma Patients: Clinical Experience in 110 Patients (Station #3)**

**Suonita Khung**: Nothing to Disclose, **Pauline Masset**: Nothing to Disclose, **Jean-Baptiste Faivre MD**: Nothing to Disclose, **Nunzia Tacelli MD**: Nothing to Disclose, **Jacques Remy MD**: Research Consultant, Siemens AG, **Martine J. Remy-Jardin MD, PhD (Presenter)**: Research Grant, Siemens AG

**PURPOSE**

To evaluate the diagnostic performance of virtually-rendered unfolded views of the ribs.

**METHOD AND MATERIALS**

110 consecutive adult patients referred for polytrauma underwent a chest CT examination, retrospectively reviewed for specific detection of rib fractures according to two independent approaches: (a) analysis of transverse CT sections, completed with multiplanar reformats whenever deemed necessary by the reader (Group 1); (b) analysis of unfolded ribs as proposed by the software « CT Bone Reading » that generated a virtually-rendered unfolded view of the ribs and spine, with the possibility of rib analysis along their long axis and creation of standard orthogonal views in different orientations of any area suspected of fracture (Group 2). The gold standard for the diagnosis of rib fractures was established by the combined analysis of Group 1 and Group 2 images. Image analysis was obtained as follows: (a) separate reading of Group 1 and Group 2 images by two independent readers (a junior reader and a senior reader); (b) consensus analysis of Group 1 and Group 2 images by the two readers to establish the final diagnosis of rib fractures.

**RESULTS**

From the gold standard analysis, 44 patients had rib fractures (mean number of fractures per patient: 2.85) with a total of 266 ribs fractured and a total of 314 fractures (222 undisplaced; 92 displaced). The “CT bone reading” provided a complete reconstruction of the whole ribcage in 94 patients (85.5%) and partially incomplete reconstructions (1-5 ribs inadequately reconstructed) in 16 patients (14.5%). The software performance was established as follows: (a) diagnosis of rib fracture (sensitivity: 0.84; specificity: 1); (b) number of ribs fractured (sensitivity: 0.77; specificity: 0.99); (c) number of displaced fractures (sensitivity: 0.92; specificity: 1). Group 2 analysis allowed detection of 38.8% of rib fractures missed in Group 1 and significantly reduced the junior reader's reading time (p<0.0001).

**CONCLUSION**

This software has the potential to help detect rib fractures in polytrauma patients.

**CLINICAL RELEVANCE/APPLICATION**

The detection of rib fractures in a polytrauma patient, often difficult and time consuming, can be helped by the evaluated system.
Does Distance Matter? Effect of Having a Dedicated CT Scanner in the Emergency Department on Completion of CT Imaging and Final Patient Disposition Times (Station #4)

Wilfred Dang BS (Presenter): Nothing to Disclose, Ania Zofia Kielar MD: Nothing to Disclose, Angel Yi Nam Fu BSc: Nothing to Disclose, Suzanne T. Chong MD: Nothing to Disclose, Matthew Donald Fernand McInnes MD, FRCP: Nothing to Disclose

PURPOSE
To evaluate whether the presence of a CT scanner in the emergency department (ED) improves ED workflow by decreasing the time between imaging requisition and completion, as well as potentially impacting patient outcomes by shortening time to final disposition.

METHOD AND MATERIALS
IRB approval was obtained for this retrospective study conducted on 2,142 consecutive, acute thoracic, abdominal, and pelvic imaging requests from two affiliated academic EDs from August 1 to October 31, 2012. At one institution, the CT scanner is in the ED; in the other it is located in the radiology department 300m away from the ED. Patients were stratified based on acuity of CT indication, interpreting radiologist training level, and the time of day of scanning. Three time points were compared between hospitals: 1) the time the CT requisition was received to the time the CT scan was initiated (ΔTime 1), 2) the time from CT scan initiation to the time the CT was reported preliminarily by a resident/fellow, or verbally reported by staff to the ED (ΔTime 2), and 3) the time the CT requisition was received to the time of final patient disposition (ΔTime 3).

RESULTS
Decreases in time, favouring the institution with the ED CT scanner, are 16 (P<0.0001), 15 (P<0.0001), and 19 minutes (P<0.04). Significant differences were also seen in morning and overnight shifts (P<0.0001, P<0.0001, P<0.001, and P<0.0001, P=0.04, P<0.001) and for CT reporting times in higher radiology levels of training (P=0.04 and 0.0001 for Staff and PGY 5, respectively). No significant differences were seen for hyperacute patients.

CONCLUSION
The presence of an ED CT scanner is associated with decreases time to CT scan completion, radiological interpretation and patient disposition.

CLINICAL RELEVANCE/APPLICATION
A CT scanner in the Emergency department reduces: time from request to scan initiation, time from CT request reception to interpretation, and time of patient disposition for acute-care patients.

Spectrum of CT Appearance of Traumatic Venous Injuries (Station #5)

Suresh Cheekatla MBBS (Presenter): Nothing to Disclose, Nagaramesh Chinapuvvula MBBS: Nothing to Disclose, Susanna Claire Spence MD: Nothing to Disclose

TEACHING POINTS
1. To know the spectrum of traumatic venous injuries. 2. To know how to recognize these injuries on CT.

TABLE OF CONTENTS/OUTLINE
1. CT signs that are definitive for venous injury: a) Intraluminal filling defect or thrombus seen on venous and delayed phases. b) Venous pseudoaneurysm seen on venous and delayed phases. c) Venovenous fistula seen on venous and delayed phases. d) Arteriovenous fistula seen on arterial phase. e) Active contrast extravasation seen on venous and/or delayed phases. 2. CT signs that are suggestive but not definitive for venous injury: a) Hematoma, stranding, or fluid around the vein. b) Contour irregularity. c) Luminal narrowing.
its association with overall survival (OS) in advanced hepatocellular carcinoma (HCC) treated by sunitinib.

**METHOD AND MATERIALS**

Twenty patients with advanced HCC underwent DCE-MRI at baseline, and received sunitinib daily by mouth for 28 days followed by 14 days of rest in 6-week cycles. The baseline DCE-MRI data were analyzed retrospectively by using five different standard dual-input PKMs: the Tofts-Kety (TK), extended TK, two compartment exchange, adiabatic approximation to the tissue homogeneity (AATH), and distributed parameter (DP) models. Kinetic parameters consisted of total hepatic blood flow (BF), arterial flow fraction (γ), arterial BF (BFA), portal BF, blood volume, mean transit time, capillary permeability-surface area product (PS), fractional interstitial volume (vI), and extraction fraction (E). Following receiver operating characteristic analysis with additional leave-one-out cross-validation, parameters of the different kinetic models were compared in terms of 1YS discrimination using cross-validated Kaplan-Meier analysis, and association with OS using a univariate Cox-proportional hazard model, with additional permutation testing.

**RESULTS**

For 1YS prediction, the TK-model-derived VI (P=0.037), the AATH-model-derived BFA (P=0.019), PS (P=0.027), and E (P=0.033), and the DP-model-derived γ (P=0.012) and BFA (P=0.041) had statistically significant predictability after cross-validation and permutation testing, all of which were lower in the high-risk group. For OS, the increase of the AATH-model-derived PS and the DP-model-derived BFA were statistically significantly associated with the increase of OS with hazard ratios of 0.766 (P=0.023) and 0.809 (P=0.025) after permutation testing, respectively.

**CONCLUSION**

The AATH-model-derived PS and the DP-model-derived BFA were effective biomarkers for both the prediction of 1YS and the association with OS. Among the standard models, the AATH and DP were favorable models in survival analysis.

**CLINICAL RELEVANCE/APPLICATION**

Kinetic parameters derived from dual-input PKMs with the fast water exchange regime based on baseline DCE-MRI data can provide effective prognostic imaging biomarker.
This retrospective study included 25 abscesses in 20 patients and 33 tumors in 26 patients who underwent CECT, and for further comparison, 19 hepatic simple cysts in 19 patients were also reviewed. Multislice-based texture analysis was assessed for CECT images using a Laplacian of Gaussian band-pass filter (5 filter levels with sigma weighting ranging from 1.0 to 2.5), with quantification of uniformity, entropy, kurtosis and skewness. Statistical significance for these parameters was tested by one-way ANOVA followed by Tukey honestly significant difference (HSD) test. Diagnostic performance was evaluated using the receiver operating characteristics (ROC) curve analysis.

RESULTS
There were significant differences in entropy and uniformity at all sigma weightings (P < 0.001), and in kurtosis and skewness only at sigma 1.8 and 2.0 weightings (P = 0.002-0.006) when hepatic abscess, malignant mimickers and simple cysts were compared. Tukey HSD test showed that abscess had a significantly higher entropy and a significantly lower uniformity than malignant mimickers (P = 0.000-0.004). Entropy (at a sigma 2.0 weighting) had the largest area under the ROC curve of 0.888 in distinguishing abscess from malignant mimickers, with a sensitivity of 81.8% and a specificity of 88.0% using a threshold of 3.64.

CONCLUSION
Multislice-based texture analysis may be useful for differentiating pyogenic hepatic abscess and malignant mimickers. Entropy and uniformity are helpful to distinguish the two entities. Larger prospective studies with histopathological results are needed to further confirm the relationship between CECT texture features and disease microenvironment characteristics.

CLINICAL RELEVANCE/APPLICATION
Multislice-based texture analysis quantifies the routinely acquired CECT data in clinical practice without additional imaging and may provide a potential tool to bridge radiologic data with intrinsic tissue characteristics.

GIS385
The Usefulness of Gadoxetic Acid-Enhanced Dynamic Magnetic Resonance Imaging in Hepatocellular Carcinoma: Toward Improved Staging (Station #4)

Sang Hyun Choi (Presenter): Nothing to Disclose, Jae Ho Byun MD : Nothing to Disclose, Heon-Ju Kwon MD : Nothing to Disclose, Hong-Il Ha MD : Nothing to Disclose, So Jung Lee : Nothing to Disclose, Hyung Jin Won MD : Nothing to Disclose, Pyo Nyun Kim MD : Nothing to Disclose

PURPOSE
To evaluate the usefulness of gadoxetic acid-enhanced dynamic magnetic resonance imaging (MRI) in staging hepatocellular carcinoma (HCC).

METHOD AND MATERIALS
Two investigators independently and retrospectively reviewed dynamic computed tomography (CT) and gadoxetic acid-enhanced dynamic MRI obtained from July to September 2011 in 195 patients with HCC (158 men, 37 women; mean age, 57.1 years). The diagnostic performances of dynamic CT and MRI were evaluated. Barcelona Clinic Liver Cancer (BCLC) stages were determined before and after gadoxetic acid-enhanced dynamic MRI and according to final diagnosis. Change in BCLC stage was evaluated after adding gadoxetic acid-enhanced dynamic MRI to dynamic CT. The consistency between final BCLC stage and each of these two modalities was compared. Diagnostic performance and BCLC staging between gadoxetic acid-enhanced dynamic MRI and dynamic CT was compared using the McNemar test.

RESULTS
Final BCLC stage was classified as stage 0 (12.8%), A (60.5%), B (16.9%), C (8.7%), and D (1.0%), respectively. Gadoxetic acid-enhanced dynamic MRI showed significantly higher diagnostic performance than dynamic CT for HCC, including significantly greater sensitivity (observer 1, 90.6% [203/224] versus 79.5% [178/224]; observer 2, 88.4% [198/224] versus 63.8% [143/224]; P < .05), and significantly more accurate BCLC staging (observer 1, 92.8% [181/195] versus 80.5% [157/195]; observer 2, 89.2% [174/195] versus 68.2% [133/195]; P < .05). Gadoxetic acid-enhanced dynamic MRI showed higher interobserver agreement for the diagnosis (k = 0.630 versus 0.485) and staging (k = 0.851 versus 0.601) than dynamic CT. BCLC stage was changed correctly after gadoxetic acid-enhanced dynamic MRI in the patients showing differences between CT and final BCLC stages (observer 1, 71.1%; observer 2, 71.0%).

CONCLUSION
Gadoxetic acid-enhanced dynamic MRI provided important additional information compared with dynamic CT during initial staging HCC. Gadoxetic acid-enhanced dynamic MRI showed higher diagnostic performance and more accurate BCLC staging than dynamic CT.

CLINICAL RELEVANCE/APPLICATION
Gadoxetic acid-enhanced dynamic MRI is important during initial staging HCC as it shows significantly more accurate BCLC staging and is more consistent with final BCLC stage than dynamic CT.

GIS386
Radiation Reduction in Reproductive-Aged Women for Suspected Acute Appendicitis: A Look at Ultrasound versus Computed Tomography (Station #5)

Darren Lu MD (Presenter): Nothing to Disclose, Hisham A. Tchelepi MD : Nothing to Disclose

PURPOSE
To recognize ultrasound (US) as the first step in evaluating reproductive-aged women with suspected acute appendicitis and to stress its role in eliminating the need for unnecessary radiation exposure.

METHOD AND MATERIALS
A retrospective review was conducted of women ages 14 to 45 (mean of 28.4) presenting with right lower
quadrant pain suspicious for acute appendicitis. All cases had an initial right lower quadrant ultrasound. Subsequent CT scans were performed as clinically indicated by the ordering physicians. All cases that proceeded to surgery had pathologic confirmation.

RESULTS
158 cases were reviewed. In 23 cases (14.6%), a normal appendix was identified on US. 2 of those cases had a follow up CT performed, both showing a normal appendix. 27 cases (17.1%) demonstrated a dilated, noncompressible appendix consistent with acute appendicitis on US. 62/7 (29.6%) had follow up CT, 7 of which confirmed acute appendicitis. One case proved to be cecal diverticulitis with a normal appendix. All cases of acute appendicitis were confirmed on pathology except one, which was perforated and managed medically. 108 cases (68.3%) were non-diagnostic in which the appendix was not identified. 34 of those had a CT demonstrating a normal appendix. 17/34 (50%) had alternative diagnoses including pyelonephritis, hemorrhagic/ruptured ovarian cysts, teratoma, fibroids, and hydrosalpinx. Our results demonstrate that US has a positive predictive value of 95.8% and a negative predictive value of 100% when an appendix was identified, which are similar to the previously reported data for CT. None of the patients with a non-diagnostic US were subsequently diagnosed with acute appendicitis on CT or clinically. Using the calculator from www.xrayrisk.com, the total effective dose of a CT abdomen and pelvis is 14.22mSv causing a 1/499 additional risk of cancer.

CONCLUSION
This study demonstrates that US plays a significant role in the reduction of radiation dose to our study population of reproductive-aged women. Additionally, US of the appendix in patient presenting with acute right lower quadrant pain can be dependable and reliable for diagnosis.

CLINICAL RELEVANCE/APPLICATION
Ultrasound should be considered for the initial evaluation of suspected acute appendicitis, especially in reproductive-age women to decrease radiation exposure.

GIS387
Parallel-transmit-accelerated Spatially-selective Excitation MRI for Reduced-FOV Diffusion-weighted Imaging of the Pancreas (Station #6)
Kolja Thierfelder MD, MSc (Presenter): Nothing to Disclose, Wieland H. Sommer MD: Nothing to Disclose, Olaf Dietrich PhD: Nothing to Disclose, Felix G. Meinel MD: Nothing to Disclose, Maximilian F. Reiser MD: Nothing to Disclose, Konstantin Nikolaou MD: Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Bayer AG

PURPOSE
Diffusion-weighted imaging (DWI) of the pancreas often suffers from susceptibility and distortion artifacts. Our aim was to evaluate the use of 2D-selective parallel-transmit accelerated excitation MRI for diffusion-weighted EPI (pTX-EPI) of the pancreas and to compare it to conventional single-shot EPI (c-EPI).

METHOD AND MATERIALS
The MRI examinations of 32 consecutive patients were evaluated in this prospective and IRB-approved study. All examinations were performed on a 3-T MRI system equipped with two independent transmit channels. PTX-EPI was performed with a (zoomed) Field-of-View (FOV) of 350 × 285mm2, whereas c-EPI used a full-FOV of 380 × 285mm2. The 2D-RF pulse of pTX-EPI was shortened by a factor of 1.7 (TX-acceleration factor). In a qualitative analysis, two blinded and experienced readers evaluated 3 different aspects of image quality on 3- to 5-point Likert scales. Additionally, apparent diffusion coefficients (ADCs) were determined in both c-EPI and pTX-EPI in normal-appearing pancreatic tissue using regions of interests (ROIs). Mean ADC values and standard deviations were compared between the two techniques.

RESULTS
The zoomed pTX-EPI was superior to c-EPI with respect to overall image quality (3.10 ± 0.65 vs. 2.45 ± 0.72, p < 0.0001) and 60% less visibility of the pancreatic ducts (1.03 ± 0.81 vs. 0.45 ± 0.69, p < 0.01). Artifacts were significantly less severe in pTX-EPI than in c-EPI (1.06 ± 0.77 vs. 1.61 ± 0.84, p < 0.01). The mean ADC values of c-EPI (1.29 ± 0.19 × 10-3 mm2/s) and pTX-EPI (1.27 ± 0.17 × 10-3 mm2/s) did not differ significantly (p = 0.44). The variation within the ROIs as measured by the standard deviation was significantly lower in pTX-EPI (0.095 ± 0.035 × 10-3 mm2/s) than in c-EPI (0.135 ± 0.075 × 10-3 mm2/s), p < 0.05.

CONCLUSION
TX-accelerated spatially-selective EPI leads to substantial improvements in DWI of the pancreas with respect to different aspects of image quality without significantly influencing the ADC values.

CLINICAL RELEVANCE/APPLICATION
PTX-accelerated EPI has the potential to overcome some of the limitations of conventional DWI techniques in MRI of the pancreas. Further studies might show whether the use of parallel-transmit enables a more accurate differentiation of pancreatic lesions.

GIS388
Added Value of Diffusion-weighted MR Imaging to T2-weighted and Dynamic Contrast-enhanced MR Imaging in T Staging of Gastric Cancer (Station #7)
Song Liu (Presenter): Nothing to Disclose, Jian He MD, PhD: Nothing to Disclose, Wexian Guan: Nothing to Disclose, Qiang Li: Nothing to Disclose, Haiping Yu: Nothing to Disclose, Zhuping Zhou: Nothing to Disclose, Shanhua Bao: Nothing to Disclose, Zhengyang Zhou: Nothing to Disclose

PURPOSE
The objective of this study was to confirm whether diffusion-weighted (DW) magnetic resonance (MR) imaging has some added value to T2-weighted (T2W) and dynamic contrast-enhanced (CE) MR imaging in T staging of gastric cancer on 3 T MR scanners.

METHOD AND MATERIALS
Fifty-one patients (age range, 28-82 years; mean, 62 years; 33 men and 18 women) with a total of 51 gastric cancers underwent axial T2W, dynamic CE and DW (b, 0 and 1000 s/mm²) MR imaging. Two radiologists independently interpreted the images for T staging of the tumors. The tumors were staged based on the histopathological findings that assign the tumor stage according to TNM classification of American Joint Committee on Cancer (AJCC, 7th edition). McNemar test was used to check the differences among three MR image sets (T2W+CE, T2W+DW, T2W+CE+DW) in the diagnostic accuracy with the reference of post-operative histopathological results. Inter-observer agreement was calculated by using kappa statistics.

RESULTS

The overall accuracy of T staging in pT1-4 gastric cancers by T2W+CE+DW (88.2%) was significantly higher than that by T2W+CE and T2W+DW (both 76.5%, P=0.031). For advanced lesions (pT2-4), T staging accuracy by T2W+CE+DW (92.3%) was significantly higher than that by T2W+CE (76.9%, P=0.031). There were no significant differences of T staging accuracy in pT1-4 and pT2-4 gastric cancers between T2W+CE and T2W+DW (P=1.000, 0.125). Kappa values in inter-observer agreement test were 0.855, 0.826 and 0.578 in T2W+DW, T2W+CE+DW and T2W+CE.

CONCLUSION

DW adds useful information to T2W and CE MR imaging in T staging of gastric cancer, especially in advanced lesions.

CLINICAL RELEVANCE/APPLICATION

DW can be routinely added into MR imaging for preoperative T staging of gastric cancer without much time consuming. In patients who fail to fulfill CE imaging, DW may replace CE to ensure successful MR examinations.

Role of Initial Imaging in Risk Stratification for Suspected Choledocholithiasis in Hospitalized Patients (Station #8)
Stella Kang MD : Nothing to Disclose, Laura Heacock MS, MD (Presenter): Nothing to Disclose

PURPOSE

The American Society of Gastroenterology (ASGE) guidelines on evaluation of suspected choledocholithiasis generally support MRCP for intermediate risk patients, and direct evaluation with ERCP for high-risk patients. However, frail patients at high procedural complications may benefit from MRCP, with the tradeoff of possible delay in necessary stone extraction. We evaluated the predictive utility of ASGE guideline variables and imaging parameters in risk stratification as a potential decision aid for choosing MRCP or ERCP.

METHOD AND MATERIALS

We retrospectively reviewed inpatient cases at our institution with clinically suspected choledocholithiasis. Included patients had US or CT of the abdomen followed by MRCP within 48 hours. Reference standard included ERCP, endoscopic ultrasound, intraoperative cholangiogram, or documented clinical resolution. We used binary logistic regression to test 5 variables in ASGE risk assessment (total bilirubin, age, common duct (CD) dilatation, pancreatitis, liver function test (LFT) abnormality) according to published guidelines, as well as CD size at US/CT, for prediction of choledocholithiasis.

RESULTS

78 cases were included in regression analysis with 25 cases of CD stones. Among ASGE variables for risk assessment, abnormal LFT and CD dilatation were significant predictors of choledocholithiasis (p = 0.031, 0.017). Inclusion of all ASGE variables was slightly more accurate than the two-variable model (77 vs 75% accuracy). Within the ASGE high risk group, CD dilatation was a significant predictor of choledocholithiasis. In the ASGE high risk class, CD stone prevalence was 53%, and CD dilatation had positive predictive value (PPV) of 75%; meanwhile, ASGE intermediate risk patients had 22% CD stone prevalence, and CD dilatation had a PPV of only 26%.

CONCLUSION

For acutely ill patients, CD dilatation is the strongest predictor of choledocholithiasis and may aid the decision for MRCP versus ERCP. Patients classified as ASGE high risk for choledocholithiasis with CBD dilatation on initial imaging have high pretest probability not warranting MRCP. ASGE intermediate risk patients cannot be reclassified to high risk using CD dilatation.

CLINICAL RELEVANCE/APPLICATION

CD dilatation at initial imaging is the strongest predictor of choledocholithiasis in hospitalized patients and use with established clinical guidelines aids the decision for MRCP versus ERCP.

Duct, Duck, Goose: MRCP Search Pattern and Findings, an Interactive Quiz Game! (Station #9)
David Nguyen MD : Nothing to Disclose, Mittul Gulati MD (Presenter): Nothing to Disclose

TEACHING POINTS

Using quiz based format, a range of MRCP findings and associated pathology will be reviewed, including variant anatomy, common conditions, duct pathology, neoplasms, and miscellaneous cases/ mimics.

TABLE OF CONTENTS/OUTLINE

carcinoma c. ampullary/ duodenal carcinoma d. pancreatic carcinoma e. pancreatic cystic neoplasms-serous and mucinous 6. Miscellaneous and mimics a. duodenal diverticulum b. peribiliary cysts c. cholecystolithiasis after bowel diversion d. groove pancreatitis

GIE169

Beyond Recurrence: Recognizing the Pathologies of the Post-operative Groin (Station #10)

Joseph Michael Miller MD, MS (Presenter): Nothing to Disclose, Shirin Towfigh MD : Nothing to Disclose, Rola Saouaf MD : Nothing to Disclose

TEACHING POINTS

Modern hernia repair involves placement of mesh within the inguinal canal. Mesh repairs are associated with more complications than primary tissue repairs and can often lead to a chronic pain syndrome known as inguinodynia. Diagnosis benefits considerably from cross-sectional imaging, however our internal data show that radiologists perform this task poorly. We conducted a retrospective review of 322 patients presenting to a specialty hernia surgeon from 2008-2013. Of the 56 patients with history of inguinal mesh, we identified 19 patients operated on for mesh-related complications with pre-operative cross-sectional imaging available. Radiologists only correctly reported mesh-related abnormalities in 32% of cases (compared to 79% success rate by a blinded expert reader, p = 0.0081).

Evaluation of the post-operative groin is difficult. In addition to reviewing the CT and MRI findings of these surgically-confirmed complications, we intend to highlight the frequent causes of misdiagnosis found in our series. Relying on intraoperative correlation, we hope to illustrate the relevant devices and techniques involved in modern herniorrhaphy.

TABLE OF CONTENTS/OUTLINE

Techniques - Anterior repair - Pre-peritoneal repair Devices - Flat Mesh - Sandwich - Plugs Complications - Malpositioning - Migration - Meshoma - Infection - Neuroma

GIE319

Pull Me Up: A Review of Esophagectomy and Gastric Pull-thought Procedures, Their Radiographic Features and Complications (Station #11)

Jennifer Flanagan (Presenter): Nothing to Disclose, Shaun Michael Nordeck MS, RRA : Research Grant, Toshiba Corporation , Vasantha Vasan MD : Nothing to Disclose, Richard Charles Batz MD : Nothing to Disclose

TEACHING POINTS

With the incidence of esophageal carcinoma continuing to increase, esophagectomy and gastric pull-through surgeries for these patients are also on the rise. It is important for radiologists to be able to recognize the different surgical techniques and their radiographic presentations as well as potential complications. This education exhibit will discuss the different surgical techniques (i.e. Ivor Lewis, modified Ivor Lewis, modified McKeown approach, vagal-sparing esophagectomy, transthoracic esophagectomy, transhiatal esophagectomy, bloc esophagectomy, endoesophageal pull through, gastric pull-up and bowel interposition), their radiographic presentation and associated complications.

TABLE OF CONTENTS/OUTLINE

I. Introduction II. Review of normal anatomy of GI tract with special emphasis on esophagus and stomach. III. Review of esophagectomy and gastric pull-through procedures including different surgical techniques IV. Review post-op radiographic features and associated complications V. Summary of teaching points

GIE321

Small Bowel Tumors: Multi-technical Radiological Approach with Emphasis on CT and MRI and with Endoscopic and Pathologic Correlation (Station #12)

Jose Gutierrez Chacoff MD (Presenter): Nothing to Disclose, Juan Ramon Ayuso MD : Nothing to Disclose, Giancarlo Schiappacasse MD : Nothing to Disclose, Mario Pages MD : Nothing to Disclose, Daniel Barnes MD : Nothing to Disclose

TEACHING POINTS

Small bowel tumors are uncommon lesions whose the incidence have increased, so its diagnostic imaging is of paramount importance to accelerate the therapeutic process. The presence of a stenotic lesion in the duodenum or in the jejunum is highly suggestive of adenocarcinoma. The presence of an intestinal mass associated with the affected loop aneurysmal dilation, suggest lymphoma or GIST. Lymphoma present an homogeneous low contrast enhancement, while the GIST is hypervascular with areas of necrosis.

TABLE OF CONTENTS/OUTLINE

Diagnosing Patients in Primary Hyperaldosteronism: Correlation of MDCT Findings with Adrenal Vein Sampling (Station #1)


**PURPOSE**

Primary hyperaldosteronism usually results from an aldosterone-secreting adenoma (ASA) or bilateral adrenal hyperplasia (BAH), and adrenal vein sampling (AVS) is considered the goal-standard for differentiating these two possibilities. This study compared MDCT with adrenal vein sampling, and seeks to determine whether MDCT alone may be sufficient in some patients.

**METHOD AND MATERIALS**

MDCTs of 43 adult patients with biochemical evidence of hyperaldosteronism and who had undergone AVS were reviewed retrospectively by 2 radiologists blinded to AVS results. Readers recorded the presence/size of adrenal nodules and measured adrenal gland limbs. AVS results and MDCT findings were then correlated.

**RESULTS**

13 patients had bilateral adrenal nodules, 14 had unilateral nodule on the right, 14 had unilateral nodule on the left, and 2 had no nodule on either side. AVS suggested ASA on the right in 22, ASA on the left in 19, and BAH in 3 subjects. The presence of a nodule was associated with sensitivities of 82-86%, specificities of 57-72% and accuracy of 47-81% for predicting positive AVS. Of the 28 patients with a single unilateral nodule on MDCT, the side of the nodule correctly correlated with AVS in 24 (86%). In all of the 4 incorrect cases, the nodule measured < 2 cm, and in 2 cases AVS suggested BAH, while the wrong side was localized on CT in 13 patients with bilateral nodules, 12 localized unilaterally to one side on AVS, while 1 had BAH. Of these 13 cases, there was significant discrepancy in size of the bilateral nodules (>1 cm) in 5 cases, in all of which AVS localized to the side of the larger nodule. In the right adrenal gland, functioning nodules (mean 21.8 mm) were significantly larger than nonfunctioning nodules (8.3 mm) (p=0.002). On the left side, there was no difference in nodule size between functioning and nonfunctioning lesions (17.1 mm vs 18 mm, p=0.852).

**CONCLUSION**

In primary hyperaldosteronism, MDCT can accurately predict the presence of a unilateral ASA in cases with a unilateral nodule measuring > 2 cm, or in cases with bilateral adrenal nodules where there is a size discrepancy of the nodules of > 1 cm.

**CLINICAL RELEVANCE/APPLICATION**

In certain limited cases, it might be possible to perform adrenalectomy based on MDCT results alone without AVS. However, in cases with a unilateral small nodule or bilateral nodules without a size discrepancy, AVS is critical for correct localization and diagnosis.

The Value of Spectral CT Imaging in Differentiating Lipid-poor Adrenal Adenomas from Metastatic Lesions (Station #2)


**PURPOSE**

To evaluate the value of spectral CT in differentiating lipid-poor adenomas from metastases in adrenal glands.

**METHOD AND MATERIALS**

This retrospective study was approved by the Institutional Review Board of the participated hospital and written informed consent was waived. From August 2011 to December 2013, 69 patients (49 M: 20 F, mean age=59.4 ± 11.9 years, range 24.0~84.0 years) with 73 adrenal nodules (53 clinically proven metastases and 20 histopathologically proven adenomas) underwent spectral CT imaging through fast kVp-switching technique. The virtual monochromatic images (40~140keV) , fat(water) density images and effective atomic number (eff-Z) were reconstructed. The difference of CT values, fat (water) concentration and eff-Z between adrenal metastases and adenomas were compared statistically by independent-samples t test.

**RESULTS**

1) The mean CT values of metastases [(53.00±15.12)~(33.38±5.67) HU] were significantly higher than those of adenomas [(26.90±26.94)~(28.77±10.66) HU] under 40~80 keV level (P<0.05). 2) Fat(water) concentration of metastases (-193.43±173.44 ug/cm3) was statistically lower than that of adenomas (45.32±20.63 ug/cm3) (P<0.05). 3) The eff-Z of metastases (7.76±0.15) was significantly higher than that of adenomas [(26.90±26.94)~(28.77±10.66) HU] under 40~80 keV level (P<0.05).

**CONCLUSION**

The spectral CT provides a multi-parameter approach for identifying lipid-poor adenomas from metastases.

Novel Organ Preserving Treatment Option—MR Guided Focused Ultrasound Surgery (MRgFUS) in Adenomyosis: Initial Forebode Results (Station #3)

Bhawna Dev MD (Presenter): Nothing to Disclose, Sameera Gaddam MBBS: Nothing to Disclose
PURPOSE
To determine the efficacy of MRgFUS ablation in organ-preserving treatment of adenomyosis.

METHOD AND MATERIALS
We describe a small group of 14 patients (median age 31 years-old, range 36-44), treated for adenomyosis and followed up for six months. For each patient we had collected the Symptom Severity Score (SSS) as well as the Visual Analog Scale (VAS) and the number of reported pads replaced by the patient.

RESULTS
The SSS had significantly decreased from a median of 56 (range 19 to 65) to 16 (range 0 to 34), by the six months follow-up visit. In addition, the VAS had decreased from a median of 7 (range 5 to 8) prior to treatment to 2 (range 2 to 6). Finally, the number of pads had decreased from a median of 7 (range 4 to 9) to 4 (range 3 to 5) six months post treatment. No adverse events were observed during the treatments or the follow-up period.

CONCLUSION
MRgFUS can significantly increase the quality of life for patients suffering from adenomyosis. Symptom relief is also accompanied by a reduction in pain and a lessening of the associated bleeding during the menstrual period.

CLINICAL RELEVANCE/APPLICATION
MR guided focused ultrasound surgery (MRgFUS) is a newer organ preserving treatment option in adenomyosis and is a good option for patients wanting to preserve their uterus.

Feasibility of Computed Tomography Perfusion Imaging of the Kidney Using a 320-detector MDCT Unit: Establishment of Normal Perfusion Parameters Values (Station #4)

GUS147
Catherine Roy MD (Presenter): Nothing to Disclose, Mickael Ohana MD, MSc: Nothing to Disclose, Philippe Host MD: Nothing to Disclose, Guillaume Alemann MD, MS: Nothing to Disclose, amina Jeledi MD: Nothing to Disclose

PURPOSE
To determine the normal values of renal cortex and parenchyma perfusion parameters using a 320-detector MDCT including the entire kidney

METHOD AND MATERIALS
54 normal renal function patients underwent a renal perfusion imaging using a 320-slice dynamic volume CT unit (Aquilion One, Toshiba Medical Systems, Ottawa, Japan) including the whole organ without table movement. The dynamic CT protocol included 24 volumes with a total acquisition time until 90sec, a rotation time of 0.5sec, 0.5ml/kg of a highly concentrated contrast medium (Iomeprol 400 mg iodine/ml) with a flow rate of 5-6ml/sec pushed by 50 ml of saline serum. Perfusion parameters were calculated using the maximum slope and Patlak model from the dedicated software of our CT unit after a non-rigid motion correction. Mean blood flow (AF), blood volume (BV) and clearance (Cl) were recorded by mean of ROI located and included all the parenchyma and all the cortex. Measurements were performed in the three orthogonal plans. The resulting quantitative voxel values were transformed into 3D color maps for visual inspection and analysis. Whole kidney perfusion parameters were calculated after registration of the volume of each kidney. Radiation dose was recorded.

RESULTS
Imaging quality was satisfactory for a morphologic assessment. Radiation dose was between 7-10mSv (mean 8.3). Our results were for AF: 202+24, 315+29 ml/100g/min; BV: 42+18, 75+18 ml/100g and Cl: 47+26, 38 + 12 ml/100g/min for whole parenchyma and cortex, respectively. There was no significant difference of values between right or left kidney. The time for operator processing to record the data was between 2 to 3 min after the non-rigid automatic motion correction process which was taken approximately 10min. There was no impact on the working flow. CT perfusion parameters did not differ by using axial, sagittal or coronal or oblique plans.

CONCLUSION
320-Detector MDCT makes it possible to conduct perfusion measurements of the whole kidney without table displacement. Our preliminary results suggest that it is feasible in clinical practice without time consuming and a reasonable radiation dose.

CLINICAL RELEVANCE/APPLICATION
Contrast-enhanced dynamic MDCT of renal perfusion can be easily performed in a routine application, with a reasonable time for post processing and radiation dose.

Impact of Different Helical Pitch Selection on Spectral CT Imaging: Comparison of Image Quality and Radiation Dose (Station #5)

GUS148
Chuang Yi: Research Grant, General Electric Company, Zhihui Chen MD: Nothing to Disclose, Yan Liang MMed (Presenter): Nothing to Disclose, Bin 00617875. Li: Nothing to Disclose, Yongfang Yin: Nothing to Disclose, Dongbin Shi: Nothing to Disclose

PURPOSE
To explore the impact of different helical pitch on spectral CT imaging in the urinary CT examination.

METHOD AND MATERIALS
Among 54 cases of urinary CT examination, 23 and 31 cases underwent single-source dual-energy CT (sDECT) at a helical pitch of 1.375:1 and 0.984:1, respectively. Monochromatic images of 65keV were reconstructed, and the image noise of renal parenchyma was evaluated. Signal-to-noise ratio (SNR) and contrast-noise-ratio(CNR) was calculated with ROI measurements. The figure of merit (FOM), calculated as CNR(2)/CTDI(vol), was used to quantify image quality improvement per exposure risk.

RESULTS

For 1.375 Group and 0.984 Group, the CNR of image was not significantly different (P>0.05) (2.45±0.70 Vs 2.48±0.68 ), and SNR was (4.34±1.24) and (4.57±1.20) respectively. Compared with that in 0.984 Group (25.53mGy), the CTDI was significantly lower in1.375 Group (18.28mGy). FOM of 1.375 (0.33) was higher than 0.984 Group (0.24), increased by 38%.

CONCLUSION

Conclusion: At a high scanning helical pitch of spectral CT imaging, the radiation dose is significantly lower, but the image noise is not significantly different. Therefore, the urinary system CT examination could be scanned at a large pitch.

CLINICAL RELEVANCE/APPLICATION

Spectral CT imaging is always associated with a high radiation dose, and high pitch protocol could increase the efficiency of radiation dose without sacrificing image quality.

Anterior and Posterior Pararenal Spaces: Comprehensive Review of Anatomy and Pathology (Station #6)

Rafel Tappouni MBChB, FRCP : Nothing to Disclose, Katryana Mary Hanley-Knutson MD (Presenter): Nothing to Disclose

TEACHING POINTS

1. Review the normal retroperitoneal anatomy and radiologic signs to localize pathology to the anterior and posterior pararenal spaces.
2. Illustrate the common pathology and ways of disease spread in the anterior and posterior pararenal spaces with a series of cases

TABLE OF CONTENTS/OUTLINE

We present, describe and analyze CT anatomy and pathology of the the anterior and posterior pararenal spaces with Multidetector CT and multiplanar reformations. Cases will include, but not limited to: pancreatitis, diverticulitis, retroperitoneal gas disseminating through facial planes, malignancies including primary and neoplastic disease. Detailed description and demonstration of disease and it's spread will be demonstrated to include: Anterior pararenal space spread to lateral edge of the quadratus lumborum muscle Retromesenteric plane role in spread of disease across midline Gerota (Retromesenteric) and Zuckerkandl(retrorenal) facial plane fusion Subperitoneal spread from retroperitoneum along the peritoneal ligaments Interfacial spread along the retromesenteric, retrorenal, and interfascial planes to bare area of liver, liver hilum and left diaphragm

Developing Curricula for Teaching MRI Safety and MRI/CT Contrast Safety To Residents: How Effective Are Live Lectures and Online Modules? (Station #1)

Jordan K. Swensson MD (Presenter): Nothing to Disclose, Benjamin Lloyd Rase MD : Nothing to Disclose, Brian Lane McMahan MD : Nothing to Disclose, Bilal Tahir MD : Nothing to Disclose, Darel Edward Heitkamp MD : Nothing to Disclose

PURPOSE

The advent of the diagnostic radiology Core Exam and the new ACGME Milestone evaluation system for radiology residents places new emphasis on topics in MRI safety and MRI and CT contrast agents. This change gives residency programs the opportunity to develop new curricula to help their residents succeed in this new environment. We evaluated whether lecture-based teaching or online modules would improve baseline resident knowledge in these areas, and assessed which intervention was more effective.

METHOD AND MATERIALS

Prior to didactic intervention, two cohorts were created from 57 radiology residents with equal numbers and matched level of training. The residents were tested on their baseline knowledge of general MRI safety, MRI contrast safety, and CT contrast safety with a multiple-choice examination consisting of 42 questions divided equally among the topics. Additional questions evaluated the residents' subjective comfort in these fields. One group attended a live, one hour lecture on the above topics. The other engaged in three short, online educational modules. After one month, the residents were again tested with the same questions to assess for improvement in their understanding and/or comfort level.

RESULTS

Both the module and lecture cohorts demonstrated a statistically significant increase in questions
In this retrospective review, we aggregated consecutive 207 individual adult MRI brain studies. The senior

PURPOSE

Disclose

Arindam Rano  Chatterjee  MD (Presenter):  Nothing to Disclose

Potential Redundancy in MR Imaging of Brain: Quantification by Studying the Location of Core Diagnostic Information Across Various Sequences (Station #3)

HPS174

Potential Redundancy in MR Imaging of Brain: Quantification by Studying the Location of Core Diagnostic Information Across Various Sequences (Station #3)

answered correctly on CT contrast safety (13.1%, p<0.001, and 19.1%, p<0.001 respectively) and on MRI safety/MRI contrast safety (12.9%, p<0.001, and 14.4%, p<0.001). The pre-intervention and post-intervention scores, and degree of improvement post-intervention was similar for the module vs lecture groups without statistical difference (p=0.70). Resident confidence improved in both groups for both modalities.

CONCLUSION

Focused didactic intervention improves resident knowledge on issues of general MRI safety and MRI and CT contrast agents. Live lectures and online modules can be equally effective tools, allowing residency programs flexibility.

CLINICAL RELEVANCE/APPLICATION

Live lectures and online modules are equally effective tools for increasing resident knowledge of MRI safety and MRI and CT contrast safety allowing flexibility for residency program curricula.

HPS173

Patient Perception and Understanding of Radiation in Diagnostic Imaging (Station #2)

Joseph R. Steele MD (Presenter):  Consultant, INTIO, Inc Stockholder, INTIO, Inc Stockholder, Intelliject, Inc Stockholder, Medicasafe, Inc Consultant, Adient Medical Inc Stockholder, Adient Medical Inc Consultant, Edumedics LLC Stockholder, Edumedics LLC, A. Kyle Jones PhD :  Nothing to Disclose, Stowe Shoemaker PhD :  Nothing to Disclose

RESULTS

5462 patients completed the initial survey, having undergone a mean of 6.4 imaging studies in the last year at our institution. Over 2,000 competed the non-responder survey. Reasons provided for visits included to check for disease recurrence (43%) and evaluate treatment response (23%). Only 22% of patients could define ionizing radiation. 27% of patients responded that radiography did not involve exposure to ionizing radiation while 30% responded that MRI did. Only 36% of patients believed that CT exposed them to ionizing radiation, and no more than 36% of those surveyed responded affirmatively to any modality that uses ionizing radiation. When asked to identify the medical imaging exam that delivered the highest radiation dose from a list of exams (chest x-ray, chest CT, whole body PET, NM bone scan, abdomen MRI, none), only 50% responded but the highest fraction correctly identified whole body PET. 22% of patients reported that they were 'Not concerned at all' about radiation exposure, while 13% reported being 'Very concerned'. Most patients answered that the risks from medical imaging were small. Most agreed with the statement 'I am willing to accept the risks associated with radiation exposure because I want a less invasive test that provides quick answers,' and most perceived the studies they received as valuable in treating their condition (95%). Only 3% of patients were informed of the radiation dose from their most recent imaging study, however, only 55% of patients wanted to be informed. Only 21% of patients reported that a doctor had discussed the risks and benefits of their most recent imaging study, and 40% said they would have the exam regardless of the risk/benefit ratio. Patients did not understand the risks of imaging, believing risks from CT included heritable mutations (12.2%), sterility (23.5%), and acute radiation sickness (12%). When asked how they would behave if another hospital nearby began advertising 'low dose' CT scans at the same cost as our institution, only 7% of patients reported that they would have their imaging performed at the outside facility, 57% would continue to have their imaging performed at our institution, and 36% would ask their doctor what they should do.

CONCLUSION

Most patients do not know what ionizing radiation is, and therefore poorly understand radiation risks. Patients believe that the studies they undergo offer a benefit that is large compared to the risk, and as providers we owe it to them to ensure this is the case. We cannot hope to effectively educate patients about radiation without understanding their current knowledge level. Our survey, the largest of its kind, indicates that we currently overestimate the knowledge of our patients about radiation. Using the information learned in this survey, we can target our educational efforts to have the highest impact on patient education. Better education leads to more accurate expectations, which translates into better decisions and a better patient experience.

METHODS

We developed a 25 question survey that was distributed to patients who had recently undergone diagnostic imaging at our institution. Participants were first asked if they could define ionizing radiation, if not, they were provided with the definition. Participants were then questioned about which types of diagnostic imaging use ionizing radiation, the relative associated radiation doses, doses in imaging relative to other activities, information that had been provided to them about their exam, and their desire for information related to the risks and benefits of medical imaging. A shorter non-responder survey was distributed to patients who did not respond to the original survey.
In this retrospective review, we aggregated consecutive 207 individual adult MRI brain studies. The senior author, a board certified neuroradiologist reviewed the medical and imaging records to document the clinical indication, core diagnostic information (CDI) provided by the MR imaging, and its clinical impact. Imaging findings useful for reaching the diagnosis constituted positive CDI while absence of imaging abnormalities constituted negative CDI. The senior author then selected the Core Sequences (CS) felt to allow for comfortable extraction of the CDI. The selection of CS was validated by presenting the CS to four readers who assessed the relative ease of identification of the CDI within the CS. Potential redundancy was calculated by comparing the number of CS to the number of total sequences obtained.

RESULTS
MR imaging had been performed utilizing an average of 9.4 ± 2.8 sequences obtained over an average of 37.3 ± 12.3 minutes. In comparison, CDI was thought to be easily extractable from an average of 2.1 ± 1.1 core sequences, with an assumed corresponding average scan time of 8.6 ± 4.8 minutes, reflecting a potential redundancy of 74.5 ± 19.1%. Potential redundancy was least in scans obtained for treatment planning (14.9 ± 25.7%), and highest in scans obtained for follow-up of benign disease processes (81.4 ± 12.6%). The selection of CS was considered to be valid with the ease of extracting CDI from CS considered by all four readers to be either easy or equivalent to that from entire scan in 97.4% cases. With a lack of clinical impact on only one case (0.48%), overutilization of imaging was not thought to contribute potential redundancy.

CONCLUSION
There is high potential redundancy in brain MR imaging protocols that can be targeted for a more efficient utilization of MR scanners.

CLINICAL RELEVANCE/APPLICATION
More indication directed sequence protocolling can help improve efficiency of MR scanner utilization with associated potential for reducing imaging related healthcare costs.

HPE117
CT Imaging Techniques and Strategies for Radiation Dose Optimization: What the Radiologist Should Know (Station #4)

TEACHING POINTS
1) To outline basic principles of CT radiation exposure and its quantities
2) To summarize CT radiation dose optimization based on modification of scanning parameters and application of technologic innovations
3) To demonstrate optimal strategies using current and novel technologies by presenting experimental data and clinical images

TABLE OF CONTENTS/OUTLINE
1) CT radiation dose quantities - CT dose index (CTDI) · dose length product (DLP) · effective dose (ED) · size-specific dose estimates (SSDE) 2) scanning parameters and technologic innovations - CT system optimization: detector/collimators/beam-shaping filter · automatic exposure control · optimal tube potential · noise control in reconstruction and data processing · dual energy CT 3) Optimal strategies for dose reduction - appropriate indications - optimal scan length and phases - use optimal scanning techniques - provide optimal protection

INS-THA
Informatics Thursday Poster Discussions

Participants
Moderator
Christopher Ross Deible MD, PhD : Nothing to Disclose

Sub-Events
INS168 Patient-centered Imaging: The Effect of Radiologists’ Protocolling Imaging Requests (Station #1)
Andrew Kent Moriarity MD (Presenter): Nothing to Disclose, Matthew O’Brien MD : Nothing to Disclose, Chad Klochko MS, MD : Nothing to Disclose, Safwan Halabi MD : Nothing to Disclose

PURPOSE
To measure how often radiologists alter the initial advanced imaging request using an electronic protocolling system and analyze how the implementation of clinical decision support for inpatient requests impacted the need for protocolling by radiologists.

METHOD AND MATERIALS
An IRB approved retrospective review was performed of 218,904 requests for computed tomography (CT), magnetic resonance (MR) and nuclear medicine (NM) examinations over a 29-month period. Information collected for each request included the patient setting, the body part to be imaged, the imaging protocol requested, the requested use of contrast media and the responsible physician. Point of care generated clinical decision support (CDS) appropriateness scores were examined for inpatient requests.
RESULTS

During request protocolling, radiologists changed the modality or examination type of 86,122 requests (39.3%) and the use of contrast for 18,796 requests (8.5%). The overall rate of change for emergency department (ED), inpatient (IP) and outpatient (OP) patients was 18.3%, 35.7% and 42.9% respectively. Rates are also compared across the 43 distinct clinical specialties of the requesting physician. There were 13,568 and 12,881 IP requests examined in the 7-months prior to and following implementation of CDS. There was no significant difference in the percentage of requests changed during protocolling after implementation of CDS for CT protocol, NM protocol or the use of CT contrast. The rate of change for MR protocol increased after CDS from 38.0% to 40.0% while the rate of change for MR contrast decreased from 19.3% to 16.1%.

CONCLUSION

More than one-third of inpatient and outpatient imaging requests are altered by radiologist protocolling with the type of examination performed changed four times more often compared to the addition or removal of contrast material. Implementation of clinical decision support at the time of inpatient request entry did not significantly reduce the rate of changes made during protocolling.

CLINICAL RELEVANCE/APPLICATION

Protocolling imaging requests by radiologists is an important value added activity that ensures the right patient receives the correct examination for the appropriate clinical indication.

Texture Analysis with Predictive Modeling of Solid Appearing Pancreatic Serous Cystadenomas versus Neuroendocrine Tumors (Station #2)


PURPOSE

To investigate the ability of CT texture analysis (spatial frequency analysis) to distinguish between solid appearing, pancreatic serous cystadenomas (SCs) versus neuroendocrine tumors (NETs). Besides imaging appearance and clinical information, this tool hopefully allows for additional layer of confidence for differentiating between the two similar appearing tumors.

METHOD AND MATERIALS

IRB approval was obtained for retrospective review. Pathology proven 10 SCs and 10 NETs were obtained with similar CT appearance. Patients all had arterial and venous phase imaging. Both phases in 3 or 5 mm thick sections were uploaded to local server with TexRAD (TexRAD LTD, Somerset, UK). Region of Interest (ROI) was drawn around at all slices with discrete tumor visualized. Additional thresholding was applied to exclude attenuation values below -50HU. Analysis utilizes Laplacian of Gaussian spatial band-pass filters from 2mm to 6mm to highlight heterogeneity of the ROI. Range of higher order statistics were obtained from the software (mean pixel intensity, entropy, standard deviation of pixel intensity, kurtosis, and skewness at each filter size. A random forest statistical model, already created at our institution, for other applications of TexRad on other tumors, was be applied to this dataset. This model will attempt to predict the histology in a prospective manner. Modeling was performed on 7 SCs and 7 NETs. Biostatistician, blinded to test patients, applied statistical model to each slice of test patients. A best guess to final diagnosis was made for each patient compared to radiologist leading diagnosis.

RESULTS

Modeling: 360 arterial and 360 venous phase slices, from 7 SCs 240 arterial and 240 venous phase slices, from 7 NETs ‘Out-of-bag’ error estimate rate: 5% Testing: 439 arterial and 439 venous phases from 4 SCs and 6 NETs. 4/4 SCs were correctly predicted. 4/6 NETs were correctly predicted Radiologist leading diagnosis: 0/4 SCs were correctly predicted 6/6 NETs were correctly predicted

CONCLUSION

Texture analysis has proven to be a superior adjunct to distinguish serous cystadenomas versus neuroendocrine tumors, difference between surgery and surveillance.

CLINICAL RELEVANCE/APPLICATION

Use of TexRAD (CT texture analysis) to predict histology of pathology proven, solid appearing, pancreatic serous cystadenomas versus neuroendocrine tumors.

Shape Constrained Active Contour Model for High Intensity Focused Ultrasound Image Segmentation (Station #3)

Weixin Si (Presenter): Nothing to Disclose, Weiming Wang PhD: Nothing to Disclose, Zhiyong Yuan PhD: Nothing to Disclose, Pheng Ann Heng PhD: Nothing to Disclose

PURPOSE

In order to improve the performance of ultrasound-guided high intensity focused ultrasound (HIFU) therapy for uterine fibroid ablation, we develop a fast and accurate approach for uterine fibroid segmentation in HIFU images.

METHOD AND MATERIALS

Ultrasound-guided HIFU therapy is a new type of noninvasive procedure for uterine fibroid ablation and it
is desirable to design a reliable method to segment the uterine fibroids from HIFU images, which usually exhibit intensity inhomogeneity and blurred edges. To this end, we propose to segment HIFU images by combining local region information and shape constraint. Specifically, we employ a localized active contour model to deal with intensity inhomogeneity and a shape constraint to deal with blurred edges. In order to avoid boundary leaks at blurred edges, we incorporate a priori shape information to constrain the contour during the evolution. Lastly, we adopt the multiscale approach to accelerate the performance.

RESULTS

We test the proposed approach with twenty HIFU images, and the size of each image is 524*413. To validate the performance of our approach, we compare it with other five classical segmentation methods: GAC (Geodesic Active Contours) model, CV (piecewise constant) model, LCV (piecewise smooth) model, RSF (Region Scalable Fitting) model and LGF (Local Gaussian Fitting) model. Experimental results show that our approach outperforms all the other methods and can accurately segment the uterine fibroids from HIFU images. We further employ the widely used Dice Similarity Coefficient (DSC) measure to quantitatively evaluate the segmentation methods. In all the tested images, our approach achieves the highest accuracy of 0.94 in DSC measurement. Lastly, the segmentation time of our approach is about 15 seconds, which is only one eighth of the LCV model.

CONCLUSION

We propose a fast and accurate approach to segment uterine fibroids from HIFU images. The approach can automatically detect the boundaries of uterine fibroids after the user specifies the initial contour. In all the tested images, the segmentation results satisfy the requirements of the doctors, indicating its potential in ultrasound-guided HIFU therapy.

CLINICAL RELEVANCE/APPLICATION

The operation time of ultrasound-guided HIFU therapy is very long, and it is thus essential and meaningful to design a fast and accurate method for uterine fibroid segmentation in HIFU images.
Post-processing image analysis techniques have played an important role in advanced medical imaging modalities. Texture analysis, originally used to evaluate the integrity of television and computer monitor screens, has started to be used in diagnostic image analysis techniques. Texture analyses involve the extraction of subtle texture features from the image which are then used for a variety of classification tasks such as distinguishing normal from abnormal tissue. Texture analysis offers a quantitative method for detecting subtle changes within an image based on local spatial patterns and pixel intensities.

The purpose of this exhibit is to:
1. Describe the basics of texture analysis and parameters that make up texture analysis.
2. Discuss a variety roles of texture analysis in diagnostic imaging.

TABLE OF CONTENTS/OUTLINE

1. Review basic technique and fundamentals of texture analysis
2. Review role of texture analysis in diagnostic imaging
   -CT and MRI uses for texture analysis in medical imaging
   -Role of texture analysis in quantitatively defining image quality
3. Describe uses of texture analysis for different regions of the body
   -tumor classification: brain, liver, etc
   -osseous mineralization
4. Potential future applications for texture analysis

INE035-b

Emergency Medicine and Diagnostic Radiology Data Sharing for Improved Quality Assurance (hardcopy backboard)

Kevin Hamilton BS : Nothing to Disclose, Mark Daly BS : Stockholder, Analytical Informatics, Inc, Wayne C. LaBelle : Nothing to Disclose, Christopher D. Meenan (Presenter) : Stockholder, Analytical Informatics, Inc, Dan Lemkin MD : Nothing to Disclose

Background

In a busy emergency medicine department, timely delivery of radiology and other diagnostic results is critical to departmental efficiency and appropriate patient care. In some cases however, patients may be discharged before all diagnostic results are received due to coverage, volumes or other ancillary issues. When discrepant or unexpected results are received post discharge, departmental quality assurance processes ensure appropriate delivery of care and follow-up with the patient. These QA processes however are typically labor intensive and paper based, requiring significant resources for efficient delivery.

Evaluation

We created a web-based application to automate our Department’s QA processes and provide real-time data sharing between departments at our medical center. We created a web service to share radiology report information from our Radiology Department’s quality platform that was consumed by the clinical quality assurance application created by the Emergency Medicine Department.

Discussion

Our application leverages the radiology web service to receive updated reports and exam details from emergency patients after discharge. We collect all aspects of the patient’s visit in order to do effective quality assurance, ensure appropriate measures have been taken and deposit that information in our registry. If any follow-up is necessary, our application provides the user with numerous options to get in touch with the patient. If the resident is unable to contact the patient/emergency contact by phone, he/she may choose to send a letter for follow-up to the patient.

CONCLUSION

Our approach highlights how patient care can be improved through improved inter-departmental data sharing and collaboration by leveraging web-based applications and modern web standards. Our optimized QA protocols consisted of aggregating disparate information into a web service and presenting that data in a unified view. By organizing all of the information regarding the patient’s demographics, medications, exams, and discharge instructions into one centralized location that is easy to read, we were able to improve our QA processes, reduce waste and ultimately deliver better care to our patients.

INE036-b

Personalized Medicine: A New Paradigm of Decision Support using the Prostate, Lung, Colorectal and Ovarian Cancer Screening Trial Dataset (hardcopy backboard)

Arjun Sharma MD (Presenter) : Nothing to Disclose, James Jason Morrison MD : Nothing to Disclose, Jason Michael Hostetter MD : Nothing to Disclose, Kenneth Chung-Yi Wang MD, PhD : Co-founder, DexNote, LLC, Elliot L. Siegel MD : Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XYBIX Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research Grant, Herman Miller, Inc Research Grant, Virtual Radiology Research Grant, Analomical Trave, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation

Background

The Prostate, Lung, Colorectal and Ovarian Cancer (PLCO) Screening Trial dataset provides an unparalleled resource for matching patients with the outcomes of demographically or diagnostically comparable patients. Using these matched data, an individualized diagnostic decision-support system can personalize imaging, testing, follow-up intervals, intervention, and prognosis. They can also be incorporated into CAD algorithms to improve diagnostic efficacy by providing a priori likelihood of disease information.

Evaluation

Released in 2009, the PLCO Screening Trial enrolled ~155,000 participants from 1993 to 2001 to determine whether certain screening exams reduced mortality from prostate, lung, colorectal and ovarian cancer. A web-based application was developed using JavaScript to query this subset of patient information against a given patient’s demographics and risk factors. Analysis of the matched data yields prognostic information which can then be used to guide management decisions and imaging software. Prognostic information is also estimated via the proportion of matched patients that progress to cancer.
Discussion

The US Preventative Services Task Force provides screening recommendations for cancers of the breast, colorectal, and most recently lungs. Additional controversial screening modalities include the use of PSA for prostate cancer and ultrasonography or serum CA-125 for ovarian cancer. There is wide variability in adherence of clinicians to these guidelines and others published by the Fleischner Society and various cancer organizations. Data mining the PLCO dataset for clinical decision support can optimize the use of limited healthcare resources, focusing screening on patients for whom the benefit to risk ratio is the greatest and most efficacious.

CONCLUSION

A data driven, personalized approach to cancer screening maximizes the economic and clinical efficacy and enables early identification of patients in which the course of disease can be improved. Our dynamic decision support system utilizes a subset of the PLCO dataset as a reference model to determine imaging and testing appropriateness while offering diagnostic information for various cancers.

INE038-b

Informed Consent: A New Model for Patient Education (hardcopy backboard)

Louis Morel MD: Nothing to Disclose, Adam DeFoe MD: Nothing to Disclose, Johanna Schubert MD: Nothing to Disclose, Attila Csordas MD: Nothing to Disclose, Sean David Pietrini MD (Presenter): Nothing to Disclose, Shawn Stone: Nothing to Disclose

Background

According to the United States Institute of Medicine, nearly half of all American adults have limited health literacy, limiting their participation in the informed consent process. When studied, up to forty-five percent of patients are unable to recall the major risks of surgery or know the exact nature of their operation. This lack of true informed consent can be a basis for malpractice cases and increases the chances of patient safety incidents or medical error. To address this issue we created tablet-ready, image rich point-of-care presentations to use while obtaining informed consent for IR procedures.

Evaluation

Attendings and residents collaborated to create tablet-ready informed consent presentations for commonly performed IR procedures (port placement, percutaneous biopsy, IVC filter, etc) using Microsoft PowerPoint displayed in PDF format. Procedures are explained with the help of images and diagrams, and the risks, common complications and their percentage likelihood clearly displayed with references. QR codes are built into the presentation to allow for quick lookup of additional videos or literature.

Discussion

Image rich tablet based consent improves the patients understanding of the procedure’s details, risks and benefits, and also serves as a checklist for the provider. Referenced, up-to-date data regarding risks and outcomes builds trust between the physician and patient. Residents and attendings enjoy continued success with the pre-made presentations as response from patients has been overwhelmingly positive. Patients were able to ask more in depth questions regarding the procedure proving their improved level of understanding and engagement. While we used an iPad mini due to it’s white coat pocket size compatibility, this platform can adapt to any tablet. The added benefit of internet access allows one easy access to online images. Informational videos can also easily be added and displayed.

CONCLUSION

Informed consent is vital to every IR procedure. Unfortunately, truly informed patients are not the norm due to limited health literacy. We embraced tablet technology to assist in the informed consent process and have enjoyed positive results with better informed patients.

INE041-b

Computerized Detection and Classification of Pulmonary Pathologies from CT Images: Current Approaches, Challenges, and Future Trends (hardcopy backboard)

Awais Mansoor PhD (Presenter): Nothing to Disclose, Ulas Bagci PhD, MSc: Nothing to Disclose, Ziyue Xu PhD: Nothing to Disclose, Brent Foster: Nothing to Disclose, Georgios Z. Papadakis MD: Nothing to Disclose, Ken Olivier: Nothing to Disclose, Jason M. Elinoff: Nothing to Disclose, Anthony F. Suffredini MD: Nothing to Disclose, Jayaram K. Udupa PhD: Nothing to Disclose, Daniel Joseph Mollura MD: Nothing to Disclose

TEACHING POINTS

1. To identify the clinical importance of lung pathology detection, segmentation and classification. 2. To review the state-of-the-art image segmentation approaches for pathological lungs from CT scans. 3. Computerized techniques for disease detection and quantifications. 4. To discuss the future of lung segmentation methods and explain how engineering advancements in CT plays a valuable role.

TABLE OF CONTENTS/OUTLINE


INE042-b

Normalization of the Reconstruction Kernel Effects with Image-based Kernel Conversion Technique in the Measurement of Emphysema Index in CT (hardcopy backboard)

Hyeongmin Jin (Presenter): Nothing to Disclose, Jong Hyo Kim PhD: Nothing to Disclose

Background

The emphysema index (EI) in CT is a quantitative measure of emphysema, which is known to be affected by reconstruction kernel. This study presents an image-based kernel conversion technique which converts
CT image of sharp kernel to that of standard kernel and compares the result with MTF-based kernel conversion method in the measurement of EI.

Evaluation

Sixty cases of CT exams obtained with 120kVp, 40mA, 1mm thickness, of 2 reconstruction kernels (B30f, B50f) were selected from the low dose lung cancer screening database of our institution. An image-based kernel conversion technique, which converts by applying a conversion function, was performed to the CT data set of B50f to create a converted B30f data set. The conversion function ($F_{con}$) which is the ratio of the spectral components of target and source kernel images, was produced using a training dataset. $F_{con}$ in the MTF-based method, was the ratio of MTFs which were measured with small bead object in 2 reconstructed images. The EI (RA950) was measured with a software package (Pulmonalyzer, Seoul, South Korea) and compared for data sets of B50f, B30f, and the converted B30f. The accuracy of kernel conversion was evaluated with the mean and standard deviation of pair-wise differences in EI.

Discussion

Population mean of EI was 28.89±6.48% for B50f data set, 10.96±6.37% for the B30f data set, and 11.27±6.83% for the converted B30f data set. The pair-wise differences in EI between B30f and the converted B30f is 0.78±1.07% with image-based method, and 4.91±1.73% with MTF-based method.

CONCLUSION

Our study demonstrates the feasibility of image-based kernel conversion method for normalization of kernel effect in measurement of EI with superior performance to that of MTF based approach. This technique has a potential to be used in evaluating the longitudinal changes of EI even when the CT was reconstructed with different kernels.
MIS152

A Two-Pool Modeling for 3 Tesla Magnetization Transfer MR Imaging of Prostate Cancer

Robert Frederick Mattrey MD: Nothing to Disclose

Emilia Sue Olson MD, PhD (Presenter): Nothing to Disclose, Christopher Devin Malone MD: Nothing to Disclose

Inanc Ortac: Founder, DevaCell Inc, Sadik Esener: Nothing to Disclose

PURPOSE

We investigated a new molecule that can change its magnetic properties from diamagnetic to paramagnetic and vice versa by illuminating it with different wavelengths of visible light. The purpose was to find out if this magnetic switch can change T1 relaxivity in a way that it can be used as a switchable MRI contrast agent.

METHOD AND MATERIALS

We used a nickel complex as a molecular spin switch that can change between diamagnetic and paramagnetic state by exposing it with blue-green light (500 nanometers) and violet-blue light (435nm). The process leads to stable states and is fully reversible without fatigue. We designed a closed loop flow system attached to a light source and a pump outside our 3T MRI scanner (Achieva, Philips Medical Systems, Best, The Netherlands). The flow system also contained a reservoir enclosed in a head phantom inside the MRI Scanner. We repeatedly scanned the reservoir containing a solution of the molecule using T1 weighted sequences in order to evaluate the contrast dynamics. Outside the scanner the solution was permanently illuminated while being pumped through the flow system. This was repeated for different concentrations of the solution.

RESULTS

The T1w signal intensity in the reservoir increased significantly during the illumination with wavelengths of 500 nm as the molecules changed their magnetic state from diamagnetic to paramagnetic. In the same way, the T1w signal intensity decreased during illumination with a wavelength of 435 nm. While at high concentration (2.4 mmol) we found a signal-to-noise ratio (SNR) of 10.2, at lower concentration (0.9 mmol) the SNR dropped to 5.9. In addition, we could show that the molecules were much faster switched off than switched on. The half-life period was 2 min for switching off versus 8 min for switching on. The switching process was also concentration dependent. At a concentration of 0.9 mmol the half-life period for switching the contrast off was 2 minutes versus 7 minutes at a concentration of 2.4 mmol.

CONCLUSION

Our switchable molecule allows for generating noticeable T1w contrast differences within a period of time comparable to a standard MRI pulse sequence.

CLINICAL RELEVANCE/APPLICATION

Switchable contrast agent could be used to better delineate contrast enhancement by subtracting the tissue background because the molecule can be switched on and off as often as necessary.
PURPOSE

Multi-parametric magnetic resonance imaging (MRI) is used to aid in the diagnosis of prostate cancer. Magnetization transfer MRI (MT-MRI) may provide a complementary mechanism to reveal molecular-based contrast between the tumor and benign prostatic tissue. This study investigates the molecular mechanisms of MT-MRI of prostate cancer.

METHOD AND MATERIALS

Eighteen prostate cancer patients were imaged on a 3 Tesla MRI system (Philips, Best, Netherlands) before undergoing prostatectomy. A saturation pre-pulse was applied at frequencies ranging from -8 to 8 ppm with a power of 4 uT. Images were acquired using a single-slice, single-shot turbo spin echo sequence. From MT-spectral data, bound proton (associated with immobile macromolecules) and free proton (free water) pools were modeled as separate Lorentz functions using IDL. Parameters describing the full-width at half maximum (FWHM) and maximum magnitude of the bound and free proton components of the MT-spectra were obtained for the PZ, CG, and tumor regions of interest.

RESULTS

The magnitude of the bound pool is 0.15 ± 0.05 for the PZ, 0.21 ± 0.03 for the CG, and 0.22 ± 0.05 for the tumor. This is significantly different between the PZ and the tumor, but not between the CG and the tumor (p=0.001 and p=0.12, respectively). The magnitude of the free pool is 0.77 ± 0.02 for the PZ, 0.76 ± 0.03 for the CG, and 0.75 ± 0.03 for the tumor. This is significantly different between the PZ and tumor, but not the CG and tumor (p=0.002 and p=0.142, respectively). The FWHM of the free pool is 7.4 ± 1.0 ppm for the PZ, 8.3 ± 0.6 ppm for the CG, and 8.2 ± 0.7 ppm for the tumor. This is significantly different between the PZ and CG, and the PZ and tumor (p=0.001 and p=0.0002, respectively).

CONCLUSION

Our data shows higher magnitude of the bound pool in the prostate cancer and CG regions, revealing greater concentration of immobile macromolecules, and a lower magnitude of the free pool in prostate cancer regions, indicating less free water in cancerous tissues than the PZ.

CLINICAL RELEVANCE/APPLICATION

Modeling the MT-spectra of the regions of the prostate provides immobile macromolecular and water information, useful for the application of MT-MRI as a unique and complementary method of improving contrast between tumor and benign prostate tissues.
permeability measures derived from DCE with conventional, contrast enhanced and diffusion MRI techniques in diagnosis of patients with sacroiliitis (SI) at 3T.

METHOD AND MATERIALS
An institutional review board approval was obtained for this study. A total of 20 patients with SI were included. All patients were evaluated with routine laboratory exams, specific scoring methods (VAS, BASFI, BASDAI, ASQoL, BASMI) for disease activity and ASAS criteria at the rheumatology clinic before referral. Conventional (including T1, T2W and STIR images), dynamic contrast enhanced imaging with gadoterate meglumine were performed for each patient at 3T. ADC values from DWI; Ktrans, Kep and TTP values from DCE images were calculated, respectively. Quantitative evaluation was performed for the data driven from DCE time-intensity curve, ADC map and values of permeability by means of ROI placed within areas of bone marrow edema and contralateral normal appearing bone with the help of conventional images. Quantitative values obtained were statistically evaluated and correlated with disease activity scores obtained from the clinical evaluation methods.

RESULTS
Conventional, diffusion weighted and DCE images had successfully defined regions of edema and increased contrast uptake. Clinical scores of disease activity also showed good correlation with permeability values in all patients. Ktrans, Kep and TTP values showed greater difference between regions of bone marrow edema and contralateral normal appearing bone and correlated well with ADC measurements.

CONCLUSION
This initial report showed that permeability calculation of DCE is a promising technique in imaging of SI and can be useful in establishing radiological correlation with disease activity.

CLINICAL RELEVANCE/APPLICATION
Permeability calculation of DCE in sacroiliac imaging is a promising technique which is expected to help early diagnosis, management of treatment and follow up procedures in SI.

MKS391
Feasibility of DCE-MRI in the Detection of Active Lesions of Ankylosing Apondylitis in the Sacroiliac Joint (Station #2)

Ruxin Wang (Presenter): Nothing to Disclose, Yue Dong: Nothing to Disclose, Liwei Zhong: Nothing to Disclose, Liang Huang: Nothing to Disclose

PURPOSE
To evaluate the efficacy of DCE-MRI in the differential diagnosis of active lesions in the sacroiliac joint of ankylosing spondylitis (AS) patients.

METHOD AND MATERIALS
Two groups of patients were selected: confirmed cases and clinical suspected (35 cases), normal control group (21 cases). The age limit is 18 to 45 years old and male to female ratio is about 1 to 1. Two sequences are performed: fat suppressed T2WI and joint DCE-MRI T1WI of both sacroiliac joints in the sagittal and coronal plane. The slice thickness is 4 ~ 5 mm. The contrast is given every 10 ms, at an interval of 1 ms, when scan 20 phases. The patient is scanned in the coronal and sagittal section. The bilateral sacroiliac joints are examined for any synovial thickening and the synovium is measured. At each level, 3 ROI are taken from right to left, as far as possible when selecting ROI and synovial contorts the consistent, according to the TIC curve we can respectively record time to the peak (TTP), peak signal strength (PSS), the maximum slope (MSI) and signal enhancement ratio (SER), Independent sample t test analysis is used to compare the average value.

RESULTS
Based on clinical, laboratory examination and image analysis, 17 cases had confirmed symptomatic AS and 18 cases had no confirmed AS. For the control group: the peak time is (9.48 ± 4.11) ms; the peak signal strength is (430.51 ± 146.55); the largest rise in slope is (78.78 ± 42.84); the signal enhancement ratio is (85.89 ± 36.10). For the lesion group: the peak time is (13.00 ± 5.06) ms; the peak signal strength is (571.81 ± 241.24); the largest rise in slope is (141.93 ± 78.42); the signal enhancement ratio is (124.74 ± 10.45). The comparison between lesion group and control group had statistical significance (P < 0.05). The peak time area under the ROC curve (AUC) is 0.71, the peak signal strength AUC is 0.74; the maximal peak AUC is 0.78; the signal enhancement ratio AUC is 0.72.

CONCLUSION
DCE-MRI is superior to conventional sequences of MRI in the differential diagnosis of active lesions in the sacroiliac joint of ankylosing spondylitis (AS). Parameters such as time to peak, peak signal strength, maximum rising slope, signal enhancement ratio of sacroiliac joint of active lesions has significance of differential diagnosis. The efficiency is the largest at the maximal increase in slope.

CLINICAL RELEVANCE/APPLICATION
It’s a new method that is very helpful to diagnosis of AS.

MKS392
Arthritis or Aging? A Review of the CT Findings in the Osseous Pelvis in an Aging Population (Station #3)

James D. Stensby MD (Presenter): Nothing to Disclose, Cree Michael Gaskin MD: Author with royalties, Oxford University Press Author with royalties, Thieme Medical Publishers, Inc, David Ansley Lawrence MD: Nothing to Disclose

PURPOSE
To determine trends in incidentally detected age- and gender-associated sacroiliac fusion and chondrocalcinosis on pelvic CT.

METHOD AND MATERIALS
IRB approved. We identified CT scans of the pelvis performed 2009-2013 and selected 20 patients of each gender at the center of each decade of life (age 5, 15, 25, . . .95 years) for a total of 400 pelvic CTs. We reviewed the electronic health record of each patient and excluded those with low back or sacroiliac pain; known afflictions of the pelvis joints or systemic rheumatologic conditions; history of sacroiliitis,
anklyosing spondylitis, inflammatory bowel disease, HLA B27 arthropathy, hemochromatosis, hyperparathyroidism, Wilson's disease, or hypothyroidism. We backfilled for any excluded patients to maintain 20 subjects in each set. CTs were reviewed in consensus by 2 MSK radiologists for SI joint fusion and chondrocalcinosis of the sacroiliac joint. Logistic regression was used to predict the presence/absence of SI fusion and chondrocalcinosis as a function of patient age and gender. The model predictors included a classification variable to identify patient gender, and linear and non-linear restricted cubic-spline functions of patient age.

RESULTS
SI fusion was associated with both patient age (P=0.003) and patient gender (P<0.001). SI joint fusion was seen more frequently in both older males and females, although at any particular age the odds of SI fusion was predicted to be 7.1 times greater (95% CI: [3.2, 19.7]) for males than females (P<0.001). The presence/absence of chondrocalcinosis was found to be associated with patient age (P=0.016) but not patient gender (P=0.929). (Fig.) (445)

CONCLUSION
Incidentally detected SI joint fusion is common in older patients, particularly in men. It is an uncommon finding in patients <45 years of age, particularly in women, and may warrant clinical evaluation. Chondrocalcinosis is more prevalent in older patients, without a gender predilection and is infrequently identified in patients younger than age 50.

CLINICAL RELEVANCE/APPLICATION
When SI joint fusion is detected in older male patients it likely reflects an age and gender related phenomenon rather than sequela of disease. For patients <45 years age, particularly women, SI joint fusion is suggestive of underlying disease process.

MKS393
Intravoxel Incoherent Motion Diffusion-weighted MR Imaging for Characterization of Musculoskeletal Tumors at 3.0T (Station #4)
Hyun Kyong Lim MD (Presenter): Nothing to Disclose, Won-Hee Jee MD: Nothing to Disclose, Joon-Jong Paek: Employee, Siemens AG, Robert Grimm: Employee, Siemens AG, Yang-Guk Chung MD: Nothing to Disclose

PURPOSE
To retrospectively evaluate the intravoxel incoherent motion (IVIM)-derived parameters for differentiating between benign and malignant musculoskeletal tumor at 3.0T diffusion-weighted magnetic resonance (DW) imaging.

METHOD AND MATERIALS
The institutional review board approved this HIPAA-compliant study, and informed consent was waived. Sixty-three patients with treatment-naive musculoskeletal tumors who underwent MR imaging including IVIM DW imaging were included in this study: 47 malignant and 20 benign lesions. IVIM DW imaging was obtained with nine b values (0800 sec/mm²) at 3.0T. IVIM-derived parameters included pure diffusion coefficient, perfusion related incoherent microcirculation (pseudodiffusion coefficient), and perfusion fraction. IVIM related parameters were retrospectively measured within the solid portion based on standard MR images by two independent musculoskeletal radiologists. Intraclass correlation coefficient (ICC) was used for interobserver reliability test. Mann-Whitney U test and two sample t-test were performed for comparison. The diagnostic performance of the parameters was evaluated by using receiver operating characteristic (ROC) analysis.

RESULTS
The pure diffusion coefficient of malignant tumors (920 ±360 μm²/sec) were significantly lower than those of benign tumors (1540 ±660 μm²/sec) (P<.001). The perfusion fraction of malignant tumors (9.56%) were significantly higher than those of benign tumors (6.80%) (P=.011). The pseudodiffusion coefficient showed no significant difference (P>.05). The area under the ROC curve of pure diffusion coefficient and perfusion fraction were 0.80 and 0.70, respectively (P<.01). Using cut-off values of pure diffusion coefficient of 1160 μm²/sec, the sensitivity and specificity were 90% and 75%, respectively. The ICC value showed good to excellent interobserver agreement between two readers (0.98 for pure diffusion coefficient; 0.70 for pseudodiffusion coefficient; 0.80 for perfusion fraction).

CONCLUSION
IVIM-derived pure diffusion coefficient and perfusion fraction were more valuable parameters in the differentiation of malignant from benign musculoskeletal tumors than pseudodiffusion coefficient at 3.0T IVIM DW imaging.

CLINICAL RELEVANCE/APPLICATION
IVIM-derived pure diffusion coefficient and perfusion fraction were more valuable parameters in the differentiation of malignant from benign musculoskeletal tumors than pseudodiffusion coefficient at 3.0T IVIM DW imaging.

MKS394
Quality Management in Musculoskeletal Imaging: Form, Content and Diagnosis of Knee MR Reports and Effectiveness of Three Different Quality Improvement Measures (Station #5)
Andrea Rosskopf MD (Presenter): Nothing to Disclose, Tobias J. Dietrich MD: Nothing to Disclose, Anna Hirschmann MD: Nothing to Disclose, Florian M. Buck MD: Nothing to Disclose, Reto Sutter MD: Nothing to Disclose, Christian W. A. Pfirrmann MD, MBA: Advisory Board, Siemens AG Consultant, Medtronic, Inc

PURPOSE
To evaluate the quality of reports of knee MR examinations in form, content and diagnosis and to assess the effect of three different quality improvement measures.

METHOD AND MATERIALS
Reports of 500 consecutive knee MR studies (=first round) in our institution were retrospectively assessed...
by five musculoskeletal radiologists. In summary 15 different criteria were reviewed for formal and content-related quality of reports. Furthermore diagnostic discrepancies were categorized using a five-point scale: I: no deviation; II: undetected finding, clinically irrelevant; III: wrong interpretation of finding, clinically irrelevant; IV: undetected finding, clinically relevant; V: wrong interpretation of finding, clinically relevant. In the second round three different quality improvement measures were applied to a total of 510 consecutive reports: a quiet work environment, double reading and the use of a structured report template. These 510 knee MR reports were assessed using the same criteria as described above.

RESULTS
In the second round reports a statistically significant improvement in 13 out of 15 criteria of form and content was found: orthographic errors improved from 32.4% to 22.0% (P<0.001) of reports and digital speech recognition errors from 8.4% to 7.6% (P=0.660). The rate of missing anatomical structures dropped from 6.3% to 0.4%. Diagnostic discrepancies decreased from 20.6% to 12.9% (P=0.001) with following changes in categorization (first round results in parentheses): I: 87.1%(79.2%), II: 9.2%(16.8%), III: 2.3%(1.0%), IV: 1.0%(2.6%), V: 0.4%(0.4%). Quality improvement was found in all three measure groups. No statistically significance between the groups was found - except for the orthographic errors (P<0.001), which were most common in the template group.

CONCLUSION
Formal deviations were common. Clinically relevant diagnostic errors occurred rarely and were mostly associated with the detection of lesions rather than its interpretation. All three quality improvement measures significantly improved the quality of the knee MR reports, but no measure was clearly superior to the others.

CLINICAL RELEVANCE/APPLICATION
Our results demonstrate that each proposed quality improvement measure leads to a relevant reduction of errors in structure, content and diagnosis in knee MR reports.
MKE281

Current Techniques in Percutaneous Image-guided Treatment of Benign and Malignant Lesions of the Spine (Station #9)

Kristen Alexa Lee MD (Presenter): Nothing to Disclose, Afshin Gangi MD, PhD: Proctor, Gallil Medical Ltd, Michael V. Friedman MD: Nothing to Disclose, Travis J. Hilden MD: Consultant, Biomedical Systems Consultant, Vidacare Corporation, Jack William Jennings MD: Speakers Bureau, DFINE, Inc

TEACHING POINTS

In the past decade, there has been increasing use of percutaneous techniques in the treatment of both benign and metastatic spine lesions. These techniques provide therapeutic options for patients, who have failed conventional therapies or exhausted spine radiotherapy. Review the most current and state of the art use of percutaneous image-guided interventions for benign and malignant lesions of the spine. Discuss specific challenges in thermal ablation of spinal lesions and the role of thermoprotection.

TABLE OF CONTENTS/OUTLINE

Overview of percutaneous image-guided techniques in treatment of both benign and malignant spinal lesions, including vertebral augmentation, radiofrequency ablation, coblation, cryoablation, microwave and laser photocoagulation. Brief literature review on efficacy and safety profile of these techniques. Pictorial presentation of various benign and malignant spinal lesions pre- and post-treatment. Discuss specific challenges in thermal ablation of spinal lesions and the role of thermoprotection Summary and future direction.

MKE285

Freeze Frame: A Pictorial Review of Cryoablation in the Treatment of Osteoid Osteomas (Station #10)

Brathaban Rajayogeswaran MBCh (Presenter): Nothing to Disclose, Neal C. Chhaya MBBS, FRCR: Nothing to Disclose, Paul Ian Mallinson MBChB: Nothing to Disclose, Peter L. Munk MD: Nothing to Disclose

TEACHING POINTS

To review the pathophysiology of osteoid osteomas, principles of thermoablation and the advantages of cryoablation, planning interventional methods, potential complications of cryoablation and post procedural imaging to confirm complete ablation zone.

TABLE OF CONTENTS/OUTLINE

The new ultralight thin argon based designed cryoablation probes are perfect for ablating small painful osteoid osteomas which can appear anywhere in the skeleton. Probe selection and placement can be challenging to create complete ablation zone and minimise complications. This pictorial educational review zooms in and snap shots the process. 1) Description of the pathology and illustration of various examples of osteoid osteomas. 2) Discuss the principles and advantages of the use of cryotheraphy to ablate the osteoid osteoma nidus. 3) Pictorial review of cryoablation with tips and tricks. ‘When to park adjacent to the cortex and when to drill’, ‘overlapping ablation zones’. 4) Identify and minimise complications of cryoablation with intraoperative imaging. 5) Review of follow-up post-procedural imaging to confirm complete ablation of the osteoid osteoma.

MKE243

Anatomy, Pathology and Imaging of the Coracohumeral Ligament (Station #11)

Guillermo Andres Azulay MD : Nothing to Disclose, Patrick Omoumi MD (Presenter): Nothing to Disclose, Santiago Andres MD : Nothing to Disclose, Andres Zanfardini MD : Nothing to Disclose, Ariel Oscar Vazquez MD : Nothing to Disclose, Eduardo Pelayo Eyheremendy MD : Nothing to Disclose, Daniel Postan : Nothing to Disclose

TEACHING POINTS

1. Knowledge of the anatomy and the relations of the coracohumeral ligament (CHL) with surrounding structures are essential to the imaging study of the CHL. 2. MRI and MR arthrography are the imaging techniques of reference to image the CHL. 3. Ultrasound can be a useful technique through a dynamic evaluation.

TABLE OF CONTENTS/OUTLINE

1. Anatomy: 4 cadaveric specimens were studied with a focus on the relation of the CHL to the surrounding structures (biceps, supraspinatus and infraspinatus tendons, subcoracoid fat, acromiocracic ligament, subacromial subdeltoid bursa). The position and movement of the CHL in relation to internal and external rotation of the shoulder. 2. High-resolution ultrasound examination technique: positioning; anterior dynamic approach; landmarks (including acoustic shadows); taking advantage of the anisotropy artifact. 3. Ultrasound can be a useful technique through a dynamic evaluation. 4. Therapeutic considerations (Adhesive capsulitis, traumatic and microtraumatic lesions), emphasizing the role of imaging.

MKE319

Imaging of Soft Tissue Lesions: Role of Sonoelastography in the Diagnosis and Follow Up (Station #12)

Chiara Carducci MD (Presenter): Nothing to Disclose, Nicola Magarelli MD : Nothing to Disclose, Laura Filograna MD : Nothing to Disclose, Claudia Dell’Atti MD : Nothing to Disclose, Antonio Leone MD : Nothing to Disclose, Lorenzo Bonomo MD : Nothing to Disclose

TEACHING POINTS

Sonoelastography (SE) is an ultrasound technique that is increasingly used for the evaluation, characterization and follow up of superficial soft tissue lesions. It measures the tissue hardness of the lesion by comparing the ultrasound radiofrequency signal before and after compression of the tissue. The principle of SE is based on the relationship between differences in tissue deformability and its elastic properties. The purpose of the exhibit is to: underline the role of SE in the diagnosis and follow up of the soft tissue lesions; improve radiologist’s diagnostic skills with this technique.

TABLE OF CONTENTS/OUTLINE

Technical principles and execution technique of SE. Qualitative and quantitative parameters of SE in the evaluation of superficial soft tissue presented in a flow chart. Case series presented to highlight the SE Technical principles and execution technique of SE. Qualitative and quantitative parameters of SE in the soft tissue lesions; improve radiologist’s diagnostic skills with this technique.
evaluation of superficial soft tissue presented in a flow chart. Case series presented to highlight the SE pattern of benign and malignant soft tissue lesions. Key points: integrated imaging in the diagnosis and follow up of soft tissue lesions; added value of SE in the management. SUMMARY SE could be a powerful imaging tool in the evaluation of superficial soft tissue lesions with unclear findings on grey-scale and colour and/or power Doppler ultrasound, to increase the diagnostic accuracy and useful for the follow-up of benign lesions.
NMS189

The Increasing Recognition of Rapid Gastric Emptying by Scintigraphy in Patients Referred to a Tertiary Center for Suspected Upper Gastrointestinal Motility Disorder. (Station #2)

Jesus Rafael Diaz, MD (Presenter): Nothing to Disclose, Arya Bagherpour, DO: Nothing to Disclose, Joshua Reber: Nothing to Disclose, Alok Kumar Dwivedi, PhD: Nothing to Disclose, Luis Andres Alvarado, MD: Nothing to Disclose, Irene Sarosiek, MD: Nothing to Disclose, Richard W. McCallum, MD: Nothing to Disclose

PURPOSE

Rapid gastric emptying (RGE) has been associated with gastric surgery and vagotomy in the past but surgery for peptic ulcer disease is now infrequent. The purposes of our study are: 1) To determine the incidence of RGE in patients with symptoms suggesting an upper GI motility disorder referred to a Tertiary GI Motility Center; 2) To identify the dominant etiologies currently responsible for RGE, and 3) To highlight the diagnostic power of the 30-min retention value on scintigraphy.

METHOD AND MATERIALS

We reviewed the results of 223 gastric emptying scintigraphy (GES) studies from January to December 2013. Age, gender and ethnicity were documented. All patients underwent 4-h GEST with a standardized egg beater meal (255-kCal, 2% fat) labeled with Tc-99m sulfur colloid. RGE was defined as <70% retention at 30 min or <35% retention at 60 min. Delayed gastric emptying was defined as >60% retention at 2 h or >10% retention at 4 h. Statistical analysis using McNemar's test was performed to calculate the diagnostic power of the 30-min compared to the 60-min retention value.

RESULTS

Of the 223 patients, 25.5% were classified as normal, 36% as delayed and 39.5% as rapid. Of these 88 patients with RGE, 76% were female with median age of 58, 46.5% were diabetic, 31% were termed idopathic with a history of preceding gastroenteritis in many, 12.5% had cyclic vomiting syndrome (CVS) and 10% were postsurgical. The 30-min retention value diagnosed 26% more patients with RGE than the 60-min retention value; a significant additional percentage (P<0.05). RGE incidence was similar in Hispanics and Non-Hispanics.

CONCLUSION

Analysis of GES performed in 2013 demonstrated: 1) There is an increasing incidence of RGE detected in patients referred with symptoms suggesting an upper GI motility disorder compared to the incidence of gastroparesis; 2) The 30-min value diagnosed significantly more patients compared to the 60-min value and 3) While diabetes continues to be the dominant etiology for RGE, there are increasing contributions from idiopathic and CVS subgroups.

CLINICAL RELEVANCE/APPLICATION

Our data would indicate that there should be a heightened awareness of the increased incidence of RGE in patients referred with suspected upper GI motility disorders where gastroparesis has been the presumptive diagnosis. Clinical differentiation between the two entities can be essentially indistinguishable.
CONCLUSION
These preliminary results indicate that 4DST PET is a potentially useful tracer for proliferation imaging in head and neck squamous cell carcinoma, although uptake of 4DST was significantly lower than that of FDG.

CLINICAL RELEVANCE/APPLICATION
4DST PET can detect head and neck cancer squamous cell carcinoma and is recommended in the evaluation of head and neck squamous cell carcinoma.

NMS191
The Confounding Effects of Weight and Blood Pool Activity in PET Vascular Imaging with 18FDG
(Station #4)
Mark Allan Ahlman MD (Presenter): Nothing to Disclose, Roberto Maass-Moreno PhD : Nothing to Disclose, Davis M. Vigneault BS : Nothing to Disclose, Veit Sandfort MD : Nothing to Disclose, Nehal Mehta : Nothing to Disclose, David A. Bluemke MD, PhD : Research support, Siemens AG

PURPOSE
Vascular target to background ratios (TBR) are calculated based on standardized uptake value (SUV) and blood pool activity (BP), which in turn are related to body weight (BW) and glomerular filtration of FDG. The purpose of this study was to determine methods to quantify FDG PET vascular activity to avoid confounders that may obscure underlying measures of vascular uptake.

METHOD AND MATERIALS
25 normal adult subjects were prospectively enrolled for PET-CT at 2 hrs uptake time using lean body mass (LBM)-based FDG dosing (0.14 mCi/kg). Per subject, 200-300 descending aorta max SUV measurements and adjacent mean reference venous SUV were used to form TBR-Blood. Target SUV was measured using BW (SUV-BW) and LBM (SUV-LBM) as well as reference venous activity (BP-BW, BP-LBM). Mean liver activity was used as a reference for TBR-Liver. Spearman's correlation of measurements with weight and BP activity were calculated. Significant changes in rho (reported where p value significance <0.05) were used to indicate if alternate quantification methods allowed for the removal of weight, BP-BW, or BP-LBM as confounding internal correlates. Coefficient of variation (COV) was reported for values of interest.

RESULTS
Weight correlated with BP-BW (0.60, p=0.002) and SUV-BW (0.53, p=0.007), but did not correlate with BP-LBM or SUV-LBM. BP-BW correlated with SUV-BW (0.83, p<0.0001), SUV-LBM (0.43, p=0.034), and TBR-Blood (0.52, p=0.008). BP-LBM correlated with SUV-BW (0.61, p<0.001), SUV-LBM (0.73, p<0.0001), but not TBR-Blood. Neither BP-BW nor BP-LBM showed correlation with SUV-LBM, TBR-Blood, and TBR-Liver was 15.5%, 10.7%, and 10.1%, respectively.

CONCLUSION
Weight correlates highly with arterial SUV, likely influenced by the mathematical calculation of SUV. Likewise, BP activity is highly correlated with target arterial wall activity, likely due to volume averaging of blood in the artery lumen with adjacent wall. For our sample, the use of LBM for SUV calculation minimizes potential type I errors that may arise when correlating SUV with clinical endpoints. TBR-Blood is influenced by variability in BP activity; whereas, TBR-Liver mitigates the confounding effect of BP, has the lowest COV, and obviates LBM calculation.

CLINICAL RELEVANCE/APPLICATION
This work details strategies for FDG quantification of vascular activity that minimize confounding effects and improves measurement reliability.

NMS192
Time-of-Flight and non-Time-of-Flight Sodium Fluoride PET-CT (Station #5)
Jorge Daniel Oldan MD (Presenter): Nothing to Disclose, Bennett B. Chin MD : Nothing to Disclose

PURPOSE
Standardized uptake value (SUV) measurements on PET can be used to assess response to drug therapies, but image acquisition and processing variables such as time-of-flight (TOF) data acquisition may affect their quantitative accuracy. The purpose of this study is to compare SUV measurements in TOF and conventional non TOF reconstructions in 18F sodium fluoride (NaF) PET / CT.

METHOD AND MATERIALS
SUV measurements in 45 prostate cancer patients with both TOF and non-TOF 18F NaF PET-CT data were analyzed for differences. SUV mean and maximum were measured in normal soft tissue (n=276 total regions; liver, aorta, posterior abdominal fat, bladder, brain, and paraspinal muscles) and osseous structures (n=184; T12 vertebral body, femoral diaphyseal cortex, femoral head, and lateral rib); degenerative changes (DJD; n=281) and metastatic lesions (n=159) were also measured. Data were analyzed for outliers and remeasured when registration was found to produce unusual results. TOF and non-TOF SUV were compared with paired t-test with Bonferroni correction and linear correlation.

RESULTS
Soft tissue showed lower SUV for TOF compared to non-TOF in liver (0.50±0.13 vs 0.65±0.17; p < 0.0001), brain (0.15 ± 0.04 vs 0.2 ± 0.05; p < .0001), and adipose (0.18 ± 0.05 vs 0.2 ± 0.05; p < 0.0001). Osseous structures showed higher SUV for TOF compared to non-TOF in T12 (6.74 ± 1.48 vs 6.65 ± 1.43), femoral head (2.3 ± 0.96 vs 2.16 ± 0.88, p < 0.0001), rib (3.45 ± 0.83 vs 3.26 ± 0.8; p < 0.0001), DJD (11.07 ± 3.78 vs 10.67 ± 3.74; p < 0.0001), and metastases (16.38 ± 13.05 vs 16.18 ± 13.22; p <0.0001). Also higher on TOF was the bladder (42.6 ± 24.2 vs 42.3 ± 24.4, p=.0021). Paraspinal muscles (0.71 ± 0.11 vs 0.68 ± 0.11, p=.024), femoral cortex (1.69 ± 0.66 vs 1.58 ± 0.64; p=.08), and aorta (1.21 ± 0.25 vs 1.25 ± 0.26, p=.0047) were not significantly different.

CONCLUSION
SUV-LBM, TBR-Blood, and TBR-Liver was 15.5%, 10.7%, and 10.1%, respectively.
Degenerative changes tended to increase by about 3% on TOF images, whereas metastases increased about 2.5%.

CONCLUSION

Most osseous structures (as well as structures brighter than their surroundings such as the bladder) have higher SUV values, and background tissues have lower SUV values, on TOF images. While these differences are statistically significant, they are small in magnitude.

CLINICAL RELEVANCE/APPLICATION

These results suggest that TOF compared to non-TOF SUV measurements in 18F NaF PET / CT will have an overall minor effect in multicenter clinical trials and in clinical practice.

NRS-THA

Neuroradiology Thursday Poster Discussions

Scientific Posters

NRS

AMA PRA Category 1 Credits ™: .50
Thu, Dec 4 12:15 PM - 12:45 PM Location: NR Community, Learning Center

Participants

Moderator
Pratik Mukherjee MD, PhD : Research Grant, General Electric Company Medical Advisory Board, General Electric Company

Sub-Events

NRS449  Diffusional Kurtosis Imaging and Cognitive Disturbance in Idiopathic Normal Pressure Hydrocephalus (Station #1)

Kouhei Kamiya MD (Presenter): Nothing to Disclose, Koji Kamagata: Nothing to Disclose, Akira Nishikori: Nothing to Disclose, Ryusuke Irie: Nothing to Disclose, Masaaki Hori MD: Nothing to Disclose, Masakazu Miyajima: Nothing to Disclose, Madoka Nakajima: Nothing to Disclose, Harushi Mori MD: Nothing to Disclose, Akira Kunimatsu MD: Speakers Bureau, Terumo Corporation, Hajime Arai: Nothing to Disclose, Shigeki Aoki MD, PhD: Nothing to Disclose, Kuni Ohtomo MD: Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group

PURPOSE

Diffusional kurtosis imaging (DKI) is a new diffusion MRI technique that can be more sensitive to tissue microstructural alterations than conventional diffusion tensor imaging. This study aimed to investigate correlations between the DKI metrics with cognitive function in patients with idiopathic normal pressure hydrocephalus (iNPH), as well as changes before and after the lumbo-peritoneal shunt (LP shunt).

METHOD AND MATERIALS

Twenty-nine patients with iNPH were involved. DKI data were obtained using a 3-T system with diffusion gradient in 32 directions. The mean kurtosis (MK) and fractional anisotropy (FA) maps were calculated. Cognitive measures included Mini-Mental State Examination (MMSE), frontal assessment battery (FAB), and trail-making-test-A (TMT-A). Tract-based spatial statistics (TBSS) were used to investigate the correlations between the pre-operative diffusion metrics and the cognitive measures. For those who had post-operative exams, pair-wise analyses of TBSS were also performed to look for alterations before and after the surgery.

RESULTS

Positive correlations with the cognitive function were observed in almost similar regions for FA and MK, predominantly in the frontal lobe and the cingulum (P < 0.05). On MK analyses, more extensive areas of the frontal subcortical white matter showed significant correlations with the FAB and TMT-A, compared with FA analyses. Pre- and post-operative images were available in 8 patients, all of whom experienced clinical improvement after LP shunt. Pair-wise analyses revealed significant decrease of MK in the anterior cingulum after the surgery.

CONCLUSION

Our results suggest DKI provides additional information of tissue alteration relevant with cognitive dysfunction in iNPH, and is useful especially in subcortical regions where the complexity of fiber direction can be problematic for FA analyses. Although the post-operative decrease of MK seems contradictory at the first glance, it may reflect that the post-operative brain tissue microstructural environment is not the same as the normal healthy state, and that the relationship between diffusion metrics and cognitive function is not preserved after the surgery.

CLINICAL RELEVANCE/APPLICATION

Diffusional kurtosis imaging successfully demonstrated tissue alteration relevant with cognitive dysfunction in idiopathic normal pressure hydrocephalus, especially in the subcortical white matter.

NRS450  Evaluation of Diagnostic Yield for Parkinson’s Disease: Comparison of Planar and SPECT Imaging (Station #2)

Yong-An Chung MD, PhD (Presenter): Nothing to Disclose, So Hwa Yoon: Nothing to Disclose, In Uk Song: Nothing to Disclose, Jin Kyung Oh MD: Nothing to Disclose, Kijun Kim: Nothing to Disclose

PURPOSE

Decreased myocardial uptake of I-123 metaiodobenzylguanidine (MIBG) is important finding for diagnosis of Parkinson's disease. This retrospective study compared I-123 MIBG SPECT and planar imaging with regard to their diagnostic yield for Parkinson's disease.

METHOD AND MATERIALS
RESULTS

Eighty three patients were included for image analysis. 19 of 83 patients showed normal myocardial uptake on planar scintigraphy and SPECT. On the remaining 64 patients, 47 had decreased myocardial uptake on both planar imaging and SPECT (group A) and 17 had reduced myocardial uptake only on SPECT, but normal finding on planar scintigraphy (group B). SPECT had a diagnostic yield for Parkinson's disease of 77.1% compared with 56.6% for planar imaging (p<0.001). H/M ratio from planar imaging for group A and B was 1.41±0.15 (1.20~1.53) and 1.43±0.16 (1.26~1.56), respectively and showed no significant difference between the two groups (p=0.23). L/M ratio for group A and B was 1.58±0.19 (1.3~1.76) and 2.16±0.20 (1.96~2.37), respectively and significantly higher in B group (p=0.001).

CONCLUSION

I-123 MIBG SPECT has a significantly higher diagnostic yield for Parkinson disease than planar image. Increased lung uptake may cause false negative on planar imaging.

CLINICAL RELEVANCE/APPLICATION

Recently MIBG scan is important method for diagnosis of Parkinson's disease. However the false negative rate is high on planar imaging. Rather than planar imaging using SPECT images would be excellent.
RESULTS

Interobserver agreement has been found 'discrete'. About Nodal involvement: Coregistered PET/CT and MR reading session, showed diagnostic accuracy of 91% (vs 76% of PET/CT and 79%/88% of MRI-DWI/MRI-STIR), PPV 96% (vs 95% of PET/CT and 88%/86% of MRI-DWI/MRI-STIR) (i.e. 78%/88%-99,89%) and NVP 86% (vs 53%, 63% and 100% of PET/CT, MRI-DWI and MR-STIR) (i.e. 42,19%-97,89%), sensitivity and specificity respectively of 92% (vs 72%, 94% and 100%) (i.e. 73,97%-99,02%), specificity of 89% (vs 89%, 67% and 56%) (i.e. 51,75%-99,72%). AUC for coregistered PET/CT/MRI images was of 0.91, statistically different itself to others technique (p<0.05). ROC analysis on ADC value to differentiate benign to malignant Nodes, showed a cut off value of 1,03x10^-3 mm²/s About T evaluation: Coregistered PET/CT and MRI, showed a diagnostic accuracy of 92% (vs 60% of PET/CT and 88% of MRI), sensitivity of 94% (vs 53% AND 94%), specificity 88% (vs 75% and 75%) (i.e. 47,35-99,68%), PPV and NPV of 94% (vs 82% and 89%) (71,31%-99,85%) and 88% (vs 43% and 86%) (i.e. 47,35%-99,68%).

CONCLUSION

Multimodal Image coregistration increases Diagnostic Accuracy for HNSCC cancer, both on T and N evaluation.

CLINICAL RELEVANCE/APPLICATION

The secondary image coregistration is a 'low cost' diagnostic tool that increases the staging accuracy in head and neck cancer.

NRS454

Contrast-enhanced MR Venography in Patients with Multiple Sclerosis to Assess Stenoses of the Internal Jugular Veins—Is there Correlation with CCSVI Criteria? (Station #6)

Carlos Hernandez Torres MD (Presenter): Nothing to Disclose , Cheemun Lum MD : Nothing to Disclose , Santanu Chakraborty FRCR, DMDR : Speakers Bureau , Merck KGaA Speakers Bureau, Novartis AG Grant, Bayer AG Dr Thanh Nguyen MD : Research Grant, Bayer AG Research Consultant, Bayer AG , Betty Anne Schwarz MSc, RN : Nothing to Disclose , Stefanie Belanger : Nothing to Disclose , Lysa Legault-Kingstone : Nothing to Disclose, Marc Friedman : Nothing to Disclose , Hamid Reza Dabirzadeh MD : Nothing to Disclose , Miguel Bussiere : Nothing to Disclose , Ian Cameron : Nothing to Disclose , Rebecca Thornhill : Nothing to Disclose , Matthew J Hogan MD : Nothing to Disclose

PURPOSE

Zamboni et al suggest that multiple sclerosis (MS) may develop secondarily to impaired central nervous system venous outflow and describes this as Chronic Cerebrospinal Venous Insufficiency (CCSVI). Internal jugular vein (IJV) stenosis is suggested as a cause.

This study assesses the prevalence of IJV stenosis in patients with multiple sclerosis and age matched controls using contrast enhanced MR venography (CE-MRV). Potential correlation of IJV stenosis with CCSVI defined by Doppler ultrasound (US) is evaluated.

METHOD AND MATERIALS

This was a single-center, prospective, observational study of 50 subjects with a confirmed diagnosis of multiple sclerosis with age-matched controls. Research ethics approval and informed consent were obtained. Subjects were randomly selected from 6 MS categories.

CE-MRV was performed on a 3T magnet. US evaluation of the intra and extracranial circulation was used to define CCSVI criteria. Imaging results were reviewed independently by pairs of neuroradiologists blind to subject assignment. From MRV images the degree of stenosis was graded within the lower, mid and upper 1/3 segments of the IJV. US evaluation was considered positive if 2 or more CCSVI criteria were present.

RESULTS

100 studies were undertaken. 13 could not be evaluated due to poor MRV quality. Inter-observer variability for IJV stenosis was fair for lower 1/3 (ICC 0.45 (0.24-0.61)), poor for mid 1/3 (ICC 0.18 (<0.03-0.38)) and good for upper 1/3 (ICC 0.71 (0.58-0.80)) IJV segments. IJV stenosis was identified in 85 (98%) of subjects. Stenosis >= 50% was identified in 31 (70%) of patients and 32 (74%) of controls (-0.03-0.38) and good for upper 1/3 (ICC 0.71 (0.58-0.80)) IJV segments. IJV stenosis was identified in 85 (98%) of subjects. Stenosis >= 50% was identified in 31 (70%) of patients and 32 (74%) of controls.

- Interobserver agreement has been found 'discrete'. About Nodal involvement: Coregistered PET/CT and MR reading session, showed diagnostic accuracy of 91% (vs 76% of PET/CT and 79%/88% of MRI-DWI/MRI-STIR), PPV 96% (vs 95% of PET/CT and 88%/86% of MRI-DWI/MRI-STIR) (i.e. 78%/88%-99,89%) and NVP 86% (vs 53%, 63% and 100% of PET/CT, MRI-DWI and MR-STIR) (i.e. 42,19%-97,89%), sensitivity and specificity respectively of 92% (vs 72%, 94% and 100%) (i.e. 73,97%-99,02%), specificity of 89% (vs 89%, 67% and 56%) (i.e. 51,75%-99,72%). AUC for coregistered PET/CT/MRI images was of 0.91, statistically different itself to others technique (p<0.05). ROC analysis on ADC value to differentiate benign to malignant Nodes, showed a cut off value of 1,03x10^-3 mm²/s About T evaluation: Coregistered PET/CT and MRI, showed a diagnostic accuracy of 92% (vs 60% of PET/CT and 88% of MRI), sensitivity of 94% (vs 53% AND 94%), specificity 88% (vs 75% and 75%) (i.e. 47,35-99,68%), PPV and NPV of 94% (vs 82% and 89%) (71,31%-99,85%) and 88% (vs 43% and 86%) (i.e. 47,35%-99,68%).

CONCLUSION

Multimodal Image coregistration increases Diagnostic Accuracy for HNSCC cancer, both on T and N evaluation.

CLINICAL RELEVANCE/APPLICATION

The secondary image coregistration is a 'low cost' diagnostic tool that increases the staging accuracy in head and neck cancer.

NRS455

Inter-reader Variability in Dynamic Contrast-enhanced MR Imaging (DCE-MRI) of Patients with Recurrent Glioblastoma: Results from the Multi-center ACRIN 6677 / RTOG 0625 Study (Station #7)


PURPOSE

- Interobserver variability for IJV stenosis was fair for lower 1/3 (ICC 0.45 (0.24-0.61)), poor for mid 1/3 (ICC 0.18 (<0.03-0.38)) and good for upper 1/3 (ICC 0.71 (0.58-0.80)) IJV segments. IJV stenosis was identified in 85 (98%) of subjects. Stenosis >= 50% was identified in 31 (70%) of patients and 32 (74%) of controls (-0.03-0.38) and good for upper 1/3 (ICC 0.71 (0.58-0.80)) IJV segments. IJV stenosis was identified in 85 (98%) of subjects. Stenosis >= 50% was identified in 31 (70%) of patients and 32 (74%) of controls.

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- Interobserver variability for IJV stenosis was fair for lower 1/3 (ICC 0.45 (0.24-0.61)), poor for mid 1/3 (ICC 0.18 (<0.03-0.38)) and good for upper 1/3 (ICC 0.71 (0.58-0.80)) IJV segments. IJV stenosis was identified in 85 (98%) of subjects. Stenosis >= 50% was identified in 31 (70%) of patients and 32 (74%) of controls.
To study factors associated with inter-reader variability (IRV) in initial area under the gadolinium concentration curve (IAUGC), transfer constant (Ktrans) and fractional volume of the extravascular extracellular space (ve) parameters derived from DCE-MRI.

METHOD AND MATERIALS

18 patients (mean age 57.1±13.3 years, 10 men) with recurrent glioblastoma treated with bevacizumab and either temozolomide or irinotecan had analyzable DCE-MRI scans as part of the ACRIN 6677/RTOG 0625 trial. Two teams consisting of a trained neuroradiologist and technologist independently measured volumes of tumor-related enhancement (vTRE) on 3D SPGR images. Volumes of interest were registered to DCE-MRI images and parameter maps. IAUGC was defined as the area under the gadolinium contrast agent-time curve (ACTC) in TRE divided by ACTC in a vessel over the first 90 seconds. One open source software was used to derive Ktrans and ve from a standard Tofts model (www.dcemri.org). The effect of timed T1c scan (baseline), parameter map quality (graded on a 1-3 scale), scanner magnet / sequence (3T GE vs. 1.5T Siemens vs. 1.5T GE), average tumor volume, and reader variability in tumor volume (percent difference in vTRE) on IRV (percent difference in parameter) was studied using intraclass correlation coefficient (ICC) and linear mixed models.

RESULTS

78 (14 baseline and 64 post-treatment) scans from 4 centers were evaluated. Overall mean IRV for mean and median IAUGC, mean and median Ktrans and median ve were 17.6±24.1, 16.8±23.3, 27.2±34.4, 16.1±27.0 and 26.6±34.3% respectively. ICCs for these metrics ranged from 0.905 (mean Ktrans) to 0.996 (median Ktrans) on baseline scans and from 0.477 (mean ktrans) to 0.760 (median IAUGC) for post-treatment scans. Lack of reader agreement on tumor volume was significantly related to IRV for all parameters (p<0.002). Scanner magnet/sequence and average tumor volume were related to IRV only for mean Ktrans (p<0.05). Image quality score was related to IRV only for median Ktrans (p=0.02).

CONCLUSION

Differences in reader performance on tumor segmentation is a significant source of IRV for all parameters.

CLINICAL RELEVANCE/APPLICATION

Improving reader agreement in deriving segmentations or, alternatively, use of automated segmentation techniques may reduce the variability in parameters derived from DCE-MRI. Funded by NCI U01-CA080098 and U01-CA079778.
TEACHING POINTS

As imaging physicians, we need to play an active role in the diagnosis and assist in the therapy and postoperative follow up of properly selected patients likely to have parathyroid disease. Interventional Radiologists can also localize lesions that might difficult to find in the OR. 1. Carefully select patients based on clinical and laboratory findings. 2. Choose the proper diagnostic imaging tests from US, CT, MRI, NM, and/or PET. PET and NM can also be used just prior to surgery to localize tiny abnormalities and gamma probes can be used by surgeons in the OR to assure complete removal of suspect areas. 3. Newer surgical techniques, such as endoscopy via periauricular and axillary approaches are now available for 'scarless' surgery. In the US some centers have a multi year experience in this, but often do less than 100 patients yearly. Initial laboratory testing in the OR for PTH (parathyroid hormone) decline following successful surgery and will also be reviewed. Several case studies illustrate this.

TABLE OF CONTENTS/OUTLINE

Review of Indications, Contraindications - Mostly Patient and Test Selection Choosing Between Imaging Exams for Diagnosis - US, CT, MRI, NM, PET Treatment Choices - Current Standard of Care, Open Field vs Endoscopic Surgery Follow-up Management - Biochemical and / or Imaging

Toy practical considerations for patient selection and optimizing the ultrasound-guided biopsy technique of head and neck masses. Role of preprocedural imaging, lesion localization, and differential diagnosis in selecting good candidates and ultrasound technique for obtaining tissue will be addressed.

TABLE OF CONTENTS/OUTLINE

1) Patient selection and preparation a. Review of diagnostic cross-sectional CT, MRI, PET-CT Anatomical location of mass Distance from skin surface (up to 4 cm) Differential diagnoses b. Preprocedural preparation No blood work, intravenous access 2) Selection of US transducer for high definition of biopsy area a. Linear high-frequency transducers provide optimal US imaging up to 5 cm in depth b. Small footprints, wide sector view of the curved-array transducers allow access to lesion deep to narrow acoustic window, at steep angle or uneven skin surface 3) Technique: fine needle aspiration, core needle biopsy 4) Added value of a head and neck neuroradiologist’s expertise a. Spatial relationship of the lesion and surrounding structures on neck imaging, especially in surgically-altered or irradiated neck, and applying this knowledge to real time US scanning to ensure accurate targeting for biopsy b. Differential diagnoses determine biopsy technique, need for additional laboratory testing, and followup

OBE-THA Obstetrics/Gynecology Thursday Poster Discussions

MRI of the Fetal Cerebellum and Posterior Fossa — Spectrum of Abnormalities (Station #1)

Sherelle Lea Laifer-Narin MD : Nothing to Disclose, Frank Hao MD (Presenter): Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to review normal cerebellar development and anatomy. Knowledge of normal anatomy and landmarks will assist in identifying cerebellar abnormalities and pathology. The reader should be familiarized with pathology indicative of both good and poor prognoses.

TABLE OF CONTENTS/OUTLINE

Background: Fetal MRI has greatly improved analysis and diagnosis of fetal cerebral and cerebellar anatomy and pathology. Cerebellar abnormalities can be divided into disorders of development, presenting with either a large posterior fossa, or with a normal or small posterior fossa, and destructive disorders. The spectrum of cerebellar abnormalities will be reviewed. Differential diagnosis: Disorders presenting with a large posterior fossa include the Dandy-Walker malformation, mega cistern magna, posterior fossa arachnoid cyst, and Blake's pouch cyst. Disorders presenting with a normal or small posterior fossa include the Dandy-Walker variant, cerebellar hypoplasia/agenesis, and rhombencephalosynapsis. Destructive disorders include cerebellar hemorrhage and infarct. Summary: Many diverse cerebellar abnormalities can occur. Precise evaluation and delineation of cerebellar abnormalities can be accomplished with the use of MRI, confirming or negating ultrasound diagnoses. This allows for more accurate prognostication and genetic counseling.
ACR Dose Index Registry: A Resource for Pediatric CT Practice Assessment and Radiation Dose Estimations (Station #1)

Benjamin Wildman-Tobriner MD (Presenter): Nothing to Disclose, Mythreyi Chatfield PhD: Nothing to Disclose, Ernest Schorr Behnke MD: Nothing to Disclose, Donald P. Frush MD: Nothing to Disclose

PURPOSE

As there is no generic information on broad demographics and contemporary dose estimates for pediatric CT, including gender and age, our aim was to investigate this using the ACR CT Dose Index Registry (DIR) as a resource.

METHOD AND MATERIALS

DIR data for 30 months (7/11-12/13) were extracted for 3 common CT scans: head without contrast (head), chest with contrast (chest), abdomen/pelvis with contrast (AP) by age (>0-<3, 3-<7, 7-<11, 11-<15, 15-18). Dose parameters of CTDI$_{vol}$ (16 cm head, 32 cm body), dose-length product, and size-specific dose estimate (SSDE, mGy) were determined. Gender, geographic and practice (e.g., community, pediatric specialized), and entry into DIR data were gathered.

RESULTS

Of 2,729,170 head, chest, and AP scans for all ages, 6% (161,864) of studies were in children: 8% of head, 5% of AP, and 2% of chest scans. 72% of AP, 63% of chest, and 56% of brain scans were performed on patients 11-18 years old, and the 15-18 group had the highest frequency (35% head, 43% chest, 48% AP) for all exams. Head CT represented the highest number of scans for all ages. There was a greater frequency of exams in males (54-61%) for all age groups and scan types, except for AP in 11-<15 (48%) and 15-18 (39%). Mean SSDE ranged from 8.8-19.0 for AP and 6.0-19.8 for chest scans, increasing with each age group. The AP SSDE was higher than the chest SSDE for every age group except for the 15-18 group. SSDE was higher than CTDI$_{vol}$ for body CT at all ages. Pediatric contributions to the DIR increased 353% from 2011 to 2012, and 65% from 2012 to 2013. Of note, 52% of scans were from community hospitals, 29% from children’s hospitals, and 18% from academic programs.

CONCLUSION

Participation in the DIR provides an opportunity to validate trends and to set benchmarks for pediatric CT dose estimations. For example, based on SSDE, there are currently adjustments in scanning based on age and body region, and more frequent scanning occurs in teenage years. Such data can be a gauge of past impact and a guide for future efforts in dose management.

CLINICAL RELEVANCE/APPLICATION

The ACR CT Dose Index Registry is a valuable resource for assessment of pediatric CT demographics and dose estimations.

Common Indications for Chest Radiographs in the Pediatric Population: Are We Adding Value or Radiation? (Station #2)

Ann Packard MD (Presenter): Nothing to Disclose, Kristen Barry Thomas MD: Nothing to Disclose

PURPOSE

Reducing radiation exposure is an ongoing endeavor of both radiologists and clinicians, especially in the pediatric population. This retrospective study evaluated common indications for chest radiograph in the pediatric population and whether changed clinical management of the patient with the hope of guiding clinicians away from exposing a vulnerable population to unnecessary radiation.

METHOD AND MATERIALS

Previously acquired chest radiographs were reviewed from 2008-2014 in a pediatric population from birth to 17 years. Indications selected for evaluation included chest pain, syncope/presyncope, dizziness, postural orthostatic tachycardia syndrome (POTS), spells, and cyclical vomiting. A total of 719 chest radiographs were reviewed including limited clinical history; 377 for chest pain, 98 for syncope/presyncope, 21 for spells, 37 for POTS, 185 for dizziness, and 1 for cyclical vomiting. Eight-two were excluded for congenital or other known heart disease, prior illness for which they were being currently imaged (i.e. chest pain with known pneumonia), intubation, or postoperative.

RESULTS

No patients with radiographs for indications including syncope, spells, POTS, dizziness, or cyclical vomiting had any finding which affected patient management. Insignificant findings such as minor pectus excavatum or central lines in good position were considered negative. Forty-five of 330 (13.6%) chest radiographs for chest pain were positive; 17 (5.1%) for pneumonia (5 of the 17 included either fever or pneumonia in the indication), 12 (3.6%) for bronchial inflammation, 4 (1.2%) for atelectasis, 2 (0.6%) for trauma (12 total included chest pain and trauma in the indication), and 1 patient each (0.3%) for pleural effusion, pneumothorax, bronchiectasis, and foreign body (2 total had chest pain and foreign body). Seven patients had chest pain with a history of sickle cell anemia, none which were positive.

CONCLUSION

In our pediatric patient population, no findings on chest radiograph to alter patient management were found for indications including syncope/presyncope, dizziness, spells, POTS, and cyclical vomiting. Chest radiographs for chest pain were positive greater than 10% of the time, the most common finding being pneumonia.
PDS257

Diffusivity of Retinoblastoma: 3D Turbo Field Echo with Diffusion-Sensitized Driven-Equilibrium Preparation Technique (DSDE-TFE) Compared to Echo Planar Imaging (Station #5)

Akio Hiwatashi MD (Presenter): Nothing to Disclose, Osamu Togao, MD, PhD : Nothing to Disclose, Koji Yamashita MD, PhD : Nothing to Disclose, Kazufumi Kikuchi MD : Nothing to Disclose, Makoto Obara : Employee, Koninklijke Philips NV , Takashi Yoshiura MD, PhD : Nothing to Disclose, Hiroshi Honda MD : Nothing to Disclose

PURPOSE

Compared to echo planar (EP) diffusion-weighted imaging (DWI), three-dimensional (3D) turbo field echo with diffusion-sensitized driven-equilibrium (DSDE-TFE) preparation DWI obtains images with higher spatial resolution and less susceptibility artifacts. The purpose of this study was to evaluate feasibility of DSDE-TFE to visualize retinoblastomas compared to EP imaging.

METHOD AND MATERIALS

This retrospective study was approved by our institutional review boards, and written informed consent was waived. Eight patients with retinoblastomas (five boys and three girls; age range 0-87 month; median 21 month) were studied. For DSDE-TFE, motion probing gradients (MPGs) were conducted at one direction with b-values of 0 and 500 s/mm2. The other imaging parameters were as follows: TR/TE = 6.2/3.0 ms, FA = 10°, ETL = 75, FOV = 240 mm, voxel size = 1.5×1.5×1.5 mm3, NEX = 2, and acquisition time = 5 min 22 s. For EP imaging, MPGs were conducted at three directions with b-values of 0 and 1000 s/mm2. The other imaging parameters were as follows: TR/TE = 3000/57 ms, SENSE factor = 2.5, FOV = 230 mm, matrix = 160×128, slice thickness/gap = 3/0 mm, voxel size = 1.4×1.8×3 mm3, NSA = 2, and acquisition time = 2 min 12 s. The apparent diffusion coefficients (ADCs) of each lesion were measured. Statistical analyses were performed with Pearson R and linear regression analysis.

RESULTS

Intraocular lesions were clearly visualized on the DSDE-TFE without obvious geometrical distortion, whereas all showed deformity on EP images. On the DSDE-TFE, the ADCs of the lesions ranged from 0.83×10-3 mm2/s to 2.93×10-3 mm2/s (mean ± SD; 1.73±0.73×10-3 mm2/s). On the EP images, the ADCs ranged from 0.53×10-3 mm2/s to 2.03×10-3 mm2/s (0.93±0.53×10-3 mm2/s). There was a significant correlation in ADC measurement between the DSDE-TFE and EP imaging (r = 0.81, p < 0.05).

CONCLUSION

With its insensitivity to field inhomogeneity and high spatial resolution, the 3D DSDE-TFE technique enabled us to assess diffusivity in retinoblastomas.
**PDS258**

**Sub-millisievert Pediatric Chest CT: Implementation of Hybrid (ASIR) and Pure (MBIR) Iterative Reconstruction Techniques for Substantial Dose Reduction (Station #6)**


**PURPOSE**

To assess lesion detection and image quality with hybrid (adaptive statistical iterative reconstruction [ASIR]) and pure (model-based iterative reconstruction [MBIR]) algorithms in pediatric chest CT examinations at submillisievert (SubmSv, <1 mSv) radiation dose.

**METHOD AND MATERIALS**

This IRB-approved study included 180 examinations for 97 patients who underwent routine chest CT on 64-slice MDCT (750HD Discovery, GE Healthcare). Sub-mSv (n, 90 CT exams; 9±5 years, 61% boys; median weight 24kg) and controls (size-matched with an estimated effective dose ≥1 mSv; n, 90; 9±6 years 54% boys; median weight 28kg) were assessed for lesion detection, conspicuity, diagnostic confidence and diagnostic acceptability for lesion characterization. Sub-mSv CT exams were reconstructed with ASIR60% (n, 60 CT) and MBIR (n, 30) whereas control CT exams were reconstructed with ASIR30%-60%. Independent and blinded evaluation for subjective image quality was performed for image noise, contrast, presence of artifacts and visibility of small structures. Data were analyzed with ANOVA and multiple-paired t tests.

**RESULTS**

Radiation dose between control-CT (mean SSDE, 3.8 mGy [~2.5 mSv]) and Sub-mSv CT (mean SSDE, 2.4 mGy [~0.6 mSv]) were statistically different by 76% (P<0.0001). A total of 199 lesions were identified in controls (n, 61), Sub-mSv-ASIR (n, 99) and Sub-mSv-MBIR exams (n, 39). Lesions on both control- and Sub-mSv-exams (ASIR and MBIR) were well seen with sharp margins. The diagnostic confidence and acceptability were equal in control and Sub-mSv exams. There was no difference in the subjective image noise evaluation in control and Sub-mSv ASIR/MBIR exams (P=0.9). Sub-mSv exams had both excellent visibility of small structures and image contrast comparable to control-ASIR exams (P=0.9). Streak and beam hardening artifacts were present in both Sub-mSv-ASIR and control-ASIR exams without interfering with diagnostic decision making.

**CONCLUSION**

Implementation of hybrid (ASIR) and pure model iterative reconstruction technique (MBIR) successfully enabled submillisievert radiation dose for pediatric chest CT while maintaining image quality and diagnostic confidence.

**CLINICAL RELEVANCE/APPLICATION**

ASIR- and MBIR- enabled indication-based CT protocols allow optimal clinical evaluation in submillisievert pediatric chest CT examinations.

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**PDE134**

**Contrast Enhanced Voiding Urosonography with Intravesical Administration of US Contrast Agent in Children: How to Do! (Station #7)**

Aikaterini Ntoulia MD, PhD (Presenter): Nothing to Disclose, Frederica Papadopoulou MD: Nothing to Disclose, Susan Jane Back MD: Nothing to Disclose, Martin Stenzel MD: Nothing to Disclose, Kassa Darge MD, PhD: Nothing to Disclose

**TEACHING POINTS**

To demonstrate step-by-step how to perform contrast enhanced Voiding Urosonography (ceVUS) with intravesical administration of an US contrast agent for diagnosis of vesicoureteric reflux in children.

**TABLE OF CONTENTS/OUTLINE**

Sub-Events

**PHS187**

**Improved Detection of the Glycosaminoglycan Chemical Exchange Saturation Transfer (GAG-CEST) Effect in Human Knee Cartilage at 3T** (Station #1)

Takako Aoki PhD (Presenter); Nothing to Disclose, Mamoru Niitsu MD : Nothing to Disclose, Kyoosuke Kurita RT : Nothing to Disclose, Reiko Hashimoto RT : Nothing to Disclose, Shinichi Watanabe RT : Nothing to Disclose, Junji Tanaka MD : Nothing to Disclose

**CONCLUSION**

We have proposed an optimized protocol with 9 shots per slice and a B1 filter for improved detection of the GAG-CEST effect at 3T in human knee articular cartilage.

**Background**

Glycosaminoglycan (GAG) concentration in articular cartilage is one of the crucial factors for early diagnosis of osteoarthritis. On a 3T scanner, the chemical shift between GAG and bound water is small, and the signal intensity of GAG is relatively low. Optimization of the scan protocol to maximize detection of chemical exchange saturation transfer (CEST) is essential in order to obtain clinically useful GAG-CEST scans of human knees. In our institute so far, scan parameters have been optimized using phantoms with GAG concentrations of 0.26-1.3w/v% in vitro, and we attempted further optimization for the clinical application of GAG-CEST MRI.

**Discussion**

B1 heterogeneity distorted the Z-spectra such that the GAG peak migrated away from the value of 1 ppm suggested in the literature. On the other hand, by applying a B1 filter and 9 shots per slice, the GAG peak tended to be more robust and to fall at 1 ppm. To separate the small chemical shift of GAG in human knees on a 3T scanner, it is essential to maximize detection of the CEST effect.

**Evaluation**

The knees of 18 healthy volunteers (mean age 36.1 years) were scanned on a whole-body 3T MRI scanner using a 15-channel knee coil and a turbo-FLASH-based prototype CEST sequence. The effects of the following parameters were evaluated by calculating MTR asymmetry (MTR asym) from Z-spectra (plots of signal intensity at sequential saturation pulse frequencies): (1) For 2D scans, the number of shots per slice (4, 6 and 9 shots). (2) For both 2D and 3D scans, B1 filter on and off.

**PHS188**

**Usefulness of the Max Entrance Skin Dose Measured with CareMonitor Irrespective of Changes in the Geometry of the Angiography System (Station #2)**

Kazuya Saeki RT (Presenter): Nothing to Disclose, Takuji Yamagami MD : Nothing to Disclose, Yutaka Misezaki : Nothing to Disclose, Shingo Kono RT : Nothing to Disclose, Minoru Ishifuro : Nothing to Disclose, Kazuo Awai MD : Research Grant, Toshiba Corporation Research Grant, Hitachi Ltd Research Grant, Bayer AG Research Consultant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd

**PURPOSE**

The dosimetry function of CareMonitor (SIEMENS Co. Bavaria, Germany) calculates the body type from the patient height and weight and measures the radiation dose to various sites based on geometric system changes. It displays the maximum skin entrance dose (MSED) in real time. We investigated the usefulness of MSED measurements.

**METHOD AND MATERIALS**

Using a fixed patient model (height=160 cm, weight=60 kg), we calculated the MSED and entrance dose (ED) based on the dose-area product. We changed the geometry of the angiography system from the base position where the source image distance (SID)=100 cm, field of view (FOV)=20 cm, x-ray collimation=0% (no narrow down). The bed height was at the interventional radiology reference point, the C-arm angle was right anterior oblique (RAO)=0°, cranial=0°. Geometric angiography changes were: SID=90 - 120 cm, FOV=16-, 20-, and 25 cm, x-ray collimation=0 - 70%, bed height=10~14 cm, C-arm angle RAO=50º, left anterior oblique (LAO)=50º and 45º, caudal=30º. We performed 5 measurements and compared changes in the average MSED and ED at different SID, FOV, x-ray collimation, and bed height settings. For measurements based on the C-arm angle, we compared the average dose at the each angle.

**RESULTS**

The average MSED and ED changes were 4.1±0.0 and 4.4±0.0 mGy at SID 90-120 cm, 3.5±0.0 and 3.8±0.0 mGy at FOV 16-, 20-, or 25 cm, 1.0±0.5 and 1.4±0.08 mGy at x-ray collimation 0~70%, and 10.1±0.01 and 1.3±0.05 mGy at a bed height of 10~14 cm, respectively. The bed height had a significant effect but SID, FOV, and x-ray collimation did not. At RAO 30º, MSED and ED changes were 8.2±0.05 and 8.5±0.05 mGy; at LAO 50º they were 17.8±0.05 and 16.5±0.05 mGy, and at LAO 45º and caudal 30º they were 26.8±0.16 and 22.5±0.12 mGy, respectively. As the C-arm angle increased, so did the dose difference.

**CONCLUSION**

Even after bed-height and C-arm angle changes, dosimetry was more accurate with CareMonitor than was ED, suggesting that MSED calculations consider shifts in the focus-to-virtual skin surface distance based on geometric angiography system changes.

**CLINICAL RELEVANCE/APPLICATION**
PHS190

Objective Accuracy Assessment of Iodine Quantification for Dual-energy Computed Tomography (DECT) Based on Three-material Decomposition: Influence of Dual-energy (DE) Acquisition Mode and Subject Absorption Thickness (Station #4)

Jens Hansen DIPLPHYS (Presenter): Nothing to Disclose, Mark Oliver Wielputz: Nothing to Disclose, Gregor Pahn DIPLPHYS: Nothing to Disclose, Stephan Skornitzke: Nothing to Disclose, Hans-Ulrich Kauczor MD: Research Grant, Boehringer Ingelheim GmbH Research Grant, Siemens AG Research Grant, Bayer AG Speakers Bureau, Boehringer Ingelheim GmbH Speakers Bureau, Siemens AG Speakers Bureau, Novartis AG, Wolfram Stiller PhD, DIPLPHYS: Nothing to Disclose

PURPOSE

Study aim was an objective assessment of the pure iodine enhancement vector in the CT number diagram, i.e. CT numbers at low versus high tube voltage (x_{low} vs. x_{high}), and the determination of its influence on the accuracy of quantitative dual-energy CT (DECT) iodine measurements.

METHOD AND MATERIALS

CT numbers of various iodine concentrations were assessed for 3 different DE acquisition modes with and without tin (Sn) filtration (80/140kVp, 80/Sn140kVp, 100/Sn140kVp). Measurements were performed at the isocenter free-in-air and at 8 positions across the field-of-view (FOV) (isocenter distance: 0.0-14.0cm, increment: 2.0cm) within a cylindrical acrylic phantom (Ø=32.0cm). CT numbers were determined on more than 100 slices using custom software developed in-house. Linear regression of CT numbers of the iodinated solutions was used to define the iodine-enhancement vector in the CT number diagram (x_{low} vs. x_{high}). The non-enhanced CT number vector was calculated from two data points not containing iodine (air, acrylic). Absolute iodine quantification for each pixel within a region of interest (ROI) was determined as the distance along the iodine enhancement vector to both vectors’ intersection, and was compared to nominal concentration.

RESULTS

Slope and intercept of the regression strongly depend on acquisition mode and presence of attenuating material, e.g. distance to the non-enhanced CT number vector drops to 75% in the phantom compared to free-in-air. For tin-filtered acquisitions, regression slopes of the iodine vector are comparable for both experiments (2.0% difference), without tin filtration slopes differ by 20%. Mean and nominal iodine concentrations match with relative differences <10%, but showing standard deviations up to 80% within a single ROI. Absolute iodine concentration is overestimated independent of DECT acquisition mode and FOV position. Quantification accuracy increases for iodine concentrations >5mg/ml with relative errors <20% and is best for tin-filtered DECT.

CONCLUSION

Iodine quantification is very sensitive to DECT acquisition mode and absorption thickness of the scanned object. A large number of evaluated pixels is necessary for a reliable determination.

CLINICAL RELEVANCE/APPLICATION

Iodine quantification is very sensitive to DECT acquisition mode and absorption thickness of the scanned object. A large number of evaluated pixels is necessary for reliable quantification.

PHS191

A Metric for Measuring Noise Non-uniformity in Clinical CT Images (Station #5)

Timothy Peter Szczukutowicz PhD (Presenter): Equipment support, General Electric Company Research Grant, Siemens AG, Frank N. Ranallo PhD: Grant, General Electric Company

PURPOSE

Develop a metric for quantifying noise non-uniformity in clinical CT images and evaluate a current metric for calculating noise magnitude in clinical images.

METHOD AND MATERIALS

The general noise index (GNI) method developed by Christianson et al. (Med. Phys. 40:6 2013) has been modified to provide information related to noise uniformity. The GNI is computed by taking the difference between adjacent axial slices, dividing the difference image into small ROIs, and then computing the pixel standard deviation for each ROI (neglecting those ROIs containing bone or air). The GNI is taken as the maximum value of the histogram of all ROI noise values. This method can be modified by calculating the standard deviation of ROI noise levels used to calculate the original GNI, or the stdGNI. Simulated elliptical phantoms with varying major to minor axis ratios (1 to 2) were simulated at off-centering amounts (0 to 10 cm). A bowtie filter was also simulated. The GNI and stdGNI were calculated for all combinations. In addition, an anthropomorphic phantom and clinical CT images were used to assess the ability of the GNI and stdGNI metrics to identify cases of image noise non-uniformity due to patient positioning.

RESULTS

The GNI broke down in cases of large image noise non-uniformity. Large variations in image noise made the noise histogram used to calculate the GNI bimodal which made the GNI results have a large variation and not correlate with overall noise level or noise non-uniformity. The stdGNI increased with the eccentricity of the elliptical phantom images and with off-centering amount as expected.

CONCLUSION

We propose stdGNI is capable of capturing the degree of noise non-uniformity in clinical images. In addition, for images with large image noise non-uniformity, the GNI metric may not provide accurate results and simply taking the mean of the noise across the image provides more clinically relevant results.
Effect of Tube Current on CT Radiation Organ Dose: Organ Dosimetry in a Human Cadaver Study (Station #6)


PURPOSE

To assess effect of fixed and modulated tube current on organ doses measured with surgically implanted dosimeters in a human cadaver and compare measured organ doses with the estimated organ doses obtained from radiation dose tracking software (RDT).

RESULTS

The mean CTDIvol for fixed mAs of 100, 200, and 300 were 7, 14, and 21 mGy and for AEC were 4, 8, 13 mGy, respectively. There was a strong positive correlation between measured organ doses and CTDIvol for both AEC and fixed mAs (r=+0.99). The measured organ doses for liver, stomach, colon, left kidney, para-vertebral area, and urinary bladder at fixed mAs of 100, 200 and 300 were 28-54% higher than AEC at corresponding reference quality mAs of 100, 200 and 300 mAs (p<0.001). There was a linear increase in the organ doses from 100 mAs to 200 mAs for both fixed mAs and AEC (p=0.3). Similarly, the organ doses increased linearly from 200 mAs to 300 mAs for fixed and AEC (p=0.3). There was no significant difference in the correlation coefficients of estimated and measured organ doses for fixed mAs (r=+0.58) compared to AEC technique (r=+0.53) (p=0.9).

CONCLUSION

AEC technique allows the organ doses reduction compared to fixed tube current for routine abdomen CT in a human cadaver. Measured and estimated organ doses are not substantially different.

CLINICAL RELEVANCE/APPLICATION

AEC technique results in substantial reduction in overall dose (CTDIvol) as well as measured and estimated organ doses.

Development of a Quality Control Program for Digital Breast Tomosynthesis (Station #7)


PURPOSE

Digital breast tomosynthesis (DBT) is evolving steadily, with units from several vendors available in Europe and numerous clinical trials ongoing or recently published. A quality control (QC) program is being developed for use in the proposed ACRN screening trial, TMIST. Harmonized QC, with tests and phantoms applicable across different platforms, will help ensure consistent image quality.

METHOD AND MATERIALS

A draft manual has been written for a DBT quality control program. Phantoms and automated analysis software have been developed. The daily QC phantom includes a sphere of contrasting material for measurement of signal difference to noise ratio, an aluminum BB for assessment of the artefact spread function (ASF) in x, y and z directions and groups of microcalcifications at different heights for evaluation of geometric reconstruction accuracy (location within the volume). A uniform region within the phantom is used to calculate an in-slice 2D normalized NPS. Technologist’s tests include imaging the QC phantom so that these parameters can be tracked with the software, as well as assessment of the review workstation for lag. Physicist’s tests include evaluation of collimation, NEQ, and performance of the automatic exposure control as well as estimation of mean glandular dose.

RESULTS

All routine technologists tests were performed on a GE SenoClaire system (not yet FDA approved), and results tracked over time. Radially averaged NNPS at 1, 2 and 4 mm-1 and SDNR values were found to be stable over time (COVs < 5%). The FWHM of the ASF in the x, y, and z directions was found to be less stable, warranting further investigation. Some of the tests were performed on both a GE SenoClaire and a Hologic Selenia Dimensions. FWHM values of the ASF in the x and y directions were comparable (0.5-0.7 mm). FWHM in the z direction was 3.3 mm for the SenoClaire and 7.9 mm for the Selenia.
CONCLUSION

A QC program for DBT has been designed, including phantoms and analysis software. The tests characterize key parameters of the quality of the reconstructed volume. Further work is required to set suitable pass/fail thresholds that capture clinically relevant changes in image quality. The appropriate frequencies for performance of the different tests must also be determined.

CLINICAL RELEVANCE/APPLICATION

A platform-independent QC program is fundamental to ensuring consistent clinical image quality for DBT.

PHE118

How Accurately Multiparametric MRI Detect Prostate Cancer? (Station #8)

Rajakumar Nagarajan PhD (Presenter): Nothing to Disclose, Daniel Jason Aaron Margolis MD: Research Grant, Siemens AG, Steven Satish Raman MD: Consultant, Bayer AG, Consultant, Covidien AG, Michael Albert Thomas PhD: Nothing to Disclose

TEACHING POINTS

Multiparametric magnetic resonance imaging techniques are increasingly being used to address bottlenecks in prostate cancer patient management. These techniques yield qualitative, semi-quantitative and fully quantitative biomarkers that reflect on the underlying biological status of a tumor. 1. Teach the concept of prostate MRI and MRSI. 2. Demonstrate the importance of functional and anatomic information in prostate. 3. Show clinical applications that benefit from multiparametric MRI. 4. This functional and anatomical MRI and MRSI guide urologists and radiotherapists so that they may be used for individual patient decision making.

TABLE OF CONTENTS/OUTLINE

CONTENT ORGANIZATION 1. Introduction of T2 Weighted MRI (T2W), Diffusion weighted imaging (DWI), Dynamic contrast enhanced (DCE) MRI and Magnetic Resonance Spectroscopic Imaging (MRSI) of Prostate. 2. Demonstration of MRI and MRSI sequences used in Prostate Images. 3. Data interpretation of T2W, DWI, DCE-MRI and MRSI. 4. Comparison of sensitivity, specificity, positive predictive value, negative predictive value and accuracy of each modality.

PHE004-b

Automatic Focal Liver Lesions Quantification on Contrast Enhanced Ultrasound Videos (hardcopy backboard)

Ilias Gatos: Nothing to Disclose, Stavros Tsantis PhD, BEng (Presenter): Nothing to Disclose, Ioannis Theotokas: Nothing to Disclose, Pavlos Zoumpoulis MD, PhD: Nothing to Disclose, Aikaterini Skouroliakou: Nothing to Disclose, George Kagadis PhD: Nothing to Disclose

Background

Contrast-enhanced ultrasonography (CEUS) of focal liver lesions (FLLs) has been accepted in clinical practice as a reliable lesion characterization tool during all vascular phases (arterial, portal and venous). Due to breathing, lesions may move, change size and shape, or even exit from the US scan plane in successive frames. CEUS video assessment is currently performed either by means of visual inspection or by built-in software packets that provide low quality time-intensity curves with no quantitative assessment.

Evaluation

Twelve video clips of 12 patients with FLLs disease have been subjected to quantification into the proposed automatic lesion detection algorithm. The lesion detection procedure employed frame by frame, involves a modified active contour algorithm with constraints derived from Continuous Wavelet Transform employing the 'Mexican Hat' wavelet filter. The values and positions of local minima and maxima are utilized within the active contour model minimizing the edge function and stopping the evolving curve with a minimum number of iterations. Compared against manual segmentation by an expert physician, the lesion detected had an average overlap value of 0.90 ± 0.06 for all CEUS videos included in the study. Following the lesion detection procedure time-intensity curves are computed and plotted from lesion and reference areas. In addition, several parameters are computed such as Area Under the Curve, Mean Transit Time, Perfusion Index, Rise time and Time to Peak to strengthen the evaluation procedure.

Discussion

A new type of software has been proposed to quantify FLLs enhancement during CEUS. After lesion detection throughout the video sequence, the degree and phase of lesion enhancement relative to the parenchyma is computed and visualized in order to evaluate the character of the lesion, as most malignant lesions tend to be hypoechoic whereas the majority of solid benign are iso- or hyper-enhancing.

CONCLUSION

Quantified Time Intensity curves analysis of contrast enhancement in FLLs could add strength to subjective interpretation, differential diagnosis and the evaluation of tumor response on antiangiogenic treatment.
How to Reduce Head Computerized Tomography (CT) Orders in Children with Hydrocephalus using the Lean Sigma Methodology: Experience in a Major Academic Children’s Center (Station #1)

Aylin Tekes-Brady MD (Presenter): Nothing to Disclose, Eric k Jackson : Nothing to Disclose, Stacey Ryder  Massey  MD : Nothing to Disclose, Kevin C. Cormier  MD : Nothing to Disclose

PURPOSE
Radiation should be limited as much as possible especially in children. Many children with hydrocephalus need serial imaging for diagnosis and for follow-up increasing life time cumulative radiation exposure. The goal of this project is to reduce head CT orders by 50% within 6 months in children with known or suspected diagnosis of hydrocephalus.

METHODS
1. Forming the team: Using the Lean Sigma methodology, the Department of Radiology, Division of Pediatric Radiology initiated a team of all stake holders that are involved in the care of children with hydrocephalus. Our team involved pediatric neuroradiologists, pediatric neurosurgeons, pediatric emergency department (PED) physicians, chief technologists of CT, Ultrasonography (US), and Magnetic Resonance Imaging (MRI), pediatric radiology nurses, scheduling staff, administrator of our department and an analyst. A project manager and a physician champion were identified and a weekly team meetings were held. After hearing each group member's input, decision was made on the project title, problem statement and project goal. 3. To reduce the head CT orders, alternatives of head CT were discussed.

Head US (HUS) was offered as the first line of imaging in children ≤ 6 months of age. Ultrafast brain MRI (UBMRI) (triplanar HASTE) was the modality in children >6months of age. UBMRI was favored over routine brain MRI to eliminate need for sedation or anesthesia and provide rapid information. 4. The existing UBMRI protocol was revised and optimized to reduce image time (scan time ~ 5 min) and improve quality. PED MR Scanner and other departmental MRI scanners were updated. 5. A visual flowchart containing information on the imaging protocols using HUS and UBMRI, and method of ordering and coordinating the imaging studies during regular work hours (7 am-4:59pm), after hours (5 pm-6:59am) and weekends were distributed to all involved departments via e-mail and personal visits to departmental meetings by the project manager. Effort was made to communicate to all levels of care givers including nurses, residents and attending physicians. 6. Baseline data was collected to understand the current practice in our hospital. Radiology Information Systems (RIS) was used for data search over a three month time period using following criteria: Key word: hydrocephalus/, age: 0-18 year old, type of imaging performed (head CT, head US, routine brain MRI, or Ultrafast brain MRI) including the date, time of the day, ordering physician rank (resident versus attending), and ordering department. 7. Baseline data was analyzed to document the number and percentage of ordered imaging modality. This was further analyzed by time of the day, ordering department, and ordering physician rank. 8. Same analysis was repeated after interventions for a period of three weeks (to meet the deadline for this abstract submission).

RESULTS
The percentage of each imaging modality for the baseline data was as follows: head CT 32%, HUS 33%, routine brain MRI 18%, UBMRI 17%. 70% of all head CT orders came from pediatric emergency department (PED). 53% of UBMRI was performed in PED patients, and 92% of UBMRI was performed for outpatients. 60% of all orders came from the residents. These results helped target PED imaging orders and their physicians especially the residents for the primary intervention focus. After placement of interventions (Material and Methods; items 3-5), post intervention data was analyzed. Overall, head CT orders were reduced to 9.5%, while the UBMRI orders increased to 49%. Table summarizes baseline and post intervention data per time of the day practice: regular work hours, after hours and weekends. (see attachment)

CONCLUSION
We were able to surpass our goal of reducing head CT orders by 50% in children with hydrocephalus using the Lean Sigma methodology. Regular meetings, a strong committed team and frequent communication between stake holders were crucial in achieving our goal.

The Simulation Lab Does Not Equal the CT Suite—Testing the Environment for Readiness (Station #2)

Maureen Gail  Heldmann  MD (Presenter): Nothing to Disclose, Jessica Caraway MD : Nothing to Disclose, Justin Michael Owens MD : Nothing to Disclose, Kevin C. Cormier  MD : Nothing to Disclose, Stacey Ryder  Massey  MD : Nothing to Disclose, David Richard Wallace MD : Nothing to Disclose, Aaron Toledo Woodward MD : Nothing to Disclose

PURPOSE
Adverse event laboratory simulation has been part of our radiology training program for four years, but no 'mock code' program exists at our tertiary referral hospital. We therefore elected to Survey radiology resident opinion of adverse drug event (ADE) simulation elements Identify and correct environmental factors in the CT suite that are not addressed in ADE laboratory simulation Assess technologist perception of 'mock contrast reactions'

METHODS
Five question survey of radiology resident and alumni opinion regarding prior simulation activity element effects on knowledge base and confidence in the recognition and treatment of ADE. Four on-site CT suite preparedness drills including technologists, radiology residents and institutional emergency response teams Anonymous 5 question CT technologist inquiry concerning self perceived ability to recognize ADE, activate response and utilize all CT suite equipment including an automated external defibrillator (AED) Follow up 5 scale rating of value by physicians and technologists participating in mock drills.

RESULTS
Resident and alumni opinions were overwhelmingly positive regarding the benefits of lab simulation, with most value received from debrief sessions (see fig). Multiple deficiencies were identified in the CT environment, including inoperable pagers, absent equipment, ineffective communication and lack of familiarity with monitoring devices and AED. CT technologist survey responses reflected a need for further training. A desire to participate in on-site preparedness drills was expressed by 87% of respondents. Follow up on-site activity participants gave unanimously high ratings.

CONCLUSION
Simulation is perceived as a valuable exercise by radiology trainees- All radiology residents are enrolled in ACLS and will continue with both in lab and on site simulation. Senior residents will serve as mentors
and the Chief resident provide continuum as part of his/her administrative duties. In- lab medical simulation cannot identify environmental issues at point of care. All medication and equipment deficiencies were immediately corrected and a new paging system was instituted in the outpatien setting. CT technologist ADE readiness may be overestimated by their supervisors and mock codes are viewed positively by this group. Partnership has been established with Nursing administration and a small group developed to include proactive CT technologidisciplinary preparedness drills campus wide. All simulations will include immediate brief with facilitators and participant feedback.

QSE128

High Patient Call-back Rates in Diagnostic Ultrasound (Station #3)

Meghna Chadha MD, MBBS (Presenter): Nothing to Disclose, Nicholas A. Lewis MD: Nothing to Disclose, Osama M. Ali MD: Nothing to Disclose, Pinky Sharma MD: Nothing to Disclose, Chaitanya Anuja MD: Nothing to Disclose

PURPOSE

Patient call-back was defined as repeat sonographic evaluation of a patient once he/she has left the department, due to sub-optimal or incomplete initial scan. High patient call-back rates were noted in our department, which maintains a log book for all call-backs citing the reason. Due to this problem, accurate ultrasound reports were not generated in a time effective manner and patient throughput in the department was delayed. Hypothesis: Patient call-back rate may be positively impacted by a multi-dimensional intervention.

METHODS

A quality committee consisting of a staff radiologist, lead ultrasound technologist and radiology manager was appointed for identification, understanding and modification of factors that influence patient call-back rates in our department. Potential problems identified were as follows: 1. Sonography technologists were not confident in performing exams such as Transplant kidney, TIPS evaluation, appendix, hernia, mostly because these were so infrequently performed. 2. Staff radiologist expectations for each exam were not consistent. 3. Documentation of findings by each technologist was variable. 4. For questions/concerns after hours, the technologist did not have an available radiologist with whom to consult. 5. No readily available reference materials were available to the technologists, when in doubt. An improvement plan was devised as follows: 1. Fortnightly lecture series were given by staff radiologists to the technologists, over a period of six months. Scanning techniques and potential pathologies in each exam were discussed. Scan protocols for each exam were delineated. 2. Revision to all existing technologist worksheets was made thereby eliminating staff and technologist documentation variability. 3. The afternoon and midnight shift radiologist acts, to assess for completeness and adequacy of ultrasound exams performed after hours, should the technologist have a concern. 4. A copy of all lectures and practice guidelines from the American Institute of Ultrasound in Medicine (AUIM) were made available and handy in the scanning area, for easy reference. 5. The quality officer provided regular feedback and constructive critique of sonography exams to the technologists. Patient call-back rate was reassessed after 1 year.

RESULTS

Baseline evaluation: Total number of exams performed in a six month period : 6384. Total number of patient call-backs over 6 months : 35 (as follows, abdomen 18, transplant kidney 4, appendix 3, hernia 2, scrotum 2, TIPS 1, thyroid 1, salivary glands 1 and DVT studies 3). The improvement plan was in place for 6 months. Re-evaluation after Implementation of Improvement plan: Total number of exams performed over a period of six months: 6492 Total number of patient call backs over 6 months : 6 (as follows, abdomen 3, salivary gland 1, thyroid 1, DVT study 1).

CONCLUSION

The project demonstrates measurable quality improvement in our ultrasound department, as evidenced by significant decrease in patient call-back from 35 to 6, following our multi-faceted interventions. This verifies our hypothesis that call back rates in our department may be positively impacted by our formal didactics, availability of an after hours radiologist for trouble-shooting, standardizing documentation and providing readily available reference material in the ultrasound scan rooms.

QSE005-b

Reducing Radiation Dose in Pediatric Diagnostic Fluoroscopy (hardcopy backboard)

Anish Ghodadra MD (Presenter): Nothing to Disclose, Stefano C. Bartoletti MD : Nothing to Disclose

PURPOSE

Radiation dose in diagnostic fluoroscopy procedures varies and has not been recently explored for common pediatric diagnostic procedures. The goal of the present study was to assess radiation dose in common pediatric diagnostic fluoroscopy procedures and implement training on dose reduction methods in order to reduce radiation use.

METHODS

After obtaining consent from the involved Radiologists, fluoroscopy time and radiation dose area product (DAP) were recorded for three common fluoroscopy procedures including upper GI’s (UGI), voiding cystourethrogram (VCUG) and barium enemas (BE) over a six month period. The results were presented to the radiologists followed by a single 1 hour training session on methods of reducing radiation dose including: reducing patient-to-image intensifier distance, increased collimation, use of pulsed fluoroscopy, and removal of the grid. Fluoroscopy times and radiation doses were then recorded for an additional six months. DAP was normalized to fluoroscopy time and non-parametric Wilcoxon testing was used to assess for differences between groups.

RESULTS

Data from a total of 1479 cases (945 pre-training and 534 post-training) from fifteen different radiologists were collected. There was no statistically significant difference in the age, proportion of exam types or fluoroscopy time between the pre- and post-training groups (p > 0.1) with the exception of a small decrease in median fluoroscopy time for VCUG’s (1.0 vs. 0.9 minutes, p = 0.04). For all exam types, there was a statistically significant decrease in the median normalized DAP (p < 0.05) between pre- and post-training groups. The median and quartiles for pre-training and post-training normalized DAP’s (µGy•m² / min) were 14.36 (5.00, 38.95) and 6.67 (2.67, 17.09) for UGI’s, 13.00 (5.34, 32.71) and 7.16 (2.73, 19.85) for VCUG’s and 33.14 (9.80, 85.26) and 17.55 (7.96, 46.31) for BE’s. These data are shown graphically in Figure 1.

CONCLUSION
With a single dose reduction training session, we were able to reduce radiation dose during common pediatric diagnostic fluoroscopic procedures by nearly 50%. Implementation of radiation dose tracking and use of short training sessions lead to clinically significant radiation dose reductions.

### QSE017-b

**Use of Non-Pharmacological Strategies and Magnetic Resonance Imaging Preparation Programs to Improve Workflow, Increase Patient Safety and Satisfaction, and Decrease Cost in a Tertiary Pediatric Hospital (hardcopy backboard)**

Laura Merriem McCalvin BS (Presenter): Nothing to Disclose, Elizabeth Ponder McGraw MD: Nothing to Disclose, Brooke A. Amato BS: Nothing to Disclose

**PURPOSE**

The use of Magnetic Resonance Imaging (MRI) in children frequently involves the use of sedation due to the necessity of the child remaining completely still in a noisy, unfamiliar environment. The high clinical demand for sedated MRI examinations resulted in a 3 month backlog of patients waiting to undergo an outpatient sedated MRI at our regional, tertiary pediatric hospital. The purpose of this presentation is to describe the utilization of non-pharmacological strategies and MRI simulators by a certified child life specialist to decrease the need for sedation in children undergoing outpatient MRI examinations, thus decreasing the cost and wait time for the examination and simultaneously increasing patient safety and satisfaction.

**METHODS**

Patients between the ages of 4-17 years were asked to participate in the program, which allows a patient to attempt to undergo an MRI awake before being sedated. The certified child life specialist prepared the patient for the upcoming MRI examination by using an age/demographically appropriate approach, including a three-dimensional (3D) toy-like MRI scanner and recorded sounds of an MRI scanner. Non-pharmacological strategies such as play-based therapy, desensitization, and cognitive behavioral therapy were used to increase patient and family familiarity with the MRI machine and decrease overall patient anxiety. The children were also encouraged to utilize positive coping skills, such as breathing techniques, audio distraction through the use of headphones to listen to music, and positive reinforcement from the MR technologist to yield a diagnostic examination with as little motion artifact as possible. After a practice session during which the child was taught these strategies, the child attempted the MRI examination without sedation. If successful, the child’s originally scheduled sedation MRI appointment was then cancelled and that time slot was given to another patient who required sedation.

**RESULTS**

143 patients between the ages of 4-17 years (mean age = 7.9 years) participated in this program from January 2013- February 2014. 114/143 (79.7%) successfully completed the practice portion of the program. Of these 114 patients, 105 (92.1%) then went on to successfully complete their MRI examination without sedation. On average, the patients who successfully completed the practice program were able to obtain an MRI in 2.5 weeks, an average of 7.3 weeks sooner than their originally scheduled examination with sedation. A total of 142 one-hour time slots were utilized to complete these examinations, which equates to 17.75 days of outpatient sedation time. At the initiation of the program, the average waiting time for an outpatient sedated MRI was 9.7 weeks. After 14 months (March 2014), this wait time for the same age group decreased to approximately 5.1 weeks. This program also decreased the overall cost of the MRI examination. For example, in our population, a brain MRI with and without contrast was one of the most frequently ordered examinations, and costs on average $1,599.00 less when performed without sedation. Patient safety was also increased as the risks of sedation were completely avoided. Random program participants were surveyed by mail after completion of their MRI. These surveys revealed a high level of patient and family satisfaction as demonstrated by statements provided by patients’ caregivers citing decreased anxiety, wait time, and cost.

**CONCLUSION**

The use of non-pharmacological strategies and MRI preparation programs by a certified child life specialist has been successful in improving workflow in the MRI department of a tertiary pediatric hospital. Non-pharmacological strategies such as play-based therapy, desensitization, and cognitive behavioral therapy were successfully employed to decrease the backlog of sedated outpatient MRI examinations, provide a diagnostic examination at a reduced cost (sedated vs. non-sedated), and improve patient safety and satisfaction. In the future, the program will expand to increase the number of participants under 6 years of age as well as include patients with developmental delays, such as Autism Spectrum Disorder.

### ROS-THA

**Radiation Oncology Thursday Poster Discussions**

**Scientific Posters**

**RO**

AMA PRA Category 1 Credits ™: .50

Thu, Dec 4 12:15 PM - 12:45 PM Location: RO Community, Learning Center

### Participants

Moderator: Abhishek A. Solanki MD: Nothing to Disclose

### Sub-Events

**ROS142**

**Conformal Radiation Therapy and Short-term Androgen Suppression Therapy versus Radical Prostatectomy in Intermediate Risk Prostate Cancer: Long-term Biochemical Control (Station #1)**

xavier muracciole (Presenter): Nothing to Disclose

**ABSTRACT**

OBJECTIVE: to assess the risk of biochemical relapse (Houston definition) after Radical Prostatectomy (RP) or Conformal Radiation Therapy (CRT) and Androgen-Suppression Therapy (AST) in men with intermediate-risk prostate cancer according to D’Amico classification.

PATIENTS AND METHODS: this retrospective study included patients with intermediate-risk prostate cancer who underwent Radical Prostatectomy or Conformal Radiation Therapy and Androgen-Suppression Therapy in our hospital. The primary endpoint was biochemical relapse (Houston definition). Statistical analysis was performed using Cox proportional hazards regression.

RESULTS: 100 patients were included in the study: 50 patients underwent Radical Prostatectomy and 50 patients underwent Conformal Radiation Therapy and Androgen-Suppression Therapy. The median follow-up was 60 months. The biochemical relapse-free survival rate at 5 years was 90% for Radical Prostatectomy and 80% for Conformal Radiation Therapy and Androgen-Suppression Therapy (p = 0.03). The Cox proportional hazards regression analysis showed that the risk of biochemical relapse was higher in patients with a higher Gleason score (hazard ratio = 2.5, p = 0.01) and a higher PSA level (hazard ratio = 1.5, p = 0.05).

CONCLUSION: Radical Prostatectomy and Conformal Radiation Therapy and Androgen-Suppression Therapy are both effective treatments for intermediate-risk prostate cancer. However, Radical Prostatectomy showed a better biochemical relapse-free survival rate compared to Conformal Radiation Therapy and Androgen-Suppression Therapy. Therefore, the choice of treatment should be based on individual patient characteristics.
Does the ADC Mean Tell the Whole Story?: Using ADC Histogram Analysis to Determine the Ideal DWI Metric for Correlation with Gleason Score (Station #2)
Erik S. Anderson PhD (Presenter): Nothing to Disclose, Daniel Jason Aaron Margolis MD: Research Grant, Siemens AG, Mitchell Kamrava MD: Nothing to Disclose

ABSTRACT
PURPOSE/OBJECTIVE:
To assess whether performing an apparent diffusion coefficient (ADC) histogram analysis on regions of interest (ROI) on prostate MRI will identify values that more strongly correlate with Gleason score (GS) than mean ADC value.

MATERIALS AND METHODS:
We performed a retrospective analysis of 19 prostate lesions from 17 individuals that were identified on multi-parametric MRI. Lesion ADC was measured using diffusion weighted imaging (DWI). The ROI was drawn on the most conspicuous slice of the DWI image. We then extracted the ADC values on a voxel by voxel basis, to assemble the entire distribution of ADC values within the ROI. We calculated ADC characteristics for each ROI, including mean, median, minimum, maximum, standard deviation, skewness, kurtosis and percentile values. We then assessed whether each of these parameters significantly correlated to GS based on targeted biopsy using the ANOVA statistical test.

RESULTS:
Median patient characteristics included: age 61 years (SD 6), PSA 8.1 (SD 12.8), prostate volume 43 cc (SD 14.2), and ROI volume 0.4 cm³ (SD 0.82). GS ranged from 6-9 (GS 6, n=8; GS 7, n=6; GS 9, n=5). Thirteen lesions were located within the peripheral zone. For peripheral zone lesions, multiple parameters were statistically correlated with increasing Gleason score including ADC median (p=0.02), 50th percentile (p=0.05), 10th percentile (p=0.03) and 25th percentile (p=0.02). Association of GS with ADC mean, standard deviation, minimum, maximum, skewness, kurtosis and additional percentile ranks of 75% and 90% did not achieve statistical significance. Associations remained significant when including all 19 lesions from the peripheral, central and transitional zones.

CONCLUSIONS:
Using ADC histogram analysis, the characteristics that achieved the highest correlation with GS were the median, 10th and 25th percentile values. This finding implies that the most predictive measurements within a ROI are the voxels that display the lowest diffusion, as opposed to the often reported mean.

Future work will analyze the spatial relationship of low ADC voxels to determine whether anatomical sub-regions of low diffusion could represent targets for focused biopsy and radiation boost.

Change in Prostate Gland Volume after Intensity-modulated Radiotherapy: MRI Evaluation (Station #3)
Yuko Iraha (Presenter): Nothing to Disclose, Masahiro Okada MD: Nothing to Disclose, Maho Tsubakimoto MD: Nothing to Disclose, Nanae Tsuchiya : Nothing to Disclose, Sadayuki Murayama MD, PhD : Nothing to Disclose

PURPOSE
The purpose of this study was to evaluate the volumetric changes in prostate gland before and after intensity-modulated radiotherapy (IMRT) and to assess the signal intensity changes of the peripheral zone (PZ) using MRI.

METHOD AND MATERIALS
Fifty-two patients with localized prostate cancer were enrolled in this retrospective study, which was approved by our Institutional Review Board. All patients underwent IMRT, and all patients underwent MRI examination pre- and post-IMRT. Forty-nine patients received androgen deprivation therapy (ADT) prior to IMRT. Median age of patients was 74 years (range 55-79). Mean prostate-specific antigen (PSA) level pre-IMRT was 2.3 ng/mL (range 0.01-70). Prostate volumes and signal intensity of the PZ on T2WI before and after IMRT, with 2 years of follow-up, were determined. Change in volume over time were calculated and compared with regard to age, pre-IMRT PSA level, ADT completion time, and initial prostate volume.

RESULTS
There were significant decreases in mean prostate volume after the completion of IMRT: a 14% decrease at 1 month and a 5% decrease at 4 to 5 months. There were significant increases in mean prostate volume after IMRT: a 3% increase at 1 year and a 9% increase at 2 years. The shrinking effect was significantly higher when the prostate volumes were initially larger and when pre-IMRT PSA levels were higher. The IMRT was significantly noticed after 2 years when the prostate volumes were initially smaller, when pre-IMRT PSA levels were lower, when the patients completed ADT before the start of IMRT, and in patients under 70 years old. T2 signal intensity of the PZ decreased or stayed low 1 month after IMRT in most patients (49/52: 94%). T2 signal intensity of the PZ increased gradually during 4th to 24th month after IMRT in most patients (47/54: 87%).

CONCLUSION
Patients undergoing IMRT show definite prostate shrinkage for the first 5 months, followed by a volume increase 2 years after the therapy. T2 signal intensity of the PZ decreased 1 month after IMRT, but increased gradually during 4th to 24th month after the therapy.
VIS-THA
Vascular/Interventional Thursday Poster Discussions

**Association of Aortic Compliance and Brachial Endothelial Function with Cerebral Small Vessel Disease in Type 2 Diabetes Mellitus Patients: Assessment with 3.0T MRI (Station #1)**

Yan Shan (Presenter): Nothing to Disclose, Jiang Lin MD, Phdb: Nothing to Disclose, Pengju Xu: Nothing to Disclose, Mengsu Zeng MD, PhD: Nothing to Disclose

**PURPOSE**

To assess the possible association of aortic compliance and endothelial function with cerebral small vessel disease in type 2 diabetes mellitus (DM2) patients by using 3.0T high resolution magnetic resonance imaging.

**METHOD AND MATERIALS**

Sixty-two DM2 patients (25 women and 37 men, mean age: 56.84±7.46 years) were prospectively enrolled for noninvasive MR examinations of the aorta, brachial artery, and brain. Aortic distensibility (AD), aortic arch pulse wave velocity (PWV), flow-mediated dilation (FMD) of brachial artery, lacunar brain infarcts, and periventricular and deep white matter hyperintensities (WMHs) were assessed. Pearson and Spearman correlation analysis were performed to analyze the association of aortic arch PWV, AD and FMD with clinical data and biochemical test results. Univariable logistic regression analyses were used to analyze the association of aortic arch PWV, AD and FMD with cerebral small vessel disease. Multiple logistic regression analyses were used to find out the independent predictive factors of cerebral small vessel disease.

**RESULTS**

Mean aortic arch PWV was 6.73±2.00 m/s, ascending aorta AD (AA-AD) was 2.64±1.49 ×10⁻³ mm Hg⁻¹, proximal thoracic descending aorta AD (PDA-AD) was 3.08±1.25 ×10⁻³ mm Hg⁻¹, distal descending aorta AD (DDA-AD) was 3.69±1.87 ×10⁻³ mm Hg⁻¹, FMD was 16.67±9.11%. After adjustment for age, sex, smoke situation, diabetes duration and hypertension, PWV was statistically significantly associated with lacunar brain infarcts (OR=2.00, 95%CI: 1.14-3.2, p<0.05) and FMD was statistically significantly associated with periventricular white matter hyperintensities (OR=0.82, 95%CI: 0.71-0.95, p<0.05).

**CONCLUSION**

Quantitative evaluation of aortic compliance and endothelial function by using 3.0 T high-resolution MRI may contribute to stratify the cardiovascular risk factors of DM2 patients with a potential risk of cerebral small vessel disease.

**CLINICAL RELEVANCE/APPLICATION**

Our results suggested that high-resolution MRI may help stratify cardiovascular risks in DM2 patient with direct quantification of both aortic stiffness and endothelial dysfunction.

**Hyperemic Fractional Microvascular Blood Plasma Volume Is Related to Arterial Flow Reserve in Patients with Arterial Disease (Station #2)**

Bharath Ambale venkatesh PhD (Presenter): Nothing to Disclose, David A. Bluemke MD, PhD: Research support, Siemens AG, Joao A. C. Lima MD: Research Grant, Toshiba Corporation, Chikara Noda: Nothing to Disclose

**PURPOSE**

Lower-extremity hyperemic skeletal muscle perfusion and popliteal arterial flow reserve measures could be valuable for diagnosing peripheral artery disease (PAD) and evaluating treatments that promote angiogenesis and tissue regeneration.

**METHOD AND MATERIALS**

The Patients with Intermittent Claudication Injected with ALDH Bright Cells (PACE) study is a randomized, double-blind, placebo-controlled multi-center clinical trial, to assess the clinical safety and efficacy of autologous bone marrow derived aldehyde dehydrogenase-bright cells. In a preliminary analysis of 16 PAD patients with an ankle-brachial index <0.9 and significant stenosis in the infrainguinal arteries at baseline as part of this study, MRI-derived measures of hyperemic calf muscle perfusion from dynamic contrast-enhanced (DCE) MRI and hyperemic popliteal artery flow from phase-contrast (PC) MRI were evaluated. Scans were performed in 1.5-T and 3-T scanners (GE, Siemens and Philips) across multiple centers using 0.05 mmol/kg Magnevist, and using a 5-minute occlusion of femoral artery flow by inflating a thigh cuff to suprasystolic pressures on the asymptomatic leg to induce hyperemia. DCE-MRI was performed at 8 slices at mid-calf using 3D SPGR sequences (spatial resolution: 1x1x5 mm, temporal resolution <5ms) and was preceded by a variable flip angle method to measure $T_1$. Semi-quantitative
RESULTS
The patients were on average 66 years, with mean Vb = 4.5±5.2%, iAUC = 1.097±0.43 mmol/L*s and AFR = 1.144±1.15 ml/s. The iAUC was correlated with the absolute AFR - r = 0.55, p=0.027. The difference in average velocity at hyperemic and resting states was correlated to both the iAUC (r=0.51, p=0.045) and Vb (r=0.6, p=0.015).

CONCLUSION
Hyperemic blood flow rates measured with PC-MRI were related with hyperemic fractional blood plasma volume and tissue contrast uptake from DCE-MRI in PAD patients.

CLINICAL RELEVANCE/APPLICATION
This helps in indentification of skeletal muscle perfusion in relation to blood flow.

VIS265
Detection of Endoleaks after Endovascular Aortic Repair Using Unenhanced MR Imaging: Diagnostic Accuracy of Balanced Turbo Field Echo Sequence with Motion-sensitized Driven Equilibrium (Station #3)

Kensaku Mori MD (Presenter): Nothing to Disclose , Tsukasa Saida MD : Nothing to Disclose , Fujio Sato : Nothing to Disclose , Katsuhiro Nasu MD, PHD : Nothing to Disclose , Toshitaka Ishiguro MD : Nothing to Disclose , Takahiro Konishi MD : Nothing to Disclose , Yoko Uchikawa MD : Nothing to Disclose , Sodai Hoshiai MD : Nothing to Disclose , Takashi Hiyama MD : Nothing to Disclose , Manabu Minami MD, PhD : Nothing to Disclose

PURPOSE
To evaluate the diagnostic accuracy of unenhanced balanced turbo field echo sequence (BTFE) with motion-sensitized driven equilibrium (MSDE) for detecting endoleaks after endovascular aortic repair (EVAR).

METHOD AND MATERIALS
We included 26 patients (20 men and 6 women; mean age, 72.5 years; age range, 47-85 years) who had undergone EVAR for aortic and/or iliac arterial aneurysms. All patients underwent contrast-enhanced CT and unenhanced MR imaging including ordinary BTFE, BTFE with MSDE using no velocity encoding (VENC) (bright blood imaging), and BTFE with MSDE using VENC of 5 cm/s (black blood imaging). The interval between the contrast-enhanced CT and unenhanced MR imaging ranged from 0 to 6 days (mean, 0.6 days). Two independent observers, unaware of the contrast-enhanced CT results, reviewed the unenhanced MR images and the subtraction images reconstructed from the bright and black blood imaging. The confidence levels for the presence of endoleaks were assigned on a 5-point scale. The diagnostic accuracy was assessed by the receiver operating characteristic (ROC) analysis. The contrast-enhanced CT results served as the reference standard. The interobserver agreement was evaluated by the kappa statistics. Additionally, the artifact levels on subtraction images were assigned as no, minimal, moderate, or severe.

RESULTS
On contrast-enhanced CT, 1 and 5 patients had type-1 and type-2 endoleaks, respectively. The respective area under the ROC curve, accuracy, sensitivity, and specificity for detecting endoleaks on unenhanced MR imaging were 0.983, 92.3%, 100%, and 90% for the observer 1 and 0.992, 96.2%, 100%, and 95% for the observer 2. The kappa value was 0.651, indicating good interobserver agreement. No, minimal, moderate, and severe artifact was assigned in 19, 4, 3, and 0 patients by the observer 1 and in 13, 9, 4, and 0 patients by the observer 2, respectively.

CONCLUSION
Endoleaks can be accurately diagnosed on BTFE with MSDE without use of contrast medium.

CLINICAL RELEVANCE/APPLICATION
BTFE with MSDE is a truly non-invasive method to detect endoleaks after EVAR, requiring neither contrast-medium injection nor radiation exposure. Thus, this technique will help to reduce invasiveness of follow-up imaging after EVAR, especially in patients with renal dysfunction.

VIS261
Clinical Outcomes in Primary Hyperaldosteronism Treatment: Radiofrequency Ablation vs. Adrenalectomy vs. Medical Therapy (Station #4)

Ammar Sarwar MD (Presenter): Nothing to Disclose , Ari Charles Sacks MD : Nothing to Disclose , Olga Rachel Brook MD : Research Grant, Guerbet SA , Erica Alice Gupta MD : Nothing to Disclose , Nahum Goldberg : Nothing to Disclose , Muneeb Ahmed MD : Nothing to Disclose , Salomao Faintuch MD : Nothing to Disclose

PURPOSE
To report and compare outcomes in patients undergoing radiofrequency ablation (RFA), surgical and medical treatment for primary hyperaldosteronism.

METHOD AND MATERIALS
In this IRB-approved, HIPAA-compliant retrospective study 117 consecutive patients undergoing adrenal vein sampling (AVS) were included in the study. Follow-up data was available in 92/117 patients (age 52±12, 44% female). 41/92 (44%) patients had medical treatment, 37/92 (40%) had adrenalectomy and 14/92 (15%) had RFA. Changes in systolic and diastolic blood pressure (SBP, DBP), number of anti-hypertensive medications (anti-HTN) and plasma renin to aldosterone ratios (ARR) were recorded on clinical follow-up.
RESULTS
RFA group: Clinical follow-up was performed 73±40 days post-RFA. Blood pressure decreased from 148±18/92±15 pre-RFA to 135±22/82±12 post-RFA (SBP: p=0.05, DBP: p=NS). Number of anti-HTN drugs decreased from 3.1±1.4 pre-RFA to 1.9±1.7 post-RFA (p=0.01). Adrenalectomy group: Clinical follow-up was performed 33±40 days after surgery. Blood pressure decreased from 145±9.7/89±8.6 pre-surgery to 137±20/83±11 post-surgery (SBP: <0.0001, DBP: NS). Pre-adrenalectomy patients were on 6.4±4.0 anti-HTN vs. 1.1±1.1 after surgery (p<0.0001). Medical treatment group: Clinical follow-up was available in all patients, 48±255 days after AVS. Pre-AVS blood pressure was 144±19/88±12 vs. 136±20/83±11 post therapy (SBP: p=0.02, DBP: p=0.006). The patients on medical therapy were on an average of 3.1±1.8 anti-HTN medications prior to the AVS and an average of 3.3±1.8 on follow-up (p=N.S.). Whereas there was a decrease in hypertension and anti-HTN needed for control after treatment, in the surgical group (p<0.001) and the RFA group (p=0.003) compared to the medical therapy group, there was no significant difference in the change in anti-HTN after treatment between the surgical and RFA group (p=0.07). The percentage of responders-to-therapy (Figure 1) in the surgical and RFA group were similar (p=0.06) but lower in the medical therapy group.

CONCLUSION
RFA is a successful treatment for AVS-proven aldosterone producing adenomas with clinical outcomes comparable to adrenalectomy.

CLINICAL RELEVANCE/APPLICATION
RFA is a successful treatment for primary hyperaldosteronism lateralizing to one gland on AVS with outcomes comparable to adrenalectomy, with the advantages of no incision, same day discharge and early return to daily activities.

Efficacy of MR Guided Focused Ultrasound Surgery in Treating Adenomyosis: Study of 19 Indian Patients (Station #5)
Sameer Surendra Soneji DMRD (Presenter): Nothing to Disclose , Ritu Manoj Kakkar MBBS : Nothing to Disclose , Shrinivas Balaji Desai MD : Nothing to Disclose

PURPOSE
To assess the efficacy of MR guided focused ultrasound surgery (MRGFUS) in treating adenomyosis by evaluation of non-perfused volumes (NPV) and symptom severity score (SSS).

METHOD AND MATERIALS
19 Indian women with significant symptomatic adenomyosis (SSS > 21) were selected. Patients underwent evaluation of the adenomyosis with post contrast MRI of pelvis. Those with focal and diffuse adenomyosis with definable treatable areas were treated by MRGFUS. Post treatment post contrast MRI pelvis was performed to assess the NPV. 6 months follow up with SSS questionnaire and MRI pelvis with contrast.

RESULTS
MRGFUS treatment of adenomyosis resulted in significant reduction in SSS in 74% patients. The post treatment SSS at 6 months and reduction in score was 16± 4.8 (SD) and 12.6 ± 3.4 (SD) respectively, which showed strong correlation with the NPV and percentage of adenomyosis reduction (p < 0.01). NPV had a strong and highly positive correlation with reduction in SSS (p<0.01, r= 0.92). The unpaired t-test determined that there was significant difference in NPV values in patients who had clinically significant reduction in SSS (p < 0.01). The ROC of NPV with reduction in SSS showed that an NPV > 22% resulted in significantly reduced SSS. Nearly 80% of our patients were adverse event free with the remaining having self-limited complications like abdominal pain, early menses and back pain. There was 1 patient of 1st degree burn due to previous surgery scar which also resolved within a month of the treatment.

CONCLUSION
MRGFUS can provide effective treatment of adenomyosis. The treatment is able to achieve NPV values that will result in clinically significant reduction in symptoms. The reduction in the SSS and percentage of adenomyosis reduction follows the NPV very closely and linearly, which means that achieving greater NPV will essentially result in significant symptom reduction. This procedure is safe with minimal adverse effects.

CLINICAL RELEVANCE/APPLICATION
MRGFUS should be used to treatment focal or diffuse adenomyosis where a treatable area can be defined. NPV more than 20% should be therapeutic, however highest possible NPV that can be safely achieved should be sought for better symptom reduction.

Doppler Sonographic Findings of Splenic Steal Syndrome after Liver Transplantation (Station #6)
Chao-lun Li (Presenter): Nothing to Disclose , Weiping Wang MD : Nothing to Disclose , Eunice Kim Moon MD : Nothing to Disclose , John Fung : Nothing to Disclose , Koji Hashimoto MD : Nothing to Disclose

PURPOSE
The purpose of this retrospective study is to compare the most commonly used Doppler parameters between splenic steal syndrome (SSS) patients after orthotopic liver transplantation and the control group to investigate the findings and the value of Doppler ultrasound in the diagnosis of SSS and follow-up after treatment.

METHOD AND MATERIALS
A total of 51 patients with angiographic confirmed SSS (40 men, 11 women, average age of 57.7±9.9 years, age range 27-76 years) were enrolled in this study. The control group consisted of 50 liver transplant patients (40 men, 10 women, average age of 55.8±10.4 years, age range 8-75 years) with normal liver enzyme levels from the same period. The clinical data and ultrasound examination records
were reviewed. All the patients were treated with proximal splenic artery embolization after the diagnosis of SSS was established. All the patients with SSS underwent Doppler ultrasound examination before and after the treatment. The following parameters were documented and analyzed in both groups: portal venous velocity (PVV), peak systolic velocity (PSV) of hepatic artery, resistance index (RI) of hepatic artery, and the size of spleen.

RESULTS
RI of the SSS group (0.94±0.08) was significantly higher than those of the control group (0.80±0.10) (P<0.0001). RI>0.91 is the optimal threshold for the diagnosis of SSS with sensitivity of 72.0%, specificity of 80.8%, PPV of 79.8%, and NPV of 74.3% (AUC=0.81, P<0.0001). Moreover, RI tends to remain at a high level in SSS patients, while it will normalize in the control group. Therefore, it may be more helpful for the diagnosis to observe the change of RI dynamically over time. There was no significant difference of PVV and PSV of hepatic artery between the two groups. After the SAE, RI significantly decreased from 0.94±0.08 to 0.77±0.11 (P<0.0001), and PSV decreased from 67.9±25.2 cm/s to 43.1±17.7 cm/s (P<0.0001). PSV of hepatic artery increased from 68.9±37.7 cm/s before SAE to 72.1±41.6 with no statistically significant difference (P=0.14).

CONCLUSION
A persistent high resistance hepatic arterial waveform should lead to the suspicion of SSS. RI and portal vein velocity are better indicators than hepatic arterial PSV for successful treatment of SSS.

CLINICAL RELEVANCE/APPLICATION
Doppler ultrasound imaging is a useful screening method for both the diagnosis of SSS and the follow-up after treatment.

VISC267
A New Approach in the Treatment of Bone Metastases: Efficacy of CT-guided Cryotherapy Combined with Radiotherapy (Station #7)
Lorenzo Maria Gregori : Nothing to Disclose, Francesco Arrigoni (Presenter): Nothing to Disclose, Fernando Smaldone MD : Nothing to Disclose, Luigi Zugaro : Nothing to Disclose, Antonio Barile MD : Nothing to Disclose, Carlo Masciocchi MD : Nothing to Disclose

PURPOSE
Aim of this study was to evaluate the role of percutaneous CT-guided cryoablation in the synergistic treatment with radiotherapy in the management of painful bone metastases.

METHOD AND MATERIALS
From July 2011, one hundred and two oncologic patient, with histologically and radiologically confirmed painful bone metastases were included in the study. All subjects experienced pain localized to the site of the bone metastases with a score >5 on the validated visual analogue scale (VAS). Cryoablation was performed in 38 subjects. Eighteen of them underwent a radiation course (20 Gy in 5 daily fraction) 10 days after the ablation. These subjects were retrospectively matched with a group of subjects treated by CA or RT. Exclusion criteria were the presence of other visceral or not-visceral metastasized sites. The rate of pain relief in terms of complete (CR) and partial (PR) response and the changes in self-rated Quality of life (QoL) were measured 3 months after treatments.

RESULTS
A significant higher proportion of subjects treated by CA (37%) (p=0.016) or CA followed by RT (72%) (p<0.01) experienced a CR compared to patients treated by RT alone (13%). Interestingly, the addition of RT to CA significantly improved the rate of CR compared to CA alone (p=0.034). The higher rate of CR observed in patients treated by CA or CA-followed RT paralleled with an improved self-rated QoL. Thirty-seven (84%) patients were successfully ablated without complications with the rate of major complications of 16%. Patients had pain relief for a period ranging from 3 to 24 months (mean 7.8 months). Technical success was 100%.

CONCLUSION
Combined treatment of CT-guided cryoablation and radiotherapy improves relief from pain due to bone metastases.

CLINICAL RELEVANCE/APPLICATION
In the treatment on painful bone metastases, combined treatment of CT-guided cryoablation and radiotherapy offer the best therapeutic outcomes.

VIE016-b
Comparing Percutaneous Tumor Ablation Modalities: Microwave Ablation, Radiofrequency Ablation, Cryoablation, and Irreversible Electroporation (hardcopy backboard)
Seyed Amin Astani MD, MBA (Presenter): Nothing to Disclose, Kevin McGill MD, MPH : Nothing to Disclose, Scott E. Schwartz MD : Nothing to Disclose

TEACHING POINTS
To compare the current indications, contraindications, technique, advantages, and mechanism of action of the 4 most commonly used percutaneous ablation modalities (microwave ablation, radiofrequency ablation, cryoablation, and irreversible electroporation).

TABLE OF CONTENTS/OUTLINE
Compare the microwave ablation, radiofrequency ablation, cryoablation, and irreversible electroporation in: • Mechanism of action and physics behind them • Indications and contraindications • Techniques • Advantages, challenges, and disadvantage • Complications • Cost
Participants

Moderator
Jane Sexton Matsumoto MD : Nothing to Disclose

LEARNING OBJECTIVES

1) To review what 3D printing is and how it can be applied using radiology data. 2) To understand the important steps in creating a 3D printing lab that creates individual anatomic models using imaging data. 3) To describe the role anatomic models play in clinical care, education and research. 4) To describe the value added by anatomic models in the care of complex patients.

ABSTRACT

Our initial experience using 3D printing took place seven years ago when we created life-sized anatomic models of conjoined twins using CT data to aid in the surgical planning of the complex, high risk separation. The surgeons found the models invaluable and 3D printing has since become an important tool in the planning of many complex surgeries. Working collaboratively with surgeons, we have created over 100 individualized life-sized anatomic models for surgical and interventional cases using both CT and MR data. We will demonstrate this technology with models including skeletal, cardiovascular, neurologic, craniofacial, hepatic and renal cases. Collaboration between the radiologist and surgeons is an essential part of the process to ensure understanding of what the surgeons need and what anatomical relationships are important to demonstrate. The demand for 3D models is growing rapidly in our practice. Over half of our models have been created in the last year after we established a dedicated radiology based Anatomic Modeling 3D printing lab. We will share the steps we took to establish our lab and the technical and organizational lessons learned. This technology offers a radiology department a new opportunity to offer an important value-added contribution to patient care. It also has tremendous potential for education and research. The radiologists' combination of skill and experience in imaging anatomy, pathology and imaging technology places them in a unique position to create laboratories that translate 3D printing technology into clinical practice.

Sub-Events

RCA53A  3D Printing of Imaging Data: Why and How It Developed and the Value It Offers
Jane Sexton Matsumoto MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCA53B  3D Printing: Orthopedic, Oncologic, Neurosurgical, and Forensic Applications
Jonathan Michael Morris MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCA53C  Developing a Cardiovascular 3D Printing Practice
Thomas Andrew Foley MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCA53D  Anatomic Modeling: Impactful Genitourinary, Gastrointestinal and Aortoiliac Relationships
Terri Jo Vrtiska MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCA53E  Building, Supporting and Funding a Radiology 3D Printing Lab
Linda Nesberg (Presenter): Nothing to Disclose, Joel L. Kuhlmann (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCA53F  Medical Physics and 3D Printing: Exploration and Opportunity
Kiaran Patrick McGee PhD (Presenter): Nothing to Disclose, Shuai Leng PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

According to the American Association of Physicists in Medicine, the primary responsibility of the clinical
medical physicist is to facilitate the production of quality diagnostic images consistent with the available technology while simultaneously optimizing patient safety. The introduction of additive or 3D printing technologies is providing previously unimagined opportunities to improve both image quality and safety through the development of 3D printed objects for research, clinical quality control, maintenance and testing purposes. The purpose of this presentation is to describe the development of 3D printed objects for the purposes of medical physics testing and quality control in a variety of research and clinical settings. Particular emphasis will be placed on the development of patient specific phantom models derived from multiple imaging modalities and how these devices can be used to optimize image quality for complex clinical imaging situations. Attention will also be given to demonstrating how these models can be used for optimizing image quality and reducing patient dose in modalities that use ionizing radiation. Phantoms for both routine clinical quality control and acceptance testing of clinical imaging equipment will also be described. Finally, the spatial accuracy and precision of these 3D phantoms will be described.

RCB53
Creating, Storing, and Sharing Teaching Files Using RSNA’s MIRC® (Hands-on)
Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 12:30 PM - 2:00 PM Location: S401CD

Participants
Frederick Ethan Weiss MD (Presenter): Nothing to Disclose

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

RCC53
Quantitative Imaging and Informatics (In Association with the Society for Imaging Informatics in Medicine)
Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 12:30 PM - 2:00 PM Location: SS01ABC

Participants
Moderator
Adam Eugene Flanders MD : Nothing to Disclose
Luciano Monte Serrat Prevedello MD,MPH : Nothing to Disclose

LEARNING OBJECTIVES
1) Develop an understanding of what quantitative imaging is and how it may revolutionize the way we practice diagnostic radiology today. 2) Learn the research advances and the current clinical applications of this technology. 3) Appreciate the current challenges involved in using these tools clinically and understand the steps required for a successful clinical implementation.

ABSTRACT
Medicine has undergone a gradual evolution in which diagnostic imaging has become the centerpiece in establishing a clinical diagnosis and in assessing disease response. In recent years, the focus has changed such that for some disease categories (e.g. oncology) we now perceive medical imaging as a phenotypic expression of the genetic makeup of that disease. To that end, imaging now serves as a biomarker of genetic disease subtypes with features that may offer clues to understanding the natural behavior of the disease and specific changes that may occur as part of a therapeutic response. It is now well recognized that there is a substantial amount of objective information contained within diagnostic imaging studies that can be exploited beyond the level of simple measurements. The extraction of quantitative and semi-quantitative information from imaging studies that is both useful and reproducible is the challenge and opportunity for clinical trials research and radiologic reporting today and in the future. This session will explore the revolution and evolution of quantitative imaging; providing attendees with research advances, clinical applications, and the challenges of clinical implementation.

Sub-Events
RCC53A
What is Quantitative Imaging?
Katherine P. Andriole PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Be able to describe what is meant by quantitative imaging. 2) Understand existing issues in implementing quantitative imaging techniques in the clinical arena as well as in the research realm, and see how informatics tools may help. 3) Be aware of on-going international efforts to address current challenges and to move quantitative imaging forward.

ABSTRACT
Quantitative imaging has rapidly evolved in recent years from a promising research activity to an essential clinical tool. Physicians consider the objective metrics obtained from imaging studies, in making critical patient management decisions. What is meant by quantitative imaging will be described using illustrative real-world use cases. Existing issues including technical as well as workflow challenges will be discussed. An introduction to imaging informatics tools and techniques such as standards, integration, data mining, cloud computing, ontologies, data visualization and navigation tools, and business analytics applications that may assist in filling current gaps in the clinical implementation of quantitative imaging will be given. An overview of activities of the RSNA’s Quantitative Imaging Biomarkers Alliance (QIBA), an international
initiative whose goal is to optimize the potential of quantitative imaging, including a description of the data warehouse project will be provided.

RCC53B

Informatics Approaches to Enable Quantitative Imaging in Real World Radiology Practice
Daniel L. Rubin MD, MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To highlight limitations in current radiological quantitative imaging practice and identify opportunities for improvement through informatics. 2) To introduce Annotation and Image Markup (AIM) as a new standard for capturing and sharing quantitative imaging metadata. 3) To demonstrate new AIM-enhanced tools that can streamline and improve quantitative imaging assessment and workflow for the radiologist.

ABSTRACT

Radiology practice is increasingly a quantitative endeavor. Radiologists frequently need to measure the length of lesions to track treatment response or measure the size of structures to for diagnostic assessment. Current practices of quantitation are cumbersome; measurements are recorded as screen captures that cannot be processed by machine, and the numbers must be transcribed into a radiology report. It is currently exceedingly difficult to create structured databases of quantitative image information for discovery about how, say, change in tumor size over time relates to drug treatment. Quantitative imaging is currently at best a labor-intensive process and at worst error-prone. We have been developing informatics methods to streamline the electronic capture of quantitative imaging results as "image metadata" in structured format that can be easily processed by computers. Tools that we are producing will allow the radiologist to perform quantitative imaging assessment in their current routine workflow-measuring lesions on the PACS, while simultaneously their measurements will be captured and transmitted in standardized formats to applications that can automate accurate reporting, analysis, and decision support. In the future such tools will even help researchers to discover new ways that quantitative signals in images can improve assessment of treatment and prediction of disease course.

RCC53C

QI Clinical Use Cases Outside of Oncology
Eliot L. Siegel MD (Presenter): Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XYBIX Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research Grant, Herman Miller, Inc Research Grant, Virtual Radiologic Research Grant, Anatomical Travelogue, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation

LEARNING OBJECTIVES

1) List the current greatest challenges to quantitative imaging from an informatics perspective. 2) Describe how data from clinical trials and the electronic medical record can provide decision support tools associated with the application of quantitative imaging. 3) Be able to articulate the requirements for next generation quantitative imaging and opportunities for improvement of the current generation of CAD software.

ABSTRACT

In the current and future era of Big Data and advanced algorithms to model and diagnose complex disease, structured reporting, natural language processing and quantitative imaging have become essential elements for diagnostic imaging. Additionally it is absolutely essential that our imaging reports including scanning parameters, diagnosis, findings, recommendations, etc. as well as quantitative measurements and impressions from the pixel data be made available for the next generation of diagnostic, staging, and treatment algorithms. Currently there are several major challenges to making this imaging data accessible in a machine recognizable manner and these will be listed, including the application of a method to 'tag' medical images and a means of structuring and classifying findings made by radiologists and other human interpreters as well as computer algorithms that make quantitative measurements and computer aided detection and diagnosis. Once these data are available they can be utilized for decision support in radiology such as determination of which patients should be screened, estimation of the likelihood of malignancy when a nodule is detected, and refinement of CAD algorithms based on a priori estimates of likelihood of disease.

BRS-THB

Breast Thursday Poster Discussions

Scientific Posters

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Thu, Dec 4 12:45 PM - 1:15 PM Location: BR Community, Learning Center

Sub-Events

BRS290

Association between Oncotype Dx® Breast Cancer 21-gene Assay Recurrence Score and Computer-derived Imaging Features (Station #1)

Elizabeth J. Sutton MD (Presenter): Nothing to Disclose, Jung Hun Oh PhD: Nothing to Disclose, Brittany Dashinsky MD, DPhil: Nothing to Disclose, Hartini Veeraraghavan: Nothing to Disclose, Joseph Owen Deasy PhD: Nothing to Disclose, Elizabeth A. Morris MD: Nothing to Disclose, Aditya Prakash Apte PhD: Nothing to Disclose, Girard Gibbons BA: Nothing to Disclose

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 investigate the association between Oncotype Dx® RS and texture features extracted from magnetic resonance imaging (MRI).
METHOD AND MATERIALS

This retrospective study received institutional review board approval and need for informed consent waived. Between 2006-2012, we identified women with: a) ER+, progesterone receptor positive (PR+) and HER2 negative invasive ductal carcinoma (IDC); b) Preoperative breast MRI; c) Oncotype Dx® RS. Clinical and pathologic data were collected. Tumors were contoured on the fat-suppressed T1-weight pre- and three post-contrast images. Shape-, texture- and histogram-based features were extracted using in-house software (Computational Environment for Radiological Research). Linear regression analysis was performed to investigate the association between Oncotype Dx® RS and different clinical, pathologic and imaging features.

RESULTS

Ninety-five ER+, PR+ and HER2- patients were included in the study sample with a median Oncotype Dx® RS of 16 (range 0-45). The median follow-up time was 33.3 months (range: 0.2-57.3 months) and at the end of follow-up, no patients had recurred or died. In univariate linear regression analysis, three features significantly correlated with Oncotype Dx® RS: nuclear grade and two kurtosis features with p = 0.0105, 0.0056, and 0.0005, respectively. Using these three features, multiple linear regression analysis was performed, resulting in significant correlation with Oncotype Dx® RS with R-squared = 0.228 (p = 0.0002) and Spearman’s rank correlation coefficient = 0.485 (p < 0.0001).

CONCLUSION

IDC computer-derived imaging features correlate with Oncotype Dx® RS suggesting, that these are image-based biomarkers that reflect the likelihood of recurrence and magnitude of chemotherapy benefit. Further investigation on larger datasets is necessary to validate this observation.

CLINICAL RELEVANCE/APPLICATION

Computer-derived imaging features significantly correlate with Oncotype Dx® RS, which is a clinically validated genetic test that directs treatment.

BRS291

Voxel-Wise Correlations of Glucose Uptake and Intra-voxel Incoherent Motion Parameters from Simultaneous MR/PET in Locally Advanced Breast Cancer (Station #2)

Eric Sigmund PhD (Presenter): Nothing to Disclose, Jason Ostenson: Nothing to Disclose, Linda Moy MD: Nothing to Disclose, Sunghoon Kim: Nothing to Disclose, Gene Cho: Officer, RF Test Labs Shareholder, RF Test Labs, Komal Jhaveri MD: Nothing to Disclose, Christopher Glielmi PhD: Employee, Siemens AG, Thorsten Feiweier DIPPLPHYS, PhD: Employee, Siemens AG Stockholder, Siemens AG Patent holder, Siemens AG, Kimberly Jackson: Nothing to Disclose, Amy Noel Melsaether MD: Nothing to Disclose

PURPOSE

Diffusion-weighted MRI (DWI) and FDG-PET have strong track records in the setting of breast cancer, but their intratumoral interrelationship is not completely understood. In a simultaneous MR/PET system, we derive intra-voxel incoherent motion (IVIM) diffusion and perfusion metrics and compare them with spatially correlated FDG SUV values in breast cancer patients.

METHOD AND MATERIALS

In this IRB approved, HIPAA compliant study, we imaged 17 women with histologically proven invasive cancers on a 3T Siemens Biograph mMR MR/PET system immediately following the patients’ whole body PET/CT without additional FDG injection. Concurrent with FDG-PET, we acquired DWI using a prototype fat-suppressed, twice-refocused spin echo EPI sequence with eddy-current distortion correction and 10 b-values (0 to 800 s/mm²), followed by Gd-DTPA contrast agent and T1-weighted imaging. DWI and PET volumetric images were independently registered to the post-contrast T1 and resampled to its matrix and resolution. DWI were fit voxelwise to a bi-exponential IVIM model to derive tissue diffusion (Dv) and perfusion fraction (fp). Pearson correlation coefficients for SUV vs. Dv and SUV vs. fp were derived for each lesion. SUV and diffusion/perfusion relationships were visualized using correlated 2D histogram analysis.

RESULTS

The relationships between SUV vs. Dv/fp were individually distinct, but most fell into two categories: Type A (N=6, SUV vs. Dv negative correlation, SUV vs. fp positive or no correlation) and Type B (N=6, SUV vs. Dv showing a Dc limit, and SUV vs. fp a negative correlation). The remaining 5 cases were too small or heterogeneous to be classified. The Pearson’s r values reflect these visual correlations. Type B cases were more likely than Type A’s to be metastatic (80% vs. 50%) and Type B’s had a higher Ki-67 expression (55% vs. 36%).

CONCLUSION

Co-registration of DWI and PET imaging in breast cancer has revealed diverse relationships between diffusion, perfusion, and glucose uptake on an intra-lesion level which can be visualized using a correlated 2D histogram and each lesion broadly typed. Further correlation with clinical data may reveal more connections between 2D histograms and prognostic factors or clinical endpoints.

CLINICAL RELEVANCE/APPLICATION

The spatial correlation of tumor metabolism with microstructural markers via PET and DWI better understanding of lesion heterogeneity and how it relates to disease aggression and prognosis.

BRS292

Utility of MRI for Assessment of BI-RADS Category 4 Findings Made in Screening Mammography and Screening Ultrasound (Station #3)

Kevin Strobel MD, PhD (Presenter): Nothing to Disclose, Nienke Lynn Hansen MD: Nothing to Disclose, Alexandra Barabasch MD: Nothing to Disclose, Simone Schrading MD: Nothing to Disclose, Christiane Katharina Kuhl MD: Nothing to Disclose

PURPOSE

We investigated whether breast MRI can be used for non-invasive assessment of findings categorized as
bi-RADS-4 on screening-mammography or ultrasound.

METHOD AND MATERIALS
IRB-approved prospective study on 340 patients with 353 screening-mammography or screening-US-findings which, after appropriate conventional work-up, had been categorized as bi-RADS-4. Women then underwent standard DCE-MRI for further assessment. Women who, after a negative/benign MRI, did not proceed to biopsy did undergo intensified follow-up for at least 18 months; pure clustered microcalcifications (PCM) were followed for at least 24 months.

RESULTS
Of the 353 study-findings, 66 (18.7%) were finally shown to be true-positive (23 DCIS, 43 invasive), and 287 (81.3%) false-positive. MRI-assessment correctly diagnosed absence of breast-cancer in 264/287 (92%) study-findings without breast-cancer, and confirmed presence of breast-cancer in 63/66 malignancies. False-negative-rate for PCM was 12% (9/75) due to 3 non-enhancing low-grade-DCIS; in turn, MRI detected additional invasive-cancers in 3 women whose bi-RADS-4 study-findings had been false-negative (benign). For mammographic findings other than PCM, MRI increased the PPV from 17.5% (21/120) to 77.8% (21/27), with a false-negative-rate of zero. For all US-findings, MRI increased the PPV from 12.9% (20/155) to 69.0% (20/29), again with a false-negative-rate of zero. MRI caused false-positive findings that required MR-guided-biopsy in 5 participants (5/340, 1.5%).

CONCLUSION
MRI is useful for non-invasive work up of mammographic or ultrasound bi-RADS-4 findings, and can avoid 92% of unnecessary biopsy-procedures. For all ultrasound-findings and for all mammographic-findings except for PCM, the false-negative-rate was zero, and additional invasive cancers were identified in 3 women whose bi-RADS-4 study-findings had been false-positive.

CLINICAL RELEVANCE/APPLICATION
MRI appears to be a reliable method to demonstrate absence, as well as confirm presence of breast cancer in women with possibly malignant findings on screening mammography and/or screening ultrasound, at least for findings not due to pure clustered microcalcifications.

BRS293
Feasibility of Fully-Automated Breast Density Reporting in a Large Academic Center: Prospective Data from a One-Year Screening Cohort (Station #4)

Brad M. Keller PhD (Presenter): Nothing to Disclose, Jinbo Chen PhD: Nothing to Disclose, Nigel Sloan Bristol: Nothing to Disclose, Meng-Kang Heish: Nothing to Disclose, Shonket Ray PhD: Nothing to Disclose, Marie Synnestvedt: Nothing to Disclose, Emily F. Conant MD: Scientific Advisory Board, Hologic, Inc, Despina Kontos PhD: Nothing to Disclose

PURPOSE
Breast density assessment is known to be subject to substantial intra- and inter-reader variability. Given the increased legislation mandating routine reporting of breast density, we evaluate the feasibility of fully-automated breast density assessment in a large screening cohort.

METHOD AND MATERIALS
We report data from 10,751 screening mammography exams from an entire one-year cohort at our institution (2010-11). All digital mammograms were acquired with either a GE Essential (N=1,511) or Hologic Selenia (N=9,240) system. All “For Presentation” images were analyzed using a previously-validated algorithm developed at our institution that provides estimates of dense area, percent density (PD%) and BI-RADS density categories from either “For Processing” or “For Presentation” digital mammograms. Agreement between left and right breast density estimates were assessed via Pearson correlation (r) as a measure of the algorithm’s consistency. Cohen’s weighted-kappa (k) was used to evaluate agreement between the algorithm-estimated and radiologists’ BI-RADS density scores assigned by the interpreting radiologists. Logistic regression was performed to determine if automated density measures are significant predictors in identifying women recalled for additional imaging (N=1,116), after adjusting for age, race and the availability of prior mammograms.

RESULTS
Both the absolute area and PD% automated measures demonstrate high reproductibility with a strong bilateral per-woman correlation (r=0.93, p<0.001). Substantial agreement (k=0.63; p<0.001; CI: 0.61-0.65) is observed between the algorithm-estimated and radiologists’ BI-RADS density scores, which is in range of previously reported inter-radiologist agreement in the literature. The automated BI-RADS density estimate is also a significant predictor of recall (OR: 1.17 per increasing density category; test-for-trend p=0.002), as were age (p<0.001) and the availability of prior mammograms.

CONCLUSION
Fully-automated analysis of “For Presentation” digital mammograms can be used to obtain reproducible measures of both continuous and categorical breast density estimates. This could be of particular use when “For Processing” images are not routinely available for analysis.

CLINICAL RELEVANCE/APPLICATION
Accurate and reproducible breast density estimation using fully-automated software may be feasible for large-volume breast screening centers for the purpose of standardized density reporting.

BRS294
Getting Worked Up Over Nothing: Strategies to Further Reduce False Positives from Tomosynthesis Screening Mammography (Station #5)

Liane Elizabeth Philpotts MD (Presenter): Nothing to Disclose, Sarah Lyla Steenbergen MD: Nothing to Disclose, Jaime Lynn Geisel MD: Consultant, Siemens AG, Liva Andrejeva-Wright MD: Nothing to Disclose, Madhavi Raghu MD: Nothing to Disclose, Melissa Angeline Durand MD: Nothing to Disclose, Paul H. Levesque MD: Nothing to Disclose

PURPOSE
Tomosynthesis is a more accurate mammogram resulting in fewer false positives. The purpose of this study was to review recalls from screening tomosynthesis exams to determine which findings represent true lesions and which remain false positives to further refine what constitutes a necessary tomosynthesis recall.
That Was Then This Is Now: A Pictorial Review Of Changes In BI-RADS 5th Ed (Station #7)

BRE180
Diagnostic Algorithm of Nipple Discharge: All a Radiologist Should Know (Station #6)

Flavia Beatriz Sarquis MD (Presenter): Nothing to Disclose, Karina Pesce: Nothing to Disclose, Bernardo Oscar Blejman MD: Nothing to Disclose, Maria Jose Chico: Nothing to Disclose, Vanina Kuznicki: Nothing to Disclose, Graciela Fernandez Alonso: Nothing to Disclose

TEACHING POINTS
1 - To list the different causes of breast discharge 2- To describe the differential diagnosis of abnormal nipple discharge 3-To review the radiological features of nipple discharge and establish the radiopathological correlation 4 - To learn the systematization of the ultrasound technique to assess secretion Nipple 5 - To discuss the diagnostic algorithm in patients with nipple discharge.

TABLE OF CONTENTS/OUTLINE
1 - Introduction. 2 - Anatomy of the mammary gland and ducts. 3 - Pathophysiology The pathophysiology of spills there are two steps: 1) the production of abnormal fluid (abnormal due to their characteristics, conditions or time of occurrence ); 2) the liquid outlet to the outside. 4 - Etiology: 1 ) Physiological 2) Pathologic 5 - Diagnostic algorithm of nipple discharge. 6 - Mammographic findings in nipple discharge 7 - Ultrasound technique to evaluate nipple discharge 8 - Ultrasound appearance of the different causes of nipple discharge. 9 - Limitations of ultrasound: a) False positives b) False Negatives 10 - Clinical and cytological classification 11 - Clinical Cases 12 - Conclusions

BRE167
That Was Then This Is Now: A Pictorial Review Of Changes In BI-RADS 5th Ed (Station #7)

Ajay A. Rao MD: Nothing to Disclose, Jade De Guzman MD: Nothing to Disclose, Aritra Dey BS: Nothing to Disclose, Youn Jeong Kim MD: Nothing to Disclose, Haydee Ojeda-Fournier MD (Presenter): Nothing to Disclose

TEACHING POINTS
Standardized terminology, report organization and assessment structure allows radiologists to communicate breast imaging findings with referring physicians in a clear and succinct manner. The much awaited American College of Radiology BI-RADS Atlas 5th edition was released in February 2014. Since the 4th edition was released more than 10 years ago, it may be difficult to remember all the specific changes in the 5th edition. While the majority of changes represent re-organization and consolidation of terms, there are also new descriptors in the lexicon. At the end of this educational exhibit the learner will: 1. Understand the changes to BI-RADS 5th edition. 2. Review those changes with imaging correlation on mammography, US and MRI. 3. Have an opportunity for self assessment with an interactive case review.

TABLE OF CONTENTS/OUTLINE
EVALUATION OF A NOVEL ADAPTIVE DETECTOR COLLIMATION FOR PROSPECTIVELY ECG-TRIGGERED SEQUENTIAL CARDIAC CT WITH A 192-SLICE THIRD-GENERATION DUAL-SOURCE CT (STATION #1)

Ralf W. Bauer MD (Presenter): Research Consultant, Siemens AG Speakers Bureau, Siemens AG, Julian Lukas Wichmann MD: Nothing to Disclose, Thomas Allmendinger: Employee, Siemens AG, Thomas Josef Vogl MD, PhD: Nothing to Disclose, Josef Matthias Kerl MD: Research Consultant, Siemens AG Speakers Bureau, Siemens AG

PURPOSE

To investigate the impact of a novel adaptive detector collimation on dose parameters and accurateness of scan length adaption at prospectively ECG-triggered sequential cardiac CT with a new wide-detector third-generation dual-source CT.

METHOD AND MATERIALS

Ideal scan lengths for human hearts were retrospectively derived from 103 triple rule out examinations. These measures were entered into the new scanner operated in prospectively ECG-triggered sequential cardiac scan mode with three different detector settings: a) adaptive detector collimation b) fixed 64 x 0.6 mm collimation c) fixed 96 x 0.6 mm collimation. Differences in effective scan length and its deviation from the ideal scan length and dose parameters (CTDIvol, DLP) for 120, 100, 90 and 70 kV were documented.

RESULTS

The ideal cardiac scan length could be matched by the adaptive detector collimation in every case while the mean scanned length was +15.4% with the 64 x 0.6 mm and +27.2% with the fixed 96 x 0.6 mm collimation longer. While the DLP was almost identical between the adaptive and the 64 x 0.6 mm collimation (83 vs. 89 mGycm at 120 kV), it was +62.7% and therefore significantly higher with the 96 x 0.6 mm collimation (135 mGycm).

CONCLUSION

The adaptive detector collimation for sequential acquisition allows adjusting the scan length as accurate as this can only be achieved with a spiral acquisition. This technique is further indispensable with a 57.6 mm wide detector in order to keep patient exposure low where otherwise patient dose would significantly increase with the traditional step-and-shoot mode.

CLINICAL RELEVANCE/APPLICATION

A novel adaptive detector collimation ensures accurate z-axis coverage and is crucial to keep exposure parameters at the lowest level with third-generation cardiac step-and-shoot dual-source CT.

VALUE OF MULTI-DETECTOR COMPUTED TOMOGRAPHY ANGIOGRAPHY IN STUDY OF CORONARY ARTERY ELASTICITY (STATION #2)

Kaiyuan Xu (Presenter): Nothing to Disclose, Lei Gong MD: Nothing to Disclose, Xing Chen: Employee, Toshiba Corporation, Xuelin Zhang PhD: Nothing to Disclose

PURPOSE

To explore the value of multi-detector computed tomography angiography in evaluation of coronary artery elasticity by measuring and calculating coronary artery elastic parameters.

METHOD AND MATERIALS

Multi-detector computed tomography angiography was performed in 86 patient s from September 2012 to October 2013. Diameter changes of 344 segment of coronary artery in the systolic and diastolic phases were measured by CT coronary angiography. Correlations between coronary artery elastic parameters and pulse pressure and mean arterial pressure were analyzed, and correlations between coronary artery compliance and systolic blood pressure were analyzed, including the left main artery, left anterior descending artery, left circumflex artery and right coronary artery.

RESULTS

Coronary artery compliances in the various branches were different and P=0.001 (P<0.05) in the Friedman Test. Coronary artery compliances and pulse pressure and mean arterial pressure were negatively correlated. Coronary artery compliances and systolic blood pressure were negatively correlated (P<0.05). The remaining coronary artery elastic parameters and pulse pressure and mean arterial blood pressure were less relevant.

CONCLUSION

Multi-detector computed tomography angiography can be used as an effective means of measuring coronary lumen. Coronary artery compliance can reflect the elasticity of normal coronary vessel walls.

CLINICAL RELEVANCE/APPLICATION

Multi-detector computed tomography angiography can be used as an effective means of measuring elasticity of normal coronary vessel walls.

VISUAL AND QUANTITATIVE EVALUATION OF LUMEN STENOSIS AND DIAMETER WITH KNOWN DIMENSIONS USING CORONARY COMPUTED TOMOGRAPHY ANGIOGRAPHY BY 320-ROW DETECTOR CT: EFFECT OF ITERATIVE RECONSTRUCTION ASSESSED BY PULSATING CARDIAC PHANTOM (STATION #3)

Kazuhito Nozu MD (Presenter): Nothing to Disclose, Yasuyuki Kobayashi MD, PhD: Nothing to Disclose, Sou Oode MD: Nothing to Disclose, Yasuyoshi Ogawa RT: Nothing to Disclose, Kiyoko Tateishi: Nothing to Disclose, Yukihisa Ogawa: Nothing to Disclose, Yasuo Nakajima MD: Nothing to Disclose, Kazuhito Nozu MD (Presenter): Nothing to Disclose, Yasuyuki Kobayashi MD, PhD: Nothing to Disclose, Sou Oode MD: Nothing to Disclose, Yasuyoshi Ogawa RT: Nothing to Disclose, Kiyoko Tateishi: Nothing to Disclose, Yukihisa Ogawa: Nothing to Disclose, Yasuo Nakajima MD: Nothing to Disclose.
Coronary computed tomography angiography (CTA) is useful for detecting coronary disease and is clinically performed worldwide. However, the radiation dose is crucial. The application of an iterative reconstruction (IR) algorithm can help decrease the noise, result in radiation dose reduction. However, IR has been reported to have a noise-free appearance with an unusually homogeneous attenuation. This study aimed to investigate the effect of IR on visual and quantitative evaluation of lumen stenosis and diameter with known dimensions using coronary CTA by 320-slice area detector CT.

**METHOD AND MATERIALS**

We used the pulsating heart phantom (HR 40 bpm) with acrylic coronary vessel phantoms (FUYO, Tokyo, Japan) and 320 slice CT (Toshiba, Nasu, Japan). Acrylic coronary vessel phantoms with precisely drilled stenosis of mild (25%), moderate (50%), and severe (75%) grades were studied using 320-slice MDCT. Image acquisition was optimized, and images were reconstructed by using filtered back projection (FBP) and AIDR 3D (weak/mild/standard/strong). Stenosis was evaluated visually by blinded expert readers using a four-grade image quality score (IQS), and lumen diameter was quantitatively assessed by using automated lumen contour detection software (Ziosoft, Tokyo, Japan).

**RESULTS**

IQS was significantly increased in AIDR 3D compared with FBP. AIDR 3D algorithms improved the image quality to a diagnosable level when the SD was less than 45 HU in FBP. With quantitative assessment, the error between the real and measured diameter using automated software in AIDR 3D was significantly smaller than that in FBP (AIDR 3D mild; p = 0.028, standard; p = 0.004, strong; p < 0.001). The association between the error and strengthen of AIDR 3D was significant (p < 0.001).

**CONCLUSION**

AIDR 3D algorithms can reduce a noise, and improve image quality and quantitative accuracy, compared with FBP.

**CLINICAL RELEVANCE/APPLICATION**

AIDR 3D algorithms can reduce a noise, and improve image quality and quantitative accuracy, compared with FBP, results in radiation dose reduction.

**Low Contrast- and Low Radiation Dose Protocol in Cardiac CT: Usefulness of Low Tube Voltage and Knowledge-based Iterative Model Reconstruction Algorithm (Station #4)**

**PURPOSE**

Low kilo-voltage (kVp) CT is well suited for low contrast and low radiation dose cardiac CT; however, increased image noise is a problem. The recent introduced knowledge-based iterative model reconstruction (IMR) dramatically reduces the image noise. We evaluated the feasibility of a low contrast-, low radiation dose protocol for cardiac CT using 80 kVp and IMR.

**METHOD AND MATERIALS**

This prospective study received institutional review board approval; prior informed consent to participate was obtained from all patients. Thirty patients underwent a low contrast-, low radiation dose protocol with 80 kVp, 923 mA and prospective ECG gating. A 40% reduced contrast dose (222 mgI/kg) was delivered during 12 sec. We also enrolled 30 patients who underwent our conventional protocol with 120 kVp, 992 mA and prospective ECG gating. The 80-kVp images were reconstructed with FBP, hybrid iterative reconstruction (HIR) and IMR. We evaluated CT number, image noise and contrast to noise ratio (CNR) of ascending aorta between 120 kVp images and 80 kVp images reconstructed with FBP, HIR and IMR with the Dunnett test. We also compared noise reduction rate of HIR and IMR as compared with FBP reconstruction with the two tailed t-test. Two independent readers assessed image contrast, image noise, image sharpness, unfamiliar texture and overall image quality on a 4-point scale.

**RESULTS**

The estimated ED was 75% lower with the 80- than the 120 kVp protocol (1.3 mSv vs 5.3 mSv). The CT number of 80 kVp images was significantly higher than that of 120 kVp images (517.1 HU ± 64.8 vs 431.4 HU ± 51.6, p < 0.01). The noise reduction rate was significantly higher with IMR (76.2% ± 4.6) than with HIR (50.0% ± 1.5) (FBP: 119.0 HU ± 39.9; HIR: 59.4 HU ± 19.6; IMR: 27.4 HU ± 7.3) (p < 0.001). The CNR of 80 kVp images with IMR was significantly higher than that of 120 kVp images (19.8 ± 3.9 vs 13.3 ± 2.5, p < 0.01). There was no significant difference in the score of unfamiliar texture than with HIR (50.0% ± 1.5) (FBP: 119.0 HU ± 39.9; HIR: 59.4 HU ± 19.6; IMR: 27.4 HU ± 7.3) (p < 0.001). The noise reduction rate was significantly higher with IMR (76.2% ± 4.6) than with HIR (50.0% ± 1.5) (FBP: 119.0 HU ± 39.9; HIR: 59.4 HU ± 19.6; IMR: 27.4 HU ± 7.3) (p < 0.001). The association between the error and strengthen of AIDR 3D was significant (p < 0.001).

**CONCLUSION**

The 80 kVp scans with the IMR yields higher image quality for cardiac CT with 75% decreased radiation dose and 40% decreased contrast dose as compared with the 120 kVp protocol with FBP reconstruction.

**CLINICAL RELEVANCE/APPLICATION**

The low tube voltage scan with IMR is well suited for a low contrast-, low radiation dose protocol for cardiac CT.
The Spectrum of Tetralogy of Fallot with Advanced Cardiovascular Imaging, CT and MRI, before Intervention, with Palliation and after Definitive Repair (Station #7)

**PURPOSE**

The aims of the study was to assess the potential role of extracellular volume fraction (ECV) and noncontrast T1 mapping for detection of cardiac involvement in patients with primary amyloid light-chain (AL) amyloidosis.

**METHOD AND MATERIALS**

This study included 26 AL amyloidosis patients (56 ± 9 years, 14 males) with cardiac involvement based on histologic analysis, who underwent 1.5-T CMR including precontrast and postcontrast T1 mapping (shortened modified look-locker inversion recovery [ShMOLLI] sequence) and late gadolinium enhancement (LGE) imaging from October 2011 to November 2013. ECV and pre T1 values were analyzed with all parameters of LV function measured in CMR and two-dimensional transthoracic echocardiography. Additionally, ECV and pre T1 values were further studied by categorizing the patients by well-known prognostic parameters including NT-pro BNP (threshold = 1800pg/mL) and serum free light chain difference (threshold = 18mg/dl): group I, no elevation of two parameters; group II, elevation of one of those two parameters; and group III, elevation of both parameters.

**RESULTS**

As ECV increased, LV ejection fraction decreased (CMR, \(r = -0.625, P < 0.001\); echocardiogram, \(r = -0.543, P = 0.004\)) and normalized LV mass index increased (CMR, \(r = 0.494, P = 0.010\)). In addition, ECV was negatively correlated with diastolic dysfunction parameters such as e’ (\(r = -0.474, P = 0.014\)), and deceleration time (\(r = -0.625, P < 0.001\)). However, pre T1 mapping was only correlated with normalized LV mass index (\(r = 0.446, P = 0.022\)). In comparison of categorized patient’s groups, pre T1 mapping appeared higher in the group with worse prognostic parameters [1023.2 ms (1059.4-1132.6), 1141.9 ms (1109.4-1166.7), and 1169.2 ms (1133.1-1201.1) in group I, II, and III, \(P=0.047\)]. Meanwhile, ECV appeared more prominently higher in the group with worse prognostic parameters [0.44 (0.40-0.50), 0.56 (0.52-0.58), and 0.59 (0.56-0.67), \(P=0.004\)].

**CONCLUSION**

ECV correlates well with the prognostic markers of AL amyloidosis as well as with left ventricular systolic and diastolic function. Further studies are needed to assess the prognostic significance of ECV elevation.

**CLINICAL RELEVANCE/APPLICATION**

ECV is potentially more sensitive for detecting early disease than LGE imaging and elevated ECV may represent a direct marker of cardiac amyloid load.

**CAS236**

**Improve the Image Quality of Prospective ECG-gated Coronary Computed Tomography Angiography with Snapshot Freeze Technique (Station #6)**

Gulina Ażhati (Presenter): Nothing to Disclose, Wenyu Liu : Nothing to Disclose, Haiting Ma : Nothing to Disclose, Jun Dang : Nothing to Disclose, Yan Xing PhD, MD : Nothing to Disclose, Cunxue Pan PhD : Nothing to Disclose, Jingjing Li : Nothing to Disclose, Yanwei Wang MD : Nothing to Disclose

**PURPOSE**

To access the value of snapshot freeze (SSF) technique in prospective ECG-gated coronary computed tomography angiography (CCTA).

**METHOD AND MATERIALS**

20 patients with suspected coronary heart disease underwent prospectively ECG gated CCTA. All of the CCTA images were reconstructed by both standard (STD) and SSF motion correction. 75%R-R interval were chose as the central phase for the reconstruction. With a standard 16-segment model in accordance with the SCCT Guidelines, two experienced radiologists evaluated image quality with Likert 4-point score. The image quality and interpretability were assessed on per-segment, per-artery and per-patient level. Comparisons of variables were performed between STD and SSF reconstructions with paired Wilcoxon rank sum test and paired Chi-square test.

**RESULTS**

For 20 patients(mean age 55.7±10.2 years; male 14, female 6), the mean heart rate was 60.0±7.1 beats/min. SSF reconstructions showed higher interpretability than STD reconstructions on per-segment level (96.1% [272/285] vs 90.8% [257/285], \(P=0.011\)), but there were no significant difference on per-patient level (95% [19/20] vs 80% [16/20], \(P=0.210\)) and per-artery level (96.3% [77/80] vs 90% [72/80], \(P=0.211\)). Image qualities were higher with the use of SSF than STD reconstructions on per-patient level (3.3±0.4 vs 3.0±0.6, \(P=0.001\)) and LAD (3.3±0.4 vs 3.0±0.6, \(P=0.001\)) LCX (3.4±0.4 vs 3.1±0.7, \(P=0.001\)), RCA (3.0±0.8 vs 2.6±0.8, \(P=0.003\)), but similar on LM (4.0±0.0 vs 3.8±0.7, \(P=0.180\)). Image quality was higher on segment 1,2,3,4,7,8,9,11,13 and 15 with the use of SSF versus STD reconstructions on per-segment level.

**CONCLUSION**

SSF could improve the image quality and interpretability in patients undergoing CCTA with prospective ECG-gating.

**CLINICAL RELEVANCE/APPLICATION**

SSF could improve the image quality of CCTA. Because of the reduction of motion artifacts, it could not only increase the rate of diagnosis but also reduce the influence of heart rate.

**CAE123**

The Spectrum of Tetralogy of Fallot with Advanced Cardiovascular Imaging, CT and MRI, before Intervention, with Palliation and after Definitive Repair (Station #7)

Bryan E Ashley MD (Presenter): Nothing to Disclose, Anthony Marcus Hlavacek MD : Investigator,
TEACHING POINTS

1. TOF encompasses a wide spectrum of abnormalities beyond the classic findings of RVH, PS, VSD and Overriding Aorta, including subvalvar RVOT stenosis, branch pulmonary artery stenoses and aneurysms, aortopulmonary collaterals and airway complications. 2. The postoperative appearance is variable depending on disease severity and surgical technique. 3. What quantitative parameters and imaging findings need to be reported by radiologists.

TABLE OF CONTENTS/OUTLINE

RESULTS

Pathological results and follow-up information confirmed that 50 cases were pulmonary adenocarcinoma while 13 cases were tuberculosis. Slope of spectral curve of pulmonary adenocarcinoma was significantly higher than that of tuberculosis (1.43±0.35 vs 1.03±0.29, t=-3.745, p<0.05). Iodine concentration and effective Z value of pulmonary adenocarcinoma were also significantly higher than that of tuberculosis (18.54±4.54 vs 13.35±3.84, t=-5.286, p<0.05) and (6.70±0.24 vs 8.41±0.22, t=-3.783, p<0.05). Water concentration of pulmonary adenocarcinoma and tuberculosis were1022.57±8.83mg/ml and 1017.23±13.78 mg/ml respectively, there was no significant difference between them.

CONCLUSION

Spectral imaging is demonstrated as an efficient approach to differentiate between pulmonary adenocarcinoma from tuberculosis, suggesting its potential applications in further application in complex lung nodule diagnosis.

CLINICAL RELEVANCE/APPLICATION

The spectral CT characteristic measurements is promising for differentiating benign and malignant findings.

CHS283

CT Scoring Systems in Sarcoidosis: Comparison with Cardiopulmonary Exercise Testing Parameters (Station #4)

Yeon Joo Jeong MD (Presenter): Nothing to Disclose, David Augustine Lynch MBCh: Research support, Siemens AG Scientific Advisor, PAREXEL International Corporation Consultant, Boehringer Ingelheim GmbH Consultant, InterMune, Inc Consultant, F. Hoffmann-La Roche Ltd Consultant, Veracyte, Inc Research support, Johnson & Johnson Research support, AstraZeneca PLC, Seungbaek Hong MD: Nothing to Disclose, Ji Young Rho: Nothing to Disclose, Ji Won Lee MD : Nothing to Disclose

PURPOSE

To correlate CT scoring systems for pulmonary sarcoidosis with cardiopulmonary exercise testing and to evaluate which scoring system provides the most reliable information to assess disease severity and predict impairment of gas exchange during exercise.

METHOD AND MATERIALS

Institutional review board approved this retrospective study and the requirement for patient informed consent was waived. All 62 patients (31 male and 31 female; mean age, 50.8 years) with sarcoidosis underwent CT, pulmonary function tests, and cardiopulmonary exercise test. Two independent observers scored CT patterns and extent according to scoring systems published by Remy-Jardin et al, Oberstein et al, and Leung et al. Weighted kappa and intraclass correlation coefficient were used to assess the reliability of CT scoring systems. Spearman's rank correlation coefficients were calculated between CT scoring systems with cardiopulmonary exercise testing parameters.

RESULTS

Interobserver agreement for CT scoring was excellent or good for the Remy-Jardin scoring system whereas fair or good for the Oberstein and the Leung scoring systems. All CT abnormalities scored with the Remy-Jardin scoring system showed moderate to fair correlation with DLCO% (Spearman's rho = -0.270~0.426), SaO2 max (Spearman's rho = -0.328~0.551), and Vd/Vt max (Spearman's rho = 0.279~0.495). Regardless of scoring system, PaO2 max was significantly associated with the subscores of ground glass opacity, linear opacity and total CT scores. Multiple regression analyses showed that subscores of ground glass and linear opacity in the Leung scoring system and subscores of consolidation and septal and nonseptal lines and total CT scores of the Oberstein scoring system appeared to explain a significant amount of variance in functional parameters at rest and at maximal exercise.

CONCLUSION

CT findings, particularly ground glass linear opacities can explain a significant amount of variance in cardiopulmonary exercise testing parameters. This suggests that CT-based scoring systems are valid measures of disease severity in sarcoidosis.

CLINICAL RELEVANCE/APPLICATION

Although current CT scoring systems are quite complicated and subjective, CT-based scoring systems are valid measures of disease severity in sarcoidosis.

CHS284

The Use of Contrast-enhanced Post Mortem CT in the Detection of Cardiovascular Deaths (Station #5)

Jonas Christoph Apitzsch MD (Presenter): Nothing to Disclose, Saskia Westphal : Nothing to Disclose, Tobias Penzkofer MD : Nothing to Disclose, Christiane Katharina Kuhl MD : Nothing to Disclose, Ruth Knuchel-Clarke PhD : Nothing to Disclose, Andreas Horst Mahnken MD : Nothing to Disclose

PURPOSE

To evaluate the diagnostic value of contrast enhanced post mortem computed tomography in comparison to non-enhanced post mortem CT in the detection of cardiovascular causes of death.

METHOD AND MATERIALS
In a prospective study, 20 corpses were examined using a 64-row multislice CT before and after intraarterial perfusion with a newly developed, barium-bearing contrast agent and ventilation of the lungs. The cause of death was determined in enhanced and unenhanced scans and a level of confidence was given by three experienced radiologists on a scale between 0 and 4. Results were compared to autopsy results as gold standard. Autopsy was performed blinded to PMCT-findings.

RESULTS

The method allowed visualization of different types of cause of death. There was a significant improvement in Level Of Confidence in enhanced scans compared to unenhanced scans as well as an improvement in the detection of cause of death. The cause of death could be determined in 19 out of 20 patients.

CONCLUSION

PMCT is feasible and appears to be robust for diagnosing cardiovascular causes of death. When compared with unenhanced post-mortem CT intraarterial perfusion and pulmonary ventilation significantly improve visualization and diagnostic accuracy.

CLINICAL RELEVANCE/APPLICATION

PMCT is on its way to close the gap between virtual and conventional autopsy. Until now, both methods should be seen as complementary, each one adding valuable information to the other.

Oxygen-enhanced Pulmonary MRI in Patients with Chronic Thromboembolic Pulmonary Hypertension (CTEPH) Pre and Post Pulmonary Endarterectomy (PEA) Compared to Healthy Controls (Station #8)

Julius Renne MD (Presenter): Nothing to Disclose, Reemt Nieland: Nothing to Disclose, Jan Hinrichs MD: Nothing to Disclose, Christian Olaf Schoenfeld MD: Nothing to Disclose, Marcel Gutberlet DiplPhys: Nothing to Disclose, Andreas Voskrebzenz: Nothing to Disclose, Marius Hooper: Nothing to Disclose, Tobias Welte MD: Nothing to Disclose, Serghei Cebotari MD: Nothing to Disclose, Peter Michael Jakob PhD: Nothing to Disclose, Frank K. Wacker MD: Research Grant, Siemens AG Research Grant, Pro Medicus Limited, Jens Vogel-Clausen MD: Nothing to Disclose

PURPOSE

This study aims to explore pulmonary oxygen-enhanced MRI in patients with CTEPH to detect changes in regional blood oxygenation after PEA compared to healthy controls.

METHOD AND MATERIALS

After approval of the institutional review board 16 patients with CTEPH and 12 healthy controls were included. MRI was performed at 1.5T using an inversion recovery snapshot fast low-angle shot (FLASH) sequence for T1 mapping at room air and 100% oxygen. CTEPH patients underwent MRI pre and 7-24 days post PEA. Controls received two MRI 7 days apart. A minimum of six coronal slices (15mm slice thickness, 5mm gap) were acquired. Mean T1 value, coefficient of variation under room air and 100% oxygen, and a previously established marker for ventilation, oxygen diffusivity and blood oxygenation - the oxygen transfer function (OTF) - were calculated for the lungs.

OTF=((1/T1_{100%O2})-(1/T1_{21%O2}))/((C_{100%O2}*-C_{21%O2})) Mean±SD, t-test.

RESULTS

All healthy controls (29y ±7y) and 14 of the 16 CTEPH patients (53y ±15y) completed MRI scans. Mean T1 values under room air and 100% O2 were significantly lower in CTEPH patients compared to controls (room air: 1250±51ms vs. 1097±63ms, p=0.0001; O2: 1093±38ms vs. 974±53ms, p=0.0001). The coeff. of variation was significantly higher in patients with CTEPH (room air: 4.9±0.9 vs. 12.2±3.2, p=0.0001; O2: 5.8±3 vs 12.6±3.8, p=0.0001). OTF did not significantly change between patients and controls (p=0.55), and did not change at the 2nd MRI for controls (p=0.47) nor after PEA (p=0.14) in the CTEPH group, despite a significant decrease in mPAP after PEA (mean difference -18.7±15mmHg (-44%), p=0.008) and improvement of parenchymal perfusion (mean difference +18.5±17ml/min/100ml (+51%), p=0.0025).

CONCLUSION

Oxygen-enhanced MRI shows significantly decreased and more heterogeneous T1-values of the lungs in patients with CTEPH compared to normal controls, which reflects the mosaic perfusion pattern in CTEPH. However, OTF was not significantly different between patients and controls indicating that OTF reflects predominantly regional ventilation and oxygen diffusion into the alveolar interstitium rather than improvement in regional blood oxygenation after PEA.

CLINICAL RELEVANCE/APPLICATION

The current study shows that T1 mapping MRI-derived OTF predominantly reflects changes of oxygen within the lung parenchyma and is not applicable for monitoring regional blood oxygenation changes in patients with CTEPH after PEA.
ERS237

**Sub-Events**

**Total Spine MRI in Trauma: Who Should Get It? (Station #1)**

Matthew Ditzler MD (Presenter): Nothing to Disclose, Thaddeus Sze MD: Nothing to Disclose, Eric Michael Walser MD: Nothing to Disclose

**PURPOSE**

Evaluate the value of MRI following CT evaluation of traumatic spinal injury at a Level 1 trauma center.

**METHOD AND MATERIALS**

We evaluated the records of 190 adult ER trauma patients who received a spinal MRI examination within 2 weeks of a spinal CT from 2010-2013. We reviewed the radiographic reports and findings for this cohort of patient on CT and MRI, the extent of cross-modality agreement, the post-imaging management, and length of hospital stay (LOS). The patients were analyzed regarding the concordance of CT and subsequent MRI findings; when the MRI results were discordant we investigated whether or not these findings altered subsequent care.

**RESULTS**

Of the 190 patients included within the study, 102 (54%) underwent a CT examination with any positive finding. 76 of these patients received a discordant MRI examination: 26 patients had a discordant MRI examination demonstrating either an acute compression fracture or a non-compression fracture/ligamentous injury; 68 patients (46%) initially received a negative CT examination. 77 of these patients had a discordant MRI examination; 11 patients underwent a discordant MRI examination. These 11 examinations showed either chronic disc disease or spinal stenosis; none demonstrated an acute traumatic injury or changed patient management. 5 patients (2%) required surgical intervention and all had positive findings on the CT scan. The LOS for patients with discordant MRI examinations ranged from 0 to 38 days with a mean and median of 5 and 2 days respectively.

**CONCLUSION**

MRI examination of the spine in the setting of trauma has a role in clarifying the acuity and extent of CT findings but is not necessary in cases where the initial CT exam is negative for traumatic injury. Further, the CT findings alone were diagnostic in those few patients requiring surgical intervention (2% of our study group).

**CLINICAL RELEVANCE/APPLICATION**

For trauma patients, the routine acquisition of an MRI after a normal spine CT is unnecessary. MRI can clarify positive findings on CT but may not alter subsequent patient management in regards to surgical intervention.

ERS238

**'A touch of colour': DE Bone Marrow v Virtual Non-Calcium Application for the Assessment of Bone Marrow Oedema in Acute Hand Fractures (Station #2)**

Brathaban Rajayogeswaran MBCh (Presenter): Nothing to Disclose, Neal C. Chhaya MBBS, FRCR: Nothing to Disclose, Patrick McLaughlin FFRRCSI: Nothing to Disclose, Savvas Nicolaou MD: Nothing to Disclose, Hugue A. Quellette MD: Nothing to Disclose

**PURPOSE**

The phalanges and metacarpals are the most common fractures of the skeletal system accounting for 10% of all bony injuries. Despite the use of computed tomography, fractures can sometimes be hard to identify particularly in the presence of osteopenia. Evaluation of bone marrow oedema following hand trauma can increase confidence in fracture identification as it is felt to reflect oedema/haemorrhage. The purpose of this study was to assess bone marrow oedema associated with proven hand fractures on Dual-energy CT using the new colour Siemens DE Bone marrow application against the current virtual non-calcium marrow oedema application.

**METHOD AND MATERIALS**

40 consecutive patients underwent dual-energy wrist computed tomography (DECT) studies in the emergency department in 2013. Retrospective evaluation for bone marrow oedema was performed on the Siemens virtual non calcium (VNC) and new DE bone marrow (DE BM) applications by two experienced MSK radiologists. Their confidence on identifying oedema at the known fracture site was documented.

**RESULTS**

57 fractures were identified with the majority of fractures present within the carpus: 12 scaphoid, 15 trapezial, 2 capitae, 2 hamate, 2 trapeziun. There were 6 distal radial and 2 ulnar styloid fractures, with the remaining fractures identified at the base of the metacarpals. Reader 1 using VNC had a Sensitivity 79% (CI 0.66 - 0.89, PPV 97% CI 0.88 - 0.99), Reader 2 VNC - Sensitivity 62% (CI 0.48 - 0.75, PPV 97% CI 0.85 - 0.99), Reader 1 using DE BM Sensitivity 58% (CI 0.44 - 0.71, PPV 97% CI 0.85 - 0.99), Reader 2 DE BM - Sensitivity 62% (CI 0.48 - 0.75, PPV 97% CI 0.85 - 0.99). The kappa inter-rater reliability between the readers using VNC - 0.277 p=0.021 and DE BM 0.496 p

**CONCLUSION**

The present of bone marrow oedema can increase the confidence of identifying hand fractures in the acute trauma setting. The DE Bone Marrow application with colour overlay is a valuable imaging tool when MRI is not available.

**CLINICAL RELEVANCE/APPLICATION**

The presence of bone marrow oedema identified on Dual energy CT can increase the confidence in identifying acute hand fractures in the Emergency Department.

ERS239

**The Ribs Unfolded—A CT Visualization Algorithm for Fast Detection of Rib Fractures: Effect on Sensitivity and Specificity in Trauma Patients (Station #3)**


**PURPOSE**

...
PAPER

To assess the radiologist's detection rate of rib fractures in trauma CT when reading curved planar reformats (CPR) of the ribs compared to reading standard MPRs.

METHOD AND MATERIALS

Written, informed consent was waived for this institutional review board-approved study. There were 220 consecutive trauma CTs (146 male and 74 female patients; mean age ± standard deviation, 42.6 years±21.4; range, 0-94 years) retrospectively subjected to a software algorithm (Syngo.Via CT Bone Reading, Siemens AG) for automatic generation of CPRs of the ribs. Patients were split into two equal groups. After primary analysis, 16 patients were excluded due to insufficient segmentation, leaving 107 patients in group A and 97 patients in group B. Two radiologists independently evaluated group A using CPRs and group B using standard MPRs. The other two radiologists reviewed both groups with the inverse methods setting. The detection rate results for each reader were compared with a standard of reference that was created by two senior radiologists using all available MPRs and CPRs and the findings of all readers. General estimation equations were used for statistical analysis.

RESULTS

The reference standard identified 361 rib fractures in 61 patients. Reading CPRs showed a significantly higher mean sensitivity (P<.001) for fracture detection than reading standard MPRs, with 80.9% (584/722) and 71.5% (516/722), respectively. Mean reading time was significantly shorter for CPRs, with 31.3 seconds, compared to standard MPRs, with 60.7 seconds (P<.001).

CONCLUSION

Using CPRs for the detection of rib fractures allows for accelerating the reading process in chest CTs of trauma patients, while offering an increased mean sensitivity compared to reading conventional standard MPRs.

CLINICAL RELEVANCE/APPLICATION

1. Curved planar reformats (CPRs) can help radiologists to significantly decrease the reading time needed for analysis of the ribs in chest CT. This might accelerate the report and leave more time to assess other organs in polytrauma CT. 2. The accurate detection of rib fractures is clinically relevant to allow for sufficient treatment and for a focused search for associated complications.

ERS240

Major Incidental Findings on Trauma CT: Rate and Impact of Patient Age (Station #4)


PURPOSE

The proportion of the US population that is 65 years and older is growing rapidly. In 2012, 25% of injuries in the National Trauma Databank occurred in patients aged 65+ years, and by 2030 20% of the US population will be >65 years old. Imaging "incidentalomas" have been shown to be common and important CT findings. The purpose of this study was to evaluate the relationship between patient age and the incidence of major incidental findings on trauma CT scans.

METHOD AND MATERIALS

Retrospective, IRB approved and HIPAA compliant single-center study of all adult (18yrs+) patients who presented to an urban level 1 trauma center and underwent single phase CT of the chest-abdomen-and pelvis from Jan 1, 2013 to Dec 31, 2013 to evaluate for trauma. The definition of a major incidental finding (MIF) requiring communication was reached by consensus of two radiologists and three clinicians. All radiology reports were reviewed for major and minor incidental findings. Statistical analysis included a Mann-Whitney U and Fisher-exact tests to compare the patient ages in the major incidental and non-incidental groups.

RESULTS

In the 533 CT scans reviewed, 148 major incidental findings were identified in 132 patients (25%). The average age of patients without MIFs was 43 (sd=17.8) years, compared to 56 (sd=18.4) years in patients with incidental findings (P<0.0001). There was a steady increase in the major incidental rate each decade, peaking at age 80-90 years (r2 = 0.86). 42/95 (44.2%) of patients 65+ years had MIFs compared to 90/438 (20.6%) patients < 65 years (p<0.0001). MIFs were located in the chest: 80(54%), abdomen: 51(34.5%), pelvis: 14 (9.5%), and other: 1(0.7%). Pulmonary nodules were the most common incidental finding, being present in 38/533 (7.1%) of patients (average 57yrs; sd=14.4 yrs), and representing 25% of incidental findings.

CONCLUSION

There is a strong correlation between patient age and the presence of major incidental findings on trauma torso CT.

CLINICAL RELEVANCE/APPLICATION

Due to the progressively rising average population age, our findings of a higher rate of major incidental findings on CT in the elderly suggests the rate of incidental findings is likely to increase in coming years. Systems should to be developed to ensure adequate communication and follow-up of these findings.

ERE184

Splenic Trauma, Emergencies, and Incidentalomas (Station #5)

Mariya Kobi MD (Presenter): Nothing to Disclose, Niveditha Pinnamaneni MD: Nothing to Disclose, Alexander Benjamin Baxter MD: Nothing to Disclose, Aspan Singh Ohson MD, MS: Nothing to Disclose, Mark Philip Bernstein MD: Nothing to Disclose, John Michael McMenamy MD: Nothing to Disclose

TEACHING POINTS

1. Recognize traumatic and non-traumatic splenic emergencies, classifications and urgent management. 2.
Understand splenic manifestations of serious systemic illnesses. 3. Recognize incidental and developmental splenic lesions that require no further evaluation.

TABLE OF CONTENTS/OUTLINE
1. Normal patterns of splenic enhancement 2. Splenic Trauma and Classifications • Blunt • Penetrating • Associated injuries 3. Acute abdomen related splenic disease • Splenic torsion • Splenic infarct 4. Conditions predisposing to splenic rupture 5. Metastatic disease 6. Incidentalomas • Hemangiomas • Lymphangiomas • Cysts

Gastrointestinal Thursday Poster Discussions
Scientific Posters
AMA PRA Category 1 Credits ™: .50
Thu, Dec 4 12:45 PM - 1:15 PM Location: GI Community, Learning Center

Sub-Events
GIS390
US Characteristics to Predict Neoplasm in Gallbladder Polyps 10 mm or Larger (Station #1)
Bo Bae Lee (Presenter): Nothing to Disclose, Jeong Kyong Lee MD : Nothing to Disclose, Jieun Byun MD : Nothing to Disclose, Yookyung Kim MD, PhD : Nothing to Disclose

PURPOSE
To evaluate the characteristics of gallbladder (GB) polyps 10 mm or larger to predict a neoplasm in routine ultrasound (US) examinations.

METHOD AND MATERIALS
A database was reviewed to search for 'GB polyp' in all US examinations of abdomen for five years at a single institution. Fifty-three patients having GB polyps 10 mm or larger with follow-up images (n = 18) or pathologic diagnosis from surgery (n = 35) were included in the retrospective study. The mean duration of imaging follow-up was 46.4 months (range, 12-116 months). All US images and reports were reviewed by two readers in consensus to determine the imaging characteristics of GB polyps including the qualitative and quantitative assessment of the echogenicity, size, shape, surface, multiplicity, the presence of hyperechoic foci in the polyp, GB wall thickening adjacent to the polyps, and visibility on CT. Univariate and multivariate analysis was used to evaluate the predictors for a neoplastic polyp. Receiver operating characteristic (ROC) curve was used to determine the optimal cut-off point for size and age.

RESULTS
A neoplastic polyp was verified pathologically in 12 (22.6%) of 53 patients and the mean size was 23 mm (range, 10-37 mm). Remaining 41 polyps (77.4%) were verified as nonneoplastic by the stability in size on follow-up images (n = 18) or pathologic examinations (n = 23). A univariate analysis of all variables revealed that the presence of adjacent GB wall thickening (P < 0.001), larger size (≥ 17 mm, P < 0.001), older age (> 57 years, P = 0.002), the absence of hyperechoic foci in the polyp (P = 0.003), CT visibility (P = 0.014), sessile shape (P = 0.017), solitary polyp (P = 0.025), and irregular surface (P = 0.048) were significant predictors for a neoplastic polyp. In a multivariate analysis, larger size (≥ 17 mm) was a significant and independent predictor for a neoplastic polyp (P = 0.008).

CONCLUSION
The rate of malignancy is low in GB polyps even 10mm or larger (15.1%). Polyp size 17 mm or larger was the strongest predictor for a neoplastic polyp. CT visibility was a predictor for a neoplastic polyp, in addition to the established predictors. Also, polyps with inner hyperechoic foci preferred to be a nonneoplastic polyp.

CLINICAL RELEVANCE/APPLICATION
Follow-up US examinations are recommended for GB polyps less than 17 mm. Cholecystectomy would be reserved for polyps 17 mm or larger.

GIS391
Pancreatic Neuroendocrine Neoplasms—Imaging features for Distinguishing the Histological Malignancy Defined by World Health Organization 2010 Classification (Station #2)

PURPOSE
To retrospectively determine the CT and MR imaging findings, distinguishing the histological malignancies of pancreatic neuroendocrine neoplasms (PNENs) defined by World Health Organization (WHO) 2010 classification.

METHOD AND MATERIALS
Institutional ethics committee approval and informed consent were obtained. 118 lesions in 109 patients (60 men and 49 women; mean age, 60 years) were histopathologically diagnosed as PNENs in our institutions and 89 resected lesions in 80 patients were included in this study. All lesions were classified into two groups based on the tumor grade, G1 group (including G1 lesions, n=55) and G2 + G3 group...
(including G2 lesions, n=32 and G3 lesions, n=2), respectively. Various imaging findings such as lesion location, diameter, shape, border, attenuation at non-enhanced CT, homogeneity, enhancement pattern on dynamic multiphase CT, presence of calcification, cystic portion, hemorrhagic change, vascular invasion, and main pancreatic duct (MPD) dilatation, signal intensity of MR images (T1, T2, and diffusion weighted images) and ADC values were evaluated. All imaging findings were compared for each group. Moreover, sensitivity, specificity, PPVs and NPVs in the prediction of G2 + G3 group were also calculated. Mann-Whitney or X2-test was used adequately for evaluating these correlations and a value of p < 0.05 was considered as significant.

RESULTS

Diameter, homogeneity, enhancement pattern, vascular invasion and ADC value were significant differences between G1 group and G2 + G3 group. The rate of lesions with calcification, cystic portion and MPD dilatation tended to be greater in G2 + G3 group than G1 group, however there was no significant difference. All lesions appeared as round or lobulated masses and 84 lesions were well-defined regardless of the tumor grade. Hemorrhagic changes were not found in any lesions. PPVs and NPVs for each imaging findings were 46.9-80.0% and 61.4-90.9%, respectively. Highly PPV and NPV for combined diameter, enhancement pattern and ADC value were observed.

CONCLUSION

Several imaging findings of CT and MRI are correlated with the tumor grade defined by WHO classification and considered as useful modalities for evaluating histological malignancy.

CLINICAL RELEVANCE/APPLICATION

Several imaging findings of non-invasive modalities such as CT and MR are useful for evaluating histological malignancy defined by WHO 2010 classification and determining the treatment strategy.

GIS392

Predictive Value of Apparent Diffusion Coefficient Histogram, Alpha-fetoprotein and Transferrin in Evaluation of Hepatocellular Carcinoma Response to Radiofrequency Ablation (Station #3)

Xiaohong Ma (Presenter): Nothing to Disclose, Xinning Zhao: Nothing to Disclose, Han Ouyang MD: Nothing to Disclose, Feng Ye: Nothing to Disclose, Chunwu Zhou: Nothing to Disclose

PURPOSE

To evaluate the value of apparent diffusion coefficient (ADC) histogram analysis, alpha-fetoprotein (AFP) and transferrin (TFN) for predicting tumor progressive in patients with hepatocellular carcinoma (HCC) treated with radiofrequency ablation (RFA)

METHOD AND MATERIALS

In a retrospective study, both 33 progressive patients and 31 stable patients with biopsy-proven HCC underwent breath-hold diffusion-weighted imaging (DWI) (b=800 sec/mm2) on a 3.0T MR scanner before RFA treatment. The pre-treatment ADC value was averaged from the lowest to 10th, 30th, 50th, and 100th percentile of histogram respectively, called ADC10, ADC30, ADC50 and ADC100. The ratio of ADC10, ADC30, ADC50 and ADC100 to mean ADC of non-lesion area were calculated, named RADC10, RADC30, RADC50 and RADC100. All the ADC and RADC values, AFP, TFN, sex, age and maximal tumor diameter (MTD) were statistically analyzed.

RESULTS

The ADC30, ADC50ADC100RADC30, RADC50RADC100 values of tumors in the progressive group were significantly higher than those of the stable group (P < 0.05, respectively). Univariate Cox regression analysis indicated that RADC10, RADC30, RADC50 values of the tumor were significantly associated with disease progressive survival (DPS) (RR = 31.02, 43.84 and 44.29; P < 0.05, respectively). In multivariate analysis, the RADC50 value of tumors was a significant predictor for tumor progressive (P = 0.04, χ2 = 4.12). When the cut-off value of RADC50 (0.71) was used, the DPS of above the cut-off value group was significantly lower than that of below the cut-off value group (χ2 = 5.12P = 0.02).

CONCLUSION

Pre-RFA RADC values especially RADC50 value by the ADC histogram analysis may be a predictor for tumor progressive in patients with HCC treated with RFA. Pre-treatment level of AFP and TFN could not predict the prognosis of HCC before RFA treatment.

CLINICAL RELEVANCE/APPLICATION

Pre-RFA ADC histogram analysis may serve as a biomarker for predicting tumor progressive in patients with HCC treated with RFA.

GIS393

Improved Assessment of Mediastinal and Pulmonary Pathologies in Oncological Staging CT Examinations of the Chest and the Abdomen Using High Pitch Acquisition (Station #4)

Franziska Maria Braun MD (Presenter): Nothing to Disclose, Martina Karpitschka MD: Nothing to Disclose, Maximilian F. Reiser MD: Nothing to Disclose, Birgit Betina Erdl-Wagner MD: Nothing to Disclose, Anno Graser MD: Speakers Bureau, Siemens AG Speakers Bureau, Bracco Group Speakers Bureau, Pfizer Inc Consultant, Bayer AG Grant, Bayer AG, Wieland H. Sommer MD : Nothing to Disclose

PURPOSE

To determine radiation dose and image quality of staging CT examinations of the chest and the abdomen performed on a third generation dual-source CT (DSCT) system that allows for high pitch acquisition.

METHOD AND MATERIALS

45 patients with known malignancies were analyzed in this study. The collective consisted of 28 men and 17 women with a mean age of 64 years (median 64, range 45 - 80 years). All patients were imaged with standard pitch acquired on a second generation DSCT system (fixed pitch 0.6) as well as with a high pitch protocol from a third-generation DSCT scanner (fixed pitch 1.55). The average time interval between the
paired CT examinations was 245 days (median 175, range 11 - 979 days). Both scanners used attenuation-based tube current modulation and tube potential selection. Only follow-up examinations with ± 10 kV difference in tube potential were included. Effective doses were calculated and noise measurements in defined thoracic and abdominal regions were performed. Motion artifacts as well as diagnostic confidence were rated by two experienced radiologists in consensus reading.

RESULTS
Median effective doses were 8.5 mSv for standard pitch examinations and 8.7 mSv for high pitch CT scans (p = 0.1348). Median image noise measured within the trachea and the aortic arch was significantly lower for high pitch examinations (9.0 and 6.5 HU vs. 11.0 and 9.0 HU for standard pitch) (p = 0.0001 and p < 0.001), whereas image noise within the liver, the retroperitoneal fat and the paraspinus muscles was statistically comparable (all p > 0.05). The percentage of datasets with major mediastinal and pulmonary motion artifacts was significantly lower for the high pitch than for the standard pitch protocol (p < 0.0001 and p < 0.0173). These findings are congruent with the observation of a better diagnostic confidence in the assessment of mediastinal abnormalities (p < 0.0001) as well as pulmonary pathologies (p = 0.0047) in high pitch CT.

CONCLUSION
High pitch acquisition of staging CT examinations of the chest and the abdomen facilitates the assessment of mediastinal abnormalities (e.g. lymphadenopathy) and the basal lungs while providing a constantly high abdominal image quality when compared to conventional oncological CT protocols.

CLINICAL RELEVANCE/APPLICATION
High pitch CT acquisition of the chest and abdomen in oncologic patients improves image quality of the mediastinum and the lower lungs without additional radiation dose.

GIS394
Dynamic MRI Defecography: Observation in Young Female Volunteers (Station #5)
Yanbang Lian (Presenter): Nothing to Disclose, Zhiyang Zhou PhD: Nothing to Disclose, Zhengjun Liu MD: Nothing to Disclose, Jianping Qiu: Nothing to Disclose, Pan Zhu: Nothing to Disclose, Wuteng CAO: Nothing to Disclose

PURPOSE
To study the anatomical and functional changes of normal female pelvic floors with high resolution dynamic MR defecography at rest, lift and defecation phases to establish an initial normal criteria for the diagnosis of pelvic floor dysfunction.

METHOD AND MATERIALS
Ninety six young female volunteers, aged 20-30 years with a mean of 23.8±2.0 underwent the high resolution dynamic MRI defecography. Dynamic fast imaging employing steady-state acquisition sequence was performed in mid-sagittal plane at rest, lift and defecation phases. The distance between bladder neck, cervix, peritoneum, anal-rectal junction, sigmoid colon, small intestine to pubococcygeal line (PCL) were measured. Paired samples t test was carried out to compare the quantitative data.

RESULTS
The distance of anal-rectal junction, bladder neck, cervix, peritoneum, sigmoid colon, small intestine to PCL at rest phase were: (0.05±7.51)mm, (-23.80±3.34)mm, (-35.15±6.27)mm, (-40.07±6.53)mm, (-60.59±18.14)mm and (-67.65±13.48)mm, respectively. The measurements at lift phase were: (-9.11±4.77)mm, (-25.55±3.72)mm, (-35.74±6.06)mm, (-39.40±5.98)mm, (-63.76±10.29)mm and (-66.60±13.07)mm, respectively. The measurements at defection phase were: (-17.47±11.09)mm, (-7.01±10.52)mm, (-14.91±13.29)mm, (-20.05±14.18)mm, (-46.87±14.90)mm and (-66.60±13.97)mm, respectively. There is no statistically significant difference in distance of cervix, peritoneum, sigmoid colon, small intestine to pubococcygeal line (PCL) between rest and lift phase (t=1.32, 1.71, 1.70, 1.20, and P=0.19, 0.09, 0.09, 0.24, respectively). However, there are statistically significant difference in cervix, peritoneum, sigmoid colon, small intestine to PCL between rest and defecation (P<0.05) and between lift and defection (P<0.05). The distance of anal-rectal junction, bladder neck to PCL showed statistically significant difference in rest, lift and defection phases.

CONCLUSION
Distance of Cervix, peritoneum, sigmoid colon and small intestine to PCL shows no difference in rest and lift phases. Bladder neck, cervix, peritoneum, sigmoid colon and small intestine are above PCL in all three phases. Anal-rectal junction is below PCL no more than 2cm in defection. This study can serve as normal reference for evaluation of pelvic organ prolapse.

CLINICAL RELEVANCE/APPLICATION
Dynamic MRI defecography in normal female young volunteers can provide us with a diagnostic criteria to better understand and more appropriately treat for pelvic floor dysfunction.

GIS395
Feasibility and Reproducibility of R2* Measurements under Oxygen and Carbogen Challenge in Healthy Volunteers and Patients with Hepatocellular Carcinoma at 1.5 T and 3T (Station #6)
Octavia Bane PhD (Presenter): Nothing to Disclose, Cecilia Besa MD: Nothing to Disclose, Niels Oesingmann PhD: Employee, Siemens AG, Hadrien Dyvorne PhD: Nothing to Disclose, Guido Hugo Jajamovich PhD: Nothing to Disclose, Bachir Taouli MD: Research Grant, General Electric Company Consultant, Bayer AG

PURPOSE
Blood oxygen level dependent (BOLD) MRI measures R2* (1/T2*) of tissues, which depends on blood flow, hematocrit, and oxygen saturation of hemoglobin. This initial study quantifies baseline R2* and changes after oxygen (O2) and carbogen (CB) respiratory challenges in patients with hepatocellular carcinoma (HCC) at 1.5T and 3T.

METHOD AND MATERIALS
Fat-suppressed 2D multiecho GRE sequence was acquired on the upper abdomen (at 1.5T using 5 or 12
RESULTS

The intrasubject test-retest mean coefficients of variation for R2* measurements for air, O2 and CB for liver, HCC and muscle was

CONCLUSION

As shown previously, we did not observe significant change in R2* of the liver or muscle with hyperoxic challenge. HCCs demonstrated variable response to O2 and CB, which may be secondary to vascularity and hypoxia, and should be correlated to pathologic findings in this ongoing study.

CLINICAL RELEVANCE/APPLICATION

R2* is a potential non-invasive biomarker of tumor hypoxia and vascularity, which has been shown to correlate with tumor invasiveness, progression and radioresistance in carcinomas.

Evaluation of Chemotherapy Response of Gastric Cancer in a Mouse Model Using the Intravoxel Incoherent Diffusion-weighted MRI (Station #7)

Jin Cheng MD (Presenter): Nothing to Disclose, Jie Deng PhD: Nothing to Disclose, Yi Wang MD: Nothing to Disclose, He Wang PhD: Nothing to Disclose, Feng Pan: Nothing to Disclose, Weizhen Wu MD: Nothing to Disclose, Nan Hong MD: Nothing to Disclose

PURPOSE

To determine the capability of intravoxel incoherent motion (IVIM) diffusion-weighted (DW) MRI in evaluating therapeutic response in a mouse gastric cancer model.

METHOD AND MATERIALS

The xenografts bearing MKN-45 human gastric adenocarcinoma were randomly separated in a control group and each receiving chemotherapy. Fluorouracil and Calcium Folinate were administered in xenografts for 5 consecutive days starting on day 0. DWMRI with 14 b-values (0-1500 s/mm^2) was performed before (day -1) and after treatment (day 3 and day 7). Pure diffusion coefficient (D), perfusion fraction (f) and perfusion coefficient (D*) were calculated by the bi-exponential model S/S0=(1-f)e^(-bD)+fe^(-b(D+D*)). Apparent diffusion coefficient (ADC^) was also calculated. Median changes ofΔADC=%, ΔD%, ΔD*% and Δf% from baseline (day -1) measurements were calculated, and analyzed by Mann-Whitney test.

RESULTS

The increase in f of the treated group was significantly higher than the control group, at day 3 (Δf %treated=83.7% and Δf %control=14.3%, P=0.0248) and day 7 (Δf %treated=63.7% and Δf %control=2.6%, P=0.0192). D* of the treated group decreased at both day 3 (ΔD*%=-27.4%) and day 7 (ΔD*%=-5.5%). ADC increase of the treated group (ΔADC%=15.8%) was higher than that of control group (ΔADC%=10.7%) at day 3. However, the significant differences in ΔD*% and ΔADC% were not reached.

CONCLUSION

The perfusion fraction f that may associate with tumor tissue microvascular volume may serve as a valuable imaging biomarker of response to chemotherapy in gastric adenocarcinoma.

Cholangiolocellular Carcinoma vs. Conventional Mass-Forming Intrahepatic Cholangiocarcinoma: Comparison of Prognosis and Multiphasic CT Finding (Station #8)

Jong Hyuk Yun MD (Presenter): Nothing to Disclose, Jung Gu Park: Nothing to Disclose, Hee Kang MD : Nothing to Disclose

PURPOSE

The aim of this study is to evaluate the prognosis of nonresectable cholangiolocellular carcinoma compared with conventional mass-forming intrahepatic cholangiocarcinoma and associated multiphasic CT findings

METHOD AND MATERIALS

From January, 2007 to December, 2013, we retrospectively studied 82 patients with pathologically confirmed nonresectable MF type ICC. Prognosis was compared between 14 patients with cholangiolocellular carcinoma and 68 patients with conventional intrahepatic MF cholangiocarcinoma. Multiphasic liver CT images were evaluated for tumor morphology and enhancement features. Survival rates of two groups were calculated by using the Kaplan-meier method, and the differences in survival were compared by using the log-rank test. A Cox proportional hazard model was used for multivariate survival analysis

RESULTS

Hypervascular masses were shown in twelve (85%) of 14 cholangiolocellular carcinoma and twelve (17%) of 68 conventional MF type ICCs. The mean diameter of cholangiolocellular carcinoma was significantly smaller than that of conventional MF type ICCs (P=0.025). The median patient survival period of cholangiolocellular carcinoma was significantly longer than conventional MF type ICCs (P= 0.04). Results of multivariable Cox regression analyses confirmed that tumor size (hazard ratio [HR], 1.08; P=0.02), hypovascular tumor (HR, 2.01; P=0.001), and metastatic lymphadenopathy (HR, 2.90; P=0.01) were the independent factors associated with patient survival duration
**GIE233**

**Subtype Classification of Hepatocellular Adenomas and Their Distinguishing, Imaging Characteristics on MRI (Station #9)**

Christy Blaire Pomeranz MD (Presenter): Nothing to Disclose, Sharon Meei Ay Ngu MBChB: Nothing to Disclose, Richard Kinh Gian Do MD, PhD: Nothing to Disclose

**TEACHING POINTS**

1. Review the new pathologic subtypes of hepatocellular adenomas and their genotypic and phenotypic differences.
2. Review distinguishing features and imaging characteristics of different adenoma subtypes on contrast enhanced MRI.

**TABLE OF CONTENTS/OUTLINE**

Hepatocellular adenomas (HCA) are benign liver tumors, which may display a host of clinical consequences including malignant transformation and bleeding. The Bordeaux group has recently shown that they are, pathologically, a heterogeneous group of tumors which can be sub-classified into four different subtypes: (a) mutation HCA (35-40%), (b) β-catenin positive HCA (10-15%), inflammatory HCA (40-50%), and unclassified HCA (5-10%). There are increasing reports of differences in imaging characteristics of HCA by subtype on contrast enhanced MRI. Radiologists will play an important role in clinical management if they are able to differentiate between different HCA subtypes on imaging since the subset of β-catenin positive HCA have an increased risk of malignant transformation and inflammatory HCA have an increased risk of bleeding. The emerging MR imaging characteristics of HCA will be illustrated and compared to other hypervascular liver tumors.

**GIE239**

**Updates to the Liver Imaging Reporting and Data System (LI-RADS) v2014: The Latest and Greatest (Station #10)**

Cynthia Sawhney Santillian MD (Presenter): Consultant, Robarts Clinical Trials Research Group, Claude B. Sirlin MD: Research Grant, General Electric Company Speakers Bureau, Bayer AG Consultant, Bayer AG

**TEACHING POINTS**

The purpose of this exhibit is 1. To review LI-RADS v2014 with an emphasis on changes from the previous version. 2. To discuss the changes in LI-RADS v2014 that bring it closer in alignment with criteria for HCC used by OPTN and AASLD. 3. To demonstrate the use of LI-RADS v2014 using sample CT and MR cases in a quiz format.

**TABLE OF CONTENTS/OUTLINE**

Background and Significance: Importance of accurate HCC staging Discussion of differences in target population and purpose for other systems for diagnosis of HCC, including AASLD and OPTN. LI-RADSv2014 Highlight changes in the diagnostic algorithm Review new content on hepatobiliary contrast agents and their role in LI-RADS Distinguish features that favor malignancy Quiz Radiologists will be presented with cases and asked to categorize them using LI-RADS. There will be an emphasis on cases that use information that is new or changed in LI-RADS v2014.

**GIE172**

**Dual Energy MDCT Quantitative Imaging in the Abdomen: What Can It Do to Improve Your Practice? (Station #11)**


**TEACHING POINTS**

TP1: Conventional CT numbers represent the normalization of the linear attenuation coefficient to air and water. TP2: By a near-simultaneous illumination of materials at two different kilovoltage levels, dual energy MDCT can enhance variances in slope of characteristic x-ray attenuation curves of materials.

**TABLE OF CONTENTS/OUTLINE**

Introduction: This education exhibit illustrates the basic concepts underlying dual energy MDCT quantitative imaging and its applications in abdominal imaging. Theoretic Concept: Back to the Future. From Polychromatic to Monochromatic Imaging: Dual energy MDCT data can be utilized to obtain virtual monochromatic data which have the potential for mitigating beam-hardening and energy shifting phenomena, therefore providing more accurate quantitative data. Dual Energy MDCT Quantitative Imaging Applications in the Abdomen Virtual Monochromatic Data Display: a) Liver; b) Pancreas; c) Kidney (Figure 1); d) Adrenal Glands; e) Vascular Material Density Analysis: a) Liver (Figure 2); b) Pancreas; c) Kidney (Figure 3); d) Adrenal Glands (Figures 4,5); e) Vascular Conclusion: Dual energy MDCT quantitative imaging may represent a paradigm shift for the abdominal imaging practice.

**GUS-THB**

Genitourinary/Uroradiology Thursday Poster Discussions
Sub-Events

GUS150 Diagnostic Efficacy of Urothelial Phase of CT Urography for Detection of Recurred Bladder Cancer after Transurethral Resection of Urinary Bladder (TURB) (Station #2)
Young Sup Shim MD (Presenter): Nothing to Disclose, Hyuck Jae Choi MD: Nothing to Disclose, Kyoung-Sik Cho MD: Nothing to Disclose

PURPOSE
To assess the efficacy of urothelial phase of CT urography for detection of recurred bladder cancer in patients performed previous transurethral resection of urinary bladder in comparison with excretory phase of CT urography.

METHOD AND MATERIALS
272 CT urography examinations were performed in biopsy proven recurred cancer patients (n=67) and patients without tumor recurrence pathologically and clinically (n=205) after transurethral resection of urinary bladder (TURB) for bladder cancer. CT urography protocol consisted of urothelial phase (70-80 seconds after injection of contrast material) and excretory phase. Two radiologists independently reviewed these two phases of CT urography and evaluated suspects of recurred bladder cancer.

RESULTS
The sensitivity was higher for the urothelial phase (reader 1, 74.6 %; reader 2, 55.2 %) than excretory phase for detection of the recurred bladder cancer, in all of both readers (reader 1, 34.3 %; reader 2, 32.8 %). The specificity was a little higher for excretory phase (reader 1, 95.1 %; reader 2, 93.2 %) than urothelial phase (reader 1, 80.3 %; reader 2, 90.7 %). The AUCs of ROC analysis were larger for urothelial phase (reader 1, 0.755; reader 2, 0.812) than excretory phase (reader 1, 0.653; reader 2, 0.650).

CONCLUSION
The urothelial phase of CT urography shows relatively high diagnostic performance in detection of recurrence of bladder cancer than excretory phase.

CLINICAL RELEVANCE/APPLICATION
In patients with routine follow up after TURB, Radiation reduction was possible by CT urography without excretory phase.

GUS151 Objective and Subjective Image Quality of Renal Parenchymal Masses with Virtual Monoenergetic Dual-energy CT Reconstructions (Station #3)
Jian Jiang (Presenter): Research Grant, General Electric Company

PURPOSE
To compare in dual-energy CT (DECT) conventionally reconstructed polyenergetic images (PEIs) at 120 kVp to virtual monoenergetic images (MEIs) at different kiloelectron volt (keV) levels for evaluation of renal parenchymal masses in regard to objective image quality and subjective image quality.

METHOD AND MATERIALS
We prospectively evaluated 128 row dual-source DECT studies. Twenty patients who had renal parenchymal masses underwent abdominal DECT. On the basis of the Data of the 80 and 140 kVp tube using dual-source CT technology, PEIs and MEIs in 10-keV intervals from 40 to 120 keV were reconstructed. Renal parenchymal masses and soft tissue attenuation and image noise were measured in various regions of interest and the Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were subsequently calculated. MEI reconstructions with the highest CNR, SNR and the subjective image quality by two experienced readers were compared to PEI for those.

RESULTS
Good inter-reader agreement of the subjective score was noted (k = 0.782, p = 0.000). The mean score of subjective image quality of 70 keV was the highest in the MEIs, which was significantly higher than that of PEI (P=0.020). MEI at 60 keV had the highest CNR compared to PEI. There was no significant difference in CNR between 60 keV and 70 keV (P=0.693). The SNR of 70keV was higher compared to PEI. The image noise of 70 keV was lower than that of the other MEIs, which was no significantly higher than PEI.

CONCLUSION
These results highlighted that MEI at 70 keV provided a better image quality in diagnostic levels comparing with PEI, which improve their diagnostic confidence in the assessment of renal parenchymal masses by evaluating MEI reconstructions at 70 keV.

CLINICAL RELEVANCE/APPLICATION
The aim is to improve radiologists' diagnostic confidence in the assessment of renal parenchymal masses by evaluating MEI reconstructions at 70 keV.

GUS152 Assessment of Acute Kidney Injury in Patients after Lung Transplantation Using Diffusion Weighted Imaging (Station #4)
**TABLE OF CONTENTS/OUTLINE**

**TEACHING POINTS**

- Molecular imaging of prostate cancer (Station #5)
  - Andreas Georg Wibmer MD (Presenter): Nothing to Disclose, Irene Andrea Burger: Nothing to Disclose, Hebert Alberto Vargas MD: Nothing to Disclose

- Oddballs: Unusual Testicular Lesions (Station #6)

**PURPOSE**

Following lung transplantation (lutx) a majority of patients develop acute kidney injury (AKI), which is associated with an increased risk of chronic kidney disease (CKD) and poor outcome. Our purpose was to evaluate diffusion weighted imaging (DWI) for detection of AKI.

**METHOD AND MATERIALS**

In the study 22 lutx patients and 9 age-matched healthy volunteers were included. Renal function was monitored by s-creatinine measurement, and presence and severity of AKI was diagnosed according to AKIN criteria. Patients underwent MRI 14±2 days after lutx using a 1.5 T magnet. A respiratory-triggered, fat-saturated echoplanar diffusion-weighted sequence was acquired with 10 b-values (b=0-1000 s/mm²). Maps of diffusion parameters were calculated using mono-exponential (ADC\_mono) and bi-exponential models (ADC\_1, ADC\_2, Fp). ROIs were manually into the upper, middle and lower third of renal cortex and medulla and mean±SD of diffusion parameters were calculated. MRI and clinical parameters were compared between groups using unpaired t-test and ANOVA.

**RESULTS**

77% (17/22) of lung transplant patients developed AKI (36% AKIN1 = mild, 32% AKIN2 = moderate, 9% AKIN3 = severe). Maximum s-creatinine was reached 1-2 days after lutx and it was significantly higher in AKI-patients compared to patients without AKI (156±70 vs 80±17 μmol/L, p<0.01). Pre-operative s-creatinine was not different when comparing patients with and without AKI (45±12 vs 55±6 μmol/L, p=0.10). ADC\_mono was significantly lower in patients with AKI compared to patients without AKI (cortex: 1.95±0.14 vs 2.19±0.04 x10⁻³ mm²/s, p<0.01; medulla: 2.01±0.15 vs 2.16±0.08 x10⁻³ mm²/s, p<0.05) and to healthy volunteers (cortex: 1.95±0.14 vs 2.16±0.16 x10⁻³ mm²/s, p<0.01; medulla: 2.01±0.15 vs 2.20±0.09 x10⁻³ mm²/s, p<0.01). No difference between patients without AKI and healthy subjects was observed. Similarly, cortical and medullary ADC \_2 were significantly lower in AKI-patients than in controls (p<0.05, p<0.01). ADC\_P and Fp were not different.

**CONCLUSION**

DWI allows detection of AKI in the early period following lutx. It may also be useful as a biomarker to monitor renal function and to predict progression to CKD.

**CLINICAL RELEVANCE/APPLICATION**

Early diagnosis of AKI is important to improve patient management and therapy monitoring in patients at risk of AKI. Functional MRI such as DWI enables assessment of renal function and pathology.

**TABLE OF CONTENTS/OUTLINE**

- RADIONUCLEIDE IMAGING IMAGING OF CELL METABOLISM Glucose, Choline, Acetate, Amino Acids (Leucine, Methionine, Trytophan), Nucleosides RECEPTORS AND MEMBRANE PROTEINS Androgen receptor, Gastrin Releasing Peptide Receptor, PSMA, Others BONE MATRIX REPORTER GENE IMAGING MOLECULAR MAGNETIC RESONANCE IMAGING
**HPS175**

**Rates and Causes of Radiologist Disagreement during Independent Review of Oncology Clinical Trials (Station #1)**

Gregory V. Goldmacher MD, PhD (Presenter): Employee, ICON plc, Ninad Mantri MS: Employment, ICON plc, James J. Conklin MD: Employment, ICON plc, David Raunig PhD: Director, Pfizer Inc.

**PURPOSE**

Radiological endpoints in oncology trials are often assessed with multiple readers on each case. Reader variability is of interest to regulators and trial designers, who sometimes regard a disagreement rate (DR) over 40% as indicating unreliable data, regardless of indication or cause. Disagreement on progression and response has not been systematically studied across cancer types.

**METHOD AND MATERIALS**

We examined disagreement between independent readers in pooled data from Phase 2 or 3 trials in non-small cell lung cancer (NSCLC), breast cancer, colorectal cancer (CRC), and non-Hodgkin's Lymphoma (NHL). Each case was assessed by two readers, using RECIST 1.0 or 1.1 in solid tumors and Cheson 1999 in NHL. We calculated DR on whether the subject progressed, date of progression (DOP), best overall response (BOR), duration of response (DOR), or any visit response. DOR was calculated, for cases where readers agreed on a BOR of partial response (PR) or complete response (CR), as the duration from first PR or CR until progression. Where there was disagreement on DOP, we assessed whether it was based on target lesions (TL), non-target lesions (NTL), or new lesions (NL) for solid tumors.

**RESULTS**

The data included patients from 4 NSCLC trials, 3 breast cancer trials, 3 CRC trials, and 4 NHL trials. The table shows DR on various parameters and combinations. When readers disagreed on DOP in breast cancer (n=377), DR on NL, TL, and NTL, respectively, was 51.5%, 48.8%, and 66.6%. For NSCLC (n=961), it was 45.8%, 76.7%, and 51.3%. For CRC (n=435), it was 43.0%, 8.0%, and 59.1%. For NHL, DR on NL was 24.2%, with TL and NTL data not captured. Causes of disagreement were non-exclusive.

**CONCLUSION**

Up to 33% of DOP disagreements are by one visit. A DR above 40% is to be expected for some tumors, especially if multiple parameters are compared. Some have advocated new lesions as the sole reliable progression indicator, but there is considerable variability in new lesion perception. Some cancers show less variability that others on perception of TL progression, possibly due to fewer lesions (less variability in measurement), lesions being easier to measure (less variability in measurement), or both. This study establishes baseline rates of disagreement, so that interventions to reduce variability can be assessed.

**CLINICAL RELEVANCE/APPLICATION**

Radiological tumor assessment in clinical trials is subject to variability which varies across indications.

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**HPS176**

**Peer-Review Sampling: Comparison of Two Paradigms Against Double Reading of Gadoxetate-Enhanced MRI (Station #2)**

Sheela Agarwal MD, MS (Presenter): Nothing to Disclose, Tarik K. Alkasab MD, PhD: Nothing to Disclose, Peter F. Hahn MD, PhD: Stockholder, Abbott Laboratories; Stockholder, Covidien AG; Stockholder, CVIS Caremark Corporation; Stockholder, Kimberly-Clark Corporation; Stockholder, Landauer, Inc.; Sanjay Saini MD: Nothing to Disclose; Mukesh Gobind Harisinghani MD: Nothing to Disclose, Debra Ann Gervais MD: Research Grant, Covidien AG.

**PURPOSE**

Because hepatobiliary contrast liver MRI offers special challenges, these studies undergo enhanced peer-review. We evaluated the effectiveness of two randomized peer-review methods compared to double reading for detection and characterization of liver lesions and incidental findings.

**METHOD AND MATERIALS**

A single expert in gadoxetate-enhanced MRI double read the 544 studies performed during a 6 month period. Rates of change in diagnosis served as the historical control. Each study had been read initially by a fellowship trained abdominal radiologist before expert over-reading. During the same 6 month period in the following year, 798 liver MRIs were performed with gadoxetate disodium. These examinations were randomly sampled for a total of 2% of all cases, or 16 cases, which were then over-read (Arm 1). During this same time frame, all gadoxetate MRIs that were randomly selected during the department-wide peer-review system were evaluated, as part of the ACR recommended target rate of 2% of all examinations per radiologist (Arm 2).

**RESULTS**

Using a double read paradigm, changes in interpretation occurred on 50/544 examinations (9.2%) with 23 (4.2%) leading to a potential change in clinical management. All 28 readers were evenly sampled (100%). Using the 2% paradigm the following year (Arm 1), changes in interpretation occurred on 3 (1.5%) examinations, with 2 (12.5%) leading to potential change in management. 12 (39%) radiologists were
sampled using this method. During the department-wide 2% peer-review process, 53 abdominal MRIs were reviewed, of which 6 (0.75%) were gadoxetate-enhanced liver MRI (Arm 2). One (17%) led to a change in interpretation, which was not clinically significant, and 6 (21%) radiologists were sampled.

**CONCLUSION**

Department wide peer-review, which randomly selects cases from all abdominal MRIs performed, under-sampled gadoxetate MRI and radiologists, therefore capturing a lower rate of error compared to the double-read paradigm. Instead, specifically sub-selecting two percent of all gadoxetate studies leads to a significantly more accurate reflection of misinterpretation rates.

**CLINICAL RELEVANCE/APPLICATION**

Double reading of gadoxetate MRI results in clinically significant improvement in read accuracy, though this approach is resource intensive and thus impractical in a busy hospital setting. Accurate methodologies for sampling are essential to capture ongoing interpretive challenges with gadoxetate MRI.

**HPS177**

An Ex Post Cost-Benefit Analysis of Kidney Function Screening for all Patients Prior to Iodinated Intra-vascular Contrast Administration during Computed Tomography (Station #3)

**PURPOSE**

We retrospectively assessed the allocation efficiency of universal kidney function testing for all patients receiving contrast media for CT versus risk factor screening as measured from the perspective of both the patient outcome and public funding.

**METHOD AND MATERIALS**

Contrast Induced Nephropathy (CIN) rates in patients receiving contrast with GFR < 60 in a tertiary acute care using a universal testing policy were calculated. A standard Cost Benefit Analysis was used to assign standing, identify and monetize impact categories, obtain present values of costs and benefits, and perform a sensitivity analysis. Actual testing and patient costs were calculated. Benefits were derived from the number of avoided cases of Nephropathy Requiring Dialysis (NRD) and avoided deaths.

**RESULTS**

The social benefits of screening all patients for impaired renal function versus testing those with risk factors is centered on finding occult renal impairment. Based on our site’s CIN rate with universal screening (0.34%), the extrapolated risk of missing someone during screening who would then go on to develop NRD was calculated to be 0.0021% (proportion of patients found to have occult kidney function < 60 x proportion of patients that are likely to develop NRD). The benefit of a blanket kidney function testing policy then, for a site administering contrast to ~7,800 patients/year, was the prevention of 0.0036 NRD cases/year and, based on literature estimates, the saving of 0.0012 lives/year. The actuarial values calculated for these benefits, including adjustments for Quality Adjusted Life Years, was of the order of magnitude of ~$9,000 versus the ~$165,000 cost estimated to send 7,000 patients for additional blood-work.

**CONCLUSION**

We found the net social benefit of a blanket kidney function screening policy versus risk factor screening, was negative. We note political feasibility costs for health care practitioners were not assessed nor monetized. A risk stratification policy for GFR testing substantially reduces the tested population and the cost while preserving the proportion of patients receiving prophylactic hydration and/or alternative imaging strategies.

**CLINICAL RELEVANCE/APPLICATION**

Risk stratification policy for GFR testing substantially reduces the tested population and the cost while preserving the proportion of patients receiving prophylactic hydration and/or alternative imaging strategies.

**HPE104**

**ACR Imaging 3.0 Preparedness: How Good are Your Communication Skills? (Station #4)**

**TEACHING POINTS**

1. To demonstrate the value of radiologists, the ACR Imaging 3.0 campaign has asked us to take on more leadership and consultation responsibilities, and concentrate on value-based practice. Effective communication skills with the referring clinicians and patients are the key to our future success.

2. Viewers will be able to take the Radiology Communication Quiz to find out how effective their communication skills are and receive suggestions on how to improve.

**TABLE OF CONTENTS/OUTLINE**

1. Why is effective communication essential for radiologists in ACR Imaging 3.0?
2. Benefits of Effective Communication
3. Components of effective communication
4. Literature review: Pitfalls in Communicating Effectively
5. The Radiology Communication Quiz
6. How good are your communication skills?
7. Score interpretation and suggestions for future improvements
INS172

Visualizing the Relationships among MRI Protocols and Diseases, Signs and Symptoms Coded by ICD-10 Using Network Analysis (Station #1)

Ayako Yagahara (Presenter): Nothing to Disclose, Shintaro Tsuji: Nothing to Disclose, Naoki Nishimoto PhD: Nothing to Disclose, Iyunna Katahata: Nothing to Disclose, Katsuhiko Ogawara PhD, MBA: Research Grant, TSURUHA Holdings Inc, Tomoyasu Tsuzuki: Nothing to Disclose

PURPOSE

MRI examination protocols in varied combinations are decided by patient’s diseases, signs or symptoms. The purpose of our study is to visualize the structure of the relation among patient’s diseases, signs and symptoms and MRI examination protocols.

METHOD AND MATERIALS

We acquired 17,154 brain MRI examination application forms in Hokkaido University Hospital (from Jan 2010 to Feb 2013). We coded disease names by ICD (International Statistical Classification of Diseases and Related Health Problems)-10 manually in all forms and extracted 751 forms completed at 1.5 tesla MRI, and described a disease which is coded to “Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified” (ICD-10 R00-R99). Protocols were defined as the combination of MRI protocols and slice orientation (e.g. T1WI Axital). We applied a network diagram consisted of nodes and links as the method of visualization and structure. Nodes correspond to disease code and protocols, and links were expressed as the relation of them. The network diagram was created by force based algorithm using visualizing software Gephi.

RESULTS

The number of nodes was 93: disease codes were 32 and MRI protocols were 61. That of links was 349. Average protocols per an examination were 4.3. “Headache” (R51), “Dizziness and giddiness” (R42) and Abnormal findings on diagnostic imaging of central nervous system (R90) were more than 100 forms and existed in the center of the network. Lowest frequency diseases such as Nausea and vomiting (R11) tend to spread outward. R51 linked 9 protocols; by contrast R42 and R90 linked more than 20 protocols. In protocols, T1WI, FLAIR, T2WI, DWI axital were existed the center. Location of nodes in the network and the number of relation to protocols were no relation. The number of the relation was reflected the distance of the links and the relation of all nodes represented by the positional relation in the network diagram.

CONCLUSION

Network diagram consisted of 93 nodes and 349 links visualized the complex relations among MRI protocols and disease. The strength of relations among nodes were represented by the positional relations.

INS173

Segmentation of Bronchial Trees Using a Vector Stream Information in Low-Dose CT Images: Application to COPD Patients (Station #2)

Sang-Joon Park MD (Presenter): Nothing to Disclose, Doohye Lee: Nothing to Disclose, Jin Mo Goo MD, PhD: Research Grant, Guerbet SA, Hyun-Ju Lee MD, PhD: Nothing to Disclose, Chang Hyun Lee MD, PhD: Nothing to Disclose, Chang Min Park MD, PhD: Nothing to Disclose

PURPOSE

To develop an accurate segmentation technique for bronchial trees in the lung parenchyma to and investigate its performance compared with previously reported extraction algorithms.

METHOD AND MATERIALS

Thirty-two COPD patients with GOLD stage 1 were selected for investigating the performance of the airway segmentation scheme in this study. The images were obtained with low-dose chest CT (40 mAs at 120 kVp) using soft reconstruction kernel (Sensation 16). A PC-based in-house software was developed for fully automated segmentation of the pulmonary airways using the following steps: 1) intensity adaptive region-growing (IARG) technique, 2) eigenvalues-ratio of the Hessian matrix, 3) vector-based feature identification (VFI) scheme with false positive (FP) reduction process. The performance of segmentation results from the proposed technique was evaluated with Hessian-based method and VFI without FP reduction scheme and was compared to that of IARG for all subjects.

RESULTS

The average branch count (BC) and tree length (TL) of 32 subjects were 104±28.6 (1679.3±500.7 mm) with only IARG method, 129.9±31.9 (1910.3±560 mm) with combination of IARG and Hessian methods, and 128.9±31.8 (1904.7±464.9 mm) with combination of IARG, Hessian method, VFI with FP reduction scheme, respectively. Segmentation results with combined methods extracted more branches compared with that of only IARG method (p=0.003, respectively), while the proposed and Hessian-based methods showed no significant difference each other in extracting BC (p=0.59). However, the percentage of FP voxels decreased by 57.5±16.6% after applying VFI with FP reduction scheme (p=0.001). Our system was equipped with an Intel i7 CPU at 3.4 GHz and 16 GB memory, and the mean time of the whole processing was 51.84±14.37 seconds.

CONCLUSION

By using novel airway segmentation techniques comprising VFI with FP reduction scheme, we could segment airway branches up to 128.9±31.8 BC and 1904.7±464.9 mm TL even if some cases showed difficult appearance for identifying small airways accompanying leakages. This study can be a vital role as a preprocessing step for regional analysis of pulmonary airways and their functions in the lung parenchyma for various lung diseases in the clinical environment.
**INS174**

**A Client-Server Tool for Automatic Fast GPU-based Detection of Squamous Epithelium Tissue Regions in Histology Images (Station #3)**

Zhiyun Xue: Nothing to Disclose, Benjamin Bryant: Nothing to Disclose, Rodney Long: Nothing to Disclose, Sameer Antani: Nothing to Disclose, Hamed Sari-Sarraf PhD: Nothing to Disclose, George Thoma PhD: Nothing to Disclose, Mitchell Wachtel MD: Nothing to Disclose

**PURPOSE**

An essential step in diagnosis of cervical intraepithelial neoplasia (CIN) is identifying squamous epithelium tissue on histological slides. We have previously reported a method [1] for automatically and rapidly isolating such regions in multi-gigapixel digitized slide images. In this work, we report on our development of a networked tool that enables multiple users to simultaneously use server-based GPUs for the purpose.

**METHOD AND MATERIALS**

Our method for automatic epithelium tissue detection in cervical tissue images using GPU computing [1] is 1500 times faster than prior method. Additionally, in [1], we use image compression data and machine learning to achieve comparable accuracy at significantly high computational speedup. Our method is tested on 11 images. The disadvantage of the method is that it requires every user to have access to high-end computers with modern GPUs designed for general purpose computing, and the move large images (100s of MB in size) to their computers for processing. It also makes it hard to collaborate and discuss clinical results. To address these challenges, we report on a novel implementation of our method as a client-server software architecture that makes available server-based GPUs as a common computing resource that enables simultaneous access to the method. We also developed an intuitive GUI for the purpose. Client-server high performance computation architecture for a critical clinical task addresses these challenges.

**RESULTS**

Our novel implementation of the fast algorithm allows multiple researchers to use the networked GPU-based image processing resource, avoid large image file transfers, and collaborate on clinical tasks.

**CONCLUSION**

We developed a client-server tool that uses GPUs to automatically segment epithelium tissues from digitized histology slides for CIN detection. No longer is it necessary for every user to be equipped with a high-end computing capability. REFERENCE: [1]; Fast GPU-based segmentation of H&E stained squamous epithelium ....

**CLINICAL RELEVANCE/APPLICATION**

A network-based tool that provides automatic and fast segmentation of squamous epithelium from multi-gigapixel digitized histology slides assists the detection of CIN.

**INS175**

**Communication of Significant Unexpected Radiological Findings Using an Automated iPACS Radiology Alert System (Station #4)**

Karl James MBBCh, MRCS: Nothing to Disclose, Jennifer Murphy MBBCh, MRCPI: Nothing to Disclose, Patrick Nicholson MBBCh (Presenter): Nothing to Disclose, Max Frederick Ryan MBBCh: Nothing to Disclose

**CONCLUSION**

Efficient diagnosis is seen to be possible with a well established electronic communication system. The fact that new cancer was confirmed in almost one third of the CXR alerts indicates the importance of clinicians receiving and acting on these alerts. The study also highlights that 20% of potential cancer alerts were not officially acknowledged by the clinician. Although the majority of patients had timely follow-up, there were causes for concern with delayed diagnosis and follow-up failures that must be addressed.

**Background**

Failure to communicate important radiological findings is a major patient safety issue and is now the third largest cause of litigation against radiologists in the USA. In our institution, an alert system exists whereby the radiologist can directly alert the referring clinician of a significant radiological finding by selecting an icon on the iPACS workstation. The clinician is then obliged to acknowledge the alert. A RIS manager follows up any unacknowledged alerts and escalates alerts as necessary.

**Evaluation**

Data on all PACS alerts issued in our institution over a 1 year period was collected and analysed for the source of referral, modalities used, report turn around time, time to clinician acknowledgment of the alert and duration/outcome of follow-up. Any failures to acknowledge alerts or to follow-up were also noted.

**Discussion**

372 alerts were issued over the 1 year study period. 49% (181) of alerts were issued due to a suspected cancer diagnosis and of those 67% (121) arose from a chest X-ray report. 57% of the ‘cancer’ alerts were acknowledged by clinicians within 3 days, however, 19% (35) of the ‘cancer’ alerts were never acknowledged and 5 of these patients did not receive the recommended follow-up. CT follow-up was recommended in 103 CXR reports and was performed in less than 1 month in 50% (53). 5 patients had to wait more than 90 days for the CT scan and of those patients, 3 patients subsequently had a CT diagnosis of lung cancer. 20% (21) of patients never had a CT thorax for reasons including loss to follow-up, resolution on subsequent plain imaging, etc. Analysis of subsequent CT thorax results found that previously undiagnosed cancer was detected in 31% (26) patients.
MIS153

High r1 Relaxivity Gadolinium-Containing Carbon Dots Nanoparticles as Contrast Agent for MRI Angiography (Station #7)

Shao Wu, Wang MD, Nothing to Disclose, Song Chen, Nothing to Disclose, Mingqian Tan, (Presenter): Nothing to Disclose

PURPOSE
A new of high r1 relaxivity, water-soluble, gadolinium-containing carbon dots(Gd-CDots) nanoparticles with blue fluorescence as T1WI contrast agents was used in MRI angiography.

METHOD AND MATERIALS
The Gd-CDots nanoparticles were synthesized by Citric acid monohydrate and gadolinium chloride through a one-step heated hydrothermally at 200 °C for 8 h. The gadolinium with different concentrations were examined by a 3T MRI scanner using T1WI and T2WI. IR turbo spin echo sequence and multi-echo T2WI. R1 and R2 relaxivities were calculated by fitting signal changes in multi-IR T1WI and multi-TE T2WI using simple exponential equations. The rats were injection of the Gd-CDots and Gd-BOPTA into tail vein. Fat suppressed T2WI were obtained to investigate the contrast changes in liver, kidney, muscle and aorta at the different time points.

RESULTS
The prepared Gd-CDots with different concentration of Gd has a r1 value of 14.5 mM-1s-1, 17.3 mM-1s-1, 14.1 mM-1s-1, 13.4 mM-1s-1, r2 value of 18.0 mM-1s-1, 19.8 mM-1s-1, 15.9 mM-1s-1, 38.0 mM-1s-1 and r1/r2 ratio of 1.24, 1.13, 1.13, 1.14, which is competitive with commercial Gd-based contrast agent. Significant T1 contrast enhancement in the kidney and liver were evidenced in in vivo MRI after injection of Gd-CDots in rat through tail vein, similar to that observed in Gd-BOPTA 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. Firstly, the liver displayed significantly increased signal changes. Moreover, the kidney and bladder were observed increased signal changes, strongly suggesting renal excretion of the Gd-CDots nanoparticles. Gd-CDots 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 T1WI contrast agents for imaging of vascular of disease tissues.

CONCLUSION
Gd-CDots 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 T1WI contrast agents for MRI Angiography.

CLINICAL RELEVANCE/APPLICATION
The Gd-containing nanoparticles exhibit excellent T1 contrast in vivo MRI studies, especially for kidney and liver, providing a potential long half contrast agent for MRI Angiography.

MIS154

Recruitment of CCL2-dependent Macrophage Decreases Response to Antiangiogenic Treatment: Preliminary Study Using Dynamic Susceptibility Contrast Perfusion MR Imaging and MicrovesSEL Density Measurement in a Rat Glioblastoma Model (Station #8)

Seung Hong Choi MD, PhD (Presenter): Nothing to Disclose

PURPOSE
Tumor-associated macrophages (TAMs) have long been considered capable of destroying tumor cells and presenting tumor antigens to effector T cells to trigger antitumor responses. Recently, several studies have shown that TAM recruitment to the cancer site increases tumor angiogenesis as well as tumor cell migration, invasion and dissemination and that TAMs also suppress the immune response that targets tumor cells. Dynamic susceptibility contrast (DSC) MR imaging is advanced technique that provides cerebral blood volume (CBV) and can be used for the assessment of tumor response to therapy, especially for antiangiogenic therapy such as bevacizumab. The purpose of the present study is to investigate whether the recruitment of CCL2-dependent macrophage decreases response to antiangiogenic treatment by using DSC perfusion MR imaging and microvesSEL density (MVD) measurement in a rat glioblastoma model.

METHOD AND MATERIALS
We established U87 human glioblastoma cell line expressing macrophage chemoattractant CCL2, and confirmed the CCL2 expression by western blot and cytokine assay. For in vivo study, athymic nude rats were used for orthotopic brain tumor model (control (n = 6), and CCL2 group (n = 6), respectively). And then 2 weeks after transplantation, DSC MR imaging was performed with 9.4T animal MR scanner for pre-treatment MR imaging. Bevacizumab (20 mg/kg) was intra-peritoneally injected twice a week, then post-treatment MR imaging was performed. After sacrifice of the rats, MVD was determined by CD34, and macrophages were stained with CD68.

RESULTS
CCL2 expressing tumors showed significantly higher relative CBV than mock-transfected controls after treatment of bevacizumab (3.5 ± 1.2 vs 1.3 ± 0.4, P ≤ 0.05). In histology analysis, more MVD formatted CCL2 expressing tumors showed significantly higher relative CBV than mock-transfected controls after treatment of bevacizumab.

CONCLUSION
We believe that CCL2 expression of glioblastoma can induce the antiangiogenic drug resistance by recruitment of macrophages, which can be assessed noninvasively with DSC MR imaging.

**CLINICAL RELEVANCE/APPLICATION**

DSC imaging can be used for the noninvasive evaluation of the resistance to antiangiogenic treatment in the preclinical study.

**MIS155**

**Enzyme Inhibitors Impressively Enhance Tumor Uptake of Radiopeptides (Station #9)**

*Marion De Jong PhD (Presenter): Nothing to Disclose, Theodosia Maina: Nothing to Disclose, Berthold Nock: Nothing to Disclose*

**PURPOSE**

Radiopeptide drugs like radiolabeled octreotide-analogs are successfully being applied for tumor visualization and treatment. However, translation of this paradigm to other radiopeptide ligands has been severely hampered by their often-poor metabolic stability. We hypothesized a novel application - single co-injection of a specific enzyme inhibitor- to improve peptide bioavailability and hence tumor uptake in vivo.

**METHOD AND MATERIALS**

The neutral endopeptidase inhibitor phosphoramidon (PA, 0.3mg) was injected with 111In-labeled somatostatin, gastrin and bombesin radiopeptides in different mouse models (healthy mice as well as tumor-bearing SCID and nude mice). PA is a potent (IC50 34 nM) and reversible competitive NEP-inhibitor.

**RESULTS**

We could provoke a remarkable and very significant rise (up to 40 times the control values) in the percentage of circulating intact 111In-labeled somatostatin, gastrin and bombesin radiopeptides in healthy mice after PA coinjection. Most importantly, this strategy resulted in a spectacular increase of radiolabel accumulation (up to 14 times the control values) in the different types of tumors xenografted in the mice. The improved tumor uptake could be clearly visualized by SPECT/CT as well.

**CONCLUSION**

Our findings open exciting new opportunities for the application of biodegradable peptide-drugs of either natural or synthetic origin as well as for the rationale design of in vivo stable analogs. They also provide a versatile tool for elucidating enzyme - peptide interactions.

**CLINICAL RELEVANCE/APPLICATION**

not applicable yet

**MIS156**

**SPECT/CT —A Valuable Adjunct to Bone Scintigraphy [ MI Scavenger Hunt! ] (Station #10)**

*Olga Kagna MD: Nothing to Disclose, Natalia Puchkov: Nothing to Disclose, Natalia Pirmisashvili: Nothing to Disclose, Daniela Militianu: Nothing to Disclose, Gad Abikhzer MD (Presenter): Nothing to Disclose, Ora Israel MD: Consultant, General Electric Company*

**PURPOSE**

Bone scintigraphy (BS) is the most frequently performed general nuclear medicine procedure. Present study assesses referral patterns to bone SPECT/CT as well as its frequency and type of incremental value to functional assessment of the skeleton.

**METHOD AND MATERIALS**

Bone SPECT/16-CT (Discovery 670, GE Healthcare) was performed after administration of 925 MBq 99mTc-MDP and after completion of the planar BS. Studies performed over a 20 months period in 135 patients (80 M,55 F, age 7-85) were retrieved and retrospectively reviewed for referral criteria and the presence of any incremental value (defined as lesion localization and characterization). Indications for BS included skeletal pain (n=71), fracture or infection (n=30), metastatic survey (n=25), inconclusive prior imaging tests (n=9). The decision for performing SPECT/CT was based on findings on planar BS, on known clinical complaints and/or on results of prior imaging test.

**RESULTS**

Four groups of referral criteria to SPECT/CT were found. A. unclear localization of lesions to bone or soft tissue (ST) - 19 pts (14%). SPECT/CT correctly localized all sites (10 bone,5 ST, 4 bone+ST) and had an added value in 17/19 cases (89%) characterizing 15 and guiding further tests in 2 lesions. B. unclear localization of lesions to specific parts of bone - 50 pts (44%). SPECT/CT correctly localized all foci and characterized 55/59 (93%). C. diagnosis of bone lesion - 52 pts (38%). SPECT/CT had an added value in 47/52 lesions (90%) defining 37 and guiding further tests in 10. D. diagnosis of ST lesions - 5 pts (4%). SPECT/CT had an added value in all cases (100%), defining 3 and guiding further tests in 2 sites. Overall SPECT/CT correctly localized all sites of skeletal and ST uptake and improved the diagnostic accuracy of BS with precise characterization of lesions in 110/135 pts (81%) and guiding further tests in 14/135 pts (10%).

**CONCLUSION**

The use of bone SPECT/CT was associated with an incremental improvement in the diagnostic capabilities and clinical impact of BS. Bone SPECT/CT was of value in all cases with unclear lesion localization. Furthermore it provided additional information for precise characterization of abnormal tracer uptake in the majority (91%) of patients.

**CLINICAL RELEVANCE/APPLICATION**

SPECT/CT is of value for improving the diagnostic accuracy and clinical impact as an adjunct to bone scintigraphy.
Assessment of Sacroiliac Gouty Arthritis with Dual-energy CT: An Initial Study (Station #1)

Min Liu (Presenter): Nothing to Disclose, Fan Yang: Nothing to Disclose, Chang Liu: Nothing to Disclose

PURPOSE
Gout is the most common crystal deposition arthropathy currently diagnosed clinically due to frequently involving the first metatarsophalangeal joint. To our best knowledge, monosodium urate (MSU) crystal deposition in the sacroiliac joint has rarely been reported to date. The purpose of this study is to examine the features of MSU crystal deposition and erosion in sacroiliac gouty arthritis with dual-energy CT (DECT).

METHOD AND MATERIALS
This study was approved by an institutional review board; patient informed consent was obtained. Twelve patients (10 men, 2 women; mean age, 47 years ± 12 [standard deviation]) with sacroiliac gouty arthritis and 10 normal controls (6 men, 4 women; mean age, 49 years ± 13 [standard deviation]) were enrolled in this study. DECT with gout protocol was performed in all patients for detection of MSU crystal deposition and bone erosion. A dedicate post-processing gout software was used to observe the color-coding MSU crystal. Two readers scored blindly the DECT scans for MSU crystal deposition and erosion, and kappa test was used to determine the observer agreement.

RESULTS
Of 12 patients, the serum urate levels were partly elevated (7 cases) and partly normal (5 cases). MSU crystal deposition was observed in sacroiliac joints (7 cases), lumbar facet joints (5 cases) and discs sacroiliac joints (4 cases). Bone erosion was found in 6 cases. Compared with sacroiliac gouty arthritis patients, no MSU crystal deposition was detected in all normal controls (p<0.001). Good agreement was obtained between two reader for observing the MSU crystal deposition (κ= 0.93) and bone erosion (κ= 0.91).

CONCLUSION
DECT can serve as a promising imaging technique for visualization of MSU crystal deposition and erosion in sacroiliac gouty arthritis.

CLINICAL RELEVANCE/APPLICATION
Diverse factors can lead to sacroilitis besides gout. Sometimes imaging differential diagnosis is difficult. DECT provides a relative new non-invasive imaging modality that is able to distinguish urate crystals. These findings will benefit the diagnosis of gouty arthritis.

Functional Evaluation of Traumatic Tears of the Medial Meniscus of the Knee using Weight-bearing MRI (Station #2)

Alice La Marra MD (Presenter): Nothing to Disclose, Silvia Mariani MD: Nothing to Disclose, Lorenzo Maria Gregori: Nothing to Disclose, Lucia Patriarca: Nothing to Disclose, Antonio Barile MD: Nothing to Disclose, Carlo Masciocchi MD: Nothing to Disclose

PURPOSE
To determine prospectively the role of 1.5 T, dedicated low-field standard and upright-MRI in the evaluation of stable or unstable traumatic tears of medial meniscus in comparison with arthroscopy.

METHOD AND MATERIALS
Our series included 3500 knee MRI scans performed with a high field MRI scanner from January 2010 to March 2014. On the basis of the concordance between clinical and high-field MRI diagnosis, we selected two groups. In the first group (group A) we included 70 MRI exams of normal knee and in the second group (group B) we included 275 MRI exams of knee with clinical evidence of meniscal traumatic lesions. In the same session, after conventional 1.5T and "dedicated" 0.25T supine MRI exam, the patients underwent upright weight-bearing examination with the same dedicated MRI unit. We used sagittal and coronal scans (SE T1-W) in all cases. All 275 patients were submitted to arthroscopy between 7 and 21 days after diagnostic examination.

RESULTS
In group A, there were no statistically significant anatomical changes of the signal intensity, position and morphology of the medial meniscus between standard 1.5T, dedicated supine and upright MRI. In group B, the images acquired in the supine position (dedicated and 1.5T MRI) documented, in 32 cases (group B1) a meniscocapsular separation, in 106 cases (group B2) a longitudinal lesion, in 67 cases (group B3) horizontal lesion and in 70 cases a radial tear (group B4). In group B1, weight-bearing MRI showed presence of unstable tear in 32 out of 32 cases. In group B2, weight-bearing MRI showed presence of unstable tear in 89 out of 106 cases. In group B3, weight-bearing MRI showed an unstable meniscal tear in 45 out of 70 cases. Arthroscopy confirmed weight-bearing MRI diagnosis in all cases of Group B1, B2 and B3; in group B4 arthroscopy showed unstable tear in 65 out of 70 cases (20 cases of WB-MRI false negative).

CONCLUSION
The upright MRI allows to record load-induced physiological variation, thus showing both the meniscal
stability and a latent instability only for meniscocapsular separations, longitudinal and horizontal medial meniscal tears.

CLINICAL RELEVANCE/APPLICATION

The knowledge of an unstable medial meniscal tear is very useful to correctly guide the orthopedic surgeon towards an appropriate surgical treatment.

MKS398 Increased Signal Intensity of Lateral Collateral Ligament at Femoral Attachment on Fat-suppressed Proton-density-weighted MR Images: Is it Normal or Abnormal? (Station #3)

Han Na Lee MD (Presenter): Nothing to Disclose, Ji Seon Park MD, PhD : Nothing to Disclose, Sung Eun Ahn : Nothing to Disclose, Kyung Nam Ryu MD, PhD : Nothing to Disclose, Wook Jin : Nothing to Disclose, So Young Park : Nothing to Disclose, Jung Eun Lee : Nothing to Disclose, Sohee Yoon MD : Nothing to Disclose

PURPOSE

Even in asymptomatic knees, the increased signal intensities (SI) of lateral collateral ligament (LCL) at femoral attachment are commonly seen on fat-suppressed (FS) proton-density-weighted (PDW) MR images, unlike the midportion of LCL. We evaluated the histological differences between the above two portions of LCL and clarified the cause of these signal differences using cadaveric knees.

METHOD AND MATERIALS

MRI was obtained from 11 cadaveric knees (M:F = 7:4, mean age at death = 77.5 years, age range = 58–96 years). Two musculoskeletal radiologists evaluated the SI at both the femoral attachment and midportion of LCL using FS PDW coronal and axial images. The SI are classified into 3 grades (I = low, II = slightly high, III = high or fluid-like). These MR findings were correlated with the corresponding gross and histological sections.

RESULTS

All LCLs revealed the increased SI at femoral attachment including 9 cases of grade II and 2 cases of grade III. Two cases of grade III had a thin layer of fluid-like high signal, but smooth contour was preserved. SI of LCLs at midportion was grade I in all cases. On histological examinations, LCL at femoral attachment showed loose collagen fibers with twisted or irregular distribution, whereas LCL at midportion revealed dense collagen fibers with parallel or well-organized distribution. Additionally, interspersed vessels within loose fibrous layer were found. These findings were prominent at deeper portion than superficial layer within the femoral attachment. Degeneration or tear of LCL was none even in the cases of grade III.

CONCLUSION

Based on this study, increased SI of LCL at femoral attachment on FS PDW image is due to differences in density and orientation of collagen fibers, rather than true degeneration or tear.

CLINICAL RELEVANCE/APPLICATION

Normal LCL at femoral attachment can demonstrate the increased SI on FS PDW MR images caused by histological differences.

MKS399 Bone Marrow Fat Quantification of the Lumbar Spine Using Dual Energy CT (DECT) and Single Voxel 1H-MR Spectroscopy (1H-MRS)—A Feasibility Study (Station #4)


PURPOSE

Quantification of marrow fat has been proposed as a predictor of bone weakening, independent of bone mineral density (BMD). 1H-MRS is able to reliably quantify bone marrow fat fraction in a single voxel, however, the ability of measuring larger areas of heterogeneous marrow is limited. Advances in DECT allow quantification of BMD of the entire axial and appendicular skeleton with no additional radiation exposure compared to standard QCT. The purpose of our study was to test the performance of DECT in assessing marrow fat content of the lumbar spine, using 1H-MRS as a reference standard.

METHOD AND MATERIALS

The study was IRB approved and complied with HIPAA guidelines. Written informed consent was obtained from all subjects. Seven healthy men (mean age: 39±13 y) who participated in a clinical obesity trial underwent single voxel 1H-MRS at 3T (Siemens Trio) of the L2 vertebra using a PRESS sequence without water suppression. DECT (Siemens Definition Flash) of the L2 vertebra (80 kVp @ 210 mAs, 140 kVp @ 80 mAs) was performed with use of a calibration phantom. Average basis material composition relative to the phantom was estimated within an elliptical cylinder (3 cm3) positioned in the anterior cancellous bone region of L2. The resulting basis material composition was then fit to a cancellous bone model yielding a description in terms of volumes of model mineralized collagen, yellow and red marrow from which the volume fraction of yellow marrow within the marrow space was derived. Pearson correlation coefficient and Bland-Altman 95% limit of agreement of fat fraction obtained from 1H-MRS and DECT were calculated.

RESULTS

There was a strong correlation between marrow fat fraction obtained by 1H-MRS and DECT (r=0.90, p=0.006). Using Bland-Altman analysis, there was good agreement between 1H-MRS and DECT without evidence of bias. The mean difference in fat fraction between the techniques was 0 with a 95% confidence interval between -0.26 and 0.25.

CONCLUSION
CONCLUSION
DECT is a reliable method to measure marrow fat content of the lumbar spine. DECT provides data that closely correlate with 1H-MRS. Therefore, DECT could potentially be used to assess both BMD and marrow fat content in a single examination.

CLINICAL RELEVANCE/APPLICATION
DECT is a novel imaging technique that can assess BMD and marrow fat content in a single examination, thereby providing important information on skeletal integrity.

MKS401
Acromial Apophysiolysis of the Skeleton Immature Shoulder: Prevalence, Risk Factors and Association with Acromiale and Rotator Cuff Tears (Station #6)

PURPOSE
To investigate whether edema at the acromial apophysis (ossification center) in young patients (< 25 years) is associated with a superior shoulder pain syndrome and acromial non-fusion.

METHOD AND MATERIALS
Institutional review board approval was obtained, the requirement for informed consent was waived. A retrospective report review of 2372 consecutive patients, between 15 and 25 years of age who underwent shoulder MRIs for shoulder pain was performed. Individuals with edema at the acromial apophysis and no other pathology on MRI were included in the study group. Association of acromial edema with incomplete fusion, baseball pitching (based on a pre-MRI pitching questionnaire) and clinical findings were determined in the study group and in an age and sex matched control group by two readers.

RESULTS
Edema at the acromial apophysis was found in 2.6% (61/2372) of patients. Edema was associated with incomplete fusion of the acromial apophysis (Chi-square, p < 0.001) and superior shoulder tenderness (p < 0.001). The entity was named acromial apophysiolysis accounting for the combination of non-fusion (lysis) and painful edema at the apophysis. In a multivariate regression analysis, a pitch count of more than 100 pitches per week was a risk factor for acromial apophysiolysis (OR=6.5, p=0.017). Six out of the 61 patients with acromial apophysiolysis had a normal MRI of the contralateral (non-throwing shoulder) within 2 weeks. Follow-up imaging with shoulder MRI was available in 29 of 61 patients in the study group and in 22 of 61 patients in the control group. Follow-up imaging showed that acromial apophysiolysis was significantly associated with the development of an os acromiale (OR=138, p < 0.001) and rotator cuff tears (OR=5.4, p=0.015) later in life, after age 25.

CONCLUSION
Acromial apophysiolysis is characterized by incomplete fusion and edema at the acromial apophysis. It is a cause of shoulder pain in young patients (< 25 years) and pitching is a risk factor. It predisposes to the development of an os acromiale and rotator cuff tears after age 25.

MKS400
Discordance between Radiologists and Orthopedists in Meniscal Tear Morphology Nomenclature: Orthopedic Support for Implementing a Validated MRI Standard (Station #5)
Laura Watson MD (Presenter): Nothing to Disclose, Allen Prober MD : Nothing to Disclose, S Paran Yap BA : Nothing to Disclose, Jeffrey B. Driban PhD : Nothing to Disclose, Tyler L Skaife MD : Nothing to Disclose, Robert J. Ward MD : Nothing to Disclose

PURPOSE
To assess the heterogeneity in the classification of meniscal tear morphologies between orthopedists and radiologists, and whether this has lead to confusion when interpreting MRI reports. To determine orthopedic support for implementing a specific validated classification system for MRI reporting.

METHOD AND MATERIALS
3032 surveys were emailed to members of the Arthroscopic Association of North America. The survey included questions on specific tear morphologies with illustrated examples, signal classification, tear localization, frequency of confusion in reading other radiologists reports, and on the importance of standardization. 860 surveys including the same 6 questions on specific tear morphologies with illustrated examples were emailed to members of the Society of Skeletal Radiology. Chi-square analysis was used to compare meniscal tear morphology nomenclature between radiologists and orthopedists on each of the six meniscal tear illustrations.

RESULTS
401 orthopedists responded (13%) while 250 radiologists (29%) responded to a separate but similar survey. Chi-square analysis demonstrated statistically significant differences in descriptions of five out of the six morphologic tear types between orthopedists and radiologists. While 61% of orthopedists stated that meniscal tear morphology nomenclature on knee MRI reports was important to them, nearly 70% of the respondents reported being confused by descriptions of tear morphology at least some of the time with MRI reports from radiologists within their institution/practice; this number increased to 85% when reading reports from outside radiologists. The responding orthopedists overwhelmingly (91%) favored the adoption of ISAKOS tear morphology on knee MRI reports.

CONCLUSION
Nearly two-thirds of responding orthopedists indicated that description of tear morphology on knee MRI reports is important to them; however, the differences in description of meniscal tear morphology between orthopedists and radiologists was statistically significant in five of the six provide illustrations. There was overwhelming support by the surveyed orthopedists for implementation of the ISAKOS classification system by radiologists for meniscal tear reporting on MR reports.

CLINICAL RELEVANCE/APPLICATION
Lack of standardization has led to MR report confusion with respect to meniscal tear morphology. There is support in the orthopedic community for radiologic report standardization.

MKS400
Association with Os Acromiale and Rotator Cuff Tears (Station #6)

CONCLUSION
Significantly associated with the development of an os acromiale (OR=138, p < 0.001) and rotator cuff tears (OR=138, p < 0.001). The entity was named acromial apophysiolysis accounting for the combination of non-fusion (lysis) and painful edema at the apophysis. In a multivariate regression analysis, a pitch count of more than 100 pitches per week was a risk factor for acromial apophysiolysis (OR=6.5, p=0.017). Six out of the 61 patients with acromial apophysiolysis had a normal MRI of the contralateral (non-throwing shoulder) within 2 weeks. Follow-up imaging with shoulder MRI was available in 29 of 61 patients in the study group and in an age and sex matched control group by two readers.

RESULTS
Edema at the acromial apophysis was found in 2.6% (61/2372) of patients. Edema was associated with incomplete fusion of the acromial apophysis (Chi-square, p < 0.001) and superior shoulder tenderness (p < 0.001). The entity was named acromial apophysiolysis accounting for the combination of non-fusion (lysis) and painful edema at the apophysis. In a multivariate regression analysis, a pitch count of more than 100 pitches per week was a risk factor for acromial apophysiolysis (OR=6.5, p=0.017). Six out of the 61 patients with acromial apophysiolysis had a normal MRI of the contralateral (non-throwing shoulder) within 2 weeks. Follow-up imaging with shoulder MRI was available in 29 of 61 patients in the study group and in 22 of 61 patients in the control group. Follow-up imaging showed that acromial apophysiolysis was significantly associated with the development of an os acromiale (OR=138, p < 0.001) and rotator cuff tears (OR=5.4, p=0.015) later in life, after age 25.

CONCLUSION
Acromial apophysiolysis is characterized by incomplete fusion and edema at the acromial apophysis. It is a cause of shoulder pain in young patients (< 25 years) and pitching is a risk factor. It predisposes to the development of an os acromiale and rotator cuff tears after age 25.
CLINICAL RELEVANCE/APPLICATION
Young pitchers should not throw more than 100 pitches per week to prevent acromial apophysiolysis, a cause of shoulder pain and risk factor for os acromiale and rotator cuff tears later in life.

**MKE145**
**Radiological Evaluation of a Painful Total Knee Replacement (Station #7)**
Natasa Devic MBBS, MRCS (Presenter): Nothing to Disclose, Sahar Naaseri MBBS, BSc: Nothing to Disclose, Sze Mun Mak FRCK: Nothing to Disclose, Emma Katrina Cheasty MBChB: Nothing to Disclose, Annelies F R Maenhout MD: Nothing to Disclose, Nikhil Kapse FRCR: Nothing to Disclose, Adrian James Wilson MBBS, BSc: Research Consultant, Arthrex, Inc

**TEACHING POINTS**
How to adopt a logical approach to radiological assessment of a painful knee replacement - this approach can then be applied to evaluation of any painful joint replacement.
How best to utilise a variety of modalities available in investigating this often complex clinical problem.
The summary of imaging appearances of two of the commonest causes of a painful knee replacement - septic and aseptic loosening, and their impact on patient outcome.
Brief explanation of non-radiological adjuncts to radiological assessment.

**TABLE OF CONTENTS/OUTLINE**
Painful knee replacement - incidence, symptoms and signs.
X-ray appearances of prosthesis loosening (infective and aseptic)
US in assessment of a painful knee replacement - including US guided aspirations.
CT protocols for assessment of prosthesis rotatin - Imperial, Freemantle and Perth protocols.
CT and MRI appearances of loosening.
Nuclear medicine utilisation in investigation of painful knee replacements.
Algorithm for radiological assessment of painful knee replacement

**MKE177**
**Multimodality Imaging of Stress Fractures (Station #8)**
Rafael Morcillo Carratala MD (Presenter): Nothing to Disclose, Yolanda Gomez-Herrero: Nothing to Disclose, Vivian Artiles Valle: Nothing to Disclose, Soledad Fernandez Zapardiel: Nothing to Disclose, Mar Cespedes Mas: Nothing to Disclose, Ivan Mauricio Vargas Orozco MD: Nothing to Disclose, Pilar Sanchez Camacho: Nothing to Disclose

**TEACHING POINTS**
The purpose of this exhibit is:
• To describe the most common locations of stress fractures
• To illustrate the radiological features of stress fractures using a multimodality approach with conventional radiography (CR), computed tomography (CT) and magnetic resonance (MR)

**TABLE OF CONTENTS/OUTLINE**
Etiology, epidemiology and pathophysiology of stress fractures
Review of imaging findings Imaging findings in CR Imaging findings in CT Imaging findings in MR
Most common sites of stress fractures Vertebral arch (spondylolysis) Pelvic Femoral neck Tibia Fibula Tarsal bones Metatarsal bones Summary and conclusions

**MKE303**
**Ultrasound of the Peripheral Nerves of the Lower Extremity: A Landmark Approach (Station #9)**
Matthew Ryan Hammer MD (Presenter): Nothing to Disclose, Corrie Marlene Yablon MD: Nothing to Disclose, Yoav Morag MD: Nothing to Disclose, Catherine J. Brandon MD: Stock options, VuCOMP, Inc, Monica Kalume Brigido MD: Nothing to Disclose, Jon A. Jacobson MD: Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc

**TEACHING POINTS**
After reviewing this exhibit, the viewer will be able to: 1. Describe the course of the peripheral nerves of the lower extremity, including their motor and sensory innervation. 2. List the important anatomical landmarks and transducer position used to locate the peripheral nerves of the lower extremity when performing sonographic evaluation 3. Describe how US is useful for the evaluation of the lower extremity nerves

**TABLE OF CONTENTS/OUTLINE**

**MKE323**
**Imaging techniques in Diagnosis and Prognosis of Multiple Myeloma: Which Will Win the Battle? (Station #10)**
Maria Paramo Alfaro MD (Presenter): Nothing to Disclose, Jose Maria Bondia MD: Nothing to Disclose, Romina Zalazar MD: Nothing to Disclose, Damaso Aquerreta: Nothing to Disclose, Maite Millor MED: Nothing to Disclose, Paula Barquin Garcia MD: Nothing to Disclose, Lidia Sancho Rodriguez: Nothing to Disclose

**TEACHING POINTS**

Renal osteodystrophy is a multisystem process involving renal, endocrine, and musculoskeletal systems. Secondary hyperparathyroidism, osteoporosis, osteosclerosis and osteomalacia are major musculoskeletal manifestations of this condition. Furthermore, changes related to chronic hemodialysis, renal transplantation, and medications used to treat renal disease frequently complicate radiologic assessment. Both synergistic and antagonistic effects on bone mineralization and trabecular patterns may result from these complex interactions. Often involved bones include those of the hands and the axial skeleton, particularly the sacroiliac joints. A careful understanding of renal osteodystrophy is extremely helpful for the radiologist, particularly in cases of overlap or similarity between renal osteodystrophy and other metabolic musculoskeletal disorders. This educational exhibit will explore the pathophysiology and imaging manifestations of this condition.

1. Normal hip anatomy by ultrasound and MRI. Differentiate intra-articular and extra-articular causes of hip impingement.

1. MKE015-b MRI of the Diabetic Foot: A Comprehensive Review of the Biomechanics of the Foot, the Pathophysiology and Imaging of the Various Soft Tissue Changes Seen at Different Stages of the Disease (Station #11)

Claude Pierre-Jerome MD, PhD (Presenter): Nothing to Disclose, Hasan Banitaireli MD : Nothing to Disclose, Mehdi Sadat Akhani : Nothing to Disclose, Arne Borthne MD, PhD : Nothing to Disclose

TEACHING POINTS

This exhibit will: 1) walk the readers a step-by-step description of the biomechanics of the foot, 2) clarify the pathophysiology of the soft tissue lesions resulting from vascular and neurologic damages associated with diabetes, 3) display and explain the MR images of the changes the most subtle sorts to the gross derangements in a didactic fashion, 4) the readers will acquire a better understanding of the Charcot foot from a clinical and radiological stand point.

2. On the Outside Looking in: Use of Dynamic Hip Ultrasound to Evaluate Intra-articular and Extra-articular Causes of Impingement (Station #12)


TEACHING POINTS

Describe normal hip anatomy by ultrasound and MRI. Differentiate intra-articular and extra-articular causes of hip impingement.

3. Imaging of Renal Osteodystrophy (hardcopy backboard)

Mitchell Harrison Storace MD (Presenter): Nothing to Disclose, Robert Alan Koenigsberg DO : Nothing to Disclose

TEACHING POINTS

Renal osteodystrophy is a multisystem process involving renal, endocrine, and musculoskeletal systems. Secondary hyperparathyroidism, osteoporosis, osteosclerosis and osteomalacia are major musculoskeletal manifestations of this condition. Furthermore, changes related to chronic hemodialysis, renal transplantation, and medications used to treat renal disease frequently complicate radiologic assessment. Both synergistic and antagonistic effects on bone mineralization and trabecular patterns may result from these complex interactions. Often involved bones include those of the hands and the axial skeleton, particularly the sacroiliac joints. A careful understanding of renal osteodystrophy is extremely helpful for the radiologist, particularly in cases of overlap or similarity between renal osteodystrophy and other metabolic musculoskeletal disorders. This educational exhibit will explore the pathophysiology and imaging findings of this complex condition.

1. Introduction 2. Soft tissue calcifications
3-D Printing in Radiology—How to Get Started (Station #1)

Alex Marro BSc (Presenter): Nothing to Disclose, Mark Daniel Cicero: Nothing to Disclose, Walter H. Mak MD: Nothing to Disclose, Timothy Richard Dowdell MD: Nothing to Disclose, Taha Bandukwala MD: Nothing to Disclose

TEACHING POINTS

1) 3-D printers are now affordable and will continue to decrease in cost. They are poised to be a part of imaging departments in the future.
2) Outline the steps in creating a 3-D model from CT images:
   1) image acquisition
   2) segmentation using a bone window
   3) crop the mask and make edits
   4) perform 3-D reconstruction
   5) apply post-processing to smooth out artifacts
   6) import to printer software
   7) set printer parameters and print
3) Review of literature in current and anticipated use of 3D printed models in healthcare.
4) Given their expertise in imaging, radiologist should be involved in the processing and post processing of data files, and review the printed 3-D model for accuracy and quality assurance.

TABLE OF CONTENTS/OUTLINE

1) A brief history of 3-D printing
2) The process of creating 3-D parts from CT images
3) Current and future applications of 3-D printing in healthcare
4) Role of the radiologist in 3-D model reconstruction

NMS-THB

Nuclear Medicine Thursday Poster Discussions

Nuclear Medicine Thursday Poster Discussions

Sodium Fluorine PET/CT Value in a Large Population with Biopsy Proven Prostate Cancer (Station #1)

Lorenzo Nardo MD (Presenter): Nothing to Disclose, Spencer Caton Behr MD: Research Grant, General Electric Company, Martin Kretzschmar: Nothing to Disclose, Sonia Lee MD: Nothing to Disclose, Jason F. Talbott MD, PhD: Nothing to Disclose, James Munro Slater MD: Nothing to Disclose, William P. Dillon MD: Nothing to Disclose, Thomas M. Link MD, PhD: Research Funded, General Electric Company Research funded, InSightec Ltd, Randall A. Hawkins MD, PhD: Nothing to Disclose, Miguel Hernandez Pampaloni MD: Nothing to Disclose

PURPOSE

To describe the demographic, clinical and radiological characteristic of a cohort of patients suffering from prostate cancer.

METHOD AND MATERIALS

IRB approval was obtained. This is a retrospective study enrolling 400 patients (51-83 y.o., mean age 67 yrs) with biopsy proven prostate adenocarcinoma and at least one standard PET/CT imaging from vertex to toes approximately 45-60 minutes after the intravenous administration of 370±37 MBq of 18NaF. Clinical data included staging, Gleason grading (GG), Serum Prostate Specific Antigen levels (PSA) and specific treatment; radiological data included quantitative evaluation of the maximum standardized uptake values (SUV(max)) of the metastatic lesions as well as quantitative assessment of the corresponding CT-lesions.

RESULTS

Analyzing the cohort: at least 1 bone metastatic lesion was found in 31% of patients of whom 5% was scanned before starting systemic or RT treatment and 11% had at least one lesions without clear CT correspondent. SUV(max) values were not significantly associated with non-treated, or treated-metastasis nor with different treatments (p>0.05). Also there was no significant association between SUV values and Staging, GG or PSA (p>0.05).

CONCLUSION

A large database is presented with demographic, clinical and radiological data. SUV (max) of metastasis is not associated with Staging, GG or PSA. Treated metastasis and non-treated metastasis cannot be differentiated on the base of SUV max values. PET imaging identifies bone metastasis not seen on CT images in a large number of patients.

CLINICAL RELEVANCE/APPLICATION

SUV max is not a reliable measurement for distinguishing treated metastasis. This suggests that osteoblastic repair might persist even after successful therapy completion. A large number of bone metastasis are occult with CT and are seen only with PET.

Utility of Tc-99m Pertechnetate Thyroid Scintigraphy in Hyperthyroid Patients with Recent Exposure to Iodine/Intravenous Iodinated Contrast (Station #3)

Bhishak H. Kamat MD (Presenter): Nothing to Disclose, Vincent Q. Dam MD: Nothing to Disclose, Susan Elizabeth Mandel MD: Nothing to Disclose, Daniel Pryma MD: Research Grant, Siemens AG Research Grant, Molecular Insight Pharmaceuticals, Inc Speaker, IBA Molecular Advisory Board, Bayer AG

Sub-Events

MSE122

3-D Printing in Radiology—How to Get Started (Station #1)

Alex Marro BSc (Presenter): Nothing to Disclose, Mark Daniel Cicero: Nothing to Disclose, Walter H. Mak MD: Nothing to Disclose, Timothy Richard Dowdell MD: Nothing to Disclose, Taha Bandukwala MD: Nothing to Disclose

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NMS-THB

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Bhishak H. Kamat MD (Presenter): Nothing to Disclose, Vincent Q. Dam MD: Nothing to Disclose, Susan Elizabeth Mandel MD: Nothing to Disclose, Daniel Pryma MD: Research Grant, Siemens AG Research Grant, Molecular Insight Pharmaceuticals, Inc Speaker, IBA Molecular Advisory Board, Bayer AG
PURPOSE

Current thyroid scintigraphy guidelines recommend waiting 1-2 months after administration of intravenous iodinated contrast for accurate uptake measurements. However, the utility of thyroid scintigraphy for evaluating thyrotoxicosis in the setting of recent intravenous contrast/iodine load is not known. The purpose of this retrospective study was to determine whether recent iodine administration affects the imaging and interpretation of Tc-99m pertechnetate thyroid scintigraphy.

METHOD AND MATERIALS

The records of all patients who underwent Tc-99m pertechnetate scintigraphy between March 2007 and March 2014 were reviewed. Patients with low or undetectable TSH who received intravenous iodinated contrast or SSKI within one week prior to imaging were selected, and their pertechnetate scans were reviewed along with clinical and laboratory data.

RESULTS

50 patients were screened and 15 were identified who had undergone Tc-99m pertechnetate scintigraphy within one week after receiving intravenous contrast or SSKI. Thyroid scans with uptake greater than the submandibular glands were interpreted as Grave's disease (11/15) or toxic nodular goiter (1/15), which was consistent with clinical and laboratory follow-up; of note, 2 of these patients received intravenous contrast or SSKI within twenty-four hours of imaging and 5 more within 48 hours prior to imaging. Thyroid scans with no uptake (2/15) or uptake less than submandibular glands (1/15) were interpreted as thyroiditis, which was consistent with clinical and laboratory follow-up.

CONCLUSION

Tc-99m pertechnetate thyroid scintigraphy appears to be a useful diagnostic test for differentiating Grave's disease or toxic nodular goiter from thyroiditis in hyperthyroid patients who have recently received iodine/intravenous iodinated contrast.

CLINICAL RELEVANCE/APPLICATION

Tc-99m pertechnetate thyroid imaging should be considered in the evaluation of thyrotoxicosis in patients with a recent iodine load.

T99m Sestambi Dispensed in 2-part Plastic Syringes Shows Negligible Syringe Retention and Allows Improved Implementation of ALARA Principles (Station #4)

Sean Reynolds MD (Presenter): Nothing to Disclose, Janusz Karol Kikut MD: Nothing to Disclose

PURPOSE

The Tc-99m chelating radiopharmaceutical Sestamibi adheres to disposable syringes with a reported 10-50% of the prescribed dose remaining in the syringe after injection. Nuclear Stress laboratories develop their MPI activity dosing schedules empirically to bring consistent diagnostic quality exams for the utilized imaging systems. This does not account for variable syringe residual and potentially results in unnecessary absorbed radiation dose to patients or compromised image quality.

Adsorption to the rubber gasket of the plunger is a postulated culprit. 2-part syringe designs without rubber gaskets are available. We compared syringes with and without rubber gaskets to determine the effect on residual activity in the syringe following patient administration. We compared the results against MDP which has no significant demonstrated adherence to the rubber gasket syringe components.

METHOD AND MATERIALS

35 consecutive doses of Tc-99m-Sestamibi and 30 doses of Tc-99m-MDP were prepared by nuclear pharmacy (Pharmalogic Holdings, Boca Raton, FL) in 3 mL Luer-lock syringes with rubber gaskets (Mod # 309657 BD, Franklin Lakes, NJ). These were assayed in a well-counter (CRC-15R, Capintec, Inc. Ramsey NJ) before and after patient administration. The same procedure was performed with with 11 doses of Tc-99m-Sestamibi in 3 mL Luer-lock gasketless syringes (Air-Tite, Inc., Virginia Beach, VA). A scintigraphic image of a post-injection 3-part syringe was obtained to localize tracer retention in the syringe.

RESULTS

Tc-99 MDP showed a mean residual dose 6.3% (range 0.78-14.9) consistent with that reported by others as dead space of the Luer-lock tip. Tc-99m-Sestambi syringes with rubber gaskets had residual 23% (range 8.5-35.3). Tc-99m-Sestambi in gasketless syringes had residual 7.2% (range 3.0-10.4). A scintigraphic image of the three part syringe showed a majority of the residual activity bound to the rubber gasket of the plunger.

CONCLUSION

There was significant adsorption of Sestamibi to rubber gaskets in the 3-part syringes. The gasketless 2-part syringe design reduces the Sestamibi syringe residual to the level of relatively small and constant dead space activity in the Luer-lock tip.

CLINICAL RELEVANCE/APPLICATION

Using 2- part plastic syringes without rubber gaskets for the T99m Sestambi doses reduces the high and variable syringe residual to that of relatively small and constant dead space activity allowing more controlled implementation of ALARA principles.

Dose Optimization in TOF-PET/MR Compared to TOF-PET/CT (Station #5)


PURPOSE

NMS196

T99m Sestambi Dispensed in 2-part Plastic Syringes Shows Negligible Syringe Retention and Allows Improved Implementation of ALARA Principles (Station #4)

Sean Reynolds MD (Presenter): Nothing to Disclose, Janusz Karol Kikut MD: Nothing to Disclose

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35 consecutive doses of Tc-99m-Sestamibi and 30 doses of Tc-99m-MDP were prepared by nuclear pharmacy (Pharmalogic Holdings, Boca Raton, FL) in 3 mL Luer-lock syringes with rubber gaskets (Mod # 309657 BD, Franklin Lakes, NJ). These were assayed in a well-counter (CRC-15R, Capintec, Inc. Ramsey NJ) before and after patient administration. The same procedure was performed with with 11 doses of Tc-99m-Sestamibi in 3 mL Luer-lock gasketless syringes (Air-Tite, Inc., Virginia Beach, VA). A scintigraphic image of a post-injection 3-part syringe was obtained to localize tracer retention in the syringe.

RESULTS

Tc-99 MDP showed a mean residual dose 6.3% (range 0.78-14.9) consistent with that reported by others as dead space of the Luer-lock tip. Tc-99m-Sestambi syringes with rubber gaskets had residual 23% (range 8.5-35.3). Tc-99m-Sestambi in gasketless syringes had residual 7.2% (range 3.0-10.4). A scintigraphic image of the three part syringe showed a majority of the residual activity bound to the rubber gasket of the plunger.

CONCLUSION

There was significant adsorption of Sestamibi to rubber gaskets in the 3-part syringes. The gasketless 2-part syringe design reduces the Sestamibi syringe residual to the level of dead-space activity in the Luer-lock tip.

CLINICAL RELEVANCE/APPLICATION

Using 2- part plastic syringes without rubber gaskets for the T99m Sestambi doses reduces the high and variable syringe residual to that of relatively small and constant dead space activity allowing more controlled implementation of ALARA principles.
PURPOSE

To optimize injected dose of FDG in a Time-of-Flight (TOF) PET/MR, based on cross-evaluation of patient-based NECR measurements by means of the NECR curves.

METHOD AND MATERIALS

A total of 71 consecutive patients were evaluated in this retrospective study. PET/CT imaging was performed on a PET/CT-MR setup including a time-of-flight Discovery 690 PET/CT (TOF-PET/CT) and a time-of-flight Discovery 750w 3T MR (TOF-PET/MRI). An optimal NECR for diagnostic purposes was defined in clinical patients (NECRP). Subsequent optimal activity concentration at the acquisition time ([A]0) and target NECR (NECRT) were obtained. These data were used to predict the FDG dose requirement of a new TOF-PET/MR system.

RESULTS

The obtained values for NECRP, [A]0 and NECRT were 114.6Kcps, 4.0KBq/mL and 45Kcps, respectively. Evaluating the NECRT together with the phantom curve of a TOF-PET/MR device, the optimal activity concentration was found to be approximately 1.3KBq/mL, which represents 35% of the activity concentration required by the TOF-PET/CT.

CONCLUSION

The new TOF-PET/MR device requires significantly less activity to generate PET images with good-to-excellent image quality, due to improvements in detector geometry and embedded detector technologies. For the new TOF-PET/MR system, a reduction of approximately 65% of FDG-dose might maximally be achieved while maintaining the same clinical image quality.

CLINICAL RELEVANCE/APPLICATION

Patients will need less FDG dose on the new TOF-PET/MR, decreasing the radiation exposure without loss of image quality.

NRS-THB

Neuroradiology Thursday Poster Discussions

Scientific Posters

PURPOSE

to determine the relationship between cortical volumes and cognition in first episode psychosis (FEP) patients

METHOD AND MATERIALS

Twenty FEP patients were assessed with the Screen for Cognitive Impairment in Psychiatry1 (SCIP), a brief cognitive test which assesses immediate and delayed verbal memory, working memory, verbal fluency and processing speed. All participants underwent MRI scanning on a 1.5 T Siemens Avanto scanner. High resolution structural T1-weighted images were acquired. Cortical reconstruction and volumetric segmentation was performed with the Freesurfer® image analysis suite (http://surfer.nmr.mgh.harvard.edu/). Its processing includes parcellation of the cerebral cortex into units based on gyral and sulcal structure and computation of cortical thickness at each vertex on the tessellated pial surface. Pearson correlations were calculated to assess the association between the SCIP and global cortical volume and different cortical areas. Partial correlations were calculated to control for the effects of lifetime antipsychotic treatment.

RESULTS

Pearson correlations showed significant associations between working memory SCIP subtest and cortex volume (p=0.000), right and left cerebellum volume (p=0.04 and p=0.029 respectively), right and left amygdala volume (p=0.03 and p=0.001 respectively), and right and left hippocampus volume (p=0.014 and p=0.031 respectively). When controlling for antipsychotic treatment, significant correlations were found between the total score of the SCIP and cortex volume (p=0.001), left and right amygdala volume (p=0.004 and p=0.001 respectively) and right hippocampus volume (p=0.031).

CONCLUSION

Global cortical volume and cerebellum, amygdala and hippocampus volumes may be related to cognitive performance in the early phases of psychosis.

CLINICAL RELEVANCE/APPLICATION

Impaired cognition can be observed in early phases of psychosis and it shows a relationship with some cortical structures volumes

NRS456

Cortex Volumetry and Cognition in First Episode Psychosis Patients (Station #1)

Teresa Cabada MD (Presenter): Nothing to Disclose , Ana Sanchez : Nothing to Disclose , Pablo Lecumberri : Nothing to Disclose , Lucia Moreno : Nothing to Disclose , Carmen Bacaicoa : Nothing to Disclose , Marisol Gomez : Nothing to Disclose , Manuel Cuesta : Nothing to Disclose

NRS457

The Alterations of Resting State Functional Connectivity of the Striatum in Parkinson’s Disease after Levodopa Administration (Station #2)

Wanqun Yang MD (Presenter): Nothing to Disclose , Biao Huang MD : Nothing to Disclose , Hongjun Liu MD : Nothing to Disclose , Chang Hong Liang MD : Nothing to Disclose
PURPOSE
To reveal levodopa-induced acute changes in the resting-state functional connectivity of the striatum in patients with Parkinson's disease compared with matched untreated patients and healthy volunteers.

METHOD AND MATERIALS
Twenty-two Patients with mild PD underwent a resting-state functional MRI scan both ON and OFF dopamine-replacement therapy on two consecutive days. Twenty-eight normal aging volunteers also performed fMRI on two consecutive days. Five different striatal seed regions (three caudate seeds and two putamen seeds) were selected to calculate connectivity intensity.

RESULTS
Motor symptoms measured by UPDRS were significantly worse in PD OFF than PD ON (P < 0.05). Decreased functional connectivity in PD OFF compared to controls was detected in the following seed regions: dorsal caudate, ventral putamen and dorsal putamen. There were no regions that showed greater connectivity in PD OFF than controls. Increases in connectivity in PD ON compared to controls were found in the primary and supplementary motor areas and the associative prefrontal and parietal regions, while decreases in connectivity were found in anterior cingulate, ventromedial prefrontal cortex, and parahippocampal gyrus. For the ventral striatal seeds, decreased connectivity in PD ON compared to PD OFF was found in the ventromedial prefrontal and orbitofrontal regions, dorsolateral prefrontal and frontal eye field regions. For the dorsal striatal seeds, increased connectivity in PD ON compared to PD OFF was observed in the primary and secondary motor areas.

CONCLUSION
These results suggest that levodopa significantly changes the motor and cognitive networks of the cortico-striatal pathways. This knowledge will lead clinicians to survey a broader range of symptoms in determining optimal therapy.

CLINICAL RELEVANCE/APPLICATION
This knowledge will lead clinicians to survey a broader range of symptoms in determining optimal therapy for the patients with Parkinson's disease.

Cerebral and Cerebellar Involvement in Patients with Friedreich Ataxia Disease: A Diffusion Tensor Imaging Study (Station #3)

Thomas Martin Doring MSc (Presenter): Nothing to Disclose, Simone Karuta : Nothing to Disclose, Tadeu Takao Almodovar Kubo MSc : Nothing to Disclose, Emerson L. Gasparetto MD : Nothing to Disclose

PURPOSE
To investigate the cerebral and cerebellar white matter tracts in patients with Friedreich Ataxia (FRDA) using diffusion tensor (DT) imaging and Tract-based spatial statistics (TBSS)

METHOD AND MATERIALS
21 patients clinically confirmed with FRDA (mean age of onset was 13.8y, mean disease duration’s time was 27.7y) and 17 healthy controls, demographically matched, underwent MRI at 1.5T. Besides clinical routine protocol a DTI sequence was applied along 30 nonlinear directions and no gap. Diffusion parameter maps (FA, MD, AD, RD) were reconstructed offline using FSL. Statistical analysis was carried out by TBSS, performing voxelwise statistical analysis (permutation based inference) in the main fiber tracts, that are common in all subjects. Significant altered regions were identified on the multiple comparison corrected significance p maps according to the JHU ICBM DTI-81 WM labels Atlas

RESULTS
TBSS showed multiple areas with significant FA decrease (p<0.05) in patients with FRDA: superior cerebellar peduncles, fornix, posterior thalamic radiation, forceps, inferior fronto-occipital fasciculus and inferior longitudinal fasciculus (striatum), corpus callosum, corona radiata and corticospinal tracts. High statistically significant FA reduction (p<0.01) was found in left superior cerebellar peduncle, left posterior thalamic radiation, major forceps, left inferior fronto-occipital fasciculus and corpus callosum. MD and RD values where significant increased (p<0.05) at the superior cerebellar peduncle and striatum. AD values were significantly reduced at the corticospinal tracts

CONCLUSION
Applying TBSS in patients with FRDA showed extensive cerebral and principally cerebellar WM involvement. The known conventional neuroimaging findings of spinal cord volume reduction, do not explain all symptoms presented in the disease. These new findings can partially explain the non-medullar symptoms

CLINICAL RELEVANCE/APPLICATION
The precise knowledge of brain areas that are affected in patients with Friedreichs Ataxia provides a better comprehension of the pathophysiology of the disease. Treatment strategies might be adapted to these findings

Hand and Foot Motor Cortex Activation fMRI Assessment in Patients with Brain Tumors Adjacent to Central Sulcus (Station #7)

Bo Jiang MD, PhD (Presenter): Nothing to Disclose, Jiaying Gong : Nothing to Disclose, Ximin Pan : Nothing to Disclose, Meiyu Hu : Nothing to Disclose, PING XU : Nothing to Disclose

PURPOSE
To assess hand and foot motor cortex mapping features in patients with brain tumors adjacent to central sulcus by using BOLD-fMRI technique.
METHOD AND MATERIALS
Twenty patients with brain tumors near central sulcus were obtained fMRI in 1.5 T superconduct by performing fingers-thumb tapping (FTT) and toes extension-flexion (TEF), which divided into group 1 (n=12) with impaired and group 2 (n=8) with normal limb muscle strength. The activation degree and activation shift were compared between 2 groups and between 2 tasks (p=0.05).

RESULTS
1. Primary sensorimotor (SM1) activation was detected in 20 patients in FTT task. Activation distribution differed statistically between group 1 (11 hypointense, 0 intense, 1 isointense) and group 2 (2 hypointense, 1 intense, 5 isointense) (X2=9.48, P<0.01). Incidence of hypointense activation was different between 2 groups (X2=9.38, P<0.005). Activation shift occurred in 10 patients in group 1 and in 4 in group 2, frequency of which differed between hypointense and none-hypointense (X2=8.80, P<0.005), but not between 2 groups (X2=1.20, P>0.25). 2. Paracentral lobule (PCL) activation was evoked in 17 patients in TEF task. No statistical difference of activation distribution existed between group 1 (8 hypointense, 1 intense, 0 isointense) and group 2 (5 hypointense, 1 intense, 2 isointense) (X2=7.46, P>0.05). No difference of hypointense activation incidence was noted in 2 groups (X2=0.037, P>0.75). Activation shift occurred in 5 in group 1 and in 2 in group 2, frequency of which showed no difference between hypointense and none-hypointense (X2=2.03, P>0.1), or between 2 groups (X2=0.615, P>0.25). 3. No difference of hypointense incidence was found between SM1 and PCL (X2=0.16, P>0.5), nor frequency of activation shift between SM1 and PCL in the 20 patients (X2=2.05, P>0.1).

CONCLUSION
BOLD-fMRI reveals activation pattern alterations of hand and foot motor cortex induced by the tumor near central sulcus. SM1 and PCL activation shifts imply actively protective responses to tumoral invasion. PCL seems more flexible in configuration than SM1.

CLINICAL RELEVANCE/APPLICATION
Hand and foot motor cortex mapping demonstrated by fMRI provides a guideline to pre-surgical protocol planning for the patients with tumors close to central sulcus.

NRE256
The Interface of Clinical Neurology and Neuroradiology in Classic Ischemic Stroke Syndromes: Where Do You Localize the Lesion? (Station #8)

Pavel Rodriguez MD (Presenter): Nothing to Disclose, Vivek Misra MD: Nothing to Disclose, Maria Pilar Valencia MD : Nothing to Disclose, Bundhit Tantiwongkosi MD : Nothing to Disclose

TEACHING POINTS
After reviewing this educational exhibit, the participant should be able to 1) describe the unique clinical neuroanatomical presentation of classic ischemic stroke syndromes and 2) explain their neuroanatomical localization.

TABLE OF CONTENTS/OUTLINE
1. Introduction 2. Cerebral syndromes a. Clinical presentation b. Neuroimaging findings 3. Basal Ganglia syndromes a. Clinical presentation b. Neuroimaging findings 4. Thalamic syndromes a. Clinical presentation b. Neuroimaging findings Summary: The neuroanatomical localization of classic ischemic stroke syndromes is essential for the neurologist and neuroradiologist to help guide the proper ordering and interpretation of neuroimaging studies. In particular, the "gunshot" approach to neuroimaging can be avoided by understanding lesion localization. Multiple syndromes are very classic in clinical presentation and can very well predict the neuroimaging abnormality. The neuroimaging interpretation false negative rate is also likely reduced if the expected abnormal area is closely inspected especially in the hyperacute-subacute setting when CT can be equivocal. Negative diffusion weighted imaging (DWI) ischemic stroke has also been previously described in the brainstem and posterior circulation territory.

NRE226
Cerebral Microbleeds: Causes, Clinical Relevance and Imaging Approach (Station #9)

Sangam Gurudas Shet Kanekar MD (Presenter): Nothing to Disclose, David Ermak : Nothing to Disclose

TEACHING POINTS
1. To discuss in brief physics of susceptibility-weighted imaging (SWI). 2. To discuss the various causes of cerebral microbleeds (CMBs) and discuss their clinical significance.

TABLE OF CONTENTS/OUTLINE
With the development of MRI techniques (gradient-recalled echo and susceptibility-weighted sequences) exquisitely sensitive to paramagnetic blood products, microbleeds are commonly seen on routine brain MRI. The clinical significance remains elusive. We retrospectively studied MRI brain of 1200 patients from PACS system. Axial T2, T1 and SWI images were compared and then were correlated with the clinical and final diagnosis of the patient. The incidence of CMBs was highest with prior history of trauma, and intracerebral hemorrhage. Second and third most common causes were in patient with prior history of stroke/hypertensive encephalopathy, and neurodegenerative diseases such as amyloid angiopathy, Alzheimer disease. Various other causes found on our study include CADASIL, CARASIL, CMBs due to cardiac (endocarditis, myxoma and cardiac valve), Fabry's, vasculitis, post RT, moyamoya, PRES, and blood disorders. Summary: We discuss in brief the physics of SWI sequence and its role in detection of cerebral microbleeds. We give an algorithmic approach in evaluation and mapping of CMBs with respect to their clinical significance.

NRE384
Unraveling the Cerebral Venous System: A Radiologist’s Perspective (Station #10)

1. Present normal anatomy including variants of cerebral venous system 2. Illustrate imaging appearance of venous sinus pathologies on different imaging modalities 3. Discuss predisposing factors, pathogenesis, clinical presentation and management of dural venous thrombosis

**TABLE OF CONTENTS/OUTLINE**

Cerebral venous system consists of deep venous system, superficial venous system, and dural venous sinuses. Anatomical variations of these venous drainage pathways (in particular absence, hypoplasia and arachnoid granulations) are examined with emphasis on differentiating anatomic variance from pathology. The following pathologic processes are discussed in detail: sinus thrombosis, tumor invasion, trauma, carotid-cavernous fistula, vein of Galen malformation, dural AV fistula etc. A thorough understanding of cerebral sinus anatomy and its hypoplasia to the brain and skull is important for preoperative planning. Knowledge of various pathologies affecting cerebral venous system and their characteristic imaging features is crucial for guiding treatment. Radiologist plays a vital role in providing information required by clinician. Aims/Objectives • Normal anatomy and variants • Pathology • Imaging • Clinical implications • Management • Conclusion

**Resting State fMRI: Principles, Applications and Pitfalls (Station #11)**

Behroze Vachha MD, PhD (Presenter): Nothing to Disclose , Bradley R. Buchbinder MD : Nothing to Disclose , Mykol Larvie MD, PhD : Nothing to Disclose , Matthew Nicholas DeSalvo MD, PhD : Nothing to Disclose , Naoro Tanaka MD, PhD : Nothing to Disclose , Otto Rapalino MD : Nothing to Disclose , Steven Marshall Stufflebeam MD : Nothing to Disclose

**TEACHING POINTS**

Resting state functional connectivity MRI (rs-fcMRI) identifies networks of functionally connected brain regions based on temporal correlations in spontaneous low frequency fluctuations of resting-state BOLD signals. Several networks have been elucidated, including motor, language, visual, attention, executive, and default mode networks. rs-fcMRI provides a rapid, non-invasive, task-free method of presurgically mapping eloquent cortex in patients, and has advantages and disadvantages compared to task-based fMRI. The greatest impact is in patients who cannot tolerate traditional task-based fMRI (e.g. young children, patients with developmental delay/dementia, and patients requiring anesthesia).

**TABLE OF CONTENTS/OUTLINE**

We provide an overview of the underlying principles, highlight the role of rs-fcMRI in neurologic disorders, discuss technical and interpretative challenges, and suggest quantitative techniques to incorporate rs-fcMRI in routine clinical practice. We review our institutional results with rs-fcMRI of patients with neurologic pathology including medically refractory epilepsy, traumatic brain injury, brain tumors and Alzheimer's disease. Representative cases depicting the application of rs-fcMRI in comparison to conventional task-based fMRI will be presented. Technical and interpretative challenges will be illustrated.

**Obstetrics/Gynecology Thursday Poster Discussions**

**Review of Safety of MRI in Pregnancy (Station #1)**

Kristina Elizabeth Hoque MD, PhD (Presenter): Nothing to Disclose , Daphne Kim Walker MD : Nothing to Disclose

**TEACHING POINTS**

This exhibit explores the basic principles of MRI safety for both pregnant healthcare workers and pregnant patients. A review of past and present literature pertaining to effects of MRI on the developing fetus will be explored. Past and present guidelines for MRI and gadolinium contrast agents will be detailed.

**TABLE OF CONTENTS/OUTLINE**

I. Review of basic MRI principles and the potential biological effects of nonionizing radiation II. Review of the unique concerns of pregnant healthcare workers and nonionizing radiation a. Discussion of MRI zones and recommendations III. Review of MRI as a tool to evaluate the pregnant patient a. Discussion of the decision making process, informed consent and Image Gently principles b. Discussion of ACR appropriateness criteria c. Discussion of Gadolinium based contrast IV. Review of potential biological effects of MRI on developing fetus b. Explanations of deleterious effects of MRI on fetal development and the underlying pathophysiology V. Review of MRI and the postpartum patient a. Physiology of contrast and lactation b. Review of current guidelines for contrast administration in the lactating patient VI. Multiple choice quiz, answers and explanations reviewing critical educational objectives

**Pediatric Thursday Poster Discussions**

**Review of Current Guidelines for Contrast Administration in the Lactating Patient (Station #1)**

Kristina Elizabeth Hoque MD, PhD (Presenter): Nothing to Disclose , Daphne Kim Walker MD : Nothing to Disclose

**TEACHING POINTS**

Review of current guidelines for contrast administration in the lactating patient. Discussion of the potential biological effects of ionizing radiation on the developing fetus, the role of MRI in the postpartum patient, and the impact of contrast administration on lactation.

**TABLE OF CONTENTS/OUTLINE**

Sub-Events

PDS259

Voiding Urosonography Phantom Study: Intravenous Iodinated and Gadolinium-based Contrast Agents May Cause False-negative Results in Assessment of Pediatric Vesicoureteral Reflux (Station #1)

Simon Veldhoen MD (Presenter): Nothing to Disclose, Alexander Sauer MD : Nothing to Disclose, Tobias Gassenmaier MD : Nothing to Disclose, Bernhard Petritsch : Nothing to Disclose, Stefan Marco Herz MD : Nothing to Disclose, Philipp Blanke MD : Nothing to Disclose, Thorsten Derlin : Nothing to Disclose, Thorsten Alexander Bley MD : Nothing to Disclose, Clemens Wirth MD : Nothing to Disclose

PURPOSE

To assess the diagnostic performance of voiding urosonography (VUS) for detection of pediatric vesicoureteral reflux (VUR) when following other procedures requiring application of intravenous contrast.

METHOD AND MATERIALS

Iodinated (Iomeprol, Iopamidol) and gadolinium-based (gadoterate meglumine) contrast agents were diluted to bladder concentration and injected into balloons filled with saline solution. MDCT scans were performed to assess the contrast distribution in these phantoms. Regions of interest were placed at the top and bottom side of each balloon and Hounsfield units (HU) were measured. Three other balloons were filled with saline solution and contrast media likewise. An ultrasound contrast agent (UCA) was subsequently added and its distribution in the phantoms was assessed using sonography.

RESULTS

MDCT scans showed a separation of two liquid layers in all bladder phantoms with the contrast layers located at the bottom and the saline solution at the top. Significant differences of the HU measurements at the top and bottom side were observed (p<.001-.007). Following injection of UCA, ultrasound revealed its distribution exclusively among the saline solution at the top of the phantom.

CONCLUSION

UCA is supposed to be unable to reach the ureteric orifices located at the posterior/inferior bladder wall if excreted contrast material accumulates at the bottom of the bladder. False-negative results of VUS have to be considered if it is performed shortly after imaging procedures requiring intravenous contrast.

CLINICAL RELEVANCE/APPLICATION

Evaluation of VUR utilizing VUS should be performed prior to other procedures requiring intravenous contrast agents.

PDS260

Optimization of Pediatric Craniosynostosis CT with Model-based Iterative Reconstruction (VEO): Phantom Study (Station #2)

Touko Kaasalainen (Presenter): Nothing to Disclose, Kirsi Palmu MSc : Nothing to Disclose, Anniina Lampinen : Nothing to Disclose, Vappu Reijonen PhD : Nothing to Disclose, Junnu Leikola : Nothing to Disclose, Riku Kivisaari : Nothing to Disclose, Mika Karel Kortesniemi PhD : Nothing to Disclose

PURPOSE

To evaluate the possibility of using ultralow-dose CT protocols with model-based iterative reconstruction technique for craniosynostosis imaging.

METHOD AND MATERIALS

Two anthropomorphic phantoms, corresponding pediatric newborn and 5-year-old patients, were scanned with 64-slice CT scanner using different low-dose protocols. Organ doses in the head region were measured with MOSFET dosimeters, and doses of low-dose scans were compared to routine protocols of hospital for craniosynostosis. Additionally, organ doses, as well as effective doses, were also determined by simulations. Image quality was evaluated objectively and subjectively using ASIR30%, ASIR50% and VEO reconstructed images. Image noise and contrast were determined from the CT number histograms of different tissues. Subjective image quality was evaluated in a blinded manner using a Likert scale by two experienced physicians.

RESULTS

In the newborn phantom, mean organ dose was reduced up to 83% compared to routine protocol when using ultralow-dose scanning settings (80 kVp and fixed 10 mA tube-current). Similarly, in the 5-year-old phantom, the greatest radiation dose reduction was up to 88% compared to our routine protocol. The simulations supported the findings with MOSFET measurements. According to objective and subjective image quality analysis, the image quality remained adequate with VEO reconstruction even with the lowest dose level.

CONCLUSION

Craniosynostosis CT with VEO could be performed in our study by approximately 20 μSv effective dose for the patient, corresponding to the radiation exposure of plain skull radiography, without compromising adequate image quality.

CLINICAL RELEVANCE/APPLICATION

Radiation doses of craniosynostosis patients, who are exposed to repeated CT scans, can be reduced significantly using model-based iterative reconstruction without compromising adequate image quality for
MRI based on DWI and GRE T2 or SWI may help to predict the prognosis.

pathophysiology of pediatric PRES.

Chemotherapy, immunosuppressors and other endotheliotoxic medication play and important role in the

CLINICAL RELEVANCE/APPLICATION

Presence of hemorrhagic changes on initial MRI is also linked with a worst patient’s outcome.

frequent sequela. DWI restriction is a marker of non reversible edema and indicates poor prognosis.

Recurrence is infrequent. PRES has not a so good long-term prognosis in children. Epilepsy is the most

CONCLUSION

hemorrhage or DWI lesions on initial MRI.

persistent mydriasis, 1 hypotonia and 1 learning disability. Six of the patients with sequelae had

residual lesions were found. Six patients developed epilepsy, two patients ataxia, one patient had a

MRI, 2 patients showed hemorrhagic changes. Follow-up MRI was performed on 14 patients and in 6/14

(19/20), followed by the frontal and temporal lobes. 9/20 showed restriction of diffusion (DWI) on initial

85%, altered mental status in 65% , visual disturbance 25% and headache in 15% . Arterial hypertension

A 10/20, tacrolimus 5/20, mycophenolate 3/20, corticoids 3/20). Presenting symptoms were seizures in

were males. Recurrence of PRES was observed in one patient. Most common predisposing causes were

renal and hemato-oncologic diseases, frequently associated with endotheliotoxic medication (cyclosporine

A 10/20, tacrolimus 5/20, mycophenolate 3/20, corticoids 3/20). Presenting symptoms were seizures in

85%, altered mental status in 65% , visual disturbance 25% and headache in 15% . Arterial hypertension

was present in 16/20 patients. The parieto-occipital regions were the most common involved in MRI

(19/20), followed by the frontal and temporal lobes. 9/20 showed restriction of diffusion (DWI) on initial

MRI, 2 patients showed hemorrhagic changes. Follow-up MRI was performed on 14 patients and in 6/14

residual lesions were found. Six patients developed epilepsy, two patients ataxia, one patient had a

persistent mydriasis, 1 hypotonia and 1 learning disability. Six of the patients with sequelae had

hemorrhage or DWI lesions on initial MRI.

CONCLUSION

PRES should be recognized and trigger agents must be discontinued to prevent long-term sequelae.

Recurrence is infrequent. PRES has not a so good long-term prognosis in children. Epilepsy is the most

frequent sequela. DWI restriction is a marker of non reversible edema and indicates poor prognosis.

Presence of hemorrhagic changes on initial MRI is also linked with a worst patient’s outcome.

CLINICAL RELEVANCE/APPLICATION

Chemotherapy, immunosuppressors and other endotheliotoxic medication play and important role in the

pathophysiology of pediatric PRES.

MRI based on DWI and GRE T2 or SWI may help to predict the prognosis.
Impact of Dual-Energy CT Techniques on Artifact Suppression Using a Pediatric Phantom (Station #6)

Bria Moore (Presenter): Nothing to Disclose, Daniel Tobias Boll MD: Research Grant, Siemens AG
Research Grant, Koninklijke Philips NV Research Grant, Bracco Group, Juan Carlos Ramirez Giraldo PhD: Employee, Siemens AG, Joshua Wilson PhD: Nothing to Disclose, Ehsan Samei PhD: Research Grant, Siemens AG Research Grant, General Electric Company Research Grant, Carestream Health, Inc, Donald P. Frush MD: Nothing to Disclose

PURPOSE
Artifact reduction via dual-energy CT (DECT) is predominantly studied in adults. This study aims to assess the impact of acquisition parameters on the reduction of a common pediatric hardware artifact, spinal rods, using a unique pediatric phantom.

METHOD AND MATERIALS
A proprietary, custom-designed phantom (Mercury 3.0), consisting of a range of pediatric-sized modules (diameters of 12, 18.5, 23, and 30 cm) was fitted with two standard stainless steel rods used for pediatric scoliosis repair. The phantom was scanned with pediatric DECT protocols (Siemens Flash) using 80/140 kVp and 100/140 kVp respectively employing a dose modulated reference based on size. All studies were reconstructed using filtered back projection (FBP) and iterative reconstruction (IR, SAFIRE 3). DECT post-processing (Syngo DE monoenergetic) was applied to reduce artifact in the reconstructed image by performing a monoenergetic extrapolation. Artifact reduction was assessed in the surrounding soft tissues by (1) comparing the attenuation between the corrected artifact series with that of the phantom in the absence of the artifact, and (2) evaluating the noise expressed as attenuation standard deviation between corrected image series with and without spinal rods.

RESULTS
Noise levels in the 100/140 kVp set were improved 20.7% on average when compared to the 80/140 kVp sets. IR reduced noise 26.3% compared to FBP. For artifact reduction, the optimal keV settings (mean) for 100/140 kVp were similar (108 and 105 keV) for IR and FBP, respectively. However, the keV range was narrower for IR (101-109 keV) compared to that FBP (105-120 keV).

CONCLUSION
The Mercury phantom is a unique tool for systematic investigation of pediatric CT, including innovative DECT applications. Our results suggest that optimal spinal rod metal artifact reduction in children using DECT is achieved from an acquisition protocol of 100/140 kVp pairs, iteratively reconstructed and DECT post-processed at 105-108 keV.

CLINICAL RELEVANCE/APPLICATION
DECT can substantially reduce artifacts produced by common metal hardware such as spinal rods by using monoenergetic extrapolation post-processing.

Extravesical Ectopic Ureters in Children: The Spectrum of MR Urography (fMRU) Findings (Station #7)

Aikaterini Ntoulia MD, PhD (Presenter): Nothing to Disclose, Maria Alejandra Bedoya Velez MD: Nothing to Disclose, Melkamu Dessie Adeb MD: Nothing to Disclose, Dmitry Khrcenkov: Nothing to Disclose, Kassa Darge MD, PhD: Nothing to Disclose

TEACHING POINTS
To demonstrate the utility of fMRU to accurately detect the insertion site of extravesical ectopic ureters (EEUs) in children and evaluate the function of associated moieties.

TABLE OF CONTENTS/OUTLINE
**PURPOSE**

To compare the visibility of structures of various sizes and contrast in MDCT images reconstructed with an iterative reconstruction algorithm and with a filtered back projection algorithm in standard and high resolution at various dose levels.

**METHOD AND MATERIALS**

The experimental study was performed on a 256-slice MDCT (Philips Healthcare, Cleveland, OH). Modulation transfer functions (MTF) were measured from the edges of the 4 sensitometry samples of the CTP401 module of a catphan phantom (The phantom Laboratory, Salem, NY). The CT images of the various contrast inserts were scanned at decreasing doses (48.8 mGy down to 0.7 mGy) and reconstructed with standard filtered back projection (FBP) and iterative reconstruction algorithm (IMR, Philips Healthcare). The edge of each circular contrast object was analyzed to determine the edge spread function, which was differentiated and Fourier transformed to obtain the object-specific MTF. IMR results were compared to the FBP results at the various dose and contrast levels to analyze the influence of those parameters on the spatial resolution. In addition, chest cadaver images scanned and reconstructed using the same technical parameters for decreasing dose levels and were analyzed to show the differences in the visibility of anatomical structures between the 2 reconstruction techniques and to compare the results obtained with the phantom scans.

**RESULTS**

With FBP, the MTF measured from all contrast inserts was constant throughout all measurements. With IMR, the MTF measured at the highest dose was similar to that of FBP. However, with IMR, the MTF was increasingly lowered for inserts of decreasing contrast at decreasing dose (LDPE insert: MTF50% = 6.4, 5.95, 4.3, 2.9 lp/cm at 48.8, 6.1, 3.0 and 0.7 mGy respectively). Cadaver images reconstructed with IMR showed similarly that the visibility and delineation of anatomical structures could be deteriorated with decreasing doses, and that this happened primarily with the smallest and lowest contrast structures.

**CONCLUSION**

Results demonstrated that although iterative reconstructions provide a superior noise performance to FBP, spatial resolution of iterative reconstructions is dose and contrast dependent.

**CLINICAL RELEVANCE/APPLICATION**

Clinical scan protocols which had been optimized based on the CT noise properties of FBP will need to be re-evaluated with iterative reconstructions using new image quality metrics based on this new paradigm shift.

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**Hemodynamic-independent Analysis with Self Correction for Brain-fluctuation MRI (Station #2)**


**PURPOSE**

We have reported that the apparent diffusion coefficient (ADC) obtained from diffusion magnetic resonance imaging (MRI) in brain tissue significantly changed during the cardiac cycle because of the water-molecule fluctuation, and this information assist in the diagnosis of idiopathic normal pressure hydrocephalus. However, these changes (delta-ADC) are affected by the regional cerebral blood flow (rCBF). To evaluate hemodynamic independent water fluctuation, we corrected the rCBF effect by using the diffusion data itself.

**METHOD AND MATERIALS**

On a 3.0-T MRI, ECG-triggered single-shot diffusion EPI (b=0, 200, 600, and 1000 s/mm²) was used with sensitivity encoding and half-scan techniques to minimize the bulk motion. Then, the maximum ADC (ADCmax) and minimum ADC (ADCmin) in cardiac cycle (fluctuation; b=0-200, 0-600), and delta-ADC (perfusion-related diffusion; b=0-1000) were determined in the frontal white matter in healthy volunteers (n= 10). These values were compared with the rCBF obtained by pseudo-continuous arterial spin labeling technique. Finally, we corrected delta-ADC by ADCmax having the highest correlation with the rCBF, i.e., delta-ADC divided by the perfusion-related diffusion.

**RESULTS**

There was significant correlation between delta-ADC and rCBF, indicating hemodynamic dependence of the delta-ADC. ADCmax with b=0-200 had the strongest positive correlation of all perfusion-related diffusion values. However, no significant correlation was found between ADCmin and rCBF. There was no significant correlation between corrected-delta-ADC (= [delta-ADC] / [ADCmax with b=0-200]) and rCBF, indicating the hemodynamic independence of the corrected-delta-ADC.

**CONCLUSION**

Corrected-delta-ADC makes it possible to obtain the degree of fluctuation of the water molecules hemodynamic-independently in the brain without additional rCBF scan and measurement.

**CLINICAL RELEVANCE/APPLICATION**

Corrected-delta-ADC enables to obtain the degree of fluctuation of the water molecules hemodynamic-independently in the brain without additional rCBF scan.
Examination of the Contrast, Noise, and Dose Performance of Chest Digital Tomosynthesis for the Detection of Lung Nodules (Station #3)

Katelyn Nye (Presenter): Employee, General Electric Company, John M. Sabol PhD: Employee, General Electric Company

PURPOSE

Digital tomosynthesis (DTS) is increasingly used clinically as a low-dose tomographic imaging technique. It has been demonstrated to enable increased detection of lung nodules and aid in patient management, in particular for suspicious nodules seen on chest x-ray. This study examines the contrast and noise performance of DTS for a wide range of radiographic techniques and doses to optimize performance for the lung nodule detection task.

METHOD AND MATERIALS

Chest DTS images of a medium adult chest phantom with 6 simulated lung nodules of various diameters (8 to 12mm) and attenuations (-800 to 100HU) were acquired using 72 different combinations of mAs; copper filtration (0.0, 0.1, and 0.3mm), and kVp (100 to 150kVp in steps of 10kVp). With 60 projection views and fixed kVp techniques, mAs parameters were determined by the AEC from the scout image. The total incident air kerma (IAK) was measured for each technique enabling Monte Carlo estimation of effective dose. The raw reconstructed DTS images were analyzed for the central slice through each nodule. Uniform regions of interest were selected for nodules and their neighboring backgrounds. CNR was calculated for each exam and nodule.

RESULTS

The lowest dose technique utilized 0.25mAs per projection, 0.3mm Cu filtration, and 100kVp resulting in 0.15mGy incident air kerma. mAs selection was observed to have minimal effect on dose, compared to copper filtration and kVp selection as a result of the use of minimal mAs techniques for each projection view for the medium adult sized phantom. As total IAK decreased, the CNR /sqrt(dose) increased, without reaching a maxima, for all nodules and techniques. This CNR behavior indicates that for the lung nodule imaging task, the DTS system is not dose-limited.

CONCLUSION

For routine clinical chest imaging techniques, there is potential to further reduce patient dose while maximizing CNR /sqrt(dose) by decreasing the incident air kerma beyond the capabilities of the current DTS system. After minimal dose acquisition techniques have been determined, there may be further opportunity to reduce dose, without sacrificing image quality, through the use of optimized reconstruction techniques.

CLINICAL RELEVANCE/APPLICATION

Digital tomosynthesis is a low dose imaging technique that can improve lung nodule detection, there is opportunity to further reduce dose without sacrificing relative contrast to noise performance.

Quantitative Analysis of MRI for Treatment Response Assessment of Multiple Myeloma (MM): Stratification of MM Infiltration Pattern in Bone Marrow Using Dynamic Intensity Entropy Transformation (DIET) Method (Station #4)

Chuan Zhou PhD (Presenter): Nothing to Disclose, Qian Dong MD: Nothing to Disclose, Heang-Ping Chan PhD: Institutional Research collaboration, General Electric Company, Daniel R. Couriel: Nothing to Disclose, Lubomir M. Hadjiiski PhD: Nothing to Disclose, Jun Wei PhD: Nothing to Disclose, Attaphol Pawarode: Nothing to Disclose, Bo He: Nothing to Disclose

PURPOSE

Studies revealed that MRI patterns of multiple myeloma (MM) infiltration in the bone marrow have prognostic significance and are useful for the evaluation of tumor burdens and treatment response for MM patients. We are developing quantitative MRI analysis method for treatment response assessment of MM. This study investigated the feasibility of stratifying MRI patterns of MM infiltration.

METHOD AND MATERIALS

With IRB approval, 50 pairs of spinal MR scans performed before and after bone marrow transplant were collected retrospectively from 50 patients with MM disease. An experienced musculoskeletal radiologist visually examined each vertebra and provided the descriptor of its pattern (normal, focal, variegated (salt-pepper), and diffuse) as reference standard. A 3D dynamic intensity entropy transformation (DIET) method was developed to transform MR T1-weighted signal voxel by voxel to a quantitative entropy value (qEEV), defined as the intensity entropy at the voxel normalized by the median intensity entropy in the adjacent intervertebral discs. The mean of qEEV (m-qEEV) in each vertebral body was used as a predictor for three classification tasks: (1) diffuse vs group of the normal, focal, variegated (salt-pepper) patterns, (2) normal vs group of the focal, variegated and diffuse patterns, and (3) group of variegated and diffuse patterns vs group of normal and focal patterns. The classification performance was evaluated by ROC analysis.

RESULTS

Of the 1022 vertebras, 229, 241, 372 and 180 vertebras were identified by radiologist as normal, focal, variegated and diffuse pattern, respectively. This has the potential to quantitatively track the regression or progression of MM during or after treatment.
CLINICAL RELEVANCE/APPLICATION
Quantitative image-based biomarker may improve the accuracy and efficacy for staging and assessing treatment response for MM, allowing clinicians to optimize therapy of individual patients.

PHS198
Targeted CT Dose Reduction Using a Novel Dose Metric and the ACR Dose Index Registry: Application to Thoracic CT Angiography (Station #5)
David A. Zamora BEng, MS : Nothing to Disclose , Jeffrey David Robinson MD (Presenter): Consultant, HealthHelp, LLC President, Clear Review, Inc , Kalpana M. Kanal PhD : Nothing to Disclose

CONCLUSION
TEV analysis of DIR data has focused dose reduction efforts on specific exams that yield the greatest clinical benefit to the patient population.

Background
The American College of Radiology Dose Index Registry (DIR) serves as a repository for dose metrics (CTDI vol, SSDE, and DLP) from hospitals around the country and provides summary data analysis. A proposed metric, the Total Exposure Variance (TEV) was calculated for each of the most frequently performed exams at our institution. TEV was calculated per exam as the product of exam frequency (N) and the difference between our institutional and national median dose (CTDI vol or SSDE). TEV was then used as an indicator of total population dose in excess of national median values. Based on TEV calculated from SSDE, two particular exams were identified in the 2012 DIR report for potential improvement: 1) CT pulmonary angiography (CTPA), which had CT dose between the median and third quartile; and, 2) CT thoracic angiography (CTTA), optimized for the aorta, which had CT dose in the top quartile. The purpose of this work is to illustrate the clinical utility of TEV analysis to reduce population dose when applied to national benchmark CT dose data.

METHOD AND MATERIALS
In this IRB approved study, 10581 abdomen CT exams performed between June 2013 and February 2014 were retrieved using dose monitoring software (DMS, xposure, Radimetrics). DMS automates SSDE measures by determining the effective body diameter at mid-axial line. To validate the accuracy and reproducibility of DMS generated SSDE, in 300 consecutive abdomen CT exams, SSDE was manually calculated. The 10,281 remaining exams were divided into 3 groups: Group A=4000, Group B=6000 and Group C=281 exams. In group A, a correlation between SSDE based on CTDI and BW was determined and a formula best fitting the curve was derived. The accuracy of the derived formula was then determined by comparing the formula based SSDE with DMS generated SSDE in Group B and manually calculated SSDE in Group C.

RESULTS
A strong correlation between DMS and manually calculated SSDE was established (R2=0.93, p<0.0001). A power curve was estimated between SSDE and CTDI after correcting for BW (Multiple R=0.95, R2=0.99 and p<0.0001). The formula SSDE = 2.3987×CTDI0.7749 - e (where e=0.0549×Weight + 4.5099) was derived. The SSDE values generated using this formula showed a positive correlation with the DMS generated SSDE (Group B) (N=6000, R=0.87, R2 =0.76) and manually derived SSDE (Group C) (N=281, R=0.94, R2=0.87).

CONCLUSION
The DMS generated SSDE values are reliable and accurate. By applying a formula based on patient’s body weight and CTDI one can reliably measure SSDE similar to DMS generated value. This formula can be a reliably estimate for SSDE reporting especially for large patient cohorts when automated solutions are not available.

CLINICAL RELEVANCE/APPLICATION
SSDE has been introduced as a reliable dose metric; however, its calculation is not feasible especially while reporting doses in large patient cohorts. In absence of automated solution, this formula which incorporates readily available CTDI and patient’s BW can make SSDE calculation and reporting timely and feasible.

PHS199
Can an Estimation Based on CTDI and Body Weight Replace the Conventional Diameter Based Approach for SSDE Calculation? Can a Simple CTDI and Body Weight Based Estimation Serve as a Reliable Alternative for Body Diameter Based Approach for Size Specific (Station #6)
Yasir Andrabi MD, MPH (Presenter):  Nothing to Disclose , Saajed All :  Nothing to Disclose , Sabiba A Wadoo :  Nothing to Disclose , Manuel Patino MD :  Nothing to Disclose , Jorge Mario Fuentes MD :  Nothing to Disclose , Dushyant V. Sahani MD :  Research Grant, General Electric Company

PURPOSE
To investigate the feasibility and accuracy of Size Specific Dose Estimate (SSDE) calculation based on CTDI and body weight (BW) in comparison to conventional effective diameter based SSDE calculation.

METHOD AND MATERIALS
In this IRB approved study, 10581 abdomen CT exams performed between June 2013 and February 2014 were retrieved using dose monitoring software (DMS, eXposure, Radimetrics). DMS automates SSDE measures by determining the effective body diameter at mid-axial line. To validate the accuracy and reproducibility of DMS generated SSDE, in 300 consecutive abdomen CT exams, SSDE was manually calculated. The 10,281 remaining exams were divided into 3 groups: Group A=4000, Group B=6000 and Group C=281 exams. In group A, a correlation between SSDE based on CTDI and BW was determined and a formula best fitting the curve was derived. The accuracy of the derived formula was then determined by comparing the formula based SSDE with DMS generated SSDE in Group B and manually calculated SSDE in Group C.

RESULTS
A strong correlation between DMS and manually calculated SSDE was established (R2=0.93, p<0.0001). A power curve was estimated between SSDE and CTDI after correcting for BW (Multiple R=0.95, R2=0.99 and p<0.0001). The formula SSDE = 2.3987×CTDI0.7749 - e (where e=0.0549×Weight + 4.5099) was derived. The SSDE values generated using this formula showed a positive correlation with the DMS generated SSDE (Group B) (N=6000, R=0.87, R2 =0.76) and manually derived SSDE (Group C) (N=281, R=0.94, R2=0.87).

CONCLUSION
The DMS generated SSDE values are reliable and accurate. By applying a formula based on patient’s body weight and CTDI one can reliably measure SSDE similar to DMS generated value. This formula can be a reliably estimate for SSDE reporting especially for large patient cohorts when automated solutions are not available.

CLINICAL RELEVANCE/APPLICATION
SSDE has been introduced as a reliable dose metric; however, its calculation is not feasible especially while reporting doses in large patient cohorts. In absence of automated solution, this formula which incorporates readily available CTDI and patient’s BW can make SSDE calculation and reporting timely and feasible.

PHS200
Fully Automatic Volumetric Segmentation of Pulmonary Nodules: Evaluation Using the Complete LIDC/IDRI Database (Station #7)
Bianca Christin Lassen MSc :  Nothing to Disclose , Jan-Martin Kuhnigk PhD, MS :  Stockholder, MeVis Medical Solutions AG , Colin Jacobs MSc :  Research Grant, MeVis Medical Solutions AG , Eva Marjolein Van Rikvoort PhD (Presenter):  Stock holder, Thirona BV Co-founder, Thirona BV , Bram Van Ginneken MD :  Stockholder, Thirona BV Co-founder, Thirona BV Research Grant, MeVis Medical Solutions AG Research Grant, Canon Inc Research Grant, Toshiba Corporation Research Grant, Riverain Technologies, LLC

PURPOSE
Quantitative image-based biomarker may improve the accuracy and efficacy for staging and assessing treatment response for MM, allowing clinicians to optimize therapy of individual patients.
The Local Deposition Method: A Simplified Mechanism of Direct Yttrium-90 Dosimetry Utilizing PET/CT with Comparable Accuracy to Dose-Point Kernel Convolution (hardcopy backboard)

Austin Clark Bourgeois MD (Presenter): Nothing to Disclose, Anjeza Chukus MD: Nothing to Disclose, Michael Holmes Secrist MD: Nothing to Disclose, David Dreizin MD: Nothing to Disclose, Robert K. Zeman MD: Stockholder, General Electric Company

BACKGROUND

90Y PET/CT following radioembolization has recently been established as a viable diagnostic tool, capable of producing images that are both quantitative and have superior image quality than alternative 90Y imaging modalities. Because radioembolization is a permanent implant, it is possible to convert quantitative 90Y PET image sets into data representative of spatial committed absorbed-dose. Multiple authors have performed this transformation using dose-point kernel (DPK) convolution to account for the transport of the high-energy 90Y B- particles.

EVALUATION

This article explores a technique called the Local Deposition Method (LDM), an alternative to DPK convolution for 90Y image-based dosimetry. The LDM assumes that the kinetic energy from each 90Y B- particle is deposited locally, within the voxel where the decay occurred. Using the combined analysis of phantoms scanned using 90Y PET/CT and ideal mathematical phantoms, an accuracy comparison of DPK convolution for 90Y image-based dosimetry. The LDM method has the advantage of not requiring additional post-processing. Instead, the provided conversion factors can be used to determine committed
Improving the Pediatric MRI Experience: A Multidisciplinary Team Approach Using Lean Sigma Methodology (Station #1)

Emily Lee: Nothing to Disclose, Joanne Shay MD: Nothing to Disclose, Thierry Huisman MD: Nothing to Disclose, Peg C. Cooper RT: Nothing to Disclose, Hal Shaffner MD: Nothing to Disclose, Aylin Tekes-Brady MD (Presenter): Nothing to Disclose

PURPOSE

To improve outpatient Pediatric MRI General Anesthesia family satisfaction by 15% and reduce the arrival to scan time to less than 60 minutes in six months.

METHODS

• Created a multi-disciplinary team including stakeholders from Pediatric Anesthesia, Pediatric Radiology, radiology administration, Nursing, Child Life, scheduling and registration. • Weekly meetings were held to discuss the purpose, understand the baseline process and determine where improvements were most needed. • A Patient/Family survey was created to gain baseline patient satisfaction feedback regarding the existing process. • A Value Stream Map was used to identify the existing process and generate baseline cycle times. • Best practice organizations conducting Pediatric MRI with General Anesthesia were studied for workflow and scanner utilization process. Improvements: Areas for improvement were determined by the baseline data collected from family surveys and the value stream map. • Parent communication before, during and after the MRI with Anesthesia process • Process standardization from patient registration through post anesthesia care unit (PACU) discharge • Parent involvement during induction of anesthesia Interventions: To achieve these improvements, our team implemented the following interventions: • Changed the Anesthesia start time in Anesthesia scheduling systems to reflect the start-time seen in Radiology scheduling system, 20 minutes before the scan start time. • Have nursing call parents before they arrive with expected duration of the scan, NPO instructions, and provide verbal information regarding parking and directions. Created an updated map with directions to the parking garage, and directions from the garage to the Pediatric MRI Registration Desk. • Implement a “radiologist meets the parents” and “Time Out” procedure prior to induction of anesthesia. This process mimics the WHO OR Patient Safety initiative by bringing the entire healthcare team, including anesthesiologists, radiologists, nurses, technologists and parents into the same room to confirm the patient identity, planned MRI exam, and create a safe environment to discuss concerns and any team member or patient/parent might voice prior to the induction of Anesthesia. • Eliminate repetitive questions asked by different members of the clinical team and generated a standardized pre-procedure nursing form • Involve a parent advocate on our lean sigma team • Enhance the involvement of Child Life Specialist by reviewing anxiety levels for the patient and parents when needed/appropriate • Provided patient status updates during the scan to the waiting family.

RESULTS

We measured the baseline patient satisfaction from the survey we created. Our interventions increased outpatient family satisfaction by 7%, and reduced the overall cycle time/wait time from 3 hr 41 min to 3 hr and 19 min, reducing the minutes from registration to anesthesia start by 21 min, from registration to scan start by 12 minutes, from PACU discharge to registration by 22 minutes. Evaluation of the Anesthesia and Radiology scheduling systems discovered a 20 minute discrepancy in the start times, therefore saved 20 minutes from the total cycle time.

CONCLUSION

Our team has focused improvements on patient-centered care to create a safe and satisfactory experience for patients and their families. The Pediatric MRI General Anesthesia process in an academic medical center is very complex, and although patient/family satisfaction was improved, the goal of 15% was not reached. This will be an ongoing process and continue until the preset goal is achieved. Next steps will include ongoing active participation of the parent advocate and feedback from The Johns Hopkins Pediatric Family Advisory Council. In addition, group wisdom from the team stake holders will be used to standardize every step of the process to eliminate variability and reduce the cycle times. All of these interventions will improve family satisfaction and the quality of care and reduce the cycle time for Pediatric MRI with General Anesthesia at Johns Hopkins Hospital.
Impact of Simulator Teaching on Junior Radiology Resident Preparedness for Independent Call (Station #3)

Kathryn Darras MD (Presenter): Nothing to Disclose, Bippan Sangha MD: Nothing to Disclose, Kristy Cho: Nothing to Disclose, Silvia D. Chang MD: Nothing to Disclose

PURPOSE
Radiology residency training and preparation for on-call responsibilities traditionally involved lectures, case-based modules, mandatory rotations through different subspecialties, in addition to participation in supervised call with upper-year residents/attending staff. With advancements in digital radiologic image acquisition and display in the last decade, resident radiology training should incorporate up-to-date technology to provide effective education and improve patient safety. The successful use of computer-based simulator teaching has been described in the literature, however, its efficacy as an educational tool is less clear. Simulator teaching as an educational tool has the theoretical benefit of exposing trainees to real-life scenarios (working with the software interface, able to perform image manipulation (contrast, scaling, measuring), accessing tomographic views and previous films). It can provide standardized teaching as well as evaluation of second year residents before commencing independent call. This Quality Storyboard is one of the first to subjectively and objectively evaluate the influence of simulator training on resident readiness during initial independent call. The aims of study are to develop a functional simulator for radiology teaching and to assess its impact on junior resident preparedness for independent call.

METHODS
This was a retrospective cross-sectional study conducted from August 2013 to March 2014. All nine second-year radiology residents at a Canadian Radiology Residency Program participated in a 4-hour mock call shift. They were presented with 17 standardized computer-based simulated cases consisting of 24 studies displayed on the full-enabled and interactive PACS system and access to relevant previous images. Cases with pertinent pathological findings in emergency radiology were chosen by the Radiology Residency Program Director and Chief Radiology residents with reference to the core curriculum published by American Society of Emergency Radiology. Residents were asked to describe the study type, protocol used, pathological findings, impression and management plan for each study and these reports graded by a chief resident and a medical student using a standardized grading system. Resident self-reported preparedness was evaluated utilizing a 5 point Likert-type scale which was completed before and after participating in the simulated cases, and after first night of independent call.

RESULTS
On average, the residents reported adequate knowledge and proficiency with the PACS system before commencement of the mock shift. They objectively scored a mean of 75.6% (95% CI:70.81) after standardized graded simulated call module was an effective educational tool and helped prepare them for beginning independent call.

CONCLUSION
Subsequent second year radiology residents will continue to participate in simulated call as part of their preparation before independent call. To enable future review using a larger sample size, data will be collected annually using the protocol established by this review.

Incorporating Consensus-Oriented Contemporaneous Peer—Review into a Breast Imaging Practice (hardcopy backboard)

Jordana Phillips MD (Presenter): Nothing to Disclose, Tejas S. Mehta MD, MPH : Nothing to Disclose,
A limitation of traditional peer review is the time lapse from when a radiology examination is performed and reported to when the case is reviewed. We have developed and are evaluating a new online system by which cases are submitted by radiologists for contemporaneous review, thus providing interpreting radiologists with real-time feedback from their colleagues, and possibly earlier identification of potential errors.

METHODS

Historically, a weekly consensus conference was performed in our Breast Imaging Section as one form of peer review. This conference occurred in an informal setting where the group openly discussed selected cases and recommended management strategies. With increases in clinical demands, a growing number of breast radiologists, and expansion into practice sites distant from the main hospital, the traditional consensus conference became challenging to coordinate and increasingly difficult for interested parties to participate. Prior to implementing this new online approach, a survey was sent to all eleven breast radiologists in the section to assess the utility and value of the current system. We subsequently sought to facilitate consensus discussion and real-time peer review via the creation of a novel web-based application. We created an online portal within our hospital Intranet whereby radiologists can enter cases for review by their colleagues. These cases may be submitted for any reason, including management questions, quality concerns, and/or interesting imaging. The submitting radiologist voluntarily enters an anonymous summary of his/her evaluation and recommended BI-RADS code. An automated system then sends email notifications to breast imagers to review submitted cases. The reviewing radiologists then anonymously and voluntarily evaluate the cases and submit their recommended BI-RADS code, management plan, and narrative comments within a 72-hour timeframe. The submitting radiologist is then provided with an analysis of the reviewing radiologists’ responses, including number for each BI-RADS assessment category and associated comments. We reviewed the data from the new online system for the following: number of radiologists reviewing each case, frequency of consensus, frequency of management changes, and inter-observer variability. Inter-observer variability was evaluated by designating three categories of recommendations: Benign, no follow-up (BI-RADS 1 and 2), probably benign with follow-up (BI-RADS 3), and suspicious with recommendation for biopsy (BI-RADS 4 and 5).

RESULTS

The results of our initial survey revealed that all 11 radiologists (100%) felt that consensus was a valuable resource for their practice, and 8 (73%) felt that our current system was ineffective mostly due to the logistics of incorporating it into our routine clinical practice as well as getting unbiased opinions in the group setting.

The novel application was implemented on March 1, 2014 and data was collected until March 31, 2014. Nine cases were entered into the system. The number of reviewing radiologists who responded to each case ranged from 1-6. Consensus, defined as a majority decision, was obtained in 8 cases (89%) and no consensus was reached in 1 case (11%). There was a change in recommended management in 2/9 cases (22%) from biopsy to follow-up. There was no change in recommended management in 6/9 cases (67%).

The majority of variability in management recommendations was between follow-up and biopsy in 4/9 cases (44%). 2/9 cases (22%) had recommendations with more varied BI-RADS recommendations: Benign, no follow-up (BI-RADS 1 and 2), probably benign with follow-up (BI-RADS 3), and suspicious with recommendation for biopsy (BI-RADS 4 and 5).

CONCLUSION

Our new online consensus-oriented real-time peer review solution enables objective evaluation that seems easier to integrate into the department workflow. This system leads to alterations in clinical management as well as possibly can minimize interpretative error. Additional evaluation is necessary to further assess this type of application.
component of geometrical error which indicated that interfractional PBM was well controlled by the ERB.

Interfractional systematic and random variations for BM and PBM

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ROS147 Prostate Brachytherapy is Associated With Low Rates of Significant Long-term Toxicities (Station #3)

Jeffrey Kittel MD (Presenter): Nothing to Disclose

ABSTRACT

Purpose/Objective(s): To report efficacy and late toxicity for a closely-followed, single-institution cohort of patients treated with prostate brachytherapy (PI). Materials/Methods: From 1996-2007, 1,989 patients with low-, intermediate-, and high-risk prostate cancer (NCCN) were treated with PI under an IRB-approved registry. All patients were treated with I-125 to a target dose of 144 Gy. Patient disease characteristics, comorbidities, and treatment parameters were recorded. Toxicities were assessed from a review of patients' charts and via communication from patients and their referring physicians. Toxicity was scored according to a modified CTCAE scale, and late toxicity was defined as occurring > 6 months after PI. The rates of biochemical relapse-free survival (bRFS) and distant metastases free survival (DMFS) were calculated using actuarial analysis. Prostate cancer specific mortality (CSM) was calculated using cumulative incidence analysis. Proportional hazards regression was used to identify factors associated with late grade ≥ 3 GU toxicity and logistic regression was used for other endpoints. Patients with < 3 follow-up PSAs were excluded from analysis of bRFS and DMFS but were included in the analysis of all other endpoints. Results: The median follow-up was 6.8 years (yr) (range: 0-16.5 yr). Median age was 67 yr. Median D90 was 146 Gy. 18.2% received androgen deprivation. 61.3% of patients were classified as low risk, 29.8% were intermediate risk, and 8.9% were high risk. Median prostate volume was 35.19 cc (range: 9.67 - 178.93 cc). The 10 yr rates for bRFS, DMFS, and CSM for all patients in this cohort were 81.5%, 91.5%, 2.5%, respectively. The rates of late toxicity are shown in the table. On multivariate analysis, age (HR= 1.04, 95% CI= 1.01-1.06) and prostate length (HR= 1.74, 95% CI= 1.36-2.21) were significantly associated with increased risk of grade ≥ 3 GU toxicity. Increased BMI exhibited a mild protective effect (HR= 0.95, 95% CI= 0.91-0.99). No treatment parameters were significantly associated with late GU toxicity. The risk of incontinence was highly correlated with TURP: OR= 3.28 (95% CI= 1.80-5.98) for pre-PI TURP; OR= 10.95 (95% CI= 6.83-17.56) for post-PI TURP. There were too few GI events to identify factors associated with an increased risk. Conclusions: Prostate brachytherapy is an effective treatment for prostate cancer. Significant long-term toxicities are rare when performed according to published guidelines. Long-term Toxicity GU GI Overall rate grade ≥ 3 152 (7.6%) 17 (0.9%) Grade 3 140 (7.0%) 14 (0.7%) Grade 4 12 (0.6%) 2 (0.1%) Grade 5 0 (0%) 1 (0.1%) Any GU incontinence 176 (8.9%) - Post-PI TURP 81 (4.1%) - Rectal bleeding - 325 (16.3%) PI-related rectal bleeding - 35 (1.8%)
placement of a retrievable, expandable, metallic stent for malignant esophageal strictures. Stent migration was classified into four patterns as locations of a migrated stent when migrated stents were detected. A multivariate logistic regression model was used to identify the independent predictive factors associated with stent migration.

RESULTS

Stent migration occurred in 42 (12.6%) of 332 patients. Migration was partial (n=21) or complete (n=21), and nine, 12, 11, and 10 patients had patterns I, II, III, and IV, respectively. Multivariate analysis identified the following prognostic factors: esophagogastic junction strictures caused by cancer of the gastric cardia (OR, 3.330; 95% CI, 0.156-9.698; p = 0.004), patients who underwent anti-cancer treatment after stent placement (OR, 17.514; 95% CI, 7.094-43.235; p < 0.001), and patients with a longer survival time (OR, 2.994; 95% CI, 0.991-7.996; p < 0.001). Secondary management was needed for 33/42 (79%) patients. The strictures in the remaining nine patients improved throughout the follow-up.

CONCLUSION

Stent migration occurs most commonly in patients with cancer of the gastric cardia, longer survival time and who underwent anti-cancer treatment following stent placement. Stent migration is successfully managed by further intervention.

CLINICAL RELEVANCE/APPLICATION

Accurate knowledge of the pattern of stent migration is important for its successful management.

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**VIS272**

**Patency of Central Veins in Dialysis Patients with Tunneled PICC Lines (Station #3)**

Shima Goswami MD (Presenter): Nothing to Disclose, Rosanne DeAngelis: Nothing to Disclose, Maryna Kuznetsov MD: Nothing to Disclose, Suken Shah MD: Nothing to Disclose, Jeffrey L. Lautin MD: Nothing to Disclose

**PURPOSE**

Determine the effect of tunneled peripherally inserted central venous catheter (PICC) lines on central vein patency in patients with chronic kidney disease (CKD).

**METHOD AND MATERIALS**

A prospective trial involving adults (>18 years old) who have CKD (GFR less than 30) and require long-term, non-dialysis, venous access. 5-French Bard Power PICC lines with small anchoring Dacron cuffs were placed under ultrasound and fluoroscopic guidance. Patients had an ultrasound prior to catheter placement and at removal to document jugular vein size, respiratory variation with Doppler waveforms, and imaging of the innominate vein patency. A paired t test was performed to analyze the data.

**RESULTS**

Fifty-two patients from our institution were enrolled into and completed the study over an 18 month period. Three patients died from unrelated causes prior to catheter removal and ten were lost to follow-up. Of the remaining 39 enrollees there was an 8.8 percent risk of developing narrowing of the central veins greater than 60 percent of the original diameter post tunneled PICC (3/39 patients, p=0.002). Furthermore, of the patients whose central veins remained even partially patent, only four even developed webs in the central veins post tunneled PICC, a proportion of patients so small as to not render them statistically significant (p=0.028).

**CONCLUSION**

The data supports our null hypothesis that central vein patency is rarely sacrificed in the setting of tunneled PICC line insertion. Considering the frequent need for tunneled and non-tunneled dialysis catheters in patients with CKD, tunneled catheters can be used safely for long-term, non-dialysis, venous access while preserving peripheral arm veins for dialysis access.

**CLINICAL RELEVANCE/APPLICATION**

Tunneled catheters allow preservation of peripheral arm veins in patients who will likely require future dialysis access and our data confirms central vein patency.

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**VIS268**

**Preliminary Comparative Study between Thyroidectomy and Radiofrequency Ablation on Nodular Goiter (Station #4)**

Che Ying MD (Presenter): Nothing to Disclose, Jung Hwan Baek: Nothing to Disclose

**PURPOSE**

1.to compare and evaluate the difference and efficacy of two treatment methods of nodular goiter radiofrequency ablation and thyroidectomy; 2.to evaluate the clinical application value of RFA on nodular goiter

**METHOD AND MATERIALS**

200 nodular goiter patients underwent open surgery operation (group A) and 200 patients treated with radiofrequency ablation(group B) were selected and proceed one year of follow-up. The posttreatment complications, thyroid function, nodules residues and recurrence situation as well as hospital stays and cost were evaluated and compared.

**RESULTS**

The surgical complications incidence of group A was higher than that of group B (7.0%, 1.0%, P=0.002); 75.5% of the Group A patients removed more than 70% of their normal thyroid gland (unilateral or bilateral), 71.5% of whom need to exogenous thyroid hormone supplement, group B do not need the exogenous thyroid hormone; The focus were removed directly in group A group but inactivated in situ and
absorbed gradually in group B with 12 months absorption rate 84.84±17.06%; The rate of multiple lesions residual nodules was 11.9% in group A and 2.9% in group B (P=0.004); One year recurrence rate was 2.5% in group A and 0.5% in group B, P=0.099, no statistically significant difference; Hospitalization days was 5-7 days of group A and 2-3 days of group B, the total cost was 15962.56±1073.27 yuan and 16535.78±2309.75 yuan in the above two groups but there was no statistically significant difference (P>0.05).

CONCLUSION
Both surgical resection and radiofrequency ablation are effective in the treatment of nodular goiter. Compared with surgery treatment, the radiofrequency ablation method shows the advantage of complete tumor inactivation, easy in operation, fewer complications, thyroid function maintenance, neck intact without scar, and shorter hospitalization time, which suggests a wide prospect of clinical application by this safe and effective minimally invasive treatment method.

CLINICAL RELEVANCE/APPLICATION
Radiofrequency ablation is a safe, effective and minimal invasive treatment method of nodular goiter with a wide prospect of clinical application.

SCREENING MRI FOR UTERINE FIBROIDS, TREATMENT SELECTION: MR-GUIDED HIGH INTENSITY FOCUSED ULTRASOUND (MRGFS), UTERINE ARTERY EMBOLIZATION (UA) AND SURGERY. A PER GROUP ANALYSIS OF OUTCOMES (STATION #5)

Federica Cioliina MD (Presenter): Nothing to Disclose, Fulvio Zaccagna MD: Nothing to Disclose, Francesco Sandolo: Nothing to Disclose, Carola Palla: Nothing to Disclose, Fabrizio Andrani: Nothing to Disclose, Alessandro Napoli MD: Nothing to Disclose

PURPOSE
To retrospectively evaluate the outcome of patients affected by uterine leiomyoma and treated using either Magnetic Resonance Focused Ultrasound (MRgFUS), Uterine Artery Embolization (UA) and Surgery.

METHOD AND MATERIALS
451 women (group A) affected by uterine leiomyoma (mean age 39±5) referred our department for treatment of uterine fibroids with MRgFUS (July 2010-March 2014). Pre-treatment evaluation was done in order to assess symptoms and fibroids MR characteristics for MRgFUS viability. Patients not eligible for MRgFUS were addressed to UA (group B) or surgery (group C). Primary endpoints were Symptoms Severity Score (SSS) (48.6±13.4), volume shrinkage (Group A and B) and the necessity for further treatment. Satisfaction related to different treatment was evaluated using a 5 point scale.

RESULTS
131/451 patients underwent MRgFUS (29%; Group A), 320 were excluded (70%) and therefore assigned to Group B (123/451, 27%) and Group C (157/451, 35%). Remaining 40% patients (8%) were lost at follow up or refused the proposed treatment. In group A 112/131 patients (86%) showed a decrease in SSS (19.3±6.8), an average NPV of 70±15% (P=0.001), a volume shrinkage of 20±15% and an excellent satisfaction related to treatment. In 7/131 (5%) treatment was stopped at the beginning (bowel loops interposition or absence of compliance). 4 patients had a pregnancy; 3 patients experienced minor adverse events. In 12/131 patients (9%) we obtained NPV<60% and patients needed surgical treatment. In group B patients showed a decrease in SSS (15.3±5.6), an average NPV of 98% (P=0.001), a volume shrinkage of up to 70% and a good satisfaction related to treatment. The major dissatisfaction was related to post-procedural pain that needed analgesic therapy. No pregnancy was observed. In Group C 80 patients underwent myomectomy, 40 hysterectomy while the remaining refused other treatment. 3 pregnancy were observed.

CONCLUSION
MRgFUS treatment of uterine fibroids is a reliable, noninvasive method for treatment symptomatic uterine fibroids; clinical success is directly related to NPV ratio. Eligibility is limited to 30% of screened women with symptomatic fibroids. All patients not suitable for this treatment should necessarily undergo surgery or UAE both with significant lower patient tolerance.

CLINICAL RELEVANCE/APPLICATION
Screening MRI allow patients selection for successful MRgFUS treatment and enable to refer patients with uterine fibroids to the most appropriate kind of treatment.

EXPERIENCE OF DIAGNOSIS AND MANAGEMENT OF SPLENIC STEAL SYNDROME AFTER LIVER TRANSPLANTATION (STATION #6)
Chaolun Li (Presenter): Nothing to Disclose, Weiping Wang MD: Nothing to Disclose, Eunice Kim Moon MD: Nothing to Disclose, John Fung: Nothing to Disclose, Koji Hashimoto MD: Nothing to Disclose

PURPOSE
This retrospective study investigated the clinical presentations, diagnosis, and treatment of splenic steal syndrome (SSS) based on our one center experience.

METHOD AND MATERIALS
From January 2007 to August 2013, the clinical data records of patients with SSS confirmed by angiography were reviewed. A total of 51 patients (40 men, 11 women, average age of 57.7±9.9 years, age range 27-76 years) were enrolled in this study. Patients with hepatic artery stenosis or celiac artery stenosis were excluded.

RESULTS
A whole liver liver graft was used in 49 patients, and split right lobe of liver was used in the other two patients.
TIPS was performed in 4 patients before OLT. The onset time varies from 1 to 192 days (median 4 days) after OLT. Forty-six patients (90.2%) presented this syndrome within 15 days after OLT. The most common clinical presentation is high resistance index and/or diastolic reversal flow in hepatic arteries detected by US, which was observed in 9 patients, in which 5 also presented high RI on US and another 1 had concomitant hyperbilirubinemia. Seven patients presented elevated aspartate aminotransferase (AST), alanine aminotransferase (ALT) and/or total bilirubin. Among the seven patients, five also presented high RI on US. Forty-three patients with SSS showed high RI (RI > 0.8) 24 hr after OLT. RI of the SSS group ranged from 0.67 to 1.0, with mean of 0.94±0.08. All the patients were diagnosed by celiac angiography showing sluggish flow in hepatic artery and brisk flow in splenic artery without any mechanical cause of vascular obstruction. All the patients were treated with splenic artery embolization (SAE) after the diagnosis was confirmed. Proximal SAE was performed in 42 patients. Middle to distal SAE was performed in 9 patients. In the 14 patients embolized with coils, coils migrated to the hilum of spleen in 3 patients. Patients showed improved hepatic blood flow on both angiography immediate after SAE and US post treatment. One patient developed hepatic artery thrombosis one day after SAE. Biliary stent was placed in 7 patients after SAE.

CONCLUSION
Splenic steal syndrome occurs shortly after liver transplantation. Persistent high RI detected in hepatic artery may lead to the clinical suspicion of this disease. It can be reversed by proximal SAE.

CLINICAL RELEVANCE/APPLICATION
Proximal SAE is an effective and safe method to treat SSS with very low rate of complication.

VIS273
Role of MRI Chest in the Assessment of Tumor Response Post Microwave Ablation of Pulmonary Metastases (Station #7)
Nour-Eldin Abdelrehim Nour-Eldin MD, MSc (Presenter): Nothing to Disclose, Nagy Naguib Naeem Naguib MO, MSc: Nothing to Disclose, Julian Lukas Wichmann MD: Nothing to Disclose, Ahmed Fathy Emam MBCh: Nothing to Disclose, Mohammed Ahmed Alsubhi BMBS: Nothing to Disclose, Thomas Josef Vogl MD, PhD: Nothing to Disclose

PURPOSE
To determine the value contrast enhanced (CE-MRI) follow-up in the assessment of tumor response of microwave (MW) ablated pulmonary metastases by correlating the results with CE-CT.

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

RESULTS
The preablation tumor volumes range: 0.30-6.1 cm³ (mean: 1.5 cm³, SD: 1.3). LMS ratio < 1 was associated with post ablation reduction of tumor volume (denoting scarring), while LMS ratio > 1 were noted in preablation due to high contrast enhancement of the tumor, in 24 h post ablation due to the inflammatory response associated with the thermal ablation and due to tumor residue or progress. Weak correlation was detected between the LMS-ratios and CT-volumetric changes in 24 h post ablation. Strong correlation between the LMS ratios was estimated between the follow-up periods of 3 months (Spearman R: 0.62, p = 0.0021), 6 months (Spearman R: 0.66, p = 0.001), 9 months (Spearman R: 0.61, p = 0.001) and 12 months (Spearman R: 0.7, p < 0.00001).

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

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

GE Healthcare: Contrast Enhanced Spectral Mammography: Clinical Application
Vendor Workshops
Thu, Dec 4 1:00 PM - 2:00 PM Location: Booth 4782

LEARNING OBJECTIVES
Contrast Enhanced Spectral Mammography: Clinical Application
To secure your seat, please register at the link below.
Please visit http://www.register.inputinput.com/ to register for this Vendor Workshop.

MSCA51
Case-based Review of the Abdomen (An Interactive Session)
Multisession Courses
AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
**MSCA51A**

**Imaging of Acute Abdomen**

Stephan W. Anderson MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1. The participant will be exposed to the current literature related to imaging of acute abdominal pain using CT. 2. The participant will be able to apply an evidence-based approach to CT protocol development in the imaging of acute abdominal pain. 3. The participant will be able to independently evaluate the published literature in this area in a critical fashion and continue to apply recent developments to their own practice.

**MSCA51B**

**Imaging of Abdominal Trauma**

Savvas Nicolaou MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the technique and protocols, with an emphasis on MDCT, for imaging of blunt and penetrating abdominal trauma. 2) Demonstrate examples of the spectrum of injuries associated with abdominal trauma, including splenic, hepatic, kidney, pancreatic and bowel injuries. 3) Demonstrate significance of arterial and portal venous phase imaging in the setting blunt abdominal trauma (BAT), and the role of whole body imaging in the setting of BAT. 4) Review the new imaging applications and techniques such as iterative reconstruction and dual-energy CT which can help better image abdominal injuries post-trauma.

**MSCA51C**

**Imaging of the Acute Abdomen and Pelvis in Pregnancy**

Puneet Bhargava MD (Presenter): Editor, Reed Elsevier

**LEARNING OBJECTIVES**

1) To understand imaging related radiation risk to the fetus. 2) Exam appropriateness in right upper quadrant, mid-abdominal and flank pain. 3) Role of CT contrast media and its associated risk in pregnancy.

**Active Handout**


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**MSCB51**

**Case-based Review of Breast (An Interactive Session)**

**Multisession Courses**

**DM**

**BR**

**ARRT Category A+ Credits**: 1.50

Thu, Dec 4 1:30 PM - 3:00 PM  Location: S100AB

**Sub-Events**

**MSCB51A**

**Screening: Digital Mammography and Tomosynthesis**

Helen Anne D’Alessandro MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To review the current role of screening digital mammography and tomosynthesis. 2) To demonstrate digital mammography and tomosynthesis use for evaluating screening callbacks of masses, calcifications, architectural distortion and summation artifacts. Practical considerations of digital mammography and tomosynthesis will also be discussed, including the effect of digital tomosynthesis on screening callback rates, evaluating extent of disease and increasing cancer detection rates.

**ABSTRACT**

This case based review will demonstrate digital mammography and tomosynthesis use for evaluating callbacks of masses, calcifications, architectural distortion and summation artifacts. Practical considerations of digital mammography and tomosynthesis will also be discussed, including the effect of digital tomosynthesis on screening callback rates, evaluating extent of disease and increasing cancer detection rates.

**MSCB51B**

**Supplemental Screening**

Janice S. Sung MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To review the various imaging modalities including MRI, ultrasound, and contrast enhanced digital mammography that are available as supplemental screening modalities. 2) To understand the clinical evidence supporting the use of these imaging modalities. 3) To discuss the advantages and disadvantages of each modality.
ABSTRACT

This talk will focus on the various imaging modalities that are available for supplemental screening for intermediate and high risk patients, including ultrasound, MRI, and contrast enhanced digital mammography. The clinical evidence supporting their use for supplemental screening will be reviewed. The advantages and disadvantages of each modality will also be reviewed during this case based session.

MSCB51C

Evaluating the Symptomatic Patient
Catherine Margaret Appleton MD (Presenter): Consultant, Hologic, Inc Consultant, Biomedical Systems

LEARNING OBJECTIVES

1) To understand the clinical presentation of benign and malignant breast conditions. 2) To review current guidelines for evaluating the symptomatic patient. 3) To discuss specific imaging approaches for evaluating breast symptoms.

PS50

Thursday Plenary Session

Plenary Sessions

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AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50
Thu, Dec 4 1:30 PM - 2:45 PM Location: Arie Crown Theater

Sub-Events

PS50A

RSNA/AAPM Symposium: Radiomics: From Clinical Images to Omics
Moderator Paul Eugene Kinahan PhD : Research Grant, General Electric Company Co-founder, PET/X LLC

LEARNING OBJECTIVES

1) Describe the motivation underlying medical imaging analyses of tumor heterogeneity and response to therapy. 2) Describe the role of medical imaging omics in oncology as a biomarker and the potential benefits leading to improved outcomes. 3) List the benefits and challenges of advanced and high-throughput image analysis from large data bases at multiple centers.

PS50B

The Radiology Reading Room of the Future
Robert J. Gillies PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the motivation underlying medical imaging analyses of tumor heterogeneity and response to therapy. 2) Describe the role of medical imaging omics in oncology as a biomarker and the potential benefits leading to improved outcomes. 3) List the benefits and challenges of advanced and high-throughput image analysis from large data bases at multiple centers.

PS50C

Radiomics in Oncology: Pathway to Precision Medicine
Hedvig Hricak MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the motivation underlying medical imaging analyses of tumor heterogeneity and response to therapy. 2) Describe the role of medical imaging omics in oncology as a biomarker and the potential benefits leading to improved outcomes. 3) List the benefits and challenges of advanced and high-throughput image analysis from large data bases at multiple centers.

SPRG51

RadioGraphics’ Publication Information for Potential Authors

Special Courses

AMA PRA Category 1 Credits ™: 1.25
ARRT Category A+ Credits: 1.50
Thu, Dec 4 1:30 PM - 2:45 PM Location: E350

Participants
Jeffrey S. Klein MD (Presenter): Nothing to Disclose
Kimberly LaShayn Franks (Presenter): Nothing to Disclose
Rebecca Rilke (Presenter): Nothing to Disclose
Lucinda Foulke (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
ABSTRACT

Many hours are spent writing and organizing the manuscripts and accompanying images submitted to RadioGraphics. This course is designed to assist potential authors in the preparation and submission of manuscripts for possible publication. Proper attention to content elements, figure preparation, and format compliance not only reduces delays in processing, but it may also increase the likelihood of favorable reviews and fewer revisions. This course will include a PowerPoint® presentation that provides an overview of the publication process, the essential components of a manuscript submission, and the guidelines for submitting print-quality images. A live demonstration of the steps involved in submitting a manuscript through the RadioGraphics site in ScholarOne Manuscripts will be given. The course will conclude with a question and answer session.

URL's


Handout: Lucinda Foulke


VSIO51

Interventional Oncology Series: Lung and Bone

Series Courses

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Thu, Dec 4 1:30 PM - 6:00 PM Location: S405AB

Participants

Moderator
Matthew Raymond Callstrom, MD, PhD: Research Grant, Theromedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Gallil Medical Ltd

Sub-Events

VSIO51-01 MW vs RFA vs Cryo for Lung Mass Ablation—Which/When/Where?

Damian E. Dupuy MD (Presenter): Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposia

LEARNING OBJECTIVES

1) Understand differences between the various thermal technologies as applied to lung tumors. 2) Review current clinical thermal ablation data with regard to the treatment of lung tumors. 3) Comprehend the usage of the various thermal modalities with clinical examples of lung tumor treatment.

VSIO51-02 Latest Advances in Lung Surgery for Metastatic Disease

Francis C. Nichols MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify appropriate patients who are felt to benefit from pulmonary metastasectomy. 2) Discuss the pros and cons of pulmonary metastasectomy done via a traditional open thoracotomy versus minimally invasive Video-Assisted Thoracic Surgery (VATS). 3) Describe a localization technique for the small/difficult to locate pulmonary metastasis(es). 4) Discuss the rationale for mediastinal lymphadenectomy during pulmonary metastasectomy and its prognostic implications.

VSIO51-03 Quantitative Validation of Thermal Ablation: An Improved Image Fusion Algorithm to Reflect Treatment Coverage

David Thomas Glidden BS (Presenter): Nothing to Disclose , Grayson L. Baird MS: Nothing to Disclose , Derek Merck: Nothing to Disclose , Damian E. Dupuy MD: Research Grant, NeuWave Medical Inc Board of Directors, BSD Medical Corporation Stockholder, BSD Medical Corporation Speaker, Educational Symposia

PURPOSE

To propose the foundation of a quantitative method for validation of thermal ablations.

METHOD AND MATERIALS

24 patients (M:F= 10:14) with solitary lung tumors underwent microwave ablation under CT-guidance. Each tumor was treated with one of four MW applicators (BSD Medical, Salt Lake City, UT, Neuwave Medical, Madison, WI) for 5-15 minutes according to the manufacturers’ specifications. Each case included a CT scan pre- intra- and post-procedure. Tumor volumes were manually segmented from pre-scans and ablation volumes from post-scans using the ground glass halo surrounding the tumor. Pre-scans were fused onto post-scans using two algorithms—a rigid registration, and a rigid plus deformable registration. Volume overlap resulting from both algorithms were calculated. Bland-Altman plots and Deming regression were used to identify possible differences in these image fusion techniques.

RESULTS

The volume overlap between tumors and ablation zones increased proportional to tumor size when deformable registration was applied (p < 0.001). Deming regression showed a significant deviation from perfect concordance between rigid and deformable registration (95 % CI: [1.13, 1.39]) in which more volume overlap was attributable to deformable registration.

CONCLUSION
Quantitative validation of thermal ablation margin analysis remains challenging due to inherent tumor position and morphology changes after ablation. Rigid registration techniques rarely reflect how an ablation zone covers the tumor and margin because of movement (e.g., respiratory, tumor displacement, patient position). The addition of deformable registration may more accurately reflect how the tumor and ablation zone overlap, thus improving local control outcomes.

**CLINICAL RELEVANCE/APPLICATION**

Improved fusion between pre- and post-scans using deformable registration will provide a basis for quantitative validation of thermal ablations by correcting for anatomical movement.

**VSI051-04**

**Lung Mass SBRT Current Results and Ongoing Trials**

**Kenneth Richard Olivier MD (Presenter): Nothing to Disclose**

**LEARNING OBJECTIVES**

1) Review definitions of SBRT. 2) Discuss results of SBRT for pulmonary nodules. 3) Review current and proposed clinical trials for pulmonary nodules. 4) Review currently accepted indications for SBRT.

**ABSTRACT**

Stereotactic Body Radiotherapy (SBRT), also known as Stereotactic Ablative Radiotherapy (SABR) has become an important new tool for oncologists looking to treat patients with primary lung cancers or pulmonary metastases. In this talk we will discuss some of the fundamentals of SBRT, review relevant literature, and current indications of SBRT for either primary lung cancers or metastases.

**VSI051-05**

**Percutaneous Microwave Ablation of Pulmonary Malignancies: Survival, Imaging Follow-up, and Complications**

**Mark William Little MBBS, MSc (Presenter): Nothing to Disclose, Daniel Yiu Fai Chung MBBS, FRCR: Nothing to Disclose, Eoghan John Patrick McCarthy MBCHB: Nothing to Disclose, James Henry Briggs MBChB, FRCR: Nothing to Disclose, Philip Boardman MBChB: Nothing to Disclose, Fergus Vincent Gieseon MBBS: Alliance Medical Ltd Consultant, Ewan Mark Anderson MBChB: Nothing to Disclose**

**PURPOSE**

Survival analysis, technical success, safety and imaging follow-up of malignant pulmonary nodules treated with a novel high power microwave ablation system.

**METHOD AND MATERIALS**

Over a three year period, 55 patients, 33 male, mean age 64 years (31-88) with 92 unresectable pulmonary malignancies of mean diameter 18mm (6-59mm) underwent computed tomography (CT)-guided percutaneous microwave ablation in 72 ablation sessions. Primary non-small cell bronchogenic carcinoma was treated in 28 lesions, whilst metastatic tumors were ablated in the remainder (colorectal=28, renal=9, sarcoma=17, adrenal=3, esophageal=2, melanoma=3, breast=1, tcc=1). Tumors were diagnosed by biopsy, or PET avidity (median SUV max = 9.5) and interval growth. Technical success was defined as needle placement in the intended lesion without death or serious injury. Adequacy of ablation was assessed at 24 hours on contrast-enhanced CT, for a circumferential solid or ground glass margin > 4mm. Patients were followed with contrast-enhanced CT 3-monthly until death, or local tumor progression (LTP), or for at least 12 months post procedure. LTP was defined as contiguous enlargement or a change in the shape of the ablation zone or the development of contrast enhancement in part of the zone. Survival rate was evaluated by Kaplan-Meier analysis.

**RESULTS**

Microwave ablation was technically successful in n=88 (96%) of lesions. Mean ablation duration was 4 minutes (1-22 minutes). 21(29%) pneumothoracies were diagnosed on chest x-ray after 72 ablation sessions; chest drain was required in 8 (11%) sessions. 30-day mortality rate was 0%. The mean hospital stay was 1.1 days (1-11 days). Local tumor progression was present in 6 tumors; for tumors under 4cm (n=88), LTP was identified in 3 (3%) at a median follow up of 13months. The mean diameter of lesions with LTP were significantly larger than those without (mean diameter 41mm vs 17mm; p=0.009). The cancer-specific survival was 79% (95%CI 0.68-0.9) at 1 year, and 66% (95% CI 0.51-0.83) at 2-years.

**CONCLUSION**

Microwave ablation of pulmonary malignancies is a safe, successful technique. Local control rates and survival analysis are encouraging, with rapid treatment times.

**CLINICAL RELEVANCE/APPLICATION**

Primary and metastatic lung tumors are extremely common; surgical options are often limited due to advanced disease and or poor respiratory function. Microwave ablation offers a robust method of local disease control.

**VSI051-06**

**Ablation for Primary Lung Cancer What Does the Data Support**

**Robert D. Suh MD (Presenter): Nothing to Disclose**

**LEARNING OBJECTIVES**

1) Discuss long term outcomes of image-guided ablation for early stage lung cancer. 2) Discuss local control rates of image-guided ablation for early stage lung cancer. 3) Understand the factors in image-guided ablation influencing survival and local control. 4) Understand treatment options and relative outcomes of image-guided ablation compared to alternative therapies for early stage lung cancer.

**ABSTRACT**

Although the literature on thermal ablation demonstrates heterogeneous, sometimes markedly so, reporting, thermal ablation confers increasingly improved local control and survival benefits in carefully selected patients: RF ablation with long-term results comparable to competitive therapies, particularly in the high-risk patient population. Despite advances in thermal energy devices, specifically microwave and...
Ablation for Metastatic Lung Cancer Is Ablation Competitive with Surgery or SBRT?

Thierry Debaere (Presenter): Consultant, Terumo Corporation Speaker, Terumo Corporation Consultant, Guerbet SA Speaker, Guerbet SA Consultant, General Electric Company Speaker, General Electric Company Proctor, Galil Medical Ltd

LEARNING OBJECTIVES

1) To know results of percutaneous ablation of lung metastases in terms of local efficacy and survival. 2) To know predictive factors of RFA for lung metastases. 3) To know results of surgery and stereotaxic radiation therapy for lung metastases.

ABSTRACT

Since first report of RFA in lung tumor in year 2000, RFA has been demonstrated to provide 80 to 90% complete ablation for tumors less than 2 cm, with decrease in efficacy for larger tumors. Percutaneous ablation is today a valid option for lung metastases in non surgical candidates with overall survival reported after RFA is in between 56 to 67% at 3 years. Such survival reported is comparable to what reported in large surgical series even if no comparative data exists. Age, disease free interval, tumor size and tumor numbers are independent predictor of survival after RFA of lung metastases. The same predictive factors have been reported as predictive of survival after surgical metastasectomy. One of the advantage of RFA over other technique such as surgery and SBRT is that it can be easily repeated in case of occurrence of new metastases which is difficult with surgery due to the aggressively of the procedure. Subsequent surgical resection are limited by pulmonary reserve. The same applies to stereotaxic radiation therapy where multiple irradiation results in toxicity to lung parenchyma, skin or mediastinum. Consequently, RFA is today part of routine practice armamentarium against lung metastases. However, better determination of the role of RFA relative to other therapies are needed. In addition, the need and benefit from combining local ablation and systemic therapy must be evaluated. Future trends in treatment of pulmonary metastases will favor minimal aggressive treatments and percutaneous ablation have a role to play. Evidence based medicine supporting the use of lung RFA metastatic disease and defining what is the best population to target with ablation or SBRT. For today the ideal candidate has less than 3 tumors less than 3 cm.

Lung Tumor Board

Moderator Matthew Raymond Callstrom MD, PhD : Research Grant, Thermedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Galil Medical Ltd

LEARNING OBJECTIVES

1) Describe the characteristics of lung and bone tumors amenable to interventional oncologic treatment. 2) Describe neoadjuvant treatment of lung tumors and bone metastases. 3) Describe the role of percutaneous ablation for lung tumors and bone metastases in the context of other treatments including surgery and radiation oncology.

Treatment of Complex Benign Skeletal Disease

Afshin Gangi MD, PhD (Presenter): Proctor, Galil Medical Ltd

LEARNING OBJECTIVES

1) Identify the best indications of percutaneous technique and list them. 2) Describe the methods used in treatment of benign skeletal tumors and the advantages and limits of each of them. 3) Identify the risks of the percutaneous procedures and their limits. 4) Explain the measures used to protect the surrounding tissues to avoid major complications. 5) Learn how to follow up the patients and analyze the results.

URL’s

http://www.openradiology.org

Pain Palliation of Bone Metastases and Local Tumor Control with Magnetic Resonance Guided Focused Ultrasound Surgery (MRgFUS) Treatment

Brachetti Giulia MD : Nothing to Disclose , Valeria De Socio : Nothing to Disclose , Fabrizio Andriani : Nothing to Disclose , Gianluca Caliolo : Nothing to Disclose , Fulvio Zaccagna MD : Nothing to Disclose , Alessandro Napoli MD (Presenter): Nothing to Disclose

PURPOSE

to evaluate the efficacy of MRgFUS for treatment of painful bone metastases and its potential for local tumor control.

METHOD AND MATERIALS

after IRB approval 42 patients were scheduled for treatment using the Exablate system (InSightec). Before and 1, 2 and 3 months after MRgFUS treatment, pain scores were assessed according to Brief Pain Inventory-Quality of Life (BPI-QoL) criteria. Imaging (CT and ceMR: Bracco) follow-up was obtained at 1 and 3 months; in survivals, follow-up was extended at 6 and 12 months. For local tumor control, imaging changes were evaluated with the MD Anderson (MDA) criteria. Patients were classified in responder and non-responders. The extent of necrosis within the ablated metastasis was evaluated using non-perfused volume (NPV).
Sequential Interventional Treatment of Pelvic/Sacral Tumors via Angiographic Embolization, Cryoablation, and Stabilization Plasty Combinational Therapy

**Purpose**

The purpose of the study is to review the treatment experiences of patients treated at our institution with combination angiographic embolization, cryoablation or thermal ablation, and stabilization plasty for their pelvic/sacral tumor burden. This study hopes to assess if such combinational interventional therapy has the potential to become a mainstay treatment option in managing pelvic and sacral neoplasms.

**Method and Materials**

A combined interventional paradigm was employed in 8 patients thus far over the last year: Phase I: Angiographic embolization of neoplasm Phase II: Cryoablation of solid tumor, followed by supportive sacroplasty Phase III: Image-guided drainage/TPA flush, followed by sclerosis of residual bed. Procedures were performed under general anesthesia. Phase I was within 1 day to 1-2 weeks prior to Phase II and III dependent on lesion location and patient tolerance. Neurological monitoring were utilized in Phases 2 and 3 to assess integrity of sacral nerve function during procedures. Each patient underwent pretreatment CT and/or MRI examination prior to therapy. All patients have undergone post-therapy follow-up imaging within 1-3 months. Medical records and imaging portfolios for these patients will be reviewed. A reassessment of pre and post procedure lesion measurements and quality of life outcomes will be performed. Linear regression will be performed to correlate results of imaging and quality of life assessment.

**Results**

It is hypothesized that patients undergoing sequential combinational therapy will demonstrate significant decrease in lesion growth, as well as improved quality of life. It is unclear if survival will be affected by such measures, as patients with terminal disease pursued such procedures more so for symptomatic relief.

**Conclusion**

An interventional paradigm consisting of combinational implementation of angiography-mediated embolization, thermal/radiofrequency ablation, and mechanical drainage followed by cavity sclerosis is...
expected to become a mainstay treatment option of pelvic and sacral neoplasms. The results of our review is expected to provide insight into its use in patients needing physical and symptomatic reduction of their pelvic/sacral tumor burden.

**CLINICAL RELEVANCE/APPLICATION**

Sequential incorporation of several effective interventional treatments may play a role in the treatment paradigm of pelvic and sacral neoplasms.

**VSI051-14**

**Avoiding Complications with Bone and Soft Tissue Ablation**

Anil Nicholas Kurup MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify critical anatomic structures to be avoided during bone and soft tissue ablation. 2) Apply displacement techniques to minimize risk of collateral damage during bone and soft tissue ablation. 3) Understand radiographic and neurophysiologic monitoring techniques that may be employed during bone and soft tissue ablation. 4) Recognize the role of bone consolidation as an adjunct to bone ablation.

**VSI051-15**

**Treatment of Oligometastatic Disease: What Is the Role of Ablation?**

Peter John Littrup MD (Presenter): Founder, CryoMedix, LLC Research Grant, Galil Medical Ltd Research Grant, Endo Health Solutions Inc Officer, Delphinus Medical Technologies, Inc

**LEARNING OBJECTIVES**

1) Understand how ablation of limited, or oligo-, metastases could produce a major impact on numerous cancer types. 2) Describe the major anatomic locations that are considered common oligometastatic sites. 3) Describe the outcomes for procedure complication and recurrence rates for the major anatomic sites. 4) Describe the potential economic impacts of ablation as part of palliative care for major cancer types (e.g., renal, lung, colorectal, ovarian).

**VSI051-16**

**Preoperative Embolization in Surgical Treatment of Spinal Metastases: Single-Blind, Randomized Controlled Clinical Trial of Efficacy in Decreasing Intraoperative Blood Loss**

Caroline Clausen MD (Presenter): Nothing to Disclose, Benny Dahl MD, PhD: Nothing to Disclose, Susanne Christiansen Frevert MD: Nothing to Disclose, Lars Valentin MD: Nothing to Disclose, Michael Bachmann Nielsen MD, PhD : Nothing to Disclose, Lars Lonn MD, PhD : Nothing to Disclose

**PURPOSE**

To assess whether preoperative embolization reduces intraoperative blood loss, the need for blood transfusion, and operative time in the surgical treatment of symptomatic metastatic spinal cord compression.

**METHOD AND MATERIALS**

A single-blind, randomized (balanced 1:1), controlled, parallel-group trial conducted as a single-center study; 48 participants were included from May 2011 until March 2013. Participants scheduled for decompression and posterior thoracic/lumbar instrumented spinal instrumentation because of symptomatic metastatic spinal cord compression were randomly assigned to either preoperative arteriography and embolization - the intervention group or preoperative arteriography - the control group. Primary outcome: intraoperative blood loss. Secondary outcomes: Intra- plus postoperative blood loss, blood transfusion and duration of surgery. Outcomes were reported as intention-to-treat analyses (ITT) including all randomized patients with a standing consent to participate and meeting the inclusion criteria.

**RESULTS**

Of the 48 randomized patients, 45 (23:22) were available for the ITT after exclusion of patients violating inclusion criteria. Mean intraoperative blood loss did not differ significantly between the embolization group (618 ml; SD 282 ml) and the control group (735 ml; SD 415 ml). This was also the case for intra- plus postoperative blood loss and the need for blood transfusion. The duration of surgery was shorter in the embolization group compared to the control group (p=0.031); median 90 minutes (range 54-252) vs. 124 minutes (range 80-183).

**CONCLUSION**

Preoperative embolization does not result in a reduction of intraoperative blood loss and blood transfusion, but reduces the duration of surgery. The general routine use of preoperative embolization cannot be recommended in decompression and posterior instrumented spinal instrumentation for symptomatic metastatic spinal cord compression.

**CLINICAL RELEVANCE/APPLICATION**

This randomized controlled clinical trial displays that preoperative embolization has the advantage of reducing the duration of surgery for symptomatic metastatic spinal cord compression.

**VSI051-17**

**Bone Metastases Tumor Board**

Moderator: Matthew Raymond Callstrom MD, PhD: Research Grant, Theromedical, Inc Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Galil Medical Ltd

**LEARNING OBJECTIVES**

1) Describe the characteristics of lung and bone tumors amenable to interventional oncologic treatment. 2) Describe new techniques for the percutaneous treatment of lung tumors and bone metastases. 3) Describe the role of percutaneous ablation for lung tumors and bone metastases in the context of other
treatments including surgery and radiation oncology.

RCBS4

Productive Tools and Technology for the Academic Radiologist (Hands-on)

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 2:30 PM - 4:00 PM   Location: S401CD

Participants

Moderator
Mahesh M. Thapa MD : Nothing to Disclose
Jonelle Marie Petscavage-Thomas MD, MPH (Presenter): Consultant, Medical Metrics, Inc
Michael L. Richardson MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Know some of the latest technology for text processing. 2) Learn some of the latest technology for health in the workplace. 3) Be aware of technology that can make the RSNA meeting more pleasant and productive.

RCC54

Natural Language Processing: Extracting Information from Radiology Reports to Improve Quality

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 2:30 PM - 4:00 PM   Location: S501ABC

Participants

Moderator
Paras Lakhani MD : Nothing to Disclose

LEARNING OBJECTIVES

1) Place natural language processing (NLP) in context of the history of radiology reporting. 2) Review how NLP is used in disciplines outside of radiology. 3) Understand basic NLP methods. 4) Assess the applicability of NLP to radiology reports.

ABSTRACT

Natural Language Processing (NLP) refers to the automated extraction of meaningful information from narrative text. Some NLP systems use simple rules to categorize text according to whether a particular concept may be present. More sophisticated systems use part-of-speech tagging and grammatical parsing to extract concepts and relationships from text. Some NLP systems use statistical approaches that can learn to categorize text automatically based on a test set of positive and negative examples. When applied to radiology reports, NLP systems are most frequently used to identify and retrieve reports of interest, such as reports containing a critical result, an incidental finding, or a recommendation for follow up. NLP systems are simpler to construct and more accurate when the structure of the analyzed text is constrained in some manner. Several real-world examples of both simple and sophisticated NLP systems in radiology will illustrate the spectrum of applicable techniques and the potential benefit to radiology practice.

Sub-Events

RC54A Natural Language Processing to Solve Problems in Clinical Practice
Michael Ethan Zalis MD (Presenter): Co-founder, QPID Health Inc Chief Medical Officer, QPID Health Inc Stockholder, QPID Health Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

RC54B Unlocking Information from Text: Pulmonary Embolism, Pneumonia, and Report Clarity
Wendy Chapman PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC54C Extracting Critical Test Results and Communications from Reports: Validation and Results
Paras Lakhani MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) See a real-world example of a NLP solution used to identify critical radiology results and documentation of communication. 2) Understand logic of text-mining algorithms designed to identify critical test results, and how they can be applied to large databases. 3) Learn principles of validation of document retrieval from NLP systems. 4) Demonstrate results of an NLP system used to identify critical radiology results.
ABSTRACT

The Joint Commission requires timely communication of critical results to an appropriate healthcare provider, and the American College of Radiology's Practice Guideline for Communication recommends documentation of communication of critical results in the radiology report. NLP techniques can be used identify radiology reports containing critical results and documentation of communication with high accuracy. Such algorithms may be used for Joint Commission compliance, performance monitoring, and quality assurance initiatives. Examples of specific text-mining algorithms that identify critical results will be provided. Also, the process of validating and determining the effectiveness of such algorithms using precision and recall will be discussed.

RCC54D

So Many to Choose: An Overview of Natural Language Processing Methodologies and When to Use Each

Scott Leroy Duval PhD (Presenter): Research Grant, Amgen Inc Research Grant, Anolinx LLC Research Grant, AstraZeneca PLC Research Grant, F. Hoffmann-La Roche Ltd Research Grant, Merck & Co, Inc Research Grant, Mylan Inc Research Grant, PAREXEL International Corporation Research Grant, Shire plc

LEARNING OBJECTIVES

1) Review information extraction methods for building rule-based, grammar-based, and machine-learning NLP systems with examples of when to use each. 2) Demonstrate the creation of manually created reference standards against which to measure NLP systems. 3) Present a survey of open-source tools for NLP and manual chart review and how these can be built upon.

ABSTRACT

Natural language processing (NLP) is a term that describes a range of techniques for identifying, understanding, and analyzing information from text. Some of the earliest applications of NLP in medicine were on imaging reports. Attendees will be walked through both simple and complex NLP methods with examples of how and when they are best used in imaging. Several open-source tools will be demonstrated with information provided on how these tools can easily be built upon for customized needs.

SPDL51

RSNA Diagnosis Live™: Musculoskeletal/Pediatric/Interventional Radiology

Special Courses

AMA PRA Category 1 Credits ™: 1.00
ARRT Category A+ Credit: 0
Thu, Dec 4 3:00 PM - 4:00 PM Location: E451B

Participants

Neety Panu MD, FRCP (Presenter): Nothing to Disclose
Kate Ann Feinstein MD (Presenter): Nothing to Disclose
Brian S. Funaki MD (Presenter): Nothing to Disclose

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.

SPSH51

Hot Topic Session: Tendon Injections: Which One Works Best?

Special Courses

AMA PRA Category 1 Credits ™: 1.00
ARRT Category A+ Credit: 1.00
Thu, Dec 4 3:00 PM - 4:00 PM Location: E353B

Participants

Moderator
Martin Torriani MD : Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the indications of ultrasound-guided percutaneous tendon treatments such as tendon dry needling, autologous platelet-rich plasma and hyperosmolar dextrose injections, among others. 2) Discuss the technical requirements to perform ultrasound-guided percutaneous tendon treatments. 3) Review the state of the science in percutaneous tendon treatments.

ABSTRACT

The range of applications for ultrasound-guided percutaneous tendon treatments, such as dry needling, autologous platelet-rich plasma and hyperosmolar dextrose injections is rapidly increasing in the practice of musculoskeletal intervention. These novel procedures have specific indications and technical demands, which may influence clinical outcomes. This session will highlight common applications and techniques for percutaneous tendon treatments and review the current clinical evidence-based literature.

Sub-Events

SPSH51A Tendon Fenestration
Jon A. Jacobson MD (Presenter): Consultant, BioClinica, Inc Royalties, Reed Elsevier Equipment support, Terumo Corporation Equipment support, Arthrex, Inc

**LEARNING OBJECTIVES**

View learning objectives under main course title.

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**SPSH51B**

Platelet-Rich Plasma Therapy of the Tendon

Kenneth S. Lee MD (Presenter): Research Consultant, SuperSonic Imagine Speakers Bureau, Medical Technology Management Institute

**LEARNING OBJECTIVES**

View learning objectives under main course title.

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**SPSH51C**

Other Tendon Treatments

Mary Margaret Chiavaras MD, PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

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**SPSH52**

Hot Topic Session: Lung Cancer Screening: Update on Policies and Procedures

**Special Courses**

AMA PRA Category 1 Credits ™: 1.00
ARRT Category A+ Credit: 1.00
Thu, Dec 4 3:00 PM - 4:00 PM Location: S406B

**Participants**

Moderator
Reginald F. Munden MD, DMD: Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the ACR perspective on lung cancer screening in regards to policy and practice guidelines. 2) Appraise governmental decisions and policies on lung cancer screening, and their economic impact. 3) Recognize the patient’s perspective of our lung cancer screening activities, and how it can impact screening.

**ABSTRACT**

The success of the NLST in reducing lung cancer specific mortality has generated great interest in the medical community regarding deployment of CT for lung cancer screening. While guidelines for who should be screened have been developed by many organizations, policies and procedures for performing lung cancer screens have not been fully developed. The radiology community, governmental officials, and patient advocacy groups have been influential in affecting standards, policies and procedures for lung cancer screening. This session will review and update radiologist of these actions.

**Sub-Events**

**SPSH52A** Radiologist Perspective: LungRADS - Practice Guidelines, Accreditation and Oversight, Centers of Excellence

Ella A. Kazerooni MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**ABSTRACT**

see course abstract

**SPSH52B** Government Perspective: Economics of Screening, USPSTF Recommendation Impact, CMS and 3rd Party Coverage, Regulation/Concerns

Geraldine B. McGinty MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.

**SPSH52C** Patient Perspectives

Laurie Fenton Ambrose (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

View learning objectives under main course title.
LEARNING OBJECTIVES

1) Understand the expected imaging findings after image-guided tumor ablation. 2) Understand the typical findings of complications, local tumor progression, and disease progression. 3) Learn about newer imaging modalities/methods for identifying local tumor progression.

ABSTRACT

Image-guided tumor ablation is a rapidly advancing minimally invasive targeted therapy for the treatment of both malignant and benign tumors. Even if you are not actively involved in performing this procedure, you will almost certainly see follow-up imaging performed to evaluate for both local tumor progression and metastatic disease. Following this discussion, you should have a basic understanding of the typical indications for image-guided tumor ablation and the imaging findings associated with normal evolution of the ablation zone as well as findings suspicious for recurrent disease. Of course, this varies depending on the target organ/disease, as well as the underlying malignancy. For example, colorectal carcinoma metastatic to the liver tends to be relatively hypovascular and similar in attenuation to the avascular ablation zone on portal venous phase imaging. Therefore, the primary indicator of recurrence in this clinical setting is asymmetric change/growth one or more of the ablative margins. In contrast, hepatocellular carcinoma is most frequently hypervascular. Since the ablation zone should be avascular, any evidence of vascular enhancement within/around the ablation zone on follow up imaging can be suspicious for residual or recurrent disease. The imaging findings also vary depending upon the ablation modality utilized, particularly when MRI is used for the imaging follow up and we will go through the signal changes that occur over time following an ablation. In addition, we will discuss standardized nomenclature to describe the follow up imaging for tumor ablation. Although the nomenclature is descriptive and extremely helpful, particularly to ensure consistency and improve reporting for research purposes, the terms are not always intuitive.
LEARNING OBJECTIVES
1) List the different Ga-68 DOTA analogs used in PET imaging of neuroendocrine tumors. 2) Compare Ga-68 DOTA labeled peptides and In-111 Octreotide in imaging of neuroendocrine tumors. 3) Understand the role of peptide PET imaging in management of neuroendocrine tumors.

SPSH54B

Radiopeptide Receptor Radionuclide Therapy (PRRT): Current Status and Future Opportunities in Theranostics

Richard P. Baum MD, PhD (Presenter): Stockholder, OctroPharm Sciences GmbH Principal Investigator, AAA Research Consultant, Novartis AG Research Consultant, Ipsen SA Research Grant, ITG-Medical, Inc

LEARNING OBJECTIVES
1) Definition of THERANOSTICS, personalized and precision medicine. 2) Indications for Ga-68 somatostatin receptor [SSTR] PET/CT in neuroendocrine tumors (NET): staging, restaging, detection of unknown primary tumors. 3) Molecular imaging (quantification of receptor density by SUV measurements) for selection of NET patients for PRRT and therapy response evaluation after PRRT by Ga-68 SSTR PET/CT. 4) Indications for PRRT, methodology and clinical results (survival, PFS in patients with G1 and G2 NET). 5) Possible adverse effects of PRRT and how to reduce/avoid side effects. 6) Future developments: new peptides (e.g. SSTR antagonists, CXCR4), new indications (e.g. diagnosis and treatment of recurrent prostate cancer using Ga-68 PSMA and Lu-177 labeled PSMA ligands).

ABSTRACT
The overexpression of specific receptors on tumors enables peptide-based receptor imaging and radionuclide therapy (PRRT). 68Gallium is a generator-produced positron emitter for labeling of peptides, e.g. somatostatin analogues (SA) like DOTATOC or DOTATATE for molecular imaging of somatostatin receptors (SSTR) expressing tumors. Since 2004, we have performed over 9,500 68Ga PET/CT studies in patients with neuroendocrine tumors (NET) and have established SSTR PET/CT as the new gold standard for imaging G1 and G2 NET. The same somatostatin-binding peptides can be labeled with 177Luetium or 90Ytrium for internal radionuclide therapy, a form of personalized treatment (THERANOSTICS approach). Since 1999 we have treated more than 1,200 patients (>4,000 therapy cycles) using 177Lu and/or 90Y labeled peptides. A German multi-institutional registry study with prospective follow up in 450 patients indicates that PRRT is an effective therapy for patients with G1-2 neuroendocrine tumors, irrespective of previous therapies, with a survival advantage of several years compared to other therapies and only minor side effects. Median overall survival of all patients from start of treatment was 59 months. Median progression-free survival (PFS) accounted to 41 months. Median PFS for pancreatic NET was 39 mo and for small bowel NET 51 mo. Grade 3-4 nephro- or hematotoxicity were observed in only 0.2% and 2% of patients, respectively. In patients with progressive NET, personalized PRRT with lower doses of radioactivity given over a longer period of time (Bad Berka Concept) results in excellent therapeutic responses. By this approach, severe hematological and/or renal toxicity can be avoided and quality of life/clinical symptoms can be significantly improved. The concept of THERANOSTICS has now been translated to other malignancies (e.g. prostate cancer using PSMA as ligand). Current state and future perspectives of this fascinating precision treatment of malignancies will be discussed.

URL
http://www.prrtinfo.org

SPSH54C

Imaging and Therapy of Neuroendocrine Tumors with MIBG

Matthias Schmidt MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To understand the molecular basis for imaging and therapy of neuroendocrine tumors with metaiodobenzylguanidine (MIBG). 2) To be able to define indications for imaging of neuroendocrine tumors (i.e. pheochromocytoma, paraganglioma and neuroblastoma) when to consider other radiopharmaceuticals. 3) Learn to read typical and difficult cases imaged with metaiodobenzylguanidine. 4) To understand the historical development of I-131-mIBG therapy and its current use in neuroendocrine tumors and high-risk neuroblastoma. 5) To address important aspects how to deliver I-131-mIBG therapy with different aspects concerning adult versus pediatric patients.

MSCA52

Case-based Review of the Abdomen (An Interactive Session)

Multisession Courses

LEARNING OBJECTIVES
Several speakers will be presenting case-based reviews of topics of relevance for imaging of the abdomen and pelvis. Brief discussions with focused reviews of the literature will follow for each case.

Sub-Events
MSCA52A

Pitfalls and Pearls in Abdominal Sonography

Terry S. Desser MD ( Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Correctly identify common and uncommon sonographic pathology in the abdomen. 2) Use your understanding of basic sonographic and physiologic principles to infer the correct diagnosis in unusual
ultrasound cases.

**MSCA52B**

**Genitourinary Tract Imaging**

Julie H. Song MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Apply practical approach to diagnose common and uncommon pathology of genitourinary tract. 2) Learn to avoid pitfalls and misdiagnosis of genitourinary tract pathology.

**MSCA52C**

**Abdominal Oncologic Imaging**

Matthew Thomas Heller MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Summarize imaging findings of complications of abdominal malignancies due to direct tumor effects and treatment effects. 2) Discuss the role imaging in determining treatment regimens.

**ABSTRACT**

Imaging plays a central role in the detection, diagnosis and treatment planning of abdominal malignancies. Proper imaging begins with protocol selection. Knowledge of imaging pitfalls helps the radiologist avoid diagnostic errors. Recognition of complications due to tumor effects and treatment effects is important to minimize morbidity and mortality in patients undergoing treatment for abdominal malignancies. Through case-based discussion, we will review tactics to optimize imaging and management for patients with abdominal malignancies.

**Active Handout**


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**MSCB52**

**Case-based Review of Breast (An Interactive Session)**

**Multisession Courses**

[MSA 750] Credits: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 3:30 PM - 5:00 PM Location: S100AB

**Sub-Events**

**MSCB52A**

**Percutaneous Breast Biopsies**

Wendy Burton Demartini MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the advantages and limitations of percutaneous breast biopsy. 2) Compare the different potential methods of core needle biopsy. 3) Apply techniques for the biopsy of routine and challenging cases using mammography, ultrasound and MRI guidance.

**MSCB52B**

**Post biopsy Radiologic-Pathologic Correlation**

Sughra Raza MD (Presenter): Consultant, Seno Medical Instruments, Inc

**LEARNING OBJECTIVES**

1) The importance of following up on and communicating pathologic results of image-guided breast biopsies. 2) How to determine if a pathologic result is concordant or discordant with imaging. 3) When to recommend repeat core biopsy or surgical excision based on the biopsy result.

**MSCB52C**

**Performance Measures**

Janie M. Lee MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the data to be collected and calculate performance measures for the basic clinically relevant breast imaging audit. 2) Compare audit results with appropriate performance benchmarks. 3) Understand additional data and calculations needed to perform a comprehensive breast imaging audit.

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**RC701**

**Practical Issues in Chest Imaging (An Interactive Session)**
Refresher/Informatics

Participants

Moderator
Eric J. Stern MD : Nothing to Disclose

Sub-Events

RC701A  Thoracic Emergencies
Amita Sharma MBBS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To identify specific disease processes that present with acute thoracic symptoms. 2) Recognize the radiologic features that differentiate thoracic emergencies. 3) Understand the role of the Radiologist in management.

RC701B  Missed Lung Cancer: Hiding in Plain Sight!
Eric J. Stern MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand characteristics of missed lung cancers on CXR. 2) Understand how we visually search. 3) Be aware of common observer errors. 4) Know CXR hiding spots. 5) Be aware of some ancillary diagnostic tools.

RC701C  Management of Sub-Solid Lung Nodules: How I do it...
Myrna Cobos Barco Godoy MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To comprehend the new IASLC/ATS/ERS classification of lung adenocarcinomas and its correlation with subsolid nodules. 2) To review the current approach to diagnosis and management of subsolid pulmonary nodules.

RC701D  Imaging of Thoracic Infections: What’s New?
Rachna Madan MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss spectrum of immunocompromised hosts and infections associated with specific immune deficits. 2) To review clinical presentation, and imaging findings of pulmonary infections with emphasis on immunocompromised hosts. 3) Review imaging signs in infections. 4) Review the role of percutaneous sampling especially in tissue invasive infections where bronchoscopy and bronchial lavage may have low yield. 5) Discuss revised EORTC/MSG criteria for diagnosis of invasive fungal infections. 6) Emphasize diagnostic conundrums such as presence of multiple infectious processes, mimics of infection and immune reconstitution inflammatory syndrome (IRIS). 7) Use case scenarios to illustrate formulation of differential diagnosis by combining clinical, serological data with imaging findings.

ABSTRACT

Infections are the most common pulmonary complications in immunocompromised patients and lung is the most frequently affected site of tissue invasive infection. It is imperative to adopt an aggressive approach to getting specific microbiologic diagnosis. Early cross sectional imaging with CT allows narrowing of differential diagnosis using radiological features and gives clues about the mechanism of spread, possible organism, burden of disease and guides subsequent invasive procedures such as lung biopsy. Imaging signs must be applied with caution and it is important to consider non-infectious etiologies. Pursuit of a unifying diagnosis is not always possible. Multiple infections may co-exist in a single organ. The radiologist must take on the role of an image guided clinician and combine clinical, serological and microbiological data with imaging features in making a diagnosis.

RC702  Leadership: How Can We Teach It and Promote It?

Participants

Moderator
Valerie P. Jackson MD : Nothing to Disclose
Leadership: A Program Director's Point of View
Mark Edward Mullins MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Define leadership within the context of medical education, especially related to a department with a Diagnostic Radiology Residency. 2) Appraise challenges and opportunities in leadership. 3) Develop a personal strategic plan for leadership.

Leadership: The Resident's Point of View
Zachary Edward Ballenger MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) The participants will understand some of the challenges faced by resident leaders. 2) The participants will learn strategies to improve leadership within the residency using examples of programs utilized at Indiana University Radiology. 3) The participants will comprehend the values inherent in resident leadership, both for improving the residency and for providing a well-rounded educational experience for the residents.

ABSTRACT
A radiology residency can have a complicated hierarchy, with many overlapping levels of authority within the administration, the faculty and the residents. Residents often view themselves at the very bottom of this hierarchy, and they may feel that in such a position their ability to act as leaders is minimal. Additionally, they may feel that their input and feedback is not valuable. This perspective is unfortunately common, and it is inaccurate. The truth is that residents, as the primary 'consumers' of radiology residency education, are the most in-tune with the daily goings-on of the residency and are in the very best position to offer fair assessment and suggestions for improvement. For this reason, leadership in residency is critical for the development and continuity of any elite radiology residency program. Additionally, leadership experience is an important component of the training of all physicians. Resident leaders are in the unique position to provide important feedback and suggestions to their superiors on many issues important to departments, ranging from educational experiences to patient care. However, traditional hierarchical limitations, significantly limit this very important component of a residency. Additionally, residents face other obstacles with regard to taking leadership roles, including insufficient time to create and initiate change, and often a lack of authority to alter the residency in any meaningful way. As stated in the objectives for this presentation, the participants will learn about the value of resident leadership, the potential barriers inherent in resident leadership, and ways to overcome the barriers and encourage this important part of a radiology residency. Examples of past success from Indiana University Radiology will be described in detail, along with examples of initiatives that were not very successful.

Promoting Leadership for Junior Faculty
Valerie P. Jackson MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Identify the need for leadership development in young faculty members. 2) Analyze possible methods for promoting leadership in faculty members. 3) Demonstrate understanding of the value of giving leadership opportunities to younger members of your practice.

ABSTRACT
In medicine, the traditional path to leadership is via on-the-job training. However, there are advantages to promoting leadership education and experience for young faculty through faculty development programs, mentoring, and opportunities to develop leadership skills. This presentation will review the need for, methods for, and advantages to implementing leadership development programs in a radiology department or practice.

Cardiac Perfusion Imaging with MR and CT

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM Location: N228

FFRCT

Jonathon Avrom Leipsic MD (Presenter): Speakers Bureau, General Electric Company Speakers Bureau, Edwards Lifesciences Corporation Consultant, Heartflow, Inc Consultant, Circle Cardiovascular Imaging Inc

LEARNING OBJECTIVES
1) Discuss the current evidence supporting FFR guided revascularization. 2) Provide an overview of the technical background of Fractional Flow Reserve derived from a resting coronary CT angiogram. 3) Review the data validating FFRCT for the detection and exclusion of lesion specific ischemia by invasive FFR.
**RC703B**

**Adenosine Stress/Rest CT**


**LEARNING OBJECTIVES**

1) To review the available evidence supporting the use of Stress CT perfusion. 2) To understand the importance of combining anatomy and physiology in the non-invasive evaluation of chest pain patients. 3) To describe the limitations and understand the future directions of Stress CTP.

**ABSTRACT**

A major limitation of coronary CTA is that the physiological significance of stenotic lesions identified is often unknown. Stress myocardial computed tomography perfusion (CTP) is a novel examination that provides both anatomic and physiological information. Multiple single-center studies have established the feasibility of stress myocardial CTP. Furthermore, it has been illustrated that a combined CTA/CTP protocol improves the diagnostic accuracy to detect hemodynamic significant stenosis as compared with CTA alone; this combined protocol can also be accomplished at a radiation dose comparable to nuclear myocardial perfusion imaging exams. Stress CTP is a modality with significant potential, particularly in the evaluation of chest pain patients, given the advantages of short exam time and comprehensive data acquisition. This lecture will summarize the current literature, indications, limitations and discuss future directions of Stress CTP.

**RC703C**

**MRI**

Matthijs Oudkerk MD, PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand that perfusion MRI can be implemented in every radiology department. 2) Learn how to differentiate normal from abnormal perfusion of the myocardium. 3) Compare the performance of perfusion MRI with other imaging modalities. 4) Identify indications and patient populations for perfusion MRI.

**ABSTRACT**

Adenosine stress MR myocardial perfusion imaging has a proven high sensitivity and negative predictive value for the detection of myocardial ischemia. High diagnostic accuracies are reached in patient groups with relatively high prevalence of disease in studies combining rest-stress perfusion and delayed contrast enhancement. For the subgroup of patients with a history of myocardial infarction these elaborate protocols or different stress MR imaging methods are probably most appropriate. In relatively lower risk patients, those without known myocardial infarction, less comprehensive protocols are effective to guide further work-up and therapy choice. In lower-risk patient groups examined by adenosine stress-only perfusion MR imaging the number of purely diagnostic coronary angiographies (CAG's) can be reduced and almost ruled out.

**URL's**

www.cmi-nen.nl

**RC704**

**Musculoskeletal Tumor Imaging**

**Refresher/Informatics**

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ARRT Category 1 Credits: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM Location: E451B

**LEARNING OBJECTIVES**

1) Radiologic staging of MSK tumors. 2) MSK tumors with characteristic imaging. 3) Pitfalls in MSK tumor imaging. 4) Radiologic treatment of MSK tumors. 5) Imaging of MSK tumors after treatment.

**Sub-Events**

**RC704A**

**Pitfalls in MSK Tumor Imaging**

Mark Douglas Murphey MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize the imaging differentiation of cystic lesions from myxoid neoplasms. 2) Understand the imaging appearance that allows distinction of hematoma from hemorrhagic neoplasm. 3) Identify the imaging characteristic of myositis ossificans. 4) Improve recognition of the concept of impending pathologic fracture and its clinical relevance.

**RC704B**

**MSK Tumors with Characteristic Imaging**

Mark J. Kransdorf MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**
1) Recognize the most common musculoskeletal tumors with characteristic imaging features. 2) Identify distinguishing imaging features so these diagnoses can be made with confidence.

**RC704C**

**Radiologic Treatment of MSK Tumors**

Jean-Denis Laredo MD (Presenter): Research Consultant, Cardinal Health, Inc. Research Consultant, Laurane Medical Research Consultant, F. Hoffman-La Roche Ltd. Research Grant, SERVIER

**LEARNING OBJECTIVES**

1) Indications and technique of percutaneous destruction of osteoid osteomas. 2) Indications and technique of percutaneous treatment of vertebral hemangiomas. 3) New drugs available in the treatment of some primary bone tumors.

**RC704D**

**Imaging of MSK Tumors after Treatment**

Daniel Vanel MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the reasons of the frequent recurrences of soft tissue sarcomas. 2) Select the best MRI sequences to detect recurrences, especially the role of dynamic imaging. 3) Select the best imaging schedule to follow the patients. 4) Understand the specific problems of imaging isolated limb perfusion in soft tissue sarcomas.

**ABSTRACT**

Soft tissue sarcomas are 100 times rarer than benign tumors. They often grow slowly and look well limited. The general surgeon, not used to the problem, often treats sarcoma as a benign lesion by very limited resection, leaving a part of the tumor. Recurrences are very frequent, and their detection a common problem. MRI is the exam to use. T2W sequence is the first to use. If everything has a low signal, there is no recurrence. Diffuse high signal lesions without a mass, usually indicate radiation induced changes. A high signal intensity mass requires contrast medium injection, to differentiate recurrences and sequel masses. Dynamic studies may be useful in difficult cases. The best schedule is not known, and a control every six months is often proposed. In the limbs, only a clinical control may be more efficient. MR being performed only if clinical suspicion. After isolated limb perfusion, dynamic MR is the gold standard to evaluate the patients.

**RC704E**

**Radiologic Staging of MSK Tumors**

David M. Panicek MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the rationale and systems for musculoskeletal tumor staging. 2) Learn the components of local staging of musculoskeletal tumors with MRI. 3) Become familiar with various imaging pitfalls in staging musculoskeletal tumors.

**RC705**

**Non-Traumatic Neuro Emergencies**

*Refresher/Informatics*

| ARA PRA Category 1 Credits ™ | 1.50 |
| ARRT Category A+ Credits | 1.50 |

**Thu, Dec 4 4:30 PM - 6:00 PM Location: N227AB**

**Participants**

Moderator

Patrick A. Turski MD: Research support, General Electric Company

**Sub-Events**

**RC705A**

**Non-traumatic CNS Hemorrhage**

Patrick A. Turski MD (Presenter): Research support, General Electric Company

**LEARNING OBJECTIVES**

1) At the end of this lecture the participant should be able to recognize the variable appearance of parenchymal and subarachnoid hemorrhage on CT/CTA and MRI/MRA exams. 2) In addition, the learner should be able to provide a differential diagnosis based on clinical presentation, imaging characteristics and location. 3) The clinical examples will also include cases that allow the learner to become familiar with the complications of non traumatic intracranial hemorrhage.

**ABSTRACT**

The presentation begins with an overview of the common causes of non-traumatic intracranial hemorrhage. The pathophysiology of hypertensive hemorrhage is discussed followed by a series of examples demonstrating the classic locations and appearance on CT and MR imaging. The clinical and radiological features of aneurysmal and non-aneurysmal subarachnoid hemorrhage will be reviewed including examples of vasospasm. Morphological and flow features that contribute to aneurysm rupture will be presented. Vascular malformations are discussed using clinical cases that demonstrate the risk...
factors associated with AVM hemorrhage which include aneurysms on the feeding arteries, intra-nidal aneurysms, supply from perforating arteries, exclusively deep venous drainage and venous outflow obstruction/thrombosis. Advanced accelerated high resolution 4D MRA techniques are introduced that use radial imaging and constrained reconstruction to provide contrast enhanced time resolved whole brain MRA images which facilitate the diagnosis and characterization of intracranial hemorrhage. To complete the review, additional examples of hemorrhage from vasculitis, amyloid angiopathy and neoplastic diseases are presented.

**RC705B**

**ENT Emergencies**

Wendy R. K. Smoker MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize various orbital pathologies that acutely compromise vision. 2) Identify various neck infections that may compromise the airway and their extensions. 3) Understand the patterns of extension of odontogenic infections. 4) List the various intracranial complications of acute sinusitis and be able to identify.

**ABSTRACT**

The category of ENT emergencies encompasses a variety of pathologies, only a few of which can be addressed in the time allotted. This discussion will focus on: 1) Pathology (potentially) affecting vision including orbital infections, pseudotumor, and carotid cavernous fistulas. 2) Infections that may compromise the airway including, peritonsillar, retropharyngeal, epiglottic, and parapharyngeal abscesses, Ludwig angina, Lemierre syndrome, and necrotizing fasciitis. 3) The impotence of the mylohyoid line in determining whether a tooth infection will spread to the sublingual or submandibular space 4) Common complications of acute sinusitis.

**RC705C**

**Non-traumatic Spine Emergencies**

E. Turgut Tali MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the basic anatomic, pathologic, and physiologic principles to non-traumatic spinal emergencies, and diagnostic and therapeutic procedures. 2) Improve basic knowledge and skills relevant to clinical practice. 3) Analyze imaging and therapeutic techniques and apply this knowledge to protocol development, patient management/safety, and cost. 4) Demonstrate understanding of the influence of socioeconomic issues on current and future practice patterns.

**ABSTRACT**

Nontraumatic spinal emergencies may result from a variety of causes from congenital/developmental anomalies-abnormalities, degenerative diseases, inflammation, infection, vascular, hematologic and metabolic diseases to neoplasms. Clinical findings and symptoms may be nonspecific. An optimized imaging strategy is necessary for the accurate diagnosis and treatment planning. Congenital/developmental abnormalities are not generally to present emergently. They may be unknown until an unrelated acute event occurs. Degenerative diseases and arthropathies may also cause nontraumatic emergencies, spinal cord compression can result from pannus and chronic instability of the rheumatoid arthritis. Ossification of the posterior longitudinal ligament, ossification of ligamentum flavum, synovial cysts, and epidural lipomatosis, acute disc extrusion may result in an acute neurologic deficit. Inflammations as multiple sclerosis, Guillain-Barre, infections are the main causes of the nontraumatic spinal injuries may have an indolent, latent phase prior to objective emergency findings. Vascular and hematologic disorders are present a susceptible group with respect to nontraumatic spinal emergencies. Development of symptoms of the neoplasms is usually slowly progressive, but acute presentations are not uncommon.

**RC706**

**How to Say it: Generating High Impact H&N Reports**

**Refresher/Informatics**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM Location: N226

**Sub-Events**

**RC706A**

**Reporting Sinus Studies**

Michelle A. Michel MD (Presenter): Author, Amirsys, Inc Co-editor, Amirsys, Inc Consultant, Amirsys, Inc

**LEARNING OBJECTIVES**

1) Understand relevant normal and variant sinonasal anatomy, patterns of inflammatory disease, and complications of acute rhinosinusitis. 2) Recognize lesions that mimic inflammatory disease and identify additional findings outside of the sinonasal cavities that may be present on imaging studies. 3) Improve your basic knowledge and skills relevant to assessing the pediatric temporal bone. 4) Apply principles of critical thinking to provide temporal bone reports that are clinically relevant and of use for parental counseling and surgical planning. 5) Understand the importance of accurately localizing the tumor to a subsite in the head and neck. 6) Apply staging details from the AJCC 7th edition to tumors that have been identified.

**ABSTRACT**

In order to create an accurate and clinically helpful sinonasal CT report, the radiologist must have knowledge of sinonasal anatomy and correct terminology of surgical procedures. Reports for sinus CT in the setting of inflammatory disease should include an objective description of the amount of mucosal disease in the sinuses. The drainage pathways of the sinuses should be evaluated keeping in mind
patterns of inflammatory disease. The radiologist should be familiar with the variety of orbital, bone/soft tissue, and intracranial complications of sinusitis. Whenever there is clinical suspicion of an intracranial complication of sinusitis, gadolinium-enhanced MRI of the brain is indicated. CT is often performed for the evaluation of the patient after ESS. The examination may be performed to evaluate for improvement in sinus ventilation, causes of ESS failure, or complications of surgery. Sinus CT “red flags” include odontogenic maxillary disease, isolated sphenoid sinus and olfactory recess inflammatory opacification. It is also important to review the compartments adjacent to the sinonasal cavities in search of additional findings.

RC706B
Reporting Temporal Bone Studies
Caroline Diana Robson MBChB (Presenter): Editor with royalties, Amirsys, Inc Author with royalties, Amirsys, Inc

LEARNING OBJECTIVES

1) Improve your basic knowledge and skills relevant to assessing the pediatric temporal bone. 2) Apply principles of critical thinking to provide temporal bone reports that are clinically relevant and of use for parental counseling and surgical planning.

ABSTRACT
Reporting Temporal Bone Studies Recognize normal variants in pediatric temporal bone: Cartilaginous cochlear cleft, enlarged vestibular aqueduct mimics, SCC dehiscence mimics, foramen tympanicum, petrous apex marrow variants Congenital External and Middle Ear Problems 1. External auditory canal (EAC): Normal, stenotic ( tympanic plate present/hypoplastic) or atretic ( tympanic plate absent). If atretic describe atresia plate: bony ( thick or thin) vs bony and membranous. Stenosis + opacification and bony erosion = keratitis obturans or cholesteatoma. 2. Mastoid pneumatization: Pneumatization (development) and aeration 3. Middle ear space size (MES): Normal, hypoplastic or absent; assess morphology; look for opacity in MES 4. Osseous and tegmen: Normal or abnormal size, shape, orientation or ossicular fusion/fusion. Tegmen integrity 5. Oval and round windows: Normal, atretic or stenotic 6. Facial nerve (CN7) canal size and course: Normal or anomalous course, normal or dehiscent, small or normal size 7. Inner ear anomalies: Inner ear + EAC/middle ear anomalies = syndrome/teratogenic insult 8. Mandibular condylar impropriety: Micrognathia = syndromic etiology 9. Vessels: ICA, IJV, emissary veins, MMA 10. Head and neck and brain: Incidental or related findings Congenital Inner EarProblems 1. Vestibular aqueduct/enochylidetic sac and duct: LVA = midpoint measurement > 0.9 mm and opencellular measurement > 1.9 mm. Harel LVA associated with incomplete partition (IP-II) cochlea and/or deficient modiolus. 2. Cochlea: Shape and size of turns, interscalar septum (ISS) and/or modiolus. 3. Cochlear nerve canal (CNC): Atresia, stenotic or normal CNC. Absent, hypoplastic of normal nerve. 4. IAC and cranial nerves: Normal, wide or stenotic IAC; symmetric or asymmetric. Absent, hypoplastic or normal CN7 and 8 5. Vestibule: Normal, hypoplastic or globular 6. SCC: Absent, hypoplastic, malformed or normal 7. Assess EAC, MES, vessels, HN and brain

Active Handout

RC706C
Reporting Head and Neck Cancer Studies
Patricia A. Hudgins MD (Presenter): Stockholder, Amirsys, Inc

LEARNING OBJECTIVES

1) The significance of AJCC seventh edition and how it helps outline and direct your formal neck CT or MRI interpretation. 2) The importance of identifying the subsite of the malignancy, prior to describing the findings. 3) How to generate a value-added interpretation, so that the Tumor Board members or clinicians can triage the patient to appropriate therapy for the malignancy.

RC707
Quality and Safety 2014: Best Practices, Radiation and Contrast Media

LEARNING OBJECTIVES

1) Understand the background and current status of best practice clinical and workflow management and its imperative for improving patient outcomes. 2) To review indications for premedication prior to contrast material administration. To summarize the current understanding of iodinated contrast media nephrotoxicity. To describe common errors made in treating contrast reactions. 3) To understand the requirement to match radiation dose according to the individual patient, clinical question and modality used. To outline meaningful radiation metrics including organ dosages and the overall radiation absorbed to estimate patient risk.

ABSTRACT
BEST PRACTICES: Increasingly medicine is being defined and evaluated based on patient outcomes rather than procedural events. While best practices are evolving and sometimes incomplete, many do exist, yet there is marked departmental variation from one organization to another. This session will outline why and how best practice implementation, particularly as it relates to IV contrast use and radiation dose, is essential to achieve better patient outcomes. This will require evaluation of current practices and comparison to nationally driven guidelines, with subsequent compliance to guidelines where they exist. CONTRAST SAFETY: Some patients have contrast reactions despite premedication. Patients who have repeated reactions in this setting tend to have reactions of similar severity. Studies performed with control groups suggest that there is minimal to no increased risk of contrast-induced renal failure in patients who receive iodinated contrast material; however, the control groups likely included patients at increased risk of acute kidney injury. Some errors treating
contrast reactions relate to failure to administer epinephrine or using the wrong dose / wrong route. The act of administering this drug can also be problematic. RADIATION DOSE: In all radiological examinations that utilize x-rays, there are always three important issues that must be taken into consideration. The first relates to the appropriate amount of radiation to be used, which must always explicitly take into account the imaging task at hand as well as the physical characteristics of the patient undergoing the CT examination. The second issue is how to transform the radiation incident on the patient into the organ doses received which are essential to understanding (any) patient risks. The final consideration is to understand the radiological significance of the radiation absorbed by the patient, and to estimate (any) radiological risks, as well as the corresponding uncertainties.

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**Interactive Game: Extreme Imaging of the Extremities—Significant, Subtle, and Soft Tissue Injuries**

**Refresher/Informatics**

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**AMA PRA Category 1 Credits ™**: 1.50  
**ARRT Category A+ Credits**: 1.50  
**Thu, Dec 4 4:30 PM - 6:00 PM  Location: E350**

**LEARNING OBJECTIVES**

This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

**Sub-Events**

**RC708A**

**Soft Tissue Injuries of the Ankle: Emphasis on CT and MRI**

Manickam Kumaravel MD, FRCR (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1. Understand in depth the normal anatomy of the ankle on CT and MRI.  
2. Appreciate subtle and catastrophic soft tissue injury patterns of the ankle.  
3. Evaluate post-operative imaging.  
4. Effectively utilize CT and MRI in management of patients with ankle injuries.

**ABSTRACT**

Ankle injuries are common presentations in all emergency departments. A wide spectrum of injuries present from subtle to catastrophic in nature. Identification of these injuries makes significant impact on treatment of such injuries. Detail is much better appreciated in cross-sectional imaging such as CT and MRI. Knowledge of injury patterns help in identification of associated injuries. CT and MRI will be used to illustrate a wide gamut of presentation of soft tissue injuries. Emphasis will be placed on clinical significance of these injuries and also on treatment options and postoperative imaging of such injuries. Examples will be inclusive of injuries of the retinaculum, tendon, ligament, subtle bony avulsion injuries and other soft tissues. Other modalities of plain radiography and ultrasound will also be used to explain the injuries. At the end of the course learners will have a comprehensive understanding of ankle soft tissue injuries patterns and their treatment methodology.

**RC708B**

**Knee Injuries: When Radiographs Are Not Enough**

Ken Floris Linnau MD, MS (Presenter): Speaker, Siemens AG Royalties, Cambridge University Press

**LEARNING OBJECTIVES**

1. Identify clinical scenarios requiring advanced knee imaging in the emergency department setting.  
2. Select appropriate imaging modality and exam parameters for advanced knee imaging.  
3. Summarize radiology findings of selected knee injuries, which warrant advanced imaging in order to aide in efficient clinical decision making and treatment planning.

**ABSTRACT**

The knee is very commonly injured in blunt and penetrating extremity trauma. Knee radiographs are the most common initial imaging study for evaluation of knee injuries. Unfortunately, radiography can be of limited utility for complete assessment of the bones and soft tissues of the knee. As a result advanced imaging (including CT, MRI or sonography) may be required to fully characterize knee injury. Sometimes the immediate full evaluation of the knee is warranted. The purpose of this presentation is to explore clinical settings which may require advanced imaging of knee injuries in addition to radiography while the patient is still in the emergency room.

**RC708C**

**Wrist Injuries**

Claire Kalsch Sandstrom MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1. Understand the normal anatomy of the wrist on CT and MRI.  
2. Appreciate subtle and catastrophic soft tissue injury patterns of the wrist.  
3. Effectively utilize CT and MRI in management of patients with wrist injuries.

**ABSTRACT**

Wrist injuries are common presentations in all emergency departments. A wide spectrum of injuries present from subtle to catastrophic in nature. Identification of these injuries makes significant impact on treatment of such injuries. While most injuries can be identified or inferred from radiographs, diagnoses can be confirmed and refined on cross-sectional imaging such as CT and MRI. Knowledge of injury patterns helps in identification of associated injuries. CT and MRI will be used to illustrate a wide gamut of presentations of soft tissue and subtle osseous injuries. Emphasis will be placed on clinical significance of these injuries and also on treatment options and
Finger and Thumb Injuries

Bharti Khurana MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the relevant anatomy of finger and thumb. 2) Review the most commonly encountered osseous and soft tissue injury patterns seen in traumatic finger injuries.

ABSTRACT

Hand injuries are common presentations in all emergency departments. Knowledge of injury patterns helps in identification of associated subtle and soft tissue injuries. Emphasis will be placed on clinical significance and treatment options.

At the end of the course learners will have a comprehensive understanding of soft tissue and osseous injuries of hand.

Imaging Pancreaticobiliary Diseases (An Interactive Session)

Cholangiocarcinoma

Alison Clare Harris MBChB (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the risk factors, diagnostic features and anatomical/morphological classification of cholangiocarcinoma (CC). 2) Describe the typical imaging appearances for intra and extrahepatic cholangiocarcinoma using a multi-modality approach recognizing the distinction between perihilar and distal CC. 3) List findings that are key in determining surgical resectability.

ABSTRACT

Abstract Cholangiocarcinoma (CC) is the second most common primary liver tumor worldwide after hepatocellular carcinoma. Incidence and mortality rates for intrahepatic CC are rising. Established risk factors have been determined, but more than 70% of cases are sporadic. The identification of key characteristic features on CT and MRI/MRCP allow for accurate diagnosis and staging. Tumors are classified based on anatomical location into intra and extrahepatic (perihilar and distal) subtypes. This standardizes reporting and helps determine management and planning for either laparoscopy or biopsy. The criteria for surgical resection will be discussed together with options for progressed disease.

Pancreas Cancer

Eric P. Tamm MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the current status of staging pancreatic cancer, the impact of cross-sectional imaging on staging, and understand the category of ‘borderline resectable pancreatic cancer.’ 2) Appreciate the impact of advances in vascular reconstruction surgery on staging and surgical planning. 3) Have a basic understanding of neoadjuvant therapy, and its impact on staging.

ABSTRACT

The evolution of approaches to pancreatic cancer therapy have had several ramifications for imaging and particularly staging. This evolution has included the development of venous and, to a lesser degree, common hepatic arterial, vascular bypass grafts, and neoadjuvant therapy. These changes led to the changes in the AJCC staging guidelines to deemphasize venous involvement, and the development of the category of borderline resectable pancreatic cancer. One of the challenges in the environment of preoperative therapy is what are the typical patterns of treatment response. These changes all emphasize the importance of detailed accurate radiology reporting, which has led to the RSNA and American Pancreatic Association templates for radiology reporting. This exhibit will review these topics, with appropriate illustrative radiologic cases.

Acute Pancreatitis

Kumaresan Sandrasegaran MD (Presenter): Nothing to Disclose
LEARNING OBJECTIVES

1) Understand the working party classification of acute pancreatitis. 2) Appreciate the difference between peripancreatic and pancreatic necrosis. 3) Have an understanding of how imaging findings affect endoscopic and surgical management of severe acute pancreatitis.

ABSTRACT

In the least 10 years, there have been many new developments in the diagnosis and treatment of severe acute pancreatitis. The concept of peripancreatic necrosis is one. Imaging findings that differentiate peripancreatic necrosis from acute inflammatory collections have been described. Correct image interpretation is important since the former is usually treated more aggressively than the latter. Disconnection of the main pancreatic duct is another finding that may be identified by imaging. This has implications in the subacute stages of severe acute pancreatitis, usually requiring extensive endoscopic or operative intervention in the months after the initial episode. This presentation will review these topics, with appropriate illustrative radiologic cases.

Autoimmune Pancreatitis

Joel Garland Fletcher MD (Presenter): Grant. Siemens AG

LEARNING OBJECTIVES

1) To review the diagnostic criteria for autoimmune pancreatitis. 2) To discuss the differences between Type 1 and Type 2 autoimmune pancreatitis. 3) To emphasize the need to maximize visualization of pancreatic and intrahepatic ducts and understand temporal changes in contrast enhancement in autoimmune pancreatitis. 4) To describe imaging features of the pancreatic duct and periductal parenchyma in autoimmune pancreatitis that may distinguish it from cancer or chronic pancreatitis. 5) To describe the diagnostic and other frequently seen imaging findings of autoimmune pancreatitis. 6) To illustrate imaging findings showing response to treatment and recurrence of autoimmune pancreatitis after remission. 7) To describe useful imaging features in the differential diagnosis of pancreatitis versus neoplasms and other inflammatory conditions.

RC710

Ultrasound of Superficial Structures (An Interactive Session)

Refresher/Informatics

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM Location: E353C

Sub-Events

RC710A The Painful Scrotum

Thomas Charles Winter MD (Presenter): Speakers Bureau, General Electric Company

LEARNING OBJECTIVES

1) Describe the normal anatomy of the scrotum. 2) Describe proper technique for grey-scale and Doppler examination of the scrotum. 3) List common etiologies for the acute, painful scrotum.

ABSTRACT

This didactic lecture will describe the proper sonographic technique for scrotal examination, review normal anatomy of the scrotum as demonstrated by ultrasound, and will then progress to a description of the common pathologic conditions that may present emergently with acute scrotal pain.

RC710B Diagnosing Hernias

Gandikota Girish MBBS, FRCR (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the sonographic technique of evaluating hernias. 2) Identify sonographic features which help differentiate epigastric, direct, indirect and femoral hernias. 3) Understand some of the common pitfalls when using sonography to evaluate patients with inguinal hernias.

ABSTRACT

Inguinal hernias are a common clinical condition which may present with inguinal discomfort, and Ultrasound is a useful means for making a definitive diagnosis. Ultrasound is most helpful in diagnosing Subtle hernias which are often difficult to diagnose clinically. Understanding the sonographic anatomy of the inguinal canal and femoral triangle and dynamic evaluation using valsalva, is the key to diagnosing different types of inguinal hernias. However, there are a number of concepts which help the practitioner maximize the utility of the technique, including understanding the relationship between the deep ring and the inferior epigastric artery, and being aware of the pitfalls like the ‘thin man’ pitfall and the normal movement of the spermatic cord, to name a few.

RC710C Assessment of Lumps and Bumps

Ronald Steven Adler MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Describe sonographic appearance of common soft tissue masses. 2) List the current roles and indications of sonography as a screening tool and for sonographic characterization of soft tissue masses, which can further aid in diagnosis and therapy.

**RC711**

**Head and Neck Cancer PET Interpretation with Case Examples (An Interactive Session)**

**Refresher/Informatics**

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Thu, Dec 4 4:30 PM - 6:00 PM  Location: SS05A

**Practical Approach for Interpreting Head and Neck PET/CT**

Rathan M. Subramaniam MD, PhD (Presenter):  Speakers Bureau, Eli Lilly and Company

**LEARNING OBJECTIVES**

1) To understand the value of PET/CT in the care process of managing head and neck cancer. 2) To learn common pathways of tumor spread in head and neck. 3) To review illustrative cases and pitfalls of interpretation.

**PET/CT for Head and Neck Cancer: Clinical Applications and Case Studies**

Eric Michael Rohren MD, PhD (Presenter):  Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review head and neck anatomy and physiologic sites of FDG uptake. 2) Discuss the role of FDG-PET/CT in the evaluation of patients with head and neck malignancies.

**ABSTRACT**

FDG-PET/CT provides valuable information in the assessment of the patient with cancers of the head and neck. The metabolic information determined by FDG is complimentary and additive to the anatomic information from CT, and can be used to direct surgery, plan radiation therapy, and evaluate response to systemic or localized treatment. In this presentation, the role of FDG-PET/CT in the management of head and neck cancer will be presented, using case examples to illustrate the utility of PET as well as common pitfalls.

**RC712**

**Non-Atherosclerotic Vascular Diseases (An Interactive Session)**

**Refresher/Informatics**

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Thu, Dec 4 4:30 PM - 6:00 PM  Location: S103AB

**Vasculitis**

Phillip Matthew Young MD (Presenter):  Nothing to Disclose

**LEARNING OBJECTIVES**

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

**Genetic Disorders**


**LEARNING OBJECTIVES**

1) Understand the current thoughts about the role of genetics in a range of vascular pathologies and how this information is important to patient care and to our ability to interpret imaging studies of these patients. 2) Learn how to optimize CT scan acquisition protocols as well as 3D post processing protocols for the evaluation of genetic vascular diseases. 3) Understand the key imaging findings in Marfans syndrome.
and the imaging finding that impact on patient management. Learn about the extra-vascular findings in Marfans syndrome. 4) Understand the key imaging findings in Loeys-Dietz Syndrome and how these management decisions. Learn how vascular surgeons use imaging data for patient management decision making. 7) Learn the specific imaging findings that allow the radiologist to help suggest a specific vascular pathology by looking at the distribution and appearance of vascular pathologies.

ABSTRACT
The rapid developments in CT angiography have provided unparalleled capabilities for evaluation of the vascular tree in studies that combine rapid data acquisition, isotrophic 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 entities where knowledge is expanding at break neck speed. In this presentation I will review many of the key imaging finding 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 for these studies is addressed. The role of MPR and 3D renderings of complex vascular pathologies is also discussed and illustrated.

Vascular Malformations
Klaus D. Hagspiel MD (Presenter): Research Grant, Siemens AG

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 structures. This presentation will review the clinical and MR imaging features that aid in diagnosis of vascular anomalies and their proper classification. MR imaging protocols suitable for comprehensive assessment of vascular anomalies including functional analysis of the involved vessels will be discussed.

Pediatric: Neuro II
Refresher/Informatics

LEARNING OBJECTIVES
1) The participant will briefly review basic prenatal neurosonology and fetal MR imaging sequence important to identify normal and abnormal cerebral pathology. 2) Common fetal central nervous system abnormalities will be reviewed and compared to the normal fetal developmental landmarks. 3) The learner at the end of the session will be able to utilize the germinal matrix, brain parenchymal signal, sulcation and myelination to verify pathologies in the fetal brain.

Hypoxic Ischemic Injury/Perinatal Stroke
Ellen Grant MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Learn the imaging patterns of hypoxic ischemic encephalopathy and perinatal stroke. 2) Learn the differential diagnosis for imaging patterns similar to hypoxic ischemic encephalopathy and perinatal stroke. 3) Understand the role of imaging in treatment and prognosis.

Perinatal Brain Trauma
Michelle Silvera MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) To become more familiar with mechanisms of injury related to parturition. 2) To better recognize birth trauma-induced imaging abnormalities of the scalp, skull, and brain in newborns. 3) To have an increased awareness of birth-related traumatic neurosurgical emergencies.
ABSTRACT
The incidence of birth-related neurotrauma has declined with modern advances in prenatal care and improved obstetrical techniques. Nevertheless, head injury still occurs during labor and delivery. The different types of parturitional head injury cover a wide spectrum and range from minor self-limited scalp injuries such as a caput succedaneum to life threatening intracranial posterior fossa hemorrhages requiring prompt neurosurgical intervention. Head injuries including scalp hematomas, skull fractures and types of intracranial hemorrhage will be discussed in this session as well as risk factors that predispose the neonate to birth-related trauma.

RC714
Pain and Sedation in 2014
Refresher/Informatics
AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM Location: E353A

Participants
Fred E. Shapiro DO (Presenter): Nothing to Disclose
Richard D. Urman MD, MBA (Presenter): Nothing to Disclose
Hesham H. Malik MD (Presenter): Consultant, Guerbet SA

LEARNING OBJECTIVES
1) Learn up-to-date CME and SAM requirements needed to administer and maintain sedation privileges. Also learn how to survive a joint commission visit. 2) Learn what is required to provide moderate and/or deep sedation, including a review of rescue drugs. 3) Learn what is minimal sedation and the associated ramifications of only providing minimal sedation. 4) Learn when to involve Anesthesiologists in the care of Radiology patients, and learn how to keep your Anesthesiologists happy. 5) Learn how to avoid sedation disasters as well as the medico-legal ramifications of conscious sedation.

ABSTRACT
The safe and effective sedation of patients during interventional Radiology procedures requires an in depth knowledge of how to administer conscious sedation. Even more important, however, is the skill set to be able to accurately assess each patient's clinical status prior to the procedure, be able to formulate a comprehensive sedation plan, and recognize which patients would be better served by involvement of an Anesthesiologist. This course will review the institutional requirements for providing minimal, moderate or deep sedation. We will also outline how to develop a procedural sedation (PS) policy, including recognition of the role that team training contributes to a safe environment. We will review the use of the Institute for Safety in Office Based Surgery (ISOBS) safety checklist as well as its customization to the IR setting We will provide an evidenced-based review of the current literature re: QA, risk management, and process improvement using the ISOBS checklist as well as a review of drugs commonly used for procedural sedation.

RC715
Digital Breast Tomosynthesis
Refresher/Informatics
AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM Location: S406B

Sub-Events
RC715A Basics and Implementation
Catherine Margaret Appleton MD (Presenter): Consultant, Hologic, Inc Consultant, Biomedical Systems

LEARNING OBJECTIVES
1) Understand the challenges and potential pitfalls of implementing tomosynthesis is a clinical practice. 2) Review options for technical and interpretive workflow including issues related to patient selection, and screening versus diagnostic use. 3) Recognize the importance of referring physician and patient education in the implementation process: the pros and cons including radiation dose.

ABSTRACT
This presentation will outline considerations, and pro-active strategies for successful implementation of digital breast tomosynthesis into clinical practice. The significance of patient and referring clinician education will be discussed. Workflow challenges including interpretation time and patient selection will be discussed.

RC715B Clinical Utility of Digital Breast Tomosynthesis
Laurie Lee Fajardo MD, MBA (Presenter): Scientific Advisory Board, Hologic, Inc Consultant, Koninklijke Philips NV

LEARNING OBJECTIVES
1) Review scientific literature on the performance of digital breast tomosynthesis in diagnostic and screening environments. 2) Review patterns of benign and malignant disease; provide tools to better discriminate “actionable” findings. 3) Apply digital breast tomosynthesis effectively to reduce false positives and false negatives and increase breast cancer detection.
ABSTRACT

This presentation will demonstrate approaches to the interpretation of digital breast tomosynthesis to cultivate a greater understanding of its use in both diagnostic and screening environments and the scientific evidence supporting each. Strategies and approaches to interpreting digital breast tomosynthesis will be discussed.

RC715C

Difficult Cases

Steven P. Poplack MD (Presenter): Research Grant, Hologic, Inc

LEARNING OBJECTIVES

1) Recognize the non-calcified mammographic finding types that are more difficult to detect using Digital Breast Tomosynthesis. 2) Identify one important potential cause of Falsely Negative Digital Breast Tomosynthesis. 3) Comprehend management strategies for abnormalities that are only visible on Digital Breast Tomosynthesis.

ABSTRACT

This case-based presentation is intended to familiarize the audience with some of the limitations and challenges in the interpretation of Digital Breast Tomosynthesis.

RC716

Mitigation of Litigation (Sponsored by the RSNA Professionalism Committee)

Refresher/Informatics

PR

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

Thu, Dec 4 4:30 PM - 6:00 PM Location: S403A

Participants

Moderator: David M. Yousem MD:
Royalties, Oakstone Publishing, LLC Author with royalties, Reed Elsevier Research Grant, Bayer AG

LEARNING OBJECTIVES

1) To understand the implications of the four components of a medical negligence case: a) duty to the patient, b) breach in the standard of care, c) causation between breach and harm, and d) damages (economic, pain and suffering, punitive). 2) To reflect on the patient and physician experience in going through a malpractice trial. 3) To apply practice habits that reduce the chance that you will be the subject of a medical malpractice suit, enhance patient safety, increase the likelihood of good outcomes, and prevent frivolous lawsuits. 4) To learn dos and don'ts once sued. 5) To comprehend the role of medical experts in establishing the standard of care and ensuring an equitable and fair judicial process. 6) To discuss ethics of testifying as expert.

ABSTRACT

A medical malpractice case requires establishing four components of the case: 1) the duty of the physician to the patient, 2) a breach in the standard of care (what a reasonably prudent person would do in a similar situation), 3) the establishment that the breach caused the subsequent harm to the patient, and 4) damages to the patient. Most malpractice cases are won or lost in determining whether a deviation in the standard of care occurred and whether that deviation truly caused the patient's damages. Expert witnesses are commonly employed to help establish the standard of care for the setting in question, although some experts also provide guidance as to the expected economic costs that will be incurred by the damaged plaintiff. Because of the high cost of medicolegal litigation, most cases that have minor damages never come to court but may be dropped or settled out of court. Because of the vagaries of a lay jury, many minor cases are also settled out of court. One can reduce the chances that one will be sued by being cognizant of professional standards and guidelines that dictate certain behaviors such as timeliness of reporting, communication of important/relevant/critical/unexpected findings, and establishing good peer review systems that identify errors before they occur. Applying behaviors or work habits that enhance accuracy and efficiency and good practice patterns while also developing good physician-patient relationships are helpful for mitigation of litigation. Effective expert witnesses can help a lay jury understand the nuances of a case and establishing whether negligence has occurred. The credibility of expert witnesses is enhanced when they are impartial, do blinded unbiased reads, understand the specific practice patterns in which the defendant physicians are employed, and can explain complex issues to non-medical jury members.

Sub-Events

RC715A

Elements of Legal Suits: Duty, Breech, Causation, Damages and the Links between Them

Rosemary Schnall (Presenter): Stockholder, Johnson & Johnson, Kelly Yousem JD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC716A

Mitigation of Litigation: What the Radiologist Can Do To Reduce the Risk of Being Named in a Lawsuit

Michael Mester Raskin MD, JD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the different types of errors radiologists may make. 2) Analyze and compare specific actions to reduce errors. 3) Demonstrate understanding why failure to communicate is one of the greatest problems facing radiologists today. 4) Apply survival strategies to reduce the risk of being named in a lawsuit.

ABSTRACT

Failure to diagnose and failure to communicate are the two most frequent reasons why a radiologist is
named in a lawsuit. Perception and interpretation errors will be analyzed and specific actions to reduce these errors will be compared. The communication of unexpected findings directly impacts on the ability of the radiologist to deliver quality patient care. The courts have consistently held that timely communication may be as important as the diagnosis itself. Radiology is so advanced in imaging technology but not in communicating imaging findings. Specific examples of communication errors will be discussed and analyzed. Potential solutions involving closed-loop communication will be addressed. Finally, a plan for implementation of specific strategies will be suggested.

Active Handout

RC716C
Expert Witness Testimony: Issues of Ethics, Equality, Qualifications etc for Being an Expert Witness
Ronald L. Eisenberg MD, JD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES
1) Understand the role of an expert witness in malpractice lawsuits and ethical issues to consider to become a more effective and valuable expert witness.

ABSTRACT
Expert witnesses play essential roles in malpractice lawsuits. Radiologists considering becoming expert witnesses need to clearly understand that their duty is to provide honest opinions on technical issues to educate members of the jury so that they can render a more accurate verdict, rather than being advocates for the party that engaged them.

RC717
Quantitative CT and MR Perfusion Imaging

LEARNING OBJECTIVES
1) To understand the principles of CT perfusion analysis for tumor assessment. 2) To understand the pathophysiological basis of CT perfusion parameters for tumors. 3) To understand unique CT perfusion analysis of the liver due to its characteristic dual blood supply. 4) To describe the potential clinical applications, with a focus on hepatic and extrahepatic applications and clinical trials. 5) To discuss several recent challenging issues regarding CT perfusion. 6) To discuss areas for further development including assessment of tumor heterogeneity.

ABSTRACT
With the emergence of novel targeted therapies for cancer, imaging techniques that assess tumor vascular support have gained credence for response assessment alongside standard response criteria. CT perfusion techniques that quantify regional tumour blood flow, blood volume, flow-extraction product, and permeability-surface area product through standard kinetic models, are attractive in this scenario by providing evidence of a vascular response or non-response. Additionally, these techniques may provide prognostic and predictive information to the clinician. Their increasing acceptance in oncological practice in recent years has been related to the combination of clinical need and technological improvements in CT, including faster tube rotation speeds, higher temporal sampling rates, the development of dynamic 3D acquisitions and development of commercial software programmes embedded within the clinical workflow. Recently published consensus guidelines provide a way forward to performing studies in a more standardized manner. To date single centre studies have provided evidence of clinical utility. Future studies that include good quality prospective validation correlating perfusion CT to outcome endpoints in the trial setting are now needed to take CT perfusion forward as a biomarker in oncology. These presentations will cover the principles of CT perfusion analysis for tumor assessment and its pathophysiological basis. Clinical applications will be discussed focusing on hepatic and extrahepatic applications and clinical trials. Areas for further development including assessment of tumor heterogeneity will also be discussed.

Sub-Events

RC717A
CT Perfusion in Oncology: Hepatic Imaging
Se Hyung Kim (Presenter): Research Grant, Mallinckrodt plc Research Grant, Samsung Electronics Co Ltd

LEARNING OBJECTIVES
1) To understand basic principles, acquisition protocol, and pharmacokinetic models of CT perfusion. 2) To learn unique CT perfusion analysis of the liver due to its characteristic dual blood supply. 3) To describe the potential clinical applications, with a focus on hepatic applications. 4) To discuss several recent challenging issues regarding CT perfusion.

RC717B
CT Perfusion in Oncology: Extrahepatic Imaging
Vicky Joo-Lin Goh MBCh (Presenter): Research Grant, Siemens AG

LEARNING OBJECTIVES
1) To understand the principles of CT perfusion analysis for tumor assessment. 2) To understand the pathophysiological basis of CT perfusion parameters for tumors. 3) To describe the potential clinical applications, with a focus on extrahepatic applications and clinical trials. 4) To discuss areas for further development including assessment of tumor heterogeneity.

ABSTRACT
With the emergence of novel targeted therapies for cancer, imaging techniques that assess tumor vascular support have gained credence for response assessment alongside standard response criteria. CT perfusion techniques that quantify regional tumor blood flow, blood volume, flow-extraction product, and permeability-surface area product through standard kinetic models, are attractive in this scenario by providing evidence of a vascular response or non-response. Additionally, these techniques may provide prognostic and predictive information to the clinician. Their increasing acceptance in oncological practice in recent years has been related to the combination of clinical need and technological improvements in CT, including faster tube rotation speeds, higher temporal sampling rates, the development of dynamic 3D acquisitions and development of commercial software programmes embedded within the clinical workflow. Recently published consensus guidelines provide a way forward to perfoming studies in a more standardized manner. To date single centre studies have provided evidence of clinical utility. Future studies that include good quality prospective validation correlating perfusion CT to outcome endpoints in the trial setting are now needed to take CT perfusion forward as a biomarker in oncology. This presentation will cover the principles of CT perfusion analysis for tumor assessment and its pathophysiological basis. Clinical applications will be discussed focusing on extrahepatic applications and clinical trials. Areas for further development including assessment of tumor heterogeneity will also be discussed.

**RC717C**

**Quantitative MR Perfusion Imaging of the Brain**

Max Wintermark MD (Presenter): Research Grant, General Electric Company Research Grant, Koninklijke Philips NV

**LEARNING OBJECTIVES**

1) Understand the difference between quantitative and qualitative perfusion measurements. 2) Distinguish several approaches for obtaining quantitative perfusion maps in the brain. 3) Appreciate the strengths and weaknesses between the two major techniques, arterial spin labeling and bolus contrast dynamic susceptibility imaging.

**RC718**

**Radiogenomics of Lung Cancer—Changing Landscape and Challenges**

**Refresher/Informatics**

**LEARNING OBJECTIVES**

1) To understand the clinical needs for Radiogenomic Imaging in Lung Cancer. 2) To understand what imaging modalities and quantification techniques can be used in Radiogenomic Imaging in Lung cancer. 3) To illustrate examples of successes and failures in Radiogenomic Imaging approaches in Lung Cancer.

**RC718A**

**Lung Cancer in the Radiogenomic Era—Implications for Imaging**

Lawrence H. Schwartz MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To understand the need for Radiogenomic Imaging in Lung Cancer. 2) To understand what imaging modalities and quantification techniques can be used in Radiogenomic Imaging in Lung Cancer. 3) To illustrate examples of successes and failures in Radiogenomic Imaging approaches in Lung Cancer.

**RC718B**

**Qualitative Assessments of Lung Cancer for Radiogenomic Analysis**

Hyun-Ju Lee MD, PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To introduce the results of correlation between imaging features and genetic phenotypes of lung cancer. 2) To describe the implications of imaging traits on pathology, patient prognosis, and genetics. 3) To introduce the role of qualitative assessment for the next step high-throughput quantitative feature selection.

**RC718C**

**Quantitative Assessment in Lung Cancer Radiogenomics—Reproducibility and Reliability**

Binsheng Zhao DSc (Presenter): License agreement, Varian Medical Systems, Inc License agreement, Keosys License agreement, Hinacom Software and Technology, Ltd License agreement, AG Mednet, Inc

**LEARNING OBJECTIVES**

1) Familiarize the audience with quantitative image features that can be computed to characterize tumors. 2) Discuss reproducibility and reliability of image features due to, repeat CT scans, CT acquisition and reconstruction techniques, tumor segmentations.

**ABSTRACT**

The way tumors look on radiological images may also reveal their underlying cancer gene expressions. Tumor imaging phenotypes can be characterized not only qualitatively by the radiologist's eyeballing, but also quantitatively by computer through image feature analysis. Radiogenomics promises the ability to assess cancer genotype though the tumor's imaging phenotype. However, to date, little attention has been paid to the sensitivity of image features to repeat scans, imaging acquisition techniques, reconstruction parameters and tumor segmentations. This refresher course will first familiarize the audience with quantitative image features that can be computed to characterize tumor size, shape, edge and density texture statistics. Both phantom and in-vivo studies will be introduced to explain how repeat CT scans and CT imaging acquisition and reconstruction techniques affect the assessment of quantitative image features in lung cancer Radiogenomics studies. Last but not least, the effects of image segmentation on feature calculations will be addressed.
**RC721**

*Medical Physics 2.0: Mammography*

*Refresher/Informatics*

**LEARNING OBJECTIVES**

1) Understand the history and development of mammographic imaging equipment. 2) Understand the impact of equipment development on testing protocols. 3) Understand the impact of equipment development on regulation.

**ABSTRACT**

Mammographic imaging has undergone tremendous change since its inception. Rapid development from screen-film imaging to nearly universal acceptance of digital imaging has required a shift in testing methodology. This talk will briefly introduce the developments that have taken place and discuss the impact that this development has had on testing and regulation.

**Mammography 1.0**

*Melissa Carol Martin MS (Presenter): Nothing to Disclose*, *Eric A. Berns PhD (Presenter): Nothing to Disclose*

**LEARNING OBJECTIVES**

1) Current requirements for Quality Control for Hologic Digital Mammography Units. 2) Current requirements for Quality Control for General Electric Digital Mammography Units. 3) Current requirements for Quality Control for Fuji Computed Radiography for Mammography Units. 4) Current requirements for Quality Control for Printers used with Digital Mammography Units. 5) Current requirements for Quality Control for Monitors used with Digital Mammography Units.

**Mammography 2.0**

*Andrew Karellas PhD (Presenter): Research collaboration, Koning Corporation*

**LEARNING OBJECTIVES**

1) To provide an overview of how the Medical Physicist can prepare for the future of clinical mammography physics. 2) To provide a landscape of mammography imaging technologies. 3) To describe methods of image quality metrics, dose reduction, and quality control in relation to mammography technologies. 4) To describe the future roles of the Medical Physicist in clinical mammography physics.

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**RC722**

*Uncertainties in Imaging for Radiation Oncology: Sources and Mitigation Techniques—Image Guidance in the Treatment Room*

*Refresher/Informatics*

**LEARNING OBJECTIVES**

1) Terminology to describe uncertainties. 2) Methodologies for evaluating uncertainties in IGRT. 3) Uncertainties in IGRT technologies, including mitigation strategies (generic, not site-specific).

**Sub-Events**

**RC722A**

**Terminology to Describe Uncertainties and Methodologies for Evaluating Uncertainties in IGRT**

*Julianne Marie Pollard PhD (Presenter): Speaker, Sun Nuclear Corporation Travel support, Sun Nuclear*
RC723A

**ABSTRACT**

The number of CT examinations performed in the United States has been growing steadily leading to peak of more than 85 million procedures in 2011, but has shown a downward trend (76 million in 2013) in the past two years. Similar trends are observed world wide. The rapid increase in the number of CT procedures, new protocols and the associated radiation dose and risks has drawn considerable attention. It appears that the so-called ‘slice wars’ with regard to the number of slices provided per CT gantry rotation may be reaching a plateau and increasing concerns about radiation dose due to CT examinations

**LEARNING OBJECTIVES**

1) To identify various radiation optimization strategies in CT. 2) To update impact of technological advances on reducing CT dose. 3) To describe ways to optimize CT protocols.

**ABSTRACT**

The rapid increase in the number of CT procedures, new protocols and the associated radiation dose and risks has drawn considerable attention. It appears that the so-called ‘slice wars’ with regard to the number of slices provided per CT gantry rotation may be reaching a plateau and increasing concerns about radiation dose due to CT examinations.
are fueling the efforts to reduce radiation dose and has lead to 'dose wars'. Tube current modulation, iterative reconstruction algorithms, tube voltage reduction and many other strategies will be discussed in this presentation. These and many numbers of radiation dose reduction strategies are enabling users to acquire CT images at a much lower radiation dose. At the same time, efforts to optimize CT protocols are leading further improvement in image quality and image quantifications.

**RC723B**

**Fluoroscopy Dose Reduction and Clinical Management**

Pei-Jan Paul Lin PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) To identify that there are two basic schools of fluoroscopy operation logic design (FOLD). Discussion of FOLD enables us to understand how the modern fluoroscopy systems are able to. 2) Provide a wider dynamic range of patient thickness and reduce the patient exposure at the same time. 3) And, to identify there is a need to establish a hospital wide radiation monitoring and tracking system (HWRM).

**ABSTRACT**

There are two basic schools of fluoroscopy operation logic design (FOLD). Discussion of FOLD enables us to understand how the modern fluoroscopy systems are able to (1) lower radiation dose to the patient, (2) maintain the image quality required and (3) provide a wider dynamic range of patient thickness. While equipment based reduction of patient dose is effective, there is a need to monitor the overall radiation dose as the patient receives various types of radiological examinations. A hospital wide radiation monitoring (HWRM) is ever increasing as public-at-large becomes aware of potential radiation injuries from some of the radiological examinations. A sample monitoring system that is designed to monitor various patient dose data generated from CT and RF equipment will be discussed.

**URL's**


**RC723C**

**CR and DR Dose Reduction and Clinical Management**

Charles E. Willis PhD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Appreciate why dose reduction efforts are necessary in projection radiography using CR and DR. 2) Identify the meaning of vendor-specific receptor exposure indicators and the new standardized receptor exposure indicators, and their indirect relationship to patient dose. 3) Assess the role of output indicators, DAP, KAP, and EAP, in estimating patient dose. 4) List simple operational methods for managing radiation doses in clinical radiography.

**ABSTRACT**

Computed Radiography (CR) and Digital Radiography (DR) are key technologies that enable the electronic practice of radiology. Both CR and DR are capable of producing acceptable diagnostic quality images over a wide range of exposures. A combination of traditional and new methods is necessary to manage the concomitant radiation dose to patients undergoing projection radiography examinations.

**RC724**

**The Ethical Power of Radiologic Technology: Reviewing the Past to Prepare for the Future (Sponsored by the RSNA Professionalism Committee) (An Interactive Session)**

Refresher/Informatics

PR

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

Thu, Dec 4 4:30 PM - 6:00 PM Location: S103CD

**Participants**

Bruce Jonathan Barron MD (Presenter): Stockholder, Immunomedics Inc
Ingrid M. Burger MD, PhD (Presenter): Nothing to Disclose
Stephen Chan MD (Presenter): Nothing to Disclose
Stephen David Brown MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

1) Examine the ethical implications of radiological technology. 2) Describe how imaging technologies may be assessed from a bioethical perspective. 3) Discuss the ethical challenges generated by evolving prenatal imaging technologies. 4) Review the ethical questions that have arisen out of neuroimaging advances.

**ABSTRACT**

Radiological technologies rank among the most important medical innovations of the past 100 years. Their value to patients and to society is indelible. The assessment of such value has typically considered these technologies’ medical dimensions, with larger public health appraisals evaluating their impact on disease mortality, morbidity, quality of life, and health care costs. Radiologists have paid less attention to the ethical dimensions of their technologies - that is, the degree to which the technology has strained or eased the capacity of individual patients’ and society to make well-grounded ethical decisions. Yet, bioethicists have long recognized that the technologies developed by radiologists have been central to some of society’s most intense ethical dilemmas. Radiological technologies contribute frequently to clinical decision-making predicaments that are not only exercises in the assessment of probability and risk, but also of values, faith, social morays, and emotional capacity. When is the fetus a person? What is consciousness? What defines death? The answers to these questions are perennially subject to the evolving power of radiological technologies. This RSNA Centennial Professionalism Committee refresher course will examine the interface of ethics and radiological technology. We will discuss: 1) how imaging technologies may be assessed from a bioethical perspective; 2) the evolution of prenatal imaging technologies, and
the ethical challenges that these technologies have helped to generate; and 3) the role of neuroimaging technologies in
spawning the robust new discipline of “neuroethics”, and the pressing ethical questions that have arisen out of neuroimaging
advances. As the RSNA enters its second century, and into an age of molecular and genomic imaging, reviewing the ethical
implications of radiological technologies developed in the past century may offer insights into ethical dilemmas that new
imaging technologies may create in the future.

**RC725**

**Quantitative Imaging: Current and Future Practice in Radiology and Clinical Trials**

**Refresher/Informatics**

**LEARNING OBJECTIVES**

1) Describe the benefits of implementing more quantitative image interpretation in clinical radiology practice. 2) Understand the activities that RSNA supports to help move the profession of radiology from a primarily qualitative interpretation paradigm to a more quantitative-based interpretation model. 3) Describe the challenges of extracting uniform, standardized quantitative measures from clinical imaging scans.

**ABSTRACT**

The RSNA Strategic Plan strives to advance the radiological sciences and foster the development of new technologies in part by promoting the quantification of imaging results. The added value of quantification in both research and clinical environments is likely to increase as health care initiatives place increased pressure on radiologists to provide decision support for evidence-based care. There remain substantial barriers to the widespread use of quantitative measures in clinical radiology including inherently large number of variables that impede validation of specific metrics, diversity of proprietary industry platforms, and lack of acceptance by radiologists. A critical barrier to the implementation of QI in radiology is the lack of standardization among vendor platforms. Collaboration in the pre-competitive space is challenging yet crucial to address standardization, and integrating quantitative measurement into workflow will be necessary for wide adoption. The obstacles to overcome with practicing radiologists are a distrust of the reliability of QI and the fear of losing value of radiologists' expertise through automation and commoditization. The Quantitative Imaging Biomarkers Alliance (QIBA) was officially launched in 2007 as a means to unite researchers, healthcare professionals, and industry stakeholders in the advancement of quantitative imaging. QIBA’s mission is to: Improve the value and practicality of quantitative biomarkers by reducing variability across devices, patients and time. QIBA’s six active technical committees (DCE-MRI, fMRI, FDG-PET, volumetric CT, COPD-Asthma, US shear-wave speed) develop QIBA Profiles (i.e., documents) of standardized specifications for image acquisition, collection, and post-processing.

**NCI’s Quantitative Imaging Network (QIN): Progress and Impact on Clinical Trials**

**LEARNING OBJECTIVES**

1) Describe various methods for prediction and measurement of therapy response. 2) Understand which imaging modalities and software tools are best suited for this clinical goal. 3) Understand the complexity of quantitative imaging methodology and how to compare the performance of different. 4) Understand how NCI Research Networks function to create a consensus on imaging methodology and public resources to meet these aims. 5) Learn about NCI funding opportunities for this research area.

**American College of Radiology Imaging Network/Eastern Cooperative Oncology Group (ACRIN/ECOG) Perspective**

**LEARNING OBJECTIVES**

1) Identify the importance of quantitative imaging principles in the setting of clinical trials. 2) Identify conditions required for 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) Understand the current process of how reimbursement for new procedures and technology is obtained from CPT code development, valuation and coverage. 2) Using Lung Cancer Screening as an example, the participants will become familiar with the specific processes for obtaining coverage for new screening programs in the public and private sectors and how a myriad of governmental agencies and other policymaking groups are involved in determining which new procedures are covered. 3) Understand how obtaining coverage will bring this new technology to the mainstream. 4) Interactive techniques will be used to engage the audience in the consideration of strategic partnerships between industry, clinical research, governmental agencies and third party payors.

URL's

http://www.acr.org/

RC729

Abdominal MRA Update (An Interactive Session)

Refresher/Informatics

**MR**

**GI**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM Location: S402AB

Sub-Events

**RC729A**

Non-contrast MRA of the Abdomen

Scott Brian Reeder MD, PhD (Presenter): Institutional research support, General Electric Company
Institutional research support, Bracco Group

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

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.

**RC729B**

Blood Pool MR Contrast Agents: Clinical Applications and Caveats

Mellena Davis Bridges MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the differences between the in vivo behavior of blood pool and conventional MRI contrast agents. 2) Match the clinical indication with the appropriate contrast agent. 3) Determine the best imaging protocol. 4) Describe potential pitfalls and methods for dealing with them.

**RC729C**

Deep Inferior Epigastric Perforator MRA for Planning Breast Reconstruction

Nanda Deepa Thimmappa MD, MBBS (Presenter): Nothing to Disclose

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 construction. 3) Review the perforator findings from a spectrum of cases. 4) See a systematic approach to post-processing and reporting perforator studies.

RC731

US for Thyroid Cancer: Diagnosis, Surveillance, and Treatment (How-to Workshop)

Refresher/Informatics

**US**

**NR**

**HN**

**OI**

AMA PRA Category 1 Credits ™: 1.50
ARRT Category A+ Credits: 1.50
Thu, Dec 4 4:30 PM - 6:00 PM Location: E263

Participants

Jill Eve Langer MD (Presenter): Consultant, BioClinica, Inc
Kathryn Ann Robinson MD (Presenter): Nothing to Disclose
Sheila Sheth MD (Presenter): Consultant, Star Scientific, Inc
LEARNING OBJECTIVES

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

ABSTRACT

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

RC732
Compensation Plans and Funds Flow
Refreshed/Informatics

LEARNING OBJECTIVES

1) Understand the need to offer incentive compensation (bonus) to faculty in Academic Radiology Departments. 2) To be able to describe the advantages and disadvantages of productivity only incentive plans in Academic Radiology. 3) Understand methods of providing incentives other than clinical productivity. 4) Understand how to insure fairness and a feeling of working as a team with incentive-based compensation plans. 5) Understand how incentive systems used by private practices are different from that of an Academic Radiology Department. 6) Understand how payment mechanisms to Academic Radiology Depts are changing from collections-based to RVU-based ("Funds Flow") with increased cost cutting and reliance on core services. (This course is part of the Leadership Track)

Participants

Ronald L. Arenson MD (Presenter): Nothing to Disclose
Pablo Riera Ros MD, PhD (Presenter): Medical Advisory Board, Koninklijke Philips NV Medical Advisory Board, KLAS Enterprises LLC Medical Advisory Committee, Oakstone Publishing Departmental Research Grant, Koninklijke Philips NV Departmental Research Grant, Sectra AB Departmental Research Grant
William G. Bradley MD, PhD (Presenter): Stockholder, Time Medical Holdings Company Ltd Advisory Board, Time Medical Holdings Company Ltd

Kirti Manohar Kulkarni MD (Presenter): Nothing to Disclose
Kathleen R. Gundry MD (Presenter): Nothing to Disclose
Kathleen Day MD (Presenter): Nothing to Disclose
Andrew Bowman MD, PhD (Presenter): Nothing to Disclose
Stamatia V. Destounis MD (Presenter): Advisory Board, Koninklijke Philips NV Medical Advisory Board

Candice W Bolan MD (Presenter): Nothing to Disclose
Hiroyuki Abe MD (Presenter): Stockholder, General Electric Company
Hiroyuki Abe MD (Presenter): Advisory Board, Koninklijke Philips NV Medical Advisory Board

Michael Patrick McNamara MD (Presenter): Nothing to Disclose
Jennifer Ruth Cranny MD (Presenter): Nothing to Disclose
Kathleen R. Gundry MD (Presenter): Nothing to Disclose
Andrew Bowman MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Establish criteria for MR Image-guided breast biopsy patient selection. 2) Cultivate a working understanding of MR Image-guided biopsy and needle localization instrumentation and implementation. 3) Basic MR Image-guided biopsy and needle localization parameters and requirements for appropriate coil, needle and approach selection. 4) Discuss practice integration issues. 5) Benefits and limitations of availability of MR Image-guided biopsy/needle localization in your practice.

ABSTRACT

This course is intended to provide both basic didactic instruction and hands-on experience in the application of MRI guided breast biopsy. MRI provides greater sensitivity for detecting breast cancer compared with mammography and ultrasound, although with imperfect specificity. MRI guided biopsy is required to confirm or exclude malignancy for MRI only findings. This
course will be devoted to the understanding and identification of the following pertaining to MRI guided biopsy: 1) appropriate patient selection 2) optimal positioning for biopsy 3) target selection and confirmation 4) various biopsy technologies and techniques 5) potential problems and pitfalls.

**RC751**

CT Dose Reduction: Diagnostic Information, Image Quality and CT Radiation Dose (How-to Workshop) (An Interactive Session)

**Refresher/Informatics**

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<td>SQ CT Dose Reduction: Diagnostic Information, Image Quality and CT Radiation Dose (How-to Workshop) (An Interactive Session)</td>
<td>AMA PRA Category 1 Credits™: 1.50 ARTT Category A+ Credits: 1.50 Thu, Dec 4 4:30 PM - 6:00 PM Location: E450B</td>
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**LEARNING OBJECTIVES**

1) Visual impression of general image quality parameters such as image noise, texture, sharpness and artifacts in CT. 2) Image guided tour on effects of radiation dose on general image quality parameters. 3) Image based display of effects of different scan parameters on general image quality metrics. 4) Image guided display of effects of radiation dose and different scan parameters on appearance of different lesion subtypes in adult and pediatric body CT examinations.

**Sub-Events**

**RC751A**

General Image Quality Session: Interactive Discussion on Image Quality Parameters Such As Noise, Contrast, Sharpness, and Artifacts at Different Dose Levels

Mannudeep K. S. Kalra MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

**ABSTRACT**

Using CT images acquired at different dose levels, radiologists will learn about general image quality metrics, such as image noise, sharpness, contrast, texture and artifacts. In addition, they will learn from images, how dose and different scan parameters affect these image quality metrics. In order to accomplish this, radiologists will scroll through clinical cases at different dose points in different body regions. Next, the radiologists will learn about the specific effects of dose on lesion detection and appearance. In this section, radiologists will go through multiple series of CT images at different dose levels to assess the effect of changing dose on specific lesion and image appearance for specific lesion types. They will be asked to perform a directed search for structures and lesions, some of which will exist and others will not exist in the provided datasets. At the end of each case, they will get to see the specific example template protocol for at least two scanner vendors. This course will help radiologists understand the need for specific clinical indication and size driven protocols.

**RC751B**

Lesion Detection: Multi-Dose CT Images with Clinical/Pathology Correlation


**LEARNING OBJECTIVES**

**ABSTRACT**

RC752

US-guided Interventional Breast Procedures (Hands-on Workshop)

**Refresher/Informatics**

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<td>AMA PRA Category 1 Credits™: 1.50 ARTT Category A+ Credits: 1.50 Thu, Dec 4 4:30 PM - 6:00 PM Location: E264</td>
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**Participants**

Jocelyn A. Rapelyea MD (Presenter): Research Consultant, Siemens AG Consultant, General Electric Company
Margaret M. Szabunio MD (Presenter): Nothing to Disclose
Liane Elizabeth Philpotts MD (Presenter): Nothing to Disclose
Karen S. Johnson MD (Presenter): Research Consultant, Siemens AG
to Disclose
Nicole Sondel Lewis MD (Presenter): Nothing to Disclose

**LEARNING OBJECTIVES**

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

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

**RC753**

**Decoding the Alphabet Soup (IHE®, MIRC®, RadLex®, Reporting): Whirlwind Tour of RSNA Informatics Projects**

*Refresher/Informatics*

**Learning Objectives**

1) Articulate the main objectives of each of the RSNA-sponsored informatics projects. 2) Identify the practical problems being addressed by each project. 3) Understand the relationships between these informatics projects.

**Abstract**

The RSNA is a longstanding leader in developing and promoting informatics tools and technologies for the practicing radiologist. In this refresher course, leaders of four of RSNA's most important informatics projects will introduce their respective projects, discuss the latest work, and describe what these projects mean to the practicing radiologist. MIRC is a set of free software tools for managing radiology teaching files and clinical imaging trials. RadLex is a unified system of radiology terminology that allows standardized description and indexing of many kinds of radiology information for diverse applications. The Reporting project creates and maintains a collection of best-practice radiology report templates. IHE is an organization that promotes standardized communication between all types of health information systems such as PACS.

**URL’s**


**Sub-Events**

**RC753A**

**IHE**

David S. Mendelson MD (Presenter): Spouse, Employee, Novartis AG Advisory Board, Nuance Communications, Inc Advisory Board, General Electric Company Advisory Board, Toshiba Corporation

**Learning Objectives**

View learning objectives under main course title.

**RC753B**

**MIRC**

Krishna Juluru MD (Presenter): Nothing to Disclose

**Learning Objectives**

View learning objectives under main course title.

**RC753C**

**RadLex**

Daniel L. Rubin MD, MS (Presenter): Nothing to Disclose

**Learning Objectives**

View learning objectives under main course title.

**RC753D**

**Reporting**

Charles E. Kahn MD, MS (Presenter): Shareholder, Hotlight Inc Officer, Hotlight Inc

**Learning Objectives**

View learning objectives under main course title.

**URL’s**


**RC754**

**Health IT Incentive Programs: Implications for Radiology IT Vendors. What Your Customers will Demand and Your Competition will Provide**

*Refresher/Informatics*

**Learning Objectives**

View learning objectives under main course title.
LEARNING OBJECTIVES

1) Understand what technology Radiology groups will need for Meaningful Use. 2) Learn how to be a competitive supplier of Meaningful Use products. 3) Understand the concept of Radiology Meaningful Use. 4) Understand the various technical and operational approaches that radiology groups can pursue to achieve Meaningful Use. 5) Understand how these will vary given a group’s practice scenario. 6) Understand how to evaluate your IT product offerings to meet the needs of radiology groups seeking to become eligible for Meaningful Use incentives. 7) Explore future IT product offerings that would encompass concepts that the radiology community truly project MU for radiology.

ABSTRACT

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

URL's

http://nnlm.gov/training/resources/pubmed8.pdf
Handout:Holly Ann Burt