

103rd Scientific Assembly and Annual Meeting

November 26 to December 1
McCormick Place, Chicago



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Thursday

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SPDL50

Diagnostic Challenges in MSK, Body and Neuroimaging (Case-based Competition)

Thursday, Nov. 30 7:15AM - 8:15AM Room: E451B

ER **MR** **MK** **NR**

AMA PRA Category 1 Credit™: 1.00

ARRT Category A+ Credit: 1.00

Participants

Petra J. Lewis, MD, Lebanon, NH (*Moderator*) Nothing to Disclose

Jenna N. Le, MD, Lebanon, NH (*Presenter*) Nothing to Disclose

David A. Pastel, MD, Lebanon, NH (*Presenter*) Nothing to Disclose

John J. McIntyre IV, MD, Lebanon, NH (*Presenter*) Nothing to Disclose

Michael J. Tsapakos, MD, PhD, Lebanon, NH (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jenna.le@dartmouth.edu

LEARNING OBJECTIVES

1) Identify a variety of common sports injuries utilizing MRI. 2) Review clinical presentations of sports injuries that present to orthopedic clinics and how these presentations can assist in the diagnosis when correlated with imaging. 3) Review a variety of typical and atypical musculoskeletal injuries that present to the Emergency Department. *This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.*

SPSC50

Controversy Session: Cancer Imaging: Does Second Opinion Subspecialty Interpretation Impact Patient Management?

Thursday, Nov. 30 7:15AM - 8:15AM Room: E350

OI

AMA PRA Category 1 Credit™: 1.00

ARRT Category A+ Credit: 1.00

Participants

Hebert Alberto Vargas, MD, New York, NY (*Moderator*) Nothing to Disclose

Ashley S. Shaw, MBBCh, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

Fergus V. Coakley, MD, Portland, OR (*Presenter*) Founder, OmnEcoil Instruments, Inc; Shareholder, OmnEcoil Instruments, Inc

LEARNING OBJECTIVES

1) Discuss the pros and cons of routinely providing second opinion interpretations of cancer imaging by subspecialists. 2) Highlight potential scenarios where second opinions may provide added value in the oncology patient. 3) Define situations where second opinion interpretations may not be needed or feasible. 4) Outline logistic and resource implications of second opinion interpretations and future directions.

SPSH50

Hot Topic Session: Abbreviated MRI Exam - Breast MRI in 5 Minutes

Thursday, Nov. 30 7:15AM - 8:15AM Room: E450A

BQ BR MR

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

Participants

Linda Moy, MD, New York, NY (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the concept of an abbreviated breast MRI (AB-MR) examination. 2) Discuss the role of an AB-MR examination as a screening tool. 3) Discuss the role and applications of ultrafast imaging in an AB-MR examination. .

ABSTRACT

MRI is a highly sensitive imaging tool to detect occult malignancy. However the long scan time and high costs has limited its wide availability. There is increasing interest in the role of a shorter MRI exam and the amount of information that can be obtained in a short time window. This hot topic session will discuss the concept of an abbreviated MR (AB-MR) exam of the breast. The talks will focus on both technical and clinical aspects of a comprehensive AB-MR exam. The speakers will discuss their approaches to an AB-MR of the breast. Also, we will discuss the incorporation of ultrafast imaging into an AB-MR exam.

Sub-Events

SPSH50A Abbreviated Breast MRI: A Game Changer for Screening of Breast Cancer

Participants

Christiane K. Kuhl, MD, Bonn, Germany (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ckuhl@ukaachen.de

LEARNING OBJECTIVES

1) To identify the cancer yield of breast cancer screening with MRI compared to digital breast tomosynthesis or breast ultrasound. 2) To list results of research on abbreviated breast MRI. 3) To define advantages and disadvantages of MR technology used for abbreviated breast MRI.

ABSTRACT

Breast-MRI screening is associated with high direct and indirect costs. This, together with the lack of sites that offer high level breast-MRI, limits the clinical access to screening MRI. One reason for the high cost is the fact that current breast-MRI protocols are time consuming to acquire and to read. A typical MRI study occupies the MR system for up to 40 minutes and generates several hundred images. Although MRI pulse-sequence protocols of the different MRI-screening trials conducted so far vary widely, they all have in common that for screening, the same MRI acquisition-protocol had been used that was also used for diagnostic purposes in the respective institutions. To make breast MRI a real screening tool, we proposed to use an abbreviated, short MRI-protocol that is limited to one acquisition before and after contrast injection, then to use standard image reconstruction tools (maximum intensity projection, MIP) to allow a very fast overview of the imaging volume, and finally to have expert radiologists interpret this limited protocol. Aim was to substantially reduce image acquisition and reading time of screening-MRI. Long term goal is to increase the access to screening breast-MRI. We prospectively investigated this approach in women at mildly increased risk. MRI was offered for screening in addition to digital mammography, plus ultrasound in women with dense breast. We found that the diagnostic utility of the abbreviated breast-MRI screening protocol was comparable or even identical to that of the routine breast-MRI screening protocol. The abbreviated protocol, however, allowed a substantial reduction of image acquisition time down to 3 minutes, and also a fast interpretation (radiologist reading-time of 3 seconds for MIP, and under 30 seconds for the first post contrast subtracted images). Reading the MIP-image helped exclude presence of breast-cancer with a negative predictive value of close to 100 %. Reading FAST images helped correctly characterise positive MIP findings. With the abbreviated protocol, the same added cancer yield (18 per 1000) was achieved as with the regular screening breast-MRI protocol. Most importantly, the interval cancer rate was zero. if combined with dedicated breast MR systems, it is conceivable to offer abbreviated breast MRI on a population wide level for breast cancer screening.

SPSH50B Ultrafast Imaging: Improving Screening Results with a 2 Minute Protocol

Participants

Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Presenter*) Research agreement, Siemens AG; Research agreement, Seno Medical Instruments, Inc; Research agreement, Identification Solutions Inc; Research agreement, Micrima Limited; Scientific Advisor, ScreenPoint Medical BV

LEARNING OBJECTIVES

1) Discuss the available techniques for ultrafast breast MRI. 2) Evaluate the ultrafast images in a concise manner. 3) Understand the value of ultrafast breast MRI for screening.

ABSTRACT

This session will focus on the use of ultrafast breast MRI as a tool for screening women for breast cancer. Different approaches to ultrafast imaging will be discussed and pro's and con's of the various techniques described. The clinical use of ultrafast imaging including useful lesion classification techniques will be presented and the value of the technique as a tool for breast cancer screening will be shown. All in, ultrafast breast MRI allows breast screening with MRI in under 2 minutes acquisition time, while being just as accurate as a full length diagnostic protocol.

SPSH50C New Biomarkers for Breast Cancer from Abbreviated Ultrafast DCE-MRI

Participants

Gregory S. Karczmar, PhD, Chicago, IL (*Presenter*) Nothing to Disclose

MSRT51

ASRT@RSNA 2017: Whole-body CT for Trauma

Thursday, Nov. 30 8:00AM - 9:00AM Room: N230B



AMA PRA Category 1 Credit™: 1.00

ARRT Category A+ Credit: 1.00

Participants

Martin L. Gunn, MBChB, Seattle, WA (*Presenter*) Research Grant, Koninklijke Philips NV; Royalties, Cambridge University Press; Spouse, Consultant, Reed Elsevier; Spouse, Consultant, athenahealth, Inc

For information about this presentation, contact:

marting@uw.edu

LEARNING OBJECTIVES

1) Summarize challenges when performing whole body CT in the ED. 2) Outline 'who' and 'how' to scan. 3) Review recent evidence about the value of whole body CT. 4) Discuss integrated CT during resuscitation.

ABSTRACT

Whole-body computed tomography (WBCT) has become a widely used technique for the workup of the patient with blunt polytrauma. However, current evidence suggests that WBCT is associated with either slightly improved or no significant change in patient survival, although it does reduce the emergency department (ED) length of stay (LOS). More randomized studies are needed to determine for certain whether early WBCT improves survival, to clarify which patients benefit the most and to model the costs of this technique compared with traditional workup. Advancements in modern multidetector computed tomography (MDCT) technology and an improved understanding of optimal protocols have enabled one to scan the entire body and achieve adequate image quality for a comprehensive trauma assessment in a short period.

RCB51

Prostate MRI (Hands-on) Course will be repeated Monday, Tuesday, Wednesday and Thursday from 8am-10am

Thursday, Nov. 30 8:00AM - 10:00AM Room: S401CD

GU MR

AMA PRA Category 1 Credits TM: 2.00

ARRT Category A+ Credits: 2.25

Participants

Jelle O. Barentsz, MD, PhD, Nijmegen, Netherlands (*Presenter*) Advisor, SPL Medical BV
 Jurgen J. Futterer, MD, PhD, Nijmegen, Netherlands (*Presenter*) Research Grant, Siemens AG
 Roel D. Mus, MD, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
 Geert M. Villeirs, MD, PhD, Ghent, Belgium (*Presenter*) Nothing to Disclose
 Marloes van der Leest, MD, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
 Renske L. van Delft, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
 Rianne R. Engels, Cuijk, Netherlands (*Presenter*) Nothing to Disclose
 Leonardo K. Bittencourt, MD, PhD, Rio De Janeiro, Brazil (*Presenter*) Investor, Healfies LLC
 Joseph J. Busch, MD, Chattanooga, TN (*Presenter*) Nothing to Disclose
 Baris Turkbey, MD, Bethesda, MD (*Presenter*) Nothing to Disclose
 Daniel J. Margolis, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
 Antonio C. Westphalen, MD, Mill Valley, CA (*Presenter*) Scientific Advisory Board, 3DBiopsy LLC ; Research Grant, Verily Life Sciences LLC
 Philippe A. Puech, MD, Lyon, France (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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Rianne.Engels@radboudumc.nl

Renske.vandelft@radboudumc.nl

Lkayat@gmail.com

LEARNING OBJECTIVES

1) Understand the PI-RADS v2 Category assessment to detect and localize significant cancer for both peripheral zone and transitional zone lesions. 2) Recognize benign pathology like inflammation and BPH and to differentiate these from significant prostate cancers.

ABSTRACT

In this Hands-On Workshop, the participants will be able to review up to 30 multi-parametric MRI cases with various prostatic pathology using a dedicated workstation. Focus will be on the overall assessment of PI-RADS v2 category, which enables them to score the probability of the presence of a significant cancer in patients with elevated PSA and/or clinical suspicion. All cases are from daily non-academic practice, and have various levels of difficulty. The cases include: easy and difficult significant peripheral-transition- and central zone cancers, inflammation, BPH, and the most common pitfalls. Internationally renowned teachers will guide the participants during their PI-RADS v2 scoring. There will be 50 workstations available. **PLEASE NOTICE:** Based on last year's experience, we expect this course to be very popular. We only have 50 computers, and two spots per computer. Only the first 100 people will be accepted in the room. The front rows are reserved for beginners. In case you already are experienced in prostate MR: Please take a seat in the back of the room. We will not have space for any additional listeners this year. The coursebook can be found as handout to this course. Please download and take it with you on your tablet or other device.

Active Handout: Renske Lian van Delft

http://abstract.rsna.org/uploads/2017/16002006/Active_RCB.pdf

MSCN51

Case-based Review of Neuroradiology (An Interactive Session)

Thursday, Nov. 30 8:30AM - 10:00AM Room: S406A



AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

Participants

Pina C. Sanelli, MD, Manhasset, NY (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the application of basic anatomic, pathologic, and physiologic principles to specific disease processes, and diagnostic and therapeutic procedures in neuroimaging. 2) Analyze imaging and therapeutic techniques and apply this knowledge to protocol development, patient management and safety. 3) Compare indications and contraindications of specific imaging procedures in Neuroradiology.

Sub-Events

MSCN51A Pediatric Brain

Participants

Yutaka Sato, MD, Iowa City, IA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

yutaka-sato@uiowa.edu

LEARNING OBJECTIVES

1) Identify pediatric neurologic cases in which imaging play a major role to establish diagnosis, including some newly described entities. 2) Provide key clinical and imaging findings correlating to pathologic data, when appropriate. 3) Discuss differential diagnosis based on imaging findings. Primary imaging techniques used for assessment, clinical practice, problem-solving and patient care are emphasized.

Active Handout: Yutaka Sato

<http://abstract.rsna.org/uploads/2017/17000504/RSNA Reading List.pdf>

MSCN51B Pediatric Spine

Participants

Avrum N. Pollock, MD, Wynnewood, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To utilize multimodality imaging in the assessment of diseases affecting the spine in children. 2) To understand potential congenital lesions affecting the spine in children. 3) To understand infectious, inflammatory and neoplastic processes affecting the spine in children.

MSCN51C Pediatric Head & Neck

Participants

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

LEARNING OBJECTIVES

1) Become familiar with region specific, indication based cross sectional imaging protocols to image the pediatric head and neck. 2) Improve knowledge in interpreting imaging of the pediatric head and neck. 3) Provide a relevant differential diagnosis. 4) Recognize various common syndromes that involve the pediatric head and neck.

Active Handout: Caroline Diana Robson

<http://abstract.rsna.org/uploads/2017/17000506/Active MSCN51C.pdf>

MSCN51D Pediatric Interventional

Participants

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

MSCS51

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

Thursday, Nov. 30 8:30AM - 10:00AM Room: S100AB

MK

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Stacy E. Smith, MD, Weston, MA (*Director*) Nothing to Disclose

Sub-Events

MSCS51A Muscle

Participants

Robert D. Boutin, MD, Davis, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

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

MSCS51B Soft Tissue Lesions

Participants

Stacy E. Smith, MD, Weston, MA (*Presenter*) Nothing to Disclose

MSCS51C MSK Ultrasound

Participants

Linda Probyn, MD, Toronto, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe relevant anatomy, pathology and ultrasound imaging appearances of MSK cases shown, outlining differential diagnostic considerations and the value of dynamic imaging and Doppler ultrasound where appropriate. 2) Identify potential pitfalls and artifacts relevant to MSK ultrasound. 3) Describe how other imaging modalities can be complimentary to MSK ultrasound for diagnosis.

MSCS51D Chest Trauma

Participants

Martin Torriani, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mtorriani@mgh.harvard.edu

LEARNING OBJECTIVES

1) Familiarize attendees with common injury patterns to the chest wall and musculature as seen in usual trauma and sports-related activities; discussion will include injuries to ribs, costochondral region, and muscles (pectoralis, latissimus).

MSES51

Essentials of Trauma Imaging

Thursday, Nov. 30 8:30AM - 10:00AM Room: S406B

ER MR MK

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Sub-Events

MSES51A Radiographic Evaluation of Shoulder Trauma

Participants

Jonelle M. Petscavage-Thomas, MD, MPH, Hummelstown, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe normal radiographic anatomy of the shoulder. 2) Describe commonly missed injuries of the shoulder. 3) Describe appropriate radiologic management of suspected shoulder injuries.

ABSTRACT

Injuries of the shoulder are common but some are easily overlooked or mischaracterized. This presentation will be a case-based review of shoulder injuries that are frequently missed including fractures, dislocations and clues to significant soft tissue injuries.

MSES51B MRI of Meniscal Tears

Participants

Tetyana A. Gorbachova, MD, Huntingdon Vy, PA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

GorbachT@einstein.edu

LEARNING OBJECTIVES

1) Recognize normal anatomy and MRI appearance of menisci. 2) Describe various types of meniscal tears and their clinical and treatment implications. 3) Be familiar with common pitfalls in diagnosis of meniscal tears on MRI.

ABSTRACT

Evaluation of menisci is one of the essential skills in interpreting MRI of the knee. MRI diagnosis of a meniscal tear relies on two main criteria: abnormal meniscal signal and abnormal morphology. Abnormal signal is defined as unequivocal intrameniscal signal extending to the articular surface of a meniscus, seen on two images which can be either two consecutive images or images in two orthogonal planes. Abnormal morphology is defined as abnormal meniscal contour, displaced or absent meniscal tissue or a menisco-capsular separation. Each basic meniscal tear can be described in two planes. One plane describes the orientation of the tear with respect to the meniscal circumference which can be either longitudinal or radial. The other plane defines a tear with respect to a blade of a "cutting tool" and can be vertical or horizontal. The combination of these two planes results in three basic types of meniscal tears. Basic patterns can produce displaced types of tears. Several MR imaging signs of meniscal tears as well as common pitfalls will be reviewed.

MSES51C Post-op MRI of Shoulder: Instability and Rotator Cuff

Participants

Luis S. Beltran, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the mechanisms of injury and associated pathologies in anterior shoulder instability and rotator cuff tears. 2) Be familiar with current treatment guidelines for management of anterior shoulder instability and rotator cuff disease. 3) Recognize the normal and abnormal appearances of postoperative MRI studies for anterior shoulder instability surgery and rotator cuff repairs.

ABSTRACT

The treatment of anterior glenohumeral instability varies substantially depending on patient age, level of activity, and severity of disease. The currently recommended treatment options include Bankart labral repair, Reimplissage, coracoid transfer, autograft, allograft, partial resurfacing prosthesis, and shoulder arthroplasty. Imaging plays a key role in determining the severity of disease, which is primarily determined by the degree of glenoid, humeral, or combined glenoid and humeral (bipolar) bone loss. Preoperative quantification of glenoid and humeral bone loss as well as labral pathology with MRI is one of the several key components that is necessary to determine appropriate therapy. It is also important to be familiar with normal and abnormal postoperative MRI appearance of these techniques to guide postoperative management. There are currently many surgical treatment options for rotator cuff tears including arthroscopic debridement, complete repair, partial repair, use of allograft patch to augment repair, superior capsular reconstruction, muscle tendon transfer, and reverse total shoulder arthroplasty. Appropriate therapy depends on patient age, level of activity, and severity of disease. Preoperative assessment of disease severity on MRI includes the severity of tendon tearing, retraction, and rotator cuff muscle atrophy. An understanding of the normal and abnormal postoperative MRI appearances of these techniques is also essential to assist in postoperative management.

MSES51D Injuries in the Young Athlete

Participants

Diego Jaramillo, MD, MPH, Miami, FL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

diego.jaramillo@mch.com

LEARNING OBJECTIVES

1) Understand the differences between the skeleton of the young athlete and that of the adult that predispose children and adolescents to specific injuries. 2) Recognize the imaging manifestations of the most common pediatric sports injuries. 3) Be familiar with the main contribution of the various imaging modalities for the diagnosis of these injuries.

ABSTRACT

The immature skeleton is susceptible to unique injuries. The physes at the ends of the long bones and at the apophyses where tendons insert are weak particularly during the growth spurt. Injury to the physes at the ends of long bones can result in growth arrest. The apophyseal physes are prone to avulsion. Repetitive injury to the physeal cartilage can disrupt endochondral ossification, and result in a wide, irregular physis with extensions of cartilage into the metaphysis. Once repetitive injuries are recognized, rest is recommended to avoid premature closure of the growth plate. The triplane and juvenile Tillaux fractures result from vulnerability of the partially closed distal tibial physis. The osteochondral junctions at the epiphyses and round bones are also vulnerable to sports related trauma. Acute injury can lead to avulsion of the cartilaginous lower pole of the patella, the patellar sleeve fracture and to osteochondral injuries in the patella and femoral condyles. Repetitive injury, and osteochondritis dissecans may develop in the distal femur, humeral capitellum and talar dome. The metaphyseal cortex becomes porous, also in response to increased hormone secretion during puberty, and is prone to buckling or disruption. Some tendinous and ligamentous insertions are also uniquely predisposed to avulsion, such as the tibial eminence and the lateral tibial epiphysis in the Segond fracture. In the knee, pivot shift injuries lead to tibial eminence avulsion in puberty, incomplete anterior cruciate ligament (ACL) tear in young adolescents, and complete tear in older adolescents. Meniscal tears are usually vertical, and when extensive result in flipped fragments. Patellar dislocations are common injuries in young adolescents. In the shoulder, most sport injuries affect the anterior or superior glenoid labrum. Many sports related injuries in skeletally immature athletes require imaging beyond radiographs: CT for injuries that are primarily osseous such as the triplane fracture, and MRI for injuries involving cartilage or ligaments. Ultrasound is playing a growing role in diagnosing ligamentous injuries and occult fractures.

Active Handout: Diego Jaramillo

[http://abstract.rsna.org/uploads/2017/17000082/Active MSES51D.pdf](http://abstract.rsna.org/uploads/2017/17000082/Active_MSES51D.pdf)

RC601

The Many Facets of Organizing Pneumonia: A Rad-Path Guide to Understanding and Diagnosis

Thursday, Nov. 30 8:30AM - 10:00AM Room: E451A

CH CT

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Jeffrey R. Galvin, MD, Baltimore, MD (*Moderator*) Nothing to Disclose

Sub-Events

RC601A Introduction

Participants

Jeffrey R. Galvin, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

Active Handout: Jeffrey R. Galvin

[http://abstract.rsna.org/uploads/2017/17000288/Active RC601A.pdf](http://abstract.rsna.org/uploads/2017/17000288/Active_RC601A.pdf)

RC601B Pathology of Organizing Pneumonia

Participants

Teri J. Franks, MD, Silver Spring, MD (*Presenter*) Nothing to Disclose

RC601C Imaging of Organizing Pneumonia

Participants

Seth J. Kligerman, MD, Denver, CO (*Presenter*) Nothing to Disclose

RC601D Pathways to Fibrosis and Summary

Participants

Jeffrey R. Galvin, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the microscopic anatomy of the lung that explains the high resolution CT findings associated with organizing pneumonia. 2) Improve their diagnostic skills related to the imaging recognition of organizing pneumonia. 3) Recognize the range of injuries and inhaled insults that lead to organizing pneumonia. 4) Apply a new knowledge of the pathways to fibrosis that allows for the differentiation of organizing pneumonia, IPF and diffuse alveolar damage. 5) Appreciate the importance of communication between the clinician, radiologist, and pathologist to improve diagnosis.

ABSTRACT

This presentation will review the histologic and radiologic findings of organization in lung injury due to diffuse alveolar damage, organizing pneumonia and acute fibrinous and organizing pneumonia. It will clarify the role of organizing pneumonia in the pathway to fibrosis that will sharpen the radiologist's ability to separate the various forms of fibrosis including: idiopathic pulmonary fibrosis, non-specific interstitial pneumonia and diffuse alveolar damage. Finally it will describe the multidisciplinary diagnostic process of which the radiologist is a key member.

Active Handout: Jeffrey R. Galvin

[http://abstract.rsna.org/uploads/2017/17000294/Active RC601D.pdf](http://abstract.rsna.org/uploads/2017/17000294/Active_RC601D.pdf)

RC602

Simulation and Radiology Training

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



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Sharjeel Sabir, MD, Houston, TX (*Moderator*) Travel support, Merit Medical Systems, Inc; Travel support, Boston Scientific Corporation; Travel support, NeuWave Medical, Inc

LEARNING OBJECTIVES

1) Introduce concepts underlying simulation based training. 2) Review the background for and ways to establish a contrast reaction simulation program. 3) Discuss development of a biopsy simulation workshop. 4) Understand the role of simulation in vascular interventional radiology training. 5) Explore the uses of 3D-printed models for simulation.

Active Handout: Sharjeel Sabir

<http://abstract.rsna.org/uploads/2017/17000137/Active RC602.pdf>

Sub-Events

RC602A Biopsy Simulation

Participants

Eran Ben-Levi, MD, Lake success, NY (*Presenter*) Nothing to Disclose
Towhid Ali, MD, South Ozone Park, NY (*Presenter*) Nothing to Disclose
Katherine A. Cheng, MD, New Hyde Park, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) How to setup an ultrasound guided biopsy simulation workshop.

RC602B Vascular Simulation

Participants

Sharjeel Sabir, MD, Houston, TX (*Presenter*) Travel support, Merit Medical Systems, Inc; Travel support, Boston Scientific Corporation; Travel support, NeuWave Medical, Inc

LEARNING OBJECTIVES

1) Provide a framework for thinking about simulation in vascular interventional radiology training. 2) Explore the different vascular procedural simulators that are commercially available. 3) Review the evidence for endovascular simulation. 4) Discuss opportunities for integrating simulation into the new IR residency.

Active Handout: Sharjeel Sabir

<http://abstract.rsna.org/uploads/2017/17000215/Active RC602B.pdf>

RC602C Contrast Reaction Simulation

Participants

Jay K. Pahade, MD, New Haven, CT (*Presenter*) Consultant, Precision Imaging Metrics, LLC

LEARNING OBJECTIVES

1) To briefly review literature supporting high-fidelity simulation in training management of contrast reactions. 2) To discuss critical elements of developing a contrast-reaction simulation training program and how to get faculty and trainee buy-in for the program. 3) To review some potential clinical scenarios that can be taught with simulation.

RC602D 3D Printing

Participants

Michael W. Itagaki, MD, MBA, Lynnwood, WA (*Presenter*) Owner, Embodi3D, LLC

LEARNING OBJECTIVES

1) To discuss and demonstrate how 3D printable anatomic models can be used in simulation of surgical and interventional radiology procedures. 2) To provide and share free resources to allow the learner to create customized medical 3D printed models.

RC603

MRI of Cardiomyopathies

Thursday, Nov. 30 8:30AM - 10:00AM Room: S404AB

CA **MR**

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Sachin S. Saboo, MD, FRCR, Dallas, TX (*Moderator*) Nothing to Disclose

Sub-Events

RC603A Evaluation of the Right Ventricular Cardiomyopathies and Other Disorders

Participants

Karen G. Ordovas, MD, San Francisco, CA (*Presenter*) Advisor, Arterys Inc

For information about this presentation, contact:

karen.ordovas@ucsf.edu

LEARNING OBJECTIVES

1) To recognize the MR appearance of cardiomyopathies primarily involving the right ventricle.

RC603B Hypertrophic and Dilated Cardiomyopathies

Participants

Marco Francone, MD, Rome, Italy (*Presenter*) Speakers Bureau, Bracco Group

For information about this presentation, contact:

marco.francone@uniroma1.it

LEARNING OBJECTIVES

1) To review importance of correct phenotypic recognition in dilated and hypertrophic cardiomyopathies understanding respective functional and morphological changes characterizing different stages of diseases. 2) To understand complexity and heterogeneity of genotypes underlying apparently similar phenotypic forms of disease correlating pathological changes with CMR imaging findings. 3) To recognize common and less common signal intensity abnormalities and late enhancement patterns to provide etiological differentiation of the various forms of cardiomyopathies. 4) To review prognostic implications of CMR-derived imaging biomarkers in dilated and hypertrophic cardiomyopathies.

RC603C Restrictive Cardiomyopathy and Amyloidosis

Participants

Daniel Vargas, MD, Denver, CO (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

daniel.vargas@ucdenver.edu

LEARNING OBJECTIVES

1) Discuss the physiologic aspects of restrictive cardiomyopathy. 2) Familiarize the imaging specialist with patterns of delayed enhancement and other ancillary findings that aid in differentiating causes of restrictive cardiomyopathy. 3) Review newer imaging techniques in the assessment of restrictive cardiac physiology.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Daniel Vargas, MD - 2017 Honored Educator

RC603D MRI for Cardiac Chest Pain (ACS, TakoTsubo, Myocarditis)

Participants

Jens Bremerich, MD, Basel, Switzerland (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jens.bremerich@usb.ch

LEARNING OBJECTIVES

1) To distinguish different clinical scenarios with chest pain and their suggested diagnostic algorithms. 2) To understand different diseases that might present with chest pain as leading symptom. 3) To oversee applications and limitations of MR in management of patients presenting with chest pain.

RC604

Musculoskeletal Series: Tumors

Thursday, Nov. 30 8:30AM - 12:00PM Room: E451B

MK

ARRT Category A+ Credits: 4.00
AMA PRA Category 1 Credits™: 3.25

Participants

Mark D. Murphey, MD, Berkeley, CA (*Moderator*) Nothing to Disclose
Doris E. Wenger, MD, Rochester, MN (*Moderator*) Nothing to Disclose
Stephanie A. Bernard, MD, Hershey, PA (*Moderator*) Nothing to Disclose
Mary Kristen Jesse, MD, Denver, CO (*Moderator*) Nothing to Disclose
Ronnie A. Sebro, MD, PhD, Boston, MA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) To recognize imaging appearances of common soft tissue neoplasms. 2) To identify imaging features that suggest an aggressive bone neoplasm. 3) To apply the imaging appearance of a neoplasm to help guide biopsy and improve diagnostic performance.

ABSTRACT

Important imaging features in evaluation of both bone and soft tissue tumors will be reviewed with key features that may allow diagnostic differentiation emphasized.

Sub-Events

RC604-01 Incidental Soft Tissue Lesions

Thursday, Nov. 30 8:30AM - 9:00AM Room: E451B

Participants

Mark J. Kransdorf, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

kransdorf.mark@mayo.edu

LEARNING OBJECTIVES

1) Recognize common incidental MSK soft tissue lesions that mimic more serious disease. 2) Identify characteristic distinguishing feature that will allow a confident diagnosis.

RC604-02 Common Errors in Soft Tissue Tumor Evaluation

Thursday, Nov. 30 9:00AM - 9:30AM Room: E451B

Participants

Mark D. Murphey, MD, Berkeley, CA (*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 characteristics of myositis ossificans. 4) Improve recognition of the distinction of intramuscular tendon injury from neoplasm.

ABSTRACT

Radiologists are frequently requested to evaluate a soft tissue mass by imaging. Common diagnostic dilemmas in imaging assessment of soft masses include differentiation of cystic lesion from myxoid neoplasm, distinction of hematoma from hemorrhagic neoplasm, misdiagnosis of myositis ossification on MR imaging and recognition of intermuscular tendon injury simulating a neoplastic process. This lecture emphasizes imaging features that usually allow differentiation of these diagnostic dilemmas in evaluation of a soft tissue tumor.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Mark D. Murphey, MD - 2015 Honored Educator

RC604-03 MR Imaging of Intramuscular Hematoma by Clinical Stage: Correlation with Experimental Serial MRI and Pathologic Findings

Thursday, Nov. 30 9:30AM - 9:40AM Room: E451B

Participants

Yeon-Soo Lee, MD, Daejeon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Eun Seok Choi, Daejeon, Korea, Republic Of (*Presenter*) Nothing to Disclose
Jong Ok Kim, Daejeon, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Intramuscular hematoma can mimic a hemorrhagic neoplasm or an inflammatory lesion during healing stage on MRI. Although the MRI signal intensity pattern of blood in the brain has been well documented, the mechanism of both muscular hematoma and its healing differ from those of intracranial hematoma. Thus, we evaluate the intramuscular hematoma by clinical stage and demonstrate the differential diagnostic findings from hemorrhagic neoplasm.

METHOD AND MATERIALS

This retrospective study included 66 intramuscular hematoma cases (63 patients, 49 men, 14 women; mean age 47 years) who underwent MR imaging from 2011 to 2015. Clinical stage is classified as acute (1~3 days) 12 cases, early subacute (4~7 days) 12 cases, late subacute (8~28 days) 28 cases, and chronic (29~56 days) 14 cases. MR images were reviewed. The characteristic MRI findings by clinical stage including signal intensities on T1WI, T2WI (all), gradient echo image (20 cases) and enhancement study (43 cases) were evaluated. Comparison with MRI signals of brain hematoma and correlation with previous reported experimental serial MRI with pathologic finding of intramuscular hematoma were performed.

RESULTS

On T1WI, the intramuscular hematomas exhibited isointensity compared to that muscle or high signal intensity from the acute stage. This high signal intensity persisted until chronic stage. On T2WI, hematoma showed inhomogeneously high signal intensity from acute stage. Peripheral dark signal rim was apparent after late subacute stage, which was indicative of hemosiderin on the pathology. The gradient echo imaging showed dark signal intensities at all stages. These findings were well correlated with prior experimental serial MRI and pathologic findings. Enhancement study showed rim enhancement in 20, no enhancement in 20 and nodular enhancement in 3 cases. Peripheral rim enhancement was apparent from early subacute stage.

CONCLUSION

Unlike brain hematoma, intramuscular hematoma showed high signal intensity on both T1WI and T2WI from acute stage to chronic stage. High signal with dark signal rim was prominent from early subacute stage on T2WI. Characteristic MRI findings and presence of peripheral rim or no enhancement may suggest the diagnosis of a hematoma rather than a hemorrhagic neoplasm.

CLINICAL RELEVANCE/APPLICATION

Intramuscular hematoma showed characteristic MRI finding by clinical stage, may be helpful for differential diagnosis from hemorrhagic neoplasm.

RC604-04 Integrated 18F-FDG PET/MRI Compared to MRI Alone for Identification of Local Recurrences of Soft Tissue Sarcomas: A Comparison Trial

Thursday, Nov. 30 9:40AM - 9:50AM Room: E451B

Participants

Youssef Erfanian, MD, Essen, Germany (*Presenter*) Nothing to Disclose
Johannes Grueneisen, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Julian Kirchner, Dusseldorf, Germany (*Abstract Co-Author*) Nothing to Disclose
Axel Wetter, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Ken Herrmann, Essen, Germany (*Abstract Co-Author*) Co-founder, SurgicEye GmbH Stockholder, SurgicEye GmbH Consultant, Sofie Biosciences Consultant, Ipsen SA Consultant, Siemens AG Research Grant, Advanced Accelerator Applications SA Research Grant, Ipsen SA
Michael Forsting, MD, Essen, Germany (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD, Essen, Germany (*Abstract Co-Author*) Consultant, Bayer AG

PURPOSE

Only a limited number of publications reported on the role of PET/MRI in the investigation of soft tissue sarcomas. Hence, the purpose of our study was to assess the diagnostic performance of PET/MRI and MRI alone, as well as to compare both modalities for the detection of local recurrences of soft tissue sarcomas after initial surgical resection of the primary tumor.

METHOD AND MATERIALS

A total of 41 patients with clinically suspected tumor relapse of STS underwent an 18F-FDG PET/MRI examination for assessment of local recurrence. Two experienced physicians interpreted the MRI data and subsequently the PET/MRI data sets in two separate reading sessions and were instructed to identify potential local tumor recurrences. Additionally, the diagnostic confidence in each reading for the identification of malignant lesions was determined. A McNemar test was applied to test for differences of both ratings and a Wilcoxon signed-rank test was used to identify differences of the confidence levels. Histopathological verification as well as follow up imaging was applied for standard of reference.

RESULTS

Tumor relapse was present in 27/41 patients. Calculated sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy for the detection of local tumor recurrence was 81%, 85%, 91%, 70%, 82% for MRI and 96%, 75%, 89%, 91%, 90% for PET/MRI ($p > 0.05$). Furthermore, PET/MRI showed significantly higher confidence levels ($p < 0.05$) for the

determination of malignant lesions.

CONCLUSION

Our study results demonstrate that the combined analysis of simultaneously acquired PET and MR data enables a higher detection rate of sarcoma recurrences, a higher diagnostic accuracy as well as significantly higher diagnostic confidence when compared to MRI alone. At the same time, our results revealed a small number of false-positive findings in both modalities. Thus, it can be concluded that PET/MRI demonstrates higher sensitivity and insignificantly lower specificity than MRI.

CLINICAL RELEVANCE/APPLICATION

PET/MRI may reduce potentially unnecessary biopsies and consecutive hospitalization costs. Hence, it may be the future diagnostic tool for the early and accurate diagnosis of sarcoma relapse, as well as for follow-up studies.

RC604-05 Texture Analysis for Classification of Plexiform Neurofibromas on Whole Body MRI

Thursday, Nov. 30 9:50AM - 10:00AM Room: E451B

Participants

Yunpeng Liu, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Wenli Cai, PhD, Boston, MA (*Presenter*) Stockholder: IQ Medical Imaging LLC

Miriam A. Bredella, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Scott R. Plotkin, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Gordon J. Harris, PhD, Boston, MA (*Abstract Co-Author*) Medical Advisory Board, Fovia, Inc; Member, IQ Medical Imaging LLC; Member, Precision Imaging Metrics LLC; ;

For information about this presentation, contact:

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PURPOSE

The purpose of this study was to investigate the texture-analysis and machine-learning techniques for distinguishing plexiform neurofibroma (PNF) from discrete neurofibroma (DNF) on whole-body MRI (WBMRI).

METHOD AND MATERIALS

One hundred and forty-one (141) Neurofibromatosis I (NF1) subjects who underwent WBMRI scanning using the short tau inversion recovery (STIR) sequence and had at least one neurofibroma were collected for the study. Of these subjects, a total of 1193 neurofibromas were segmented including 505 PNF and 688 DNF using our in-house volumetric image analysis platform, "3DQI". In addition to tumor volume, a set of fifty-nine (59) statistical textures and shape features was calculated as parameters for the training/testing of Random Forest (RF) classifier of PNF. Feature selection was performed by Boruta algorithm in the 5CC-tumor-volume increment manner to determine the predictive models and the significant features. A 10-fold cross-validation method was used to validate the RF performance by Receiver Operating Characteristic (ROC) curves analysis.

RESULTS

The area under curve (AUC) of ROC is 0.85 using MRI textures whereas 0.65 using tumor volume alone for all NF1 lesions. Feature selection generated four optimized predictive models in terms of tumor volume: <5 CC, 5-10 CC, 10-50 CC, and >50 CC. The AUC in each model was 0.87, 0.85, 0.92, 0.94 using MRI textures, whereas 0.45, 0.54, 0.53, 0.78 using tumor volume alone. The top five most important features were compactness (surface/volume), spherical disproportion (ratio of the surface area between a tumor and a sphere with the same volume), sphericity (similarity to a sphere), skewness and kurtosis for the predictive model including all lesions. For individual optimized predictive models of different tumor size, moments based features dominated in small-lesion models, whereas shape features became more important in large-lesion models.

CONCLUSION

This study has demonstrated that MRI texture analysis in conjunction with RF machine-learning classifier could accurately distinguish PNF from DNF on WBMRI.

CLINICAL RELEVANCE/APPLICATION

PNF is one of the hallmarks of NF1 that has the potential risk for malignant transformation. This study provides a promising tool for monitoring of PNF progression using texture analysis techniques.

RC604-06 Workup of Incidental Bone Lesions

Thursday, Nov. 30 10:00AM - 10:25AM Room: E451B

Participants

Stephanie A. Bernard, MD, Hershey, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be able to recognize features that indicate bone lesion benignity. 2) Be able to apply appropriate imaging to the work up of chondroid, osteolytic, osteoblastic and focal marrow replacing lesions.

ABSTRACT

Unexpected bone lesions are a common diagnostic dilemma. When faced with an unexpected bone lesion, the goal is to be able to accurately assess which lesions can be safely ignored from those requiring additional workup or biopsy. As part of this process, understanding the strengths and limitations of the various imaging tests when applied to the commonly encountered scenarios for unexpected bone lesions is essential for selecting the most cost-effective and expeditious work up. This lecture will review imaging options, including helpful supplemental MR sequences and an generalized approach to the work up of unexpected bone lesions in 4 frequently encountered scenarios; 1) chondroid lesions, (2) sclerotic bone lesions, (3) osteolytic lesions and (4) areas of focal marrow replacement on MRI.

RC604-07 Common Errors in Bone Tumor Evaluation

Thursday, Nov. 30 10:35AM - 11:00AM Room: E451B

Participants

Doris E. Wenger, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize bone marrow edema pattern on MRI and learn how to distinguish it from neoplasm. 2) Recognize the importance of correlation of MRI findings with radiographs when evaluating bone lesions. 3) Recognize similarity in MR imaging features of fluid and myxoid tissue and how it applies to bone tumor evaluation.

RC604-08 A Two-Center Phase III, Randomized, Controlled Study of MRgFUS versus EBRT in Patients with Metastatic Bone Disease: Palliative Strategy for Cancer-Induced Bone Pain

Thursday, Nov. 30 11:00AM - 11:10AM Room: E451B

Participants

Roberto Scipione, MD, Rome, Italy (*Presenter*) Nothing to Disclose

Alessandro Napoli, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Alberto Bazzocchi, MD, Bologna, Italy (*Abstract Co-Author*) Nothing to Disclose

Cristina Marrocchio, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Lorenzo Chiurchioni, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

roberto.scipione@uniroma1.it

PURPOSE

To examine the clinical outcome of MR-guided focused ultrasound (MRgFUS) and external beam radiation therapy (EBRT) in patients with painful bone metastasis.

METHOD AND MATERIALS

Patients with breast cancer, prostate cancer, or other solid tumours and one or more bone metastasis were included. Eligible patients were ≥ 18 years of age, had radiologically proven bone metastases, were scheduled for radiotherapy, could safely undergo both MRgFUS and radiotherapy and had pain scores ≥ 4 (on 0-to-10 numeric rating scale). Participants were randomly assigned (1:1 ratio) to receive MRgFUS or EBRT. Outcomes were compared at 4 weeks. The primary end point was treatment response, defined as a reduction of ≥ 2 points in worst pain by week 4, accompanied by a stable or reduced opioid dose, compared with baseline. Secondary end points assessed average pain, interference of pain with activity, breakthrough pain, mood, quality of life, and adverse events.

RESULTS

233 patients (M: 125; F: 108) were enrolled and randomly assigned: 116 to MRgFUS and 117 to EBRT. The most common cancers were prostate (n=88; 38%), breast (n=78; 33%), and lung (n=44; 19%). In the MRgFUS arm 90 patients (77.6%) achieved the primary end point, compared with 92 (78.6%) in the EBRT arm (adjusted odds ratio, 1.07; $p = 0.818$). There were no statistically significant differences in average pain, pain interference with activity, breakthrough pain, mood and quality of life between arms.

CONCLUSION

MRgFUS treatment of bone metastases is effective and safe in pain palliation of selected patients. MRgFUS results are comparable to EBRT, which is currently considered as the standard of care.

CLINICAL RELEVANCE/APPLICATION

MRgFUS represents a valid treatment option and could be routinely introduced in the management of painful bone metastases that are technically accessible and do not respond to conventional treatment.

RC604-09 MR-Derived Radiograph Simulations for the Assessment of Benign and Malignant Bone Tumors in Comparison to Conventional Radiographs

Thursday, Nov. 30 11:10AM - 11:20AM Room: E451B

Participants

Alexandra S. Gersing, MD, Munich, Germany (*Presenter*) Nothing to Disclose

Daniela Muenzel, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Felix K. Kopp, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Benedikt J. Schwaiger, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Marcus Settles, PhD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Peter B. Noel, PhD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Ernst J. Rummeny, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

Klaus Woertler, MD, Munich, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the diagnostic value of radiograph simulations based on MRI data compared to conventional radiographs in patients with benign and malignant bone tumors.

METHOD AND MATERIALS

In 32 patients with radiographic evidence of a bone lesion (mean age 33.9 ± 18.5 y, 17 females), benign (n=20) and malignant (n=12) bone tumors were confirmed by histology. 3T MRI was performed including a 3D T1 gradient echo sequence as basis for radiograph

simulations. Intensity-inverted MR image volumes were converted into 2D images via a forward projection in order to obtain radiograph simulations. On conventional radiographs, presence and type of periosteal reaction and matrix mineralization were determined. The destruction pattern was graded using the Lodwick classification system and diagnostic image quality was assessed using a four-point Likert scale. The same features were evaluated on the MR-derived radiograph simulations by two radiologists blinded for conventional radiographs and final diagnosis. Agreement between the two modalities was calculated using the Cohen's K.

RESULTS

Diagnostic image quality was not rated significantly different in MR-derived radiograph simulations and conventional radiographs ($P=0.71$). Analogously, agreement between MR-derived radiograph simulations and conventional radiographs was substantial (classification of periosteal reaction, $K=0.72$; destruction pattern, $K=0.75$) and the agreement of both modalities with the final diagnosis (benign vs. malignant tumor) was excellent ($K=0.92$, for each). Additional information on soft tissue extension (radiograph simulation, 34.4% vs. conventional radiographs, 12.5%; $P=0.009$) and tumor matrix (e.g. lobulation of tumor, 12.5% vs. 0%; $P<0.001$) was significantly more often found on MR-derived radiograph simulations compared to conventional radiographs.

CONCLUSION

The assessment of destruction patterns and periosteal reaction as well as the distinction between benign and malignant tumors is feasible using MR-derived radiograph simulations and is comparable to conventional radiographs. Moreover, MR-derived radiograph simulations provided additional information on soft tissue extension and tumor matrix.

CLINICAL RELEVANCE/APPLICATION

MR-derived radiograph simulations as part of a musculoskeletal imaging protocol may provide information comparable to conventional radiographs without the need of an additional x-ray examination and radiation exposure.

RC604-10 Temporal CT Subtraction and Bone Scintigraphy in Detection of Bone Metastasis: Which is More Effective?

Thursday, Nov. 30 11:20AM - 11:30AM Room: E451B

Participants

Koji Onoue, Kyoto, Japan (*Presenter*) Nothing to Disclose
Mizuho Nishio, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Masahiro Yakami, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Gakuto Aoyama, Tokyo, Japan (*Abstract Co-Author*) Employee, Canon Inc
Hiroyoshi Isoda, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Kaori Togashi, MD, PhD, Kyoto, Japan (*Abstract Co-Author*) Research Grant, Bayer AG; Research Grant, DAIICHI SANKYO Group; Research Grant, Eisai Co, Ltd; Research Grant, FUJIFILM Holdings Corporation; Research Grant, Nihon Medi-Physics Co, Ltd; Research Grant, Toshiba Medical Systems Corporation; Research Grant, Canon Inc;
Keita Nakagomi, MSc, Kyoto, Japan (*Abstract Co-Author*) Employee, Canon Inc;
Yoshio Iizuka, Kyoto, Japan (*Abstract Co-Author*) Employee, Canon Inc
Takeshi Kubo, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Yutaka Emoto, MD, PhD, Nantan, Japan (*Abstract Co-Author*) Nothing to Disclose
Thai Akasaka, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Kiyohide Satoh, Kawasaki, Japan (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Yamamoto, Tokyo, Japan (*Abstract Co-Author*) Employee, Canon Inc

PURPOSE

To compare observer performance of detecting bone metastases between bone scintigraphy (BS) and temporal CT subtraction (TS) technique based on a non-linear image registration algorithm called Large Deformation Diffeomorphic Metric Mapping (LDDMM).

METHOD AND MATERIALS

With the approval by the IRB, sixty oncology patients were recruited from our clinical database. For each patient, a pair of CT (previous and current) images and BS images were used. The previous CT images were registered to the current CT images by LDDMM. The TS images were produced by subtracting the registered previous CT images from the current CT images. The gold standard of bone metastasis location was determined in the current CT images by the consensus of two radiologists who referred to all available clinical information and imaging data. Then, 12 readers independently interpreted the following pairs of examinations with an interval of more than one month: (A) CT (previous and current) and BS, (B) CT (previous and current) and TS. The readers marked suspected bone metastases with confidence level for the diagnosis. Sensitivity, the number of false positives per patient (FPP), and reading time for each pair of examinations were analyzed to evaluate observer performance by using the Wilcoxon signed-rank test. In addition, a figure-of-merit (FOM) was calculated by using the jackknife alternative free-response receiver operating characteristic analysis, which corresponds to the area under the curve of the receiver operating characteristic analysis.

RESULTS

The sensitivity and FPP were 41% and 0.07 with (A), and 54% and 0.19 with (B) when a confidence level of 50% was considered as the threshold ($P = 0.006$ for sensitivity and $P = 0.003$ for FPP). The FOM was 0.69 with (A), and 0.74 with (B) ($P = 0.07$). The reading time was 208 seconds with (A), and 187 seconds with (B) ($P = 0.182$).

CONCLUSION

The sensitivity of TS was higher than that of BS with statistical significance. On the contrary, FPP of TS was significantly higher than that of BS. The FOM of TS tended to be better than those of BS. In summary, TS was a better screening method for detection of bone metastases than BS.

CLINICAL RELEVANCE/APPLICATION

TS was helpful for screening of bone metastases. TS could be useful for reducing economic cost and radiation exposure associated with BS because TS can be performed without any additional examination.

RC604-11 Pearls and Pitfalls of Bone and Soft Tissue Biopsies

Thursday, Nov. 30 11:30AM - 12:00PM Room: E451B

Participants

Travis J. Hillen, MD, Saint Louis, MO (*Presenter*) Consultant, Biomedical Systems; Instructor, Merit Medical Systems, Inc; Consultant, Medtronic plc

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tjhillen@wustl.edu

LEARNING OBJECTIVES

1) Indications and relative contraindications to MSK biopsy. 2) Importance of compartmental anatomy and your referring surgical oncologist in biopsy planning. 3) Tricks to make the difficult biopsy relatively easy using case illustrations.

ABSTRACT

Musculoskeletal biopsies are commonly performed in the diagnosis and staging of malignancy or to evaluate for infection. Preprocedural planning is tantamount to a successful biopsy. As radiologists we must remember that we are physicians and not just technicians. In the biopsy of primary MSK malignancies, discussion of the biopsy with a surgical/orthopedic oncologist is very important as there are potential changes in morbidity related to biopsy of these primary lesions. The majority of MSK biopsies are straightforward. Occasionally challenging biopsies will arise and having some tricks up your sleeves to get the biopsy performed can make a big difference in patient management.

LEARNING OBJECTIVES

1) Indications and relative contraindications to MSK biopsy. 2) Importance of compartmental anatomy and your referring surgical oncologist in biopsy planning. 3) Tricks to make the difficult biopsy relatively easy using case illustrations.

ABSTRACT

Musculoskeletal biopsies are commonly performed in the diagnosis and staging of malignancy or to evaluate for infection. Preprocedural planning is tantamount to a successful biopsy. As radiologists we must remember that we are physicians and not just technicians. In the biopsy of primary MSK malignancies, discussion of the biopsy with a surgical/orthopedic oncologist is very important as there are potential changes in morbidity related to biopsy of these primary lesions. The majority of MSK biopsies are straightforward. Occasionally challenging biopsies will arise and having some tricks up your sleeves to get the biopsy performed can make a big difference in patient management.

RC605

Emergency Neuroradiology (An Interactive Session)

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



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

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

LEARNING OBJECTIVES

1) Develop a systematic approach to evaluating patients with head and neck infections. 2) Recognize head and neck emergencies that result in morbidity and mortality presenting as fever, trauma, difficulty breathing, and bleeding. 3) Discuss Differential Dx for 'found down' patient. 4) Choose best imaging for each patient. 5) Recognize imaging findings that will acutely change patient management. 6) Develop a 'checklist' for imaging to improve your ability to identify significant findings.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC605A Head & Neck Emergencies

Participants

Jenny K. Hoang, MBBS, Durham, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Develop a systematic approach to evaluating patients with head and neck infections. 2) Recognize head and neck emergencies that result in morbidity and mortality presenting as fever, trauma, difficulty breathing, and bleeding.

RC605B Found Down!

Participants

James G. Smirniotopoulos, MD, Bethesda, MD (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

james.smirniotopoulos@nih.gov

LEARNING OBJECTIVES

1) Discuss Differential Dx for 'found down' patient. 2) Choose best imaging for each patient. 3) Recognize imaging findings that will acutely change patient management. 4) Develop a 'checklist' for imaging to improve your ability to identify significant findings.

ABSTRACT

A common problem in Emergency and Neuroimaging is the 'found down' patient - often complicated by altered mental status, and unable to provide a useful history. The work-up of these patients should be organized to first identify the conditions most likely to cause acute deterioration - the Four 'Hs' of the Neuro-Apocalypse: Herniation & Shift Hemorrhage (intra- and extra-axial) Hydrocephalus large Hypoxic areas We present a systematic approach; and, emphasize common conditions that require urgent management. Especially important - non-traumatic neurologic emergencies may lead to trauma - which clouds the differential diagnosis.

Active Handout: James G. Smirniotopoulos

http://abstract.rsna.org/uploads/2017/16000804/Active_RC605B.pdf

RC605C Emergency Neuroradiology: Don't Miss These Lesions!

Participants

Michael H. Lev, MD, Boston, MA (*Presenter*) Consultant, General Electric Company; Institutional Research Support, General Electric Company; Stockholder, General Electric Company; Consultant, MedyMatch Technology, Ltd ; Consultant, Takeda Pharmaceutical Company Limited; Consultant, D-Pharm Ltd

LEARNING OBJECTIVES

1) Summarize the role of imaging in the assessment of acute neurologic emergencies. 2) Apply an evidence based approach to devise effective and efficient neuroimaging algorithms. 3) Describe technological advances in CT and MRI as they relate to imaging acute neuro-vascular and traumatic injuries to the brain. 4) Determine imaging predictors in outcome assessment of cerebral

hemorrhage and acute stroke.

RC606

Head and Neck Top Five: Important Anatomy, Missed Diagnoses and Imaging Pearls

Thursday, Nov. 30 8:30AM - 10:00AM Room: E450A

HN **NR**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

LEARNING OBJECTIVES

1) Illustrate important anatomic structures key to the assessment of head and neck disease. 2) Emphasize several landmarks that are associated with developing differential diagnoses. 3) Missed diagnoses as well as misdiagnoses in head and neck cancer are as prevalent as they are easy to do. 4) This presentation will focus on specific categories of misses, illustrate with case examples, and provide suggestions on avoidance. 5) List common interpretation errors on head and neck imaging studies. 6) Identify areas where radiologically subtle findings may substantially impact patient care in head and neck imaging.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC606A Important Head and Neck Anatomy

Participants

Hugh D. Curtin, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Illustrate important anatomic structures key to the assessment of head and neck disease. 2) Emphasize several landmarks that are associated with developing differential diagnoses.

ABSTRACT

Some of the most intricate anatomy in the body is located in the head and neck. Knowledge of specific landmarks and their appearance at imaging is crucial to adequate interpretation of head and neck imaging. This section will illustrate several of the most important of these anatomic points.

RC606B Missed Diagnoses in the Head and Neck

Participants

Lawrence E. Ginsberg, MD, Houston, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

lginsberg@mdanderson.org

LEARNING OBJECTIVES

1) Missed diagnoses as well as misdiagnoses in head and neck cancer are as prevalent as they are easy to do. 2) This presentation will focus on specific categories of misses, illustrate with case examples, and provide suggestions on avoidance.

RC606C Head and Neck Imaging Pearls

Participants

Barton F. Branstetter IV, MD, Pittsburgh, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) List common interpretation errors on head and neck imaging studies. 2) Identify areas where radiologically subtle findings may substantially impact patient care in head and neck imaging.

ABSTRACT

There are numerous pitfalls and traps to avoid when interpreting head and neck imaging cases. Several of the most common errors are presented, along with advice on how to maximize the usefulness of your reports to patients and other physicians.

RC607

Genitourinary Series: Prostate MRI in the PI-RADS Era: Detection, Diagnosis and MRI Guided/Targeted Interventions

Thursday, Nov. 30 8:30AM - 12:00PM Room: E450B

GU BQ MR

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

Participants

Clare M. Tempany-Afdhal, MD, Boston, MA (*Coordinator*) Research Grant, InSightec Ltd Consultant, Profound Medical Inc Advisory Board, Profound Medical Inc Spouse, Employee, Spring Bank Pharmaceuticals, Inc Spouse, Consultant, AbbVie Inc Spouse, Consultant, Bristol-Myers Squibb Company Spouse, Consultant, Gilead Sciences, Inc Spouse, Consultant, Merck & Co, Inc Spouse, Consultant, Vertex Pharmaceuticals Incorporated Spouse, Consultant, Echosens SA Spouse, Consultant, GlaxoSmithKline plc Spouse, Consultant, Novartis AG Spouse, Consultant, Boehringer Ingelheim GmbH Spouse, Consultant, Ligand Pharmaceuticals, Inc Spouse, Consultant, Medgenics, Inc Spouse, Consultant, Kadmon Corporation, LLC Spouse, Consultant, Johnson & Johnson Spouse, Consultant, Achillion Pharmaceuticals, Inc Spouse, Stock options, Spring Bank Pharmaceuticals, Inc Spouse, Stock options, Medgenics, Inc Spouse, Editor, John Wiley & Sons, Inc

Clare M. Tempany-Afdhal, MD, Boston, MA (*Moderator*) Research Grant, InSightec Ltd Consultant, Profound Medical Inc Advisory Board, Profound Medical Inc Spouse, Employee, Spring Bank Pharmaceuticals, Inc Spouse, Consultant, AbbVie Inc Spouse, Consultant, Bristol-Myers Squibb Company Spouse, Consultant, Gilead Sciences, Inc Spouse, Consultant, Merck & Co, Inc Spouse, Consultant, Vertex Pharmaceuticals Incorporated Spouse, Consultant, Echosens SA Spouse, Consultant, GlaxoSmithKline plc Spouse, Consultant, Novartis AG Spouse, Consultant, Boehringer Ingelheim GmbH Spouse, Consultant, Ligand Pharmaceuticals, Inc Spouse, Consultant, Medgenics, Inc Spouse, Consultant, Kadmon Corporation, LLC Spouse, Consultant, Johnson & Johnson Spouse, Consultant, Achillion Pharmaceuticals, Inc Spouse, Stock options, Spring Bank Pharmaceuticals, Inc Spouse, Stock options, Medgenics, Inc Spouse, Editor, John Wiley & Sons, Inc

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LEARNING OBJECTIVES

1) Prostate MRI in the PI-RADS era: Detection, diagnosis and MRI guided/targeted interventions Overview- Current issues in Prostate cancer care MpMRI Interpretation and Reporting using PI-RADS v2 MR assessment and reporting will be reviewed and attendee will learn how to apply PI-RADS v2 MpMRI quantitative metrics- added value to PI-RADS? 2) To understand the complementary nature of quantitative metrics MpMR and prostate biopsy: when to biopsy and how Cognitive, fusion and In bore approaches will be outlined Impact of PI-RADS on outcomes of prostate biopsy and treatment. Meta-analytic and other reviews of population studies will be presented.

Sub-Events

RC607-01 mpMRI in Clinical Practice: Changes in Urology Practice Patterns in US

Thursday, Nov. 30 8:30AM - 8:50AM Room: E450B

Participants

Scott Eggener, Chicago, IL (*Presenter*) Research Grant, Visualase, Inc Speakers Bureau, Johnson & Johnson

LEARNING OBJECTIVES

View learning objectives under main course title

RC607-02 Cost-Effectiveness of Multiparametric Magnetic Resonance Imaging and Targeted Biopsy in the Diagnosis of Prostate Cancer

Thursday, Nov. 30 8:50AM - 9:00AM Room: E450B

Participants

Ruth M. Dunne, MBBCh, Aclare, Ireland (*Presenter*) Nothing to Disclose

Wendy Ye Wang, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Steven Chang, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Clare M. Tempany-Afdhal, MD, Boston, MA (*Abstract Co-Author*) Research Grant, InSightec Ltd Consultant, Profound Medical Inc Advisory Board, Profound Medical Inc Spouse, Employee, Spring Bank Pharmaceuticals, Inc Spouse, Consultant, AbbVie Inc Spouse, Consultant, Bristol-Myers Squibb Company Spouse, Consultant, Gilead Sciences, Inc Spouse, Consultant, Merck & Co, Inc Spouse, Consultant, Vertex Pharmaceuticals Incorporated Spouse, Consultant, Echosens SA Spouse, Consultant, GlaxoSmithKline plc Spouse, Consultant, Novartis AG Spouse, Consultant, Boehringer Ingelheim GmbH Spouse, Consultant, Ligand Pharmaceuticals, Inc Spouse, Consultant, Medgenics, Inc Spouse, Consultant, Kadmon Corporation, LLC Spouse, Consultant, Johnson & Johnson Spouse, Consultant, Achillion Pharmaceuticals, Inc Spouse, Stock options, Spring Bank Pharmaceuticals, Inc Spouse, Stock options, Medgenics, Inc Spouse, Editor, John Wiley & Sons, Inc

PURPOSE

The purpose of our study is to evaluate the cost-effectiveness of multiparametric magnetic resonance imaging (mp-MRI) and

targeted biopsy (MRTB) in diagnosing prostate cancer (PCa) by comparing standard transrectal ultrasound guided biopsy (TRUSGB) pathway and MRTB pathway in diagnosis of PCa and assessing whether the assessed initial costs related to MRI are balanced with the benefits of MRTB in a cost-utility model from a US perspective.

METHOD AND MATERIALS

A decision-analytic Markov model with a lifetime horizon of 10 years was developed to evaluate diagnostic accuracy, long-term health outcomes, costs, and quality-of-life of the two strategies (i.e., mp-MRI and MRTB versus TRUSGB) in men with elevated prostate-specific antigen (>4 ng/ml). Probabilities of clinical events were obtained from published literature. Direct medical costs included diagnostic and treatment-related healthcare costs were derived from the Premier Hospital Database. Costs were inflated to 2015 US dollars and discounted at an annual rate of 3%. Health outcomes were measured in quality-adjusted life years (QALYs), which were determined based on published literature and expert opinion. We calculated the incremental cost-effectiveness ratio and performed sensitivity analyses to assess uncertainty.

RESULTS

The MRTB biopsy strategy yielded a lower average discounted cost (\$5,358 versus \$6,372) and higher total QALYs-gained (7.21 versus 7.19) than TRUS. The reduced expenditures associated with MRTB was primarily due to avoiding intervention for clinically insignificant prostate cancer. The results were robust with the sensitivity analyses.

CONCLUSION

The mp-MRI and MRTB strategy generated lower total costs but higher QALYs than the TRUSGB strategy. Therefore, mp-MRI and MRTB was the optimal choice that provided the greatest health benefits for the diagnosis of men with suspected PCa in the US population.

CLINICAL RELEVANCE/APPLICATION

For men in the United States with an elevated PSA, the use of MRTB in the evaluation for PCa represents a greater value than TRUSGB, the standard of care option. Widespread adoption of MRTB may serve to reduce the economic burden of PCa.

RC607-03 Addition of Standard Systematic Biopsies to Target Prostate Biopsies May Influence Treatment Choices for Patients and Clinicians

Thursday, Nov. 30 9:00AM - 9:10AM Room: E450B

Participants

Jinxing Yu, MD, Richmond, VA (*Presenter*) Nothing to Disclose
Ann S. Fulcher, MD, Midlothian, VA (*Abstract Co-Author*) Nothing to Disclose
William C. Behl, MS, Richmond, VA (*Abstract Co-Author*) Nothing to Disclose
Sarah G. Winks, MD, Richmond, VA (*Abstract Co-Author*) Nothing to Disclose
Mary A. Turner, MD, Richmond, VA (*Abstract Co-Author*) Nothing to Disclose
Anna L. Ware, Richmond, VA (*Abstract Co-Author*) Nothing to Disclose
Lance Hampton, Richmond, VA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To determine detection rate of prostate cancer (PCa) Gleason score (GS) ≥ 7 in the other sectors of the prostate separated from the sector containing cancer suspicious region (CSR) and to determine the necessity of performing a standard systematic prostate biopsy in addition to a target biopsy for the CSR.

METHOD AND MATERIALS

Twelve sectors of prostate were generated by dividing the prostate base, midgland, and apex into four quadrants each. A total of 102 consecutive men with elevated PSA, at least one CSR detected on mp-MRI on a sector of the prostate and no TRUS-guided biopsy within the preceding 3 years underwent MRI/US fusion-guided biopsy of CSRs and standard systematic prostate biopsy (12 cores). Histopathology results, including GS, location of cancer and percentage of tumor involving positive cores were recorded. Two experienced GU radiologists retrospectively reviewed all mp-MRI studies blindly in consensus. The assessment included but was not limited to location and PI-RADS scores of CSRs. The findings from the imaging review were correlated with the histopathology results.

RESULTS

On confirmatory MRI/US fusion-guided target biopsy, 78 of 102 patients had biopsy-proven PCa (77%). By the standard systematic biopsy, 14 of 102 patients (14%) had PCa GS ≥ 7 (GS 7, $n=8$, GS 8, $n=4$ and GS 9 $n=2$) in the sectors of the prostate other than the sector containing target lesions. Among the 14 patients, the mean percentage of the positive core of PCa for GS 7 was 45, GS 8 was 25% and GS 9 was 20%. Three of 14 patients had higher GS PCa than that of the target lesions. Retrospective review of these 14 patients' mp-MRI studies detected 4 lesions with PI-RADS score 3 (positive for PCa GS ≥ 7 on TRUS biopsy) and the remaining 10 patients had corresponding normal findings.

CONCLUSION

Addition of standard systematic prostate biopsy to target biopsy detected PCa GS ≥ 7 in 14% of patients in the sectors of the prostate other than the sector containing target lesions. This result may influence treatment choices, particularly for those patients considering focal therapy for PCa.

CLINICAL RELEVANCE/APPLICATION

Addition of standard systematic prostate biopsy to target biopsy may be necessary in patients with no TRUS-guided biopsy within the preceding 3 years. That is because some significant prostate cancers (14%) may be sparsely distributed in the gland, resulting in negative mp-MRI.

RC607-04 Prostate cancer: Detection and Localization of Prostate Cancer on 3T Multiparametric MRI Based on

PI-RADS Version 2 and 39 Sector Segmentation: Correlation with Whole Mount Histopathology (WMHP)

Thursday, Nov. 30 9:10AM - 9:20AM Room: E450B

Participants

Pornphan Wibulpolprasert, MD, Bangkok, Thailand (*Presenter*) Nothing to Disclose
Steven S. Raman, MD, Santa Monica, CA (*Abstract Co-Author*) Nothing to Disclose
William Hsu, PhD, Los Angeles, CA (*Abstract Co-Author*) Research Consultant, Prosocial Applications, Inc; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Siemens AG
Daniel J. Margolis, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Nazanin H. Asvadi, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Pooria Khoshnoodi, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Amin Moshksar, MD, Reseda, CA (*Abstract Co-Author*) Nothing to Disclose
Nelly Tan, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Preeti Ahuja, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
Cleo K. Maehara, MD, Brookline, MA (*Abstract Co-Author*) Nothing to Disclose
Jiaoti Huang, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
James W. Sayre, PhD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose
David S. Lu, MD, Los Angeles, CA (*Abstract Co-Author*) Consultant, Medtronic plc; Speaker, Medtronic plc; Consultant, Johnson & Johnson; Research Grant, Johnson & Johnson; Consultant, Bayer AG; Research Grant, Bayer AG ; Speaker, Bayer AG
Robert E. Reiter, MD, Los Angeles, CA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To determine performance of 3T mp-MRI for prostate cancer detection and localization by using PI-RADS v2 scoring and segmentation correlated to whole mount histopathology (WMHP)

METHOD AND MATERIALS

With IRB approval and HIPAA compliance, the 3T mp-MRI of 415 consecutive men were compared with thin section WMHP. Two GU radiologists blindly reviewed mp-MRI and assigned PI-RADS v2 scores and then manually mapped the suspicious lesion into the PIRADS v2 39 prostate sector model by consensus. Each detected focus on 3T mp-MRI was individually matched to WMHP by a GU radiologist and GU pathologist blinded to MR findings assigned as true or false positive and manually mapped into the same prostate model. Both a rigid sector and adjust sector matching model were utilized to account for surgical deformation, shrinkage, and non-uniform slicing factors in pathologic specimens.

RESULTS

Overall 863 prostate cancer lesions and 16,185 prostate sectors were analyzed. There was significantly greater detection of PCa for lesions ≥ 1 cm (61.6% all lesions and 81.6% index lesions), higher Gleason grade lesions (GS ≥ 7) (71.4% all lesions, 80.9% index lesions), and lesions with GS ≥ 7 , ≥ 1 cm (83.3%). Adjusted tumor localization sensitivity was significantly higher than rigid tumor localization for all lesions (56.0% vs 28.5%), index lesions 55.4% vs 34.3%), GS ≥ 7 , (55.7% vs 36) and index tumors ≥ 1 cm (56.1% vs 35%). 3Tmp-MRI had similarly high specificity (96-97.5%) for overall and index tumor localization when using both sector match approaches.

CONCLUSION

Using 3T mp-MRI and the PIRADS v2, we were able to achieve the highest sensitivity (83.3%) for detection of index tumor with GS ≥ 7 lesions ≥ 1 cm with 97.5% specificity. Sectoral localization of PCa within the prostate was moderate and was best with the adjusted model compared to the rigid model.

CLINICAL RELEVANCE/APPLICATION

To date this is the largest study to evaluate the performance of 3T mpMRI with WMHP correlation. We have demonstrated excellent sensitivity and specificity for significant prostate cancer detection but moderate performance for intraprostatic sectoral localization of individual PCa foci, which may have implications for focal therapy.

RC607-05 Update on Prostate Cancer Care and Role of Imaging

Thursday, Nov. 30 9:20AM - 9:40AM Room: E450B

Participants

Clare M. Tempany-Afdhal, MD, Boston, MA (*Coordinator*) Research Grant, InSightec Ltd Consultant, Profound Medical Inc Advisory Board, Profound Medical Inc Spouse, Employee, Spring Bank Pharmaceuticals, Inc Spouse, Consultant, AbbVie Inc Spouse, Consultant, Bristol-Myers Squibb Company Spouse, Consultant, Gilead Sciences, Inc Spouse, Consultant, Merck & Co, Inc Spouse, Consultant, Vertex Pharmaceuticals Incorporated Spouse, Consultant, Echosens SA Spouse, Consultant, GlaxoSmithKline plc Spouse, Consultant, Novartis AG Spouse, Consultant, Boehringer Ingelheim GmbH Spouse, Consultant, Ligand Pharmaceuticals, Inc Spouse, Consultant, Medgenics, Inc Spouse, Consultant, Kadmon Corporation, LLC Spouse, Consultant, Johnson & Johnson Spouse, Consultant, Achillion Pharmaceuticals, Inc Spouse, Stock options, Spring Bank Pharmaceuticals, Inc Spouse, Stock options, Medgenics, Inc Spouse, Editor, John Wiley & Sons, Inc

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LEARNING OBJECTIVES

View learning objectives under main course title

RC607-06 Overview and Current Impact of PI-RADS v2 in Clinical Practice

Thursday, Nov. 30 9:40AM - 10:00AM Room: E450B

Participants

Katarzyna J. Macura, MD, PhD, Baltimore, MD (*Presenter*) Author with royalties, Reed Elsevier; Research Grant, Profound Medical Inc

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LEARNING OBJECTIVES

View learning objectives under main course title

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Katarzyna J. Macura, MD, PhD - 2012 Honored Educator Katarzyna J. Macura, MD, PhD - 2014 Honored Educator

RC607-07 Standard and New Quantitative MR Techniques - Added Value to PI-RADS

Thursday, Nov. 30 10:20AM - 10:40AM Room: E450B

Participants

Andrew B. Rosenkrantz, MD, New York, NY (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

View learning objectives under main course title

RC607-08 Imaging Facilities' Adherence to PIRADS v2 Minimum Technical Standards for the Performance of Prostate MRI

Thursday, Nov. 30 10:40AM - 10:50AM Room: E450B

Participants

Steven J. Esses, MD, New York, NY (*Presenter*) Nothing to Disclose

Samir S. Taneja, MD, New York, NY (*Abstract Co-Author*) Royalties, Reed Elsevier; Consultant, Reed Elsevier

Andrew B. Rosenkrantz, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

PIRADS v2 provides a comprehensive set of minimal technical standards for the performance of prostate MRI. We assess variability in imaging facilities' adherence to the PIRADS v2 technical standards.

METHOD AND MATERIALS

90 prostate MRI examinations performed at 90 separate imaging facilities that were referred to a tertiary care center for secondary interpretation were included. All exams were performed after the release of PI-RADS v2. The image sets, DICOM headers, and outside reports were reviewed to assess adherence to PI-RADS v2 minimum technical requirements. Comparisons were performed using Fisher's exact test.

RESULTS

The distribution of vendors was: 44% Siemens, 38% General Electric, 16% Phillips and 2% Toshiba. 25% were performed at 1.5T with a pelvic coil, 9.1% at 1.5T with an endorectal coil, 63% at 3T with a pelvic coil, and 3% at 3T with an endorectal coil. Adherence to PI-RADS v2 technical standards for T2WI: slice thickness (ST) ≤ 3 mm, 78%; no inter-slice gap, 53%; FOV 120-200mm, 82%; frequency resolution ≤ 4 mm, 0%; phase resolution ≤ 0.7 mm, 39%. Adherence for DWI (performed by 94% of facilities): TR ≥ 3000 ms, 91%; TE ≤ 90 ms, 73%; ST ≤ 4 mm, 91%; no inter-slice gap, 62%; FOV 120-220mm, 27%; frequency resolution ≤ 2.5 mm, 91%; phase resolution ≤ 2.5 mm, 77%. Among those performing DWI, 25% acquired two b-values, 58% three b-values, 12% four b-values, and 6% five or more b-values. 98% acquired a low b-value, 58% an intermediate b-value, 91% a high b-value, and 58% a very high b-value (e.g., ≥ 1400 ; calculated in 15%); 99% calculated an ADC map. Adherence for DCE (performed by 91%): TR ≤ 100 ms, 100%; TE ≤ 5 ms, 100%; ST ≤ 3 mm, spatial resolution ≤ 2 mm, 98%, phase resolution ≤ 2 mm, 89%. Median DCE duration was 4.6 min (range, 1.3-11.2 min; >2 min (minimum standard) in 93%. Temporal resolution was <10 sec (minimum standard) in 21% and <7 sec (preferred standard) in 11%. Studies performed at 3T were significantly more likely ($p < 0.05$) to adhere to a number of minimal technical standards (e.g., T2WI phase resolution and DWI inter-slice gap).

CONCLUSION

Facilities' adherence to PI-RADS v2 minimum technical standards was variable, being particularly poor for various T2WI parameters and for DCE temporal resolution.

CLINICAL RELEVANCE/APPLICATION

Greater community education regarding the PI-RADS v2 minimum technical standards is warranted. In certain circumstances, the standards may be too stringent, and revisions should be considered.

RC607-09 MR-Guided Focused Ultrasound Treatment for Management of Organ-Confined Intermediate Risk Prostate Cancer: Evaluation of Safety and Effectiveness

Thursday, Nov. 30 10:50AM - 11:00AM Room: E450B

Participants

Andrea Leonardi, MD, Roma, Italy (*Presenter*) Nothing to Disclose
Fabrizio Andrani, MD, Roma, Italy (*Abstract Co-Author*) Nothing to Disclose
Alessandro Napoli, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Leonardo Costantino, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Valeria Panebianco, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD, Rome, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the safety and effectiveness of Magnetic Resonance guided Focused Ultrasound (MRgFUS) ablation in patients with organ-confined intermediate risk prostate cancer in order to postpone or eliminate the need of definitive treatment (i.e. Radical Prostatectomy or Radiation therapy).

METHOD AND MATERIALS

This prospective single-arm study enrolled 16 patients, aged 50-74 years, with histologically proven organ-confined intermediate risk prostate cancer. Inclusion criteria for participation: Gleason score ≤ 7 ($=3+4$ or $4+3$, no grade 5 pattern), T1-T2b, N0, M0 stage, PSA ≤ 20 ng/ml, lesion visible to dynamic contrast enhanced (DCE) MR imaging and no previous prostatic surgery, radiation therapy or androgen deprivation therapy. All patient underwent pre-treatment DCE (Gd-BOPTA, Bracco) MR examination (Discovery 750, GE) and MRgFUS treatment with ExAblate (InSightec). Safety of treatment was determined by evaluation of the incidence and severity of device related complications while clinical efficacy was evaluated monitoring MR imaging changes and PSA levels at 3, 6 and 12-months.

RESULTS

1 patient reported urinary incontinence while 2 patients referred erectile dysfunction after MRgFUS treatment. DCE MR imaging at 3, 6 and 12 months showed no recurrence/residual disease in treated patients. According to imaging, laboratory exams showed a progressive decrease of PSA level from an average value of 17,1 ng/ml before treatment to 2,2 ng/ml at 12 months follow-up. No one patient needed definitive treatment so far and can be considered free of clinically significant prostate cancer.

CONCLUSION

MR guided Focused Ultrasound appears as a safe and effective treatment for patients with organ-confined intermediate risk prostate cancer and can reduce the need of definitive treatment (i.e. Radical Prostatectomy or Radiation therapy)

CLINICAL RELEVANCE/APPLICATION

MRgFUS can reduce the need of surgery or radiation therapy in patient with intermediate risk prostate cancer representing a safe and effective treatment.

RC607-10 MR Guided Prostate Biopsy: The Approaches and New Guidelines

Thursday, Nov. 30 11:00AM - 11:20AM Room: E450B

Participants

Clare M. Allen, MBBCh, London, United Kingdom (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title

RC607-11 Value of 3T Multi-Parametric MRI in the Primary Detection of Significant Prostate Cancer in Men with an Elevated PSA: A Large Prospective Multicenter Clinical Study

Thursday, Nov. 30 11:20AM - 11:30AM Room: E450B

Participants

Marloes van der Leest, MD, Nijmegen, Netherlands (*Presenter*) Nothing to Disclose
Martijn Hoogenboom, MSc, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Erik Cornel, MD, PhD, Hengelo, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Christina A. Hulsbergen-Van De Kaa, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Inge Van Oort, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jeroen Veltman, MD, Hengelo, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Jelle O. Barentsz, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Advisor, SPL Medical BV
Hans v. Lelij, MD, Rotterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the value of multi-parametric MRI prostate (mpMRI) compared to systematic transrectal ultrasound guided biopsy (TRUS-GB) in biopsy naive men with an elevated PSA. The aims are with the MRI strategy, to decrease the detection of insignificant prostate cancer (PCa), to reduce the number of biopsies, to have an equal or higher detection rate of clinically significant PCa.

METHOD AND MATERIALS

In this prospectively multicenter clinical study from February 2015 through February 2017 600 consecutive men with a PSA > 3 ng/ml were included. All subjects underwent mpMRI performed at 3T according to PI-RADS version 2 standards and routine 12 core TRUS-GB. Men with equivocal or suspicious lesions (PIRADS 3-5) on mpMRI also underwent MR guided target biopsy (MR-GB). mpMRI was scored using PI-RADS version 2 by three independent radiologists. In different outcomes a consensus assessment was used. TRUS-GB were performed blinded for the imaging results. Pathological findings were analyzed by two independent

pathologists. The detection rate of PCA (all grades) and clinically significant PCa (defined as Gleasonscore 7 and higher) compared to MR-GB and TRUS-GB were determined.

RESULTS

Of all participants 314 (52%) had Pca, and 178 (57%) of these were clinically significant PCa. MpMRI was positive (PIRADS 3-5) in 303 men (51%). With TRUS-GB 146 (24%) insignificant PCa's were detected, with the MRI strategy 80 (13%). TRUS-GB detected 134 (22%) clinically significant PCA's which about equal to MRI: 149 (25%).

CONCLUSION

This prospective multicenter powered trial shows that using mpMRI reduces the number of men who need biopsy with 49%, and only detects in 13% a clinically insignificant PCa, versus TRUS-GB in 24%. The detection of significant PCa is slightly better with mpMRI: 25% vs 22% with TRUS.

CLINICAL RELEVANCE/APPLICATION

The superior performance of MRI in this large study can alter the diagnostic workup of biopsy naive men with elevated PSA. Less will need biopsy and in only 13% insignificant cancers are detected

RC607-12 MRI-Guided Transurethral Ultrasound Ablation in Patients with Localized Prostate Cancer: State of the Art

Thursday, Nov. 30 11:30AM - 11:40AM Room: E450B

Participants

David Bonekamp, MD, PhD, Heidelberg, Germany (*Presenter*) Speaker, Profound Medical Inc
Sandeep S. Arora, MBBS, Nashville, TN (*Abstract Co-Author*) Speaker, Profound Medical Inc; Researcher, Profound Medical Inc
Masoom A. Haider, MD, Toronto, ON (*Abstract Co-Author*) Consultant, Bayer AG; Advisory Board, Siemens AG; ;
Zahra Kassam, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Gary L. Brahm, BMedSc, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Jurgen J. Futterer, MD, PhD, Nijmegen, Netherlands (*Abstract Co-Author*) Research Grant, Siemens AG
Maya B. Mueller-Wolf, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Kiran R. Nandalur, MD, Bloomfield Hills, MI (*Abstract Co-Author*) Nothing to Disclose
Robert Staruch, Mississauga, ON (*Abstract Co-Author*) Employee, Profound Medical Inc
Mathieu Burtnyk, DIPLOPHYS, Toronto, ON (*Abstract Co-Author*) Employee, Profound Medical Inc
Joseph Chin, MD, London, ON (*Abstract Co-Author*) Nothing to Disclose
Gencay Hatiboglu, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Markus Hohenfellner, MD, PhD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Heinz-Peter W. Schlemmer, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

MRI-guided transurethral ultrasound ablation (TULSA) is a novel minimally-invasive technology for ablation of malignant and benign prostate tissue, aiming to provide control of localized prostate cancer (PCa) with low morbidity. A prospective Phase I clinical study investigated safety and feasibility of TULSA; 12-month data have been published, and 30-month follow-up is presented here. Additionally, initial results are described from a larger Pivotal study (TACT) which is currently underway to evaluate the safety and efficacy of TULSA whole-gland ablation.

METHOD AND MATERIALS

Thirty PCa patients were enrolled in the Phase I trial: age ≥ 65 y, T1c/T2a, PSA ≤ 10 ng/ml, Gleason $\leq 3+3$ (3+4 in Canada only). Under general anaesthesia and 3T MRI guidance, the ultrasound device (TULSA-PRO, Profound Medical Inc.) was positioned in the prostatic urethra. Treatment planning was performed with 3mm margins at the gland periphery, and 10% residual viable prostate expected around the capsule. Treatment was delivered under continuous MRI thermometry feedback control. In the Pivotal trial, treatment planning has been adjusted to reduce residual viable prostate to $<1\%$. To-date, 20 PCa patients have been enrolled in the TACT study: age 45-80y, $\leq T2b$, PSA ≤ 15 ng/ml, Gleason $\leq 3+4$.

RESULTS

In Phase I, median (IQR) age was 69 (67-71) years and PSA 5.8 (3.8-8.0) ng/ml. Median PSA decreased 87% at 1 month, stable to 0.8 (0.6-1.1) ng/ml at 12 months (n=30), and to 0.7 (0.5-1.1) ng/ml at 30 months (n=15). MRI at 12 months shows diminutive prostates with median volume reduction of 88% (83-95%). In the first 16 TACT study patients, age was 64 (60-66) years and PSA 6.2 (5.4-7.1 ng/ml), with 53% low-risk and 47% intermediate-risk cancers (D'Amico). Spatial control of ablation was ± 1.5 mm on MRI thermometry, and correlated well with the non-perfused volume confirmed on CE-MRI immediately after treatment.

CONCLUSION

MRI-guidance enables accurate treatment planning, real-time dosimetry and control of the thermal ablation volume. Phase I data demonstrate safety and tissue ablation performance of TULSA. A larger TULSA trial with reduced safety margins is currently enrolling patients.

CLINICAL RELEVANCE/APPLICATION

Whole-gland ablation can be safely and accurately achieved using MRI-guided TULSA, which represents a minimally-invasive treatment option for organ-confined prostate cancer.

RC607-13 MR Guided Focal Therapy for Prostate Cancer: The Approaches and New Guidelines

Thursday, Nov. 30 11:40AM - 12:00PM Room: E450B

Participants

Jurgen J. Futterer, MD, PhD, Nijmegen, Netherlands (*Presenter*) Research Grant, Siemens AG

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unauthenticated -> authentication

LEARNING OBJECTIVES

View learning objectives under main course title

RC608

Emergency Ultrasound Pitfalls

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

ER **GI** **GU** **PD** **US**

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

Participants

Leslie M. Scoutt, MD, New Haven, CT (*Moderator*) Speaker, Koninklijke Philips NV

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC608A Hepatobiliary Ultrasound Pitfalls

Participants

Leslie M. Scoutt, MD, New Haven, CT (*Presenter*) Speaker, Koninklijke Philips NV

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LEARNING OBJECTIVES

1) Discuss common pitfalls encountered during US examination of the patient presenting with acute abdominal pain. 2) Discuss pitfalls in interpretation of common findings such as gallbladder wall thickening. 3) Review US diagnosis of some uncommon and easily overlooked causes of acute abdominal pain.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Leslie M. Scoutt, MD - 2014 Honored Educator

RC608B Pediatric Abdominal Sonography Pitfalls

Participants

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

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Plan safe and effective imaging protocols for pediatric gastrointestinal conditions using ultrasound. 2) Avoid pitfalls of US of the gastrointestinal tract in children by using best practices. 3) Recognize potentially confusing ultrasound findings of various pediatric abdominal conditions.

RC608C Non-obstetrical Gynecologic Ultrasound Pitfalls

Participants

Ana P. Lourenco, MD, Providence, RI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize gynecologic US pitfalls. 2) Describe strategies to avoid pitfalls.

RC608D First Trimester Sonographic Pitfalls

Participants

Mariam Moshiri, MD, Seattle, WA (*Presenter*) Grant, Koninklijke Philips NV; Author, Reed Elsevier

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LEARNING OBJECTIVES

1) Learn how to evaluate a fetus during first trimester imaging. 2) Learn which fetal abnormalities can be detected in the first trimester. 3) Learn pitfalls to avoid while imaging a first trimester pregnancy.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Mariam Moshiri, MD - 2013 Honored Educator Mariam Moshiri, MD - 2015 Honored Educator

RC609

Abdominal Imaging: Difficult Cases (An Interactive Session)

Thursday, Nov. 30 8:30AM - 10:00AM Room: E350

GI

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

LEARNING OBJECTIVES

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

ABSTRACT

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

Sub-Events

RC609A Difficult Cases Set 1

Participants
Jorge A. Soto, MD, Boston, MA (*Presenter*) Royalties, Reed Elsevier

For information about this presentation, contact:

jorge.soto@bmc.org

LEARNING OBJECTIVES

1) Through the use of illustrative cases, this course will help develop a strategy to provide logical differential diagnoses for solid and cystic pancreatic lesions. 2) Recognize common imaging pitfalls that can lead to errors in diagnosis of pancreatic and biliary lesions. 3) Understand how the various imaging modalities play a complementary role in imaging of the pancreas and biliary tract.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Jorge A. Soto, MD - 2013 Honored Educator Jorge A. Soto, MD - 2014 Honored Educator Jorge A. Soto, MD - 2015 Honored Educator Jorge A. Soto, MD - 2017 Honored Educator

RC609B Difficult Cases Set 2

Participants
Judy Yee, MD, Bronx, NY (*Presenter*) Research Grant, EchoPixel, Inc

For information about this presentation, contact:

judy.yee@ucsf.edu

LEARNING OBJECTIVES

1) Difficult cases related to small and large bowel will be featured. 2) Challenging cases will be discussed with typical patient presentation, differential diagnoses and an explanation of how to determine the best diagnosis. 3) Companion cases will be included to improve disease entity knowledge.

RC609C Difficult Cases Set 3

Participants
Courtney C. Moreno, MD, Suwanee, GA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

courtney.moreno@emoryhealthcare.org

LEARNING OBJECTIVES

1) Enhance awareness of pitfalls when interpreting difficult abdominal imaging cases. 2) Apply problem solving techniques when evaluating difficult abdominal imaging cases. 3) Practice characterizing abdominal pathology with MRI. 4) Improve basic knowledge about abdominal MRI sequences. 5) Assess complimentary roles of CT and MRI when evaluating difficult abdominal imaging cases.

Honored Educators

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

RC609D Difficult Cases Set 4

Participants

David H. Kim, MD, Middleton, WI (*Presenter*) Co-founder, VirtuoCTC, LLC; Shareholder, Collectar Biosciences, Inc; Shareholder, Elucent Medical;

LEARNING OBJECTIVES

1) Be able to apply a logic-based approach to difficult abdominal cases. 2) Be aware of typical pitfalls that may mimic disease. 3) See some unusual abdominal diagnoses or unusual presentations of more common disease.

RC610

Superficial Ultrasound

Thursday, Nov. 30 8:30AM - 10:00AM Room: S103AB

GU US

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Sub-Events

RC610A There is a Mass in the Scrotum: What Does it Mean?

Participants

Thomas C. Winter III, MD, Salt Lake City, UT (*Presenter*) Speakers Bureau, General Electric Company; ;

LEARNING OBJECTIVES

1) Describe the normal anatomy of the scrotum. 2) Describe common mass-like pathologic conditions of the scrotum. 3) Describe the significance and management of testicular microlithiasis.

ABSTRACT

This didactic lecture will review 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 and normal conditions that may present as a scrotal mass. N.B. Dr Benson is running this course, and there are 2 other presenters. Thus, please follow Dr. Benson's wishes and remove my objectives and abstract if she so desires and replace with whatever else she prefers. Thanks.

Active Handout: Thomas Charles Winter

[http://abstract.rsna.org/uploads/2017/17000110/Active RC610A.pdf](http://abstract.rsna.org/uploads/2017/17000110/Active_RC610A.pdf)

RC610B Just Below the Surface

Participants

Howard T. Heller, MD, Boston, MA (*Presenter*) Stockholder, Baxter International Inc; Stockholder, The Cooper Companies, Inc

LEARNING OBJECTIVES

1) To understand and use the most current ultrasound examination techniques for imaging superficial soft tissue structures. 2) To recognize normal anatomy of soft tissue structures. 3) To appreciate the utility of high frequency ultrasound in detecting pathologic processes of the superficial soft tissues and formulate appropriate differential diagnoses.

RC610C Art of Diagnosing Subtle Groin Hernias: Simple Protocol, Pearls and Pitfalls

Participants

Girish Gandikota, MBBS, Ann Arbor, MI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ggirish@med.umich.edu

LEARNING OBJECTIVES

1) Describe the sonographic technique/protocol of evaluating hernias. 2) Identify sonographic features which help differentiate direct, indirect and femoral hernias. 3) Understand some of the common pitfalls encountered when using sonography to evaluate groin hernias.

ABSTRACT

Groin hernias are common, often presenting with inguinal discomfort, pain and sometimes with a lump. Ultrasound is a useful means for making a definite 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 groin 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.

RC611

Advances and Updates in SPECT/CT

Thursday, Nov. 30 8:30AM - 10:00AM Room: S504CD

CT **NM**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC611A SPECT/CT in Infection and Inflammation

Participants

Christopher J. Palestro, MD, New Hyde Park, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Interpret SPECT/CT studies performed for suspected inflammatory and infectious processes to determine their precise localization and extent. 2) Compare available radiopharmaceuticals and imaging modalities for specific clinical indications in the assessment of inflammation and infection. 3) Recognize and avoid pitfalls in interpretation of SPECT/CT studies performed for inflammation and infection.

RC611B SPECT/CT in Endocrine and Neuroendocrine Disorders

Participants

Esma A. Akin, MD, Washington, DC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Through clinical case examples, this activity aims to refresh knowledge of SPECT-CT applications with emphasis on neuroendocrine disorders as well as parathyroid imaging.

RC612

Vascular Series: CT Angiography: New Techniques and Their Application

Thursday, Nov. 30 8:30AM - 12:00PM Room: E352

CT **VA**

ARRT Category A+ Credits: 4.00
AMA PRA Category 1 Credits™: 3.25

FDA Discussions may include off-label uses.

Participants

Frank J. Rybicki III, MD, PhD, Ottawa, ON (*Moderator*) Nothing to Disclose
Dominik Fleischmann, MD, Palo Alto, CA (*Moderator*) Research Grant, Siemens AG;
Suhny Abbbara, MD, Dallas, TX (*Moderator*) Author, Reed Elsevier; Editor, Reed Elsevier; Institutional research agreement, Koninklijke Philips NV; Institutional research agreement, Siemens AG

Sub-Events

RC612-01 Dual-energy and Low kVp CTA

Thursday, Nov. 30 8:30AM - 9:05AM Room: E352

Participants

Shuai Leng, DPHIL, Rochester, MN (*Presenter*) License agreement, Bayer AG

For information about this presentation, contact:

leng.shuai@mayo.edu

LEARNING OBJECTIVES

1) Understand basic principles of dual energy CT and different implementation methods. 2) Understand dual energy processing methods commonly used in CTA exams. 3) Use various types of dual energy CT images to improve diagnosis of CTA. 4) Assess impact of low kVp on image quality and radiation dose in CTA. 5) Select appropriate kVp for CTA scans for best diagnosis at lowest radiation dose.

RC612-02 Peripheral Vascular Disease Model Characterization through K-Edge Spectral Photon-Counting Computed Tomography in a Rat Model

Thursday, Nov. 30 9:05AM - 9:15AM Room: E352

Participants

Marc Vandamme, PhD, Marcy-l'Etoile, France (*Presenter*) Employee, Voxcan
Salim Si-Mohamed, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Daniel Bar-Ness, Bron, France (*Abstract Co-Author*) Nothing to Disclose
Philippe Coulon, PhD, Suresnes, France (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Philippe C. Douek, MD, PhD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
Luc Magnier, Marcy Letoile, France (*Abstract Co-Author*) Nothing to Disclose
Fannely Villot, Marcy Letoile, France (*Abstract Co-Author*) Nothing to Disclose
Thomas A. Chuzel, DVM, Marcy Letoile, France (*Abstract Co-Author*) Nothing to Disclose
Emmanuel Chereul, PhD, Lyon, France (*Abstract Co-Author*) Employee, Voxcan

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PURPOSE

To assess the capability of Spectral Photon-Counting Computed Tomography (SPCCT) to evaluate compromised peripheral vascular tissue perfusion in a specifically developed in vivo rat model of hind limb ischemia.

METHOD AND MATERIALS

After local ethics committee approval, the hind-limb ischemia model was induced, on one leg of 6 rats by femoral artery ligation, the other leg being used as a control. Imaging was performed using SPCCT (Philips Healthcare, Haifa, Israel) first in vitro on phantom tubes with range of gadolinium (Gd) concentrations (1 - 12 mg/mL) and in vivo at several time points (Day 0 to 06) after the ligation. After injection of Gd (2 ml at 279.3 mg/ml) a kinetic acquisition was performed to longitudinally measure local tissue perfusion. Regions of interest (ROI) were drawn in the arteries before and after the ischemia, and in the muscle downstream. HU and K-edge specific images were then analyzed to measure contrast agent concentrations.

RESULTS

Phantom imaging of Gd showed that K-edge measured concentration correlated well with known concentrations ($R^2 = 1$, slope = 0.91, intercept = -0.17). In vivo, HU and K-edge specific images showed differential temporal kinetic between ischemic and non-ischemic leg. An increase of Gd concentration occurred after injection (~10s) in the artery of the control leg with a peak

concentration of 6.6 ± 2.9 mg/ml (SNR of 2.3). Using HU imaging, the signal reached a peak value of 360 ± 130 (SNR of 2.6). In the ischemic leg (ROI after ligation) the Gd concentration remained near 0 ± 1.6 mg/ml with no specific signal in K-edge images and a measured value of 87 ± 39 HU on conventional imaging. In the muscle, differences of uptake occurred along time and tend to demonstrate the collateral development/angiogenesis after ischemia in this model.

CONCLUSION

SPCCT is capable of assessing muscle perfusion in this developed hind limb ischemia animal model using gadolinium contrast agent with a better sensitivity concerning HU imaging and a better specificity in K-edge imaging. Further experiments are needed to validate translation in clinics.

CLINICAL RELEVANCE/APPLICATION

SPCCT may result in clinically applicable imaging protocols for specific detection and assessment of peripheral vascular disease.

RC612-03 Evaluation of Advanced Virtual Monoenergetic Imaging (MEI+) In Dual-Energy CT Angiography of the Lower Extremity

Thursday, Nov. 30 9:15AM - 9:25AM Room: E352

Participants

JUNYAN SUN, MD,MD, JINAN, China (*Presenter*) Nothing to Disclose
Hui Yang, MD, Jinan, China (*Abstract Co-Author*) Nothing to Disclose
Dexin Yu, PHD, Jinan City, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the value of advanced virtual monoenergetic imaging (MEI+) from dual-energy CT for improving the arterial contrast and diagnostic accuracy of lower extremity CT angiography.

METHOD AND MATERIALS

Fifty-one consecutive patients (19 women, 32 men, mean 66.7 years, range 39-88 years) underwent DE-CTA (90/150 Snkvp) after the administration of 60 ml contrast media (370 mg iodine/ml) on a third generation dual source CT system. Signal intensity, noise, signal-to-noise ratio and contrast-to-noise ratio (CNR) were assessed in abdominal aorta, external iliac, femoral, popliteal and calf arteries. The software reconstructed and determined the best keV images from 40 to 190 keV (in 10 keV steps) both MEI and MEI+ series. Comparisons of 40 keV, best keV and mixed energy between MEI and MEI+ images were performed. Arterial contrast and diagnostic confidence for stenosis assessment (3-point scale). Digital subtraction angiography was performed to assess diagnostic accuracy as a reference standard.

RESULTS

433 arterial segments were evaluated. The 64-67 keV images were determined as the best by software. Both MEI and MEI+ series, 40 keV images have highest arterial enhancement ($P < 0.001$). Compared with MEI 40 keV images, the noise of MEI+ 40 keV images was lower ($P < 0.01$), and SNR and CNR were higher (both, $P < 0.01$). Compared with mixed energy images, MEI+ 40 keV images resulted in significantly higher arterial contrast enhancement (86% vs 54% optimal contrast; $P < 0.01$) and higher diagnostic confidence (76% vs 46% fully confident, $P < 0.01$). Diagnostic confidence and accuracy of artery stenoses of MEI+ 40 keV images and best keV images showed no significant difference ($p > 0.1$). MEI+ 40 keV images had a slightly higher sensitivity (93.1% vs 90.3%), and a higher specificity for detection of stenosis (94.9% vs 91.4%) of calf, compared with MEI 40 keV images.

CONCLUSION

MEI+ 40 keV images improve the contrast of DE-CTA of lower extremity, and achieve higher diagnostic confidence and accuracy of stenoses with superior quantitative image quality.

CLINICAL RELEVANCE/APPLICATION

The third generation dual source CT system has a noise-optimized MEI+ algorithm to improve image quality and increase iodine enhancement in DE-CTA, particular at low keV levels. The MEI+ techniques could be used to improve the diagnostic confidence and accuracy of stenoses of artery, especially for inadequate contrast enhancement of the lower extremities.

RC612-04 Dynamic Renal CT-Perfusion Assessing the Effect of Large Biodegradable and Non-Biodegradable Microspheres in an Experimental Swine Embolization Model

Thursday, Nov. 30 9:25AM - 9:35AM Room: E352

Participants

Christopher L. Schlett, MD, MPH, Heidelberg, Germany (*Presenter*) Nothing to Disclose
Thomas Reichenbach, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Paul G. Flechsig, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Dominik Vollherbst, MD, Heidelberg, Germany (*Abstract Co-Author*) Grant, AngioDynamics, Inc
Theresa L. Gockner, MD, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Thuy D. Do, MD, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Kristina Krumpelmann, Mainz, Germany (*Abstract Co-Author*) Nothing to Disclose
Stephan Macher-Goppinger, Heidelberg, Germany (*Abstract Co-Author*) Nothing to Disclose
Philippe L. Pereira, MD, Heilbronn, Germany (*Abstract Co-Author*) Research Consultant, Terumo Corporation; Speaker, AngioDynamics, Inc; Speaker, Terumo Corporation; Advisory Board, Siemens AG; Advisory Board, Terumo Corporation; Board, Bayer AG; Advisory Board, Medtronic plc; Support, Bracco Group; Support, PharmaCept GmbH; Support, Terumo Corporation; Support, Siemens AG; Support, Novartis AG; Support, Cook Group Incorporated; Research Grant, Biocompatibles International plc; Research Grant, Siemens AG; Research Grant, Terumo Corporation; Research Grant, BTG International Ltd
Hans-Ulrich Kauczor, MD, Heidelberg, Germany (*Abstract Co-Author*) Research Grant, Siemens AG; Research Grant, Bayer AG; Speakers Bureau, Boehringer Ingelheim GmbH; Speakers Bureau, Siemens AG; Speakers Bureau, Koninklijke Philips NV; Speakers Bureau, Bracco Group; Speakers Bureau, AstraZeneca PLC;
Christof M. Sommer, MD, Heidelberg, Germany (*Abstract Co-Author*) Research Grant, AngioDynamics, Inc; Research Grant, Terumo Corporation; Research Grant, PharmaCept GmbH; Technical support, BTG International Ltd; Technical support, Boston Scientific

Corporation; Technical support, Siemens AG; Technical support, Medtronic plc;

For information about this presentation, contact:

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PURPOSE

To assess renal perfusion by dynamic CT imaging after embolization of the right kidney comparing relatively large, new biodegradable and established non-biodegradable microspheres in a swine embolization model.

METHOD AND MATERIALS

Transarterial embolization of the kidneys was performed from a central position within 9 swine using three different microspheres: L1 and L2 as a prototype (PharmaCept, Germany) of biodegradable starch microspheres (in-vitro biodegradation time/size-d50/size-d100: <52-72h/539µm/1240µm for L1 and <54h/569µm/1495µm for L2) and EmboSphere700-900 as commercially, non-biodegradable microspheres. The right kidney was embolized on timepoint T0 and the left kidney at T0+7d. Dynamic contrast-enhanced CT (Siemens Definition Flash) was performed pre-interventional, after 1h post-interventional for all kidneys and additionally after 7d post-interventional for the right kidney; blood flow (BF) was derived from CT using Syngo Volume-Perfusion-CT-Body software. BF was measured across the entire kidney at the hilus (covering 10mm z-axis) as well as stratified into 4 anatomic regions (dorsolateral, dorsomedial, ventrolateral, ventromedial segments).

RESULTS

CT perfusion allows BF measurements in the kidney deriving physiological values of $181.03 \pm 31.4 \text{ mL}/100 \text{ mL}/\text{min}$ pre-interventional. Overall, post-interventional BF was reduced to 40.0% at 1h and recovered after 7d to 69.2% of the pre-interventional value. The observed relative BF decrease at 1h was lower for non-biodegradable than for biodegradable microspheres ($-49.2 \pm 18.6\%$ vs $-64.0 \pm 18.0\%$, respectively) without reaching statistical significance ($p=0.10$). If analyzed per anatomic section, there was a significant larger BF decrease in the dorsal segments ($\beta=0.28$, $p<0.0001$) and in the lateral segments ($\beta=0.14$, $p=0.008$), independent of the used microspheres.

CONCLUSION

Renal perfusion after embolization with relatively large microspheres varied significant across anatomic locations - potentially due to flow and gravitational effects. Observed differences between biodegradable vs. non-biodegradable microspheres did not reveal statistical significance in this limited sample size.

CLINICAL RELEVANCE/APPLICATION

Positioning of the catheter and patient/animal should be carefully considered if embolized with relatively large particles given the significant effects on the distribution of BF reduction. Further research is needed to understand the effect of the new large biodegradable microspheres.

RC612-05 Relationship between Contrast Dose and Radiation Dose in CTA

Thursday, Nov. 30 9:35AM - 10:10AM Room: E352

Participants

Mannudeep K. Kalra, MD, Boston, MA (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Obtain understanding regarding following aspects of CT angiography. 2) Relationship between scan factors, radiation dose contrast dose. 3) When and how to reduce contrast dose with modifications in scan factors. 4) When and how to reduce radiation dose with contrast dose modifications. 5) When and how to reduce both contrast dose and radiation dose.

ABSTRACT

NA

RC612-06 CTA: Acquisition Artifacts and Challenges

Thursday, Nov. 30 10:20AM - 10:55AM Room: E352

Participants

Eric E. Williamson, MD, Rochester, MN (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1. Identify common imaging artifacts seen in CT angiography and address them, if possible. 2. Discuss techniques to address common challenges encountered in the clinical practice of vascular CT.

RC612-07 Imaging Endothelial Dysfunction in Dyslipidemia with CT Perfusion

Thursday, Nov. 30 10:55AM - 11:05AM Room: E352

Participants

Nanchuan Jiang, MD, Wuhan, China (*Presenter*) Nothing to Disclose

Lise Desjardins, LONDON, ON (*Abstract Co-Author*) Nothing to Disclose

Jennifer Hadway, London, ON (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Endothelial dysfunction, associated with dyslipidemia from fatty diet, is an important contributing factor to many negative cardiovascular events. Since the dysfunction invariably leads to blunted vascular response to vasodilating stimuli, we investigate if endothelial dysfunction can be imaged with CT Perfusion (CTP).

METHOD AND MATERIALS

Twelve New Zealand White rabbits were used in the study. The experimental group of 9 rabbits were fed a fatty diet consisting of 5% fat (w/w) (2.4% lard, 2% cholesterol, and 2% dextrin) while the control group of 3 rabbits were fed regular chow. The experimental group had four CTP study sessions at 2-4 weeks intervals while the control group two sessions 2-week apart. In each study session brain perfusion was measured with and without injection of Diamox, a vasodilating agent. The first session of the experimental group was completed before the initiation of the fatty diet. Each CTP study comprised of dynamic contrast enhanced imaging with a two-phase scanning protocol on a GE Healthcare (GE) Revolution scanner: 59 images at 0.5 s intervals followed by 14 images at 10 s intervals acquired using 80 kV and 100 mAs each image. The CTP images were analyzed with CT Perfusion (GE) to calculate blood flow (BF), blood volume and mean transit time maps. BF reserve (BFR) was calculated as the ratio of whole brain BF with to without diamox. Changes in BFR in subsequent study session relative to the first were calculated as percentages.

RESULTS

For the experimental group the changes in BFR was $0.67 \pm 16.4\%$, $-5.0 \pm 13.6\%$ and $-4.9 \pm 12.5\%$ respectively at 4, 8 and 10-12 weeks after initiation of fatty diet. In contrast, the change in BFR in the control group was $-2.86 \pm 0.42\%$.

CONCLUSION

This study shows that it is feasible to use CTP on the cerebrovascular bed to investigate endothelial dysfunction from dyslipidemia. Wide variation in BFR in the experimental group but not the control group could be related to poor health of the rabbits in the former group leading to inadequate spontaneous respiration under anesthesia inducing varying levels of hypercapnia which affected BFR.

CLINICAL RELEVANCE/APPLICATION

CT Perfusion could be a possible alternative to catheter-based angiography in the investigation of endothelial dysfunction from dyslipidemia.

RC612-08 The Value of Volume Helical Shuttle Technology in Display Corona Mortis Vessels

Thursday, Nov. 30 11:05AM - 11:15AM Room: E352

Participants

Jiyang Zhang, Tianjin, China (*Presenter*) Nothing to Disclose
Anwei He, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Yue Zhang, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Fei Fu, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Xin Deng, MD, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Yeda Wan Sr, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose
Xinlong Ma, Tianjin, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The corona mortis (CMOR) vessels is an anatomic variant that involves anastomosis between obturator vessels, external iliac vessels and/or inferior epigastric vessels. It is clinically and surgically important because its section may lead to fatal consequences during pelvic surgery. Aim of this study was to assess the clinical value of volume helical shuttle (VHS) technology used in display CMOR vessels.

METHOD AND MATERIALS

40 patients diagnosed of pelvic fractures involving superior ramus of pubis and need surgical treatment were enrolled and randomly divided into two groups (20 patients in each group). These patients underwent enhanced CT scan before the operation to observe the CMOR vessels either VHS mode (group A) or conventional CT angiography (group B) on a high-definition CT scanner. 8 shuttle passes were used in group A, the other scanning parameters were the same for both groups. Display rate and the type of CMOR vessels were evaluated by two radiologists together and compared with the results for surgical finding.

RESULTS

In group A with VHS technology, among the 25 lateral hemipelvic there were 20 lateral hemipelvic with the CMOR vessels, the rate of occurrence was 80.0% (20/25) [24.0% (6/25) arterial; 44.0% (11/25) venous; 12.0% (3/25) combined]; while there were 21 lateral hemipelvic with the CMOR vessels, the rate of occurrence was 84.0% (21/25) for surgical finding [24.0% (6/25) arterial; 52.0% (13/25) venous; 8.0% (2/25) combined]. There is substantial agreement between VHS technology and during ($k=0.821$). In group B with routine CTA, among the 28 lateral hemipelvic there were 15 lateral hemipelvic with the CMOR vessels, the rate of occurrence was 53.6% (15/28) [17.9% (5/28) arterial; 28.6% (8/28) venous; 7.1% (2/28) combined]; while there were 23 lateral hemipelvic with the CMOR vessels, the rate of occurrence was 82.1% (23/28) for surgical finding [17.9% (5/28) arterial; 57.1% (18/28) venous; 7.1% (2/28) combined]. There is moderate agreement between VHS technology and surgical finding ($k=0.502$).

CONCLUSION

VHS technology can more accurately display the CMOR vessels compared to conventional CTA, especially improve the rate of

appreciation of venous type CMOR vessels, and may help clinical surgery planning.

CLINICAL RELEVANCE/APPLICATION

Use VHS technology can accurately display the CMOR vessels, especially improve the rate of appreciation of venous type CMOR vessels, and may help clinical surgery planning.

RC612-09 CT During Celiac Artery Angiography for Localization of Clinically Suspected Insulinoma

Thursday, Nov. 30 11:15AM - 11:25AM Room: E352

Participants

Feng Duan, Beijing, China (*Presenter*) Nothing to Disclose
Jieyu Yan, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Li Cui, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Yanhua Bai, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Xiaohui Li, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Mao-Qiang Wang, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To identify the location and number of insulinoma before operation is very important for improving the cure rate. The objective of the study was to assess the performance of CT during celiac artery angiography in the preoperative localization of clinically suspected insulinomas.

METHOD AND MATERIALS

From Jan 2013 to Nov 2016, 43 patients with hypoglycemic symptoms were performed CT during celiac artery angiography by MIYABI Angle CT +Artise Zeeceiling (SIEMENS, Germany), a combined CT/DSA system. After diagnosis, all 43 patients were performed operation; imaging was analyzed and compared with findings of operation pathology.

CONCLUSION

CT during celiac artery angiography is a sensitive diagnostic procedure for localizing insulinomas, it may indicate the pancreatic region of priority exploration and guiding a pancreatic resection.

CLINICAL RELEVANCE/APPLICATION

CT during celiac artery angiography for localization of clinically suspected insulinoma.

RC612-10 CTA: Post Processing and Workflow

Thursday, Nov. 30 11:25AM - 12:00PM Room: E352

Participants

Michael L. Steigner, MD, Boston, MA (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Define post-processing principles. 2) Apply post-processing techniques. 3) Implement post-processing in the clinical workflow. 4) Emerging techniques and applications.

RC613

Pediatric Series: Pediatric Safety and Quality

Thursday, Nov. 30 8:30AM - 12:00PM Room: S102CD

CT MR PD SQ

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

FDA Discussions may include off-label uses.

Participants

Jonathan R. Dillman, MD, Cincinnati, IA (*Moderator*) Research Grant, Siemens AG; Research Grant, Guerbet SA; Travel support, Koninklijke Philips NV; Research Grant, Toshiba Medical Systems Corporation; Research Grant, Bracco Group
Donald P. Frush, MD, Durham, NC (*Moderator*) Nothing to Disclose
Michael S. Gee, MD, PhD, Jamaica Plain, MA (*Moderator*) Nothing to Disclose
Robert Orth, MD, PhD, Houston, TX (*Moderator*) Nothing to Disclose

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Sub-Events

RC613-01 Intravascular Contrast Material Use in Children: Safety Update

Thursday, Nov. 30 8:30AM - 8:50AM Room: S102CD

Participants

Jonathan R. Dillman, MD, Cincinnati, IA (*Presenter*) Research Grant, Siemens AG; Research Grant, Guerbet SA; Travel support, Koninklijke Philips NV; Research Grant, Toshiba Medical Systems Corporation; Research Grant, Bracco Group

LEARNING OBJECTIVES

1) Implement practices for safe use of intravascular contrast material in children with impaired renal function. 2) Understand the literature related to gadolinium tissue deposition in the pediatric population. 3) Comprehend the basic principles for treating allergic-like contrast reactions in children.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Jonathan R. Dillman, MD - 2016 Honored Educator

RC613-02 Effect of Iodinated Contrast Medium on Thyroid Function: An Observational Study on Children Undergoing Cardiac Computed Tomography

Thursday, Nov. 30 8:50AM - 9:00AM Room: S102CD

Participants

Elena Belloni, MD, Castel San Giovanni, Italy (*Presenter*) Nothing to Disclose
Dante Chiappino, MD, Massa, Italy (*Abstract Co-Author*) Nothing to Disclose
Stefania Tentoni, Pavia, Italy (*Abstract Co-Author*) Nothing to Disclose
Mariangela Puci, MSc, Pavia, Italy (*Abstract Co-Author*) Nothing to Disclose
Cristina Montomoli, MSc, Pavia, Italy (*Abstract Co-Author*) Nothing to Disclose
Daniele Della Latta, BEng, BSc, Massa, Italy (*Abstract Co-Author*) Nothing to Disclose
Alberto Clemente, Massa, Italy (*Abstract Co-Author*) Nothing to Disclose
Francesco Avoglierio, MD, Massa, Italy (*Abstract Co-Author*) Nothing to Disclose
Carla Susini, Pisa, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate the effects on children's thyroid function of iodinated contrast medium administered during cardiac Computed Tomography (CT).

METHOD AND MATERIALS

We retrospectively collected data of 64 children (21 neonates and 43 children above 30 days of age, range 1-1642 days) undergoing cardiac CT with endovenous administration of 1.14±0.17 ml/Kg of Iopromide (370 mg I/ml). In order to evaluate thyroid function, thyroid-stimulating hormone (TSH) was measured before CT, at 48 hours after CT and at discharge from hospital, which occurred 20.30±20.81 days after the exam.

RESULTS

At baseline, TSH was normal in 47, increased in 13 and reduced in 4 children; at 48 hours it was normal in 13, increased in 2 and reduced in 44 cases (not available in 5 cases); at discharge it was normal in 40, increased in 8 and reduced in 8 children (not available in 8 cases). Of the 13 patients with increased TSH at baseline, 7 experienced normalization, 5 retained high TSH values and 1 had reduced TSH at discharge. Of the 4 children with reduced TSH at baseline, 3 experienced normalization and 1 still had reduced TSH at discharge.

CONCLUSION

Our data suggest that the majority of children experienced hyperthyroidism (reduced TSH) at 48 hours after iodinated contrast medium endovenous administration, but this condition was transient, in fact TSH normalized in most patients at discharge from hospital. In subjects with already altered TSH at baseline, hormone response following iodinated contrast medium showed high variability. Thyroid function should be closely monitored in children which experience iodine overload due to diagnostic/interventional procedures.

CLINICAL RELEVANCE/APPLICATION

Administration of iodinated contrast can have a significant effect on children's thyroid function, thus the latter should be monitored due to its critical importance in neurological development.

RC613-03 Advanced Virtual Monochromatic Reconstruction in Pediatric Abdominal CT Using a Low Iodine Concentration Contrast Medium: Image Quality Comparison with Conventional CT

Thursday, Nov. 30 9:00AM - 9:10AM Room: S102CD

Participants

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PURPOSE

To evaluate advanced virtual monochromatic images reconstructed from dual-energy abdominal CT using low iodine concentration contrast media in children, in terms of image quality and radiation dose

METHOD AND MATERIALS

From December 2016 to April 2017, 20 children (13 boys and 7 girls; mean age 10.7; range 2-19 years) underwent both dual-energy abdominal CT using a low iodine concentration contrast agent of 300 mgI/ml (Group A) and conventional polychromatic abdominal CT using a standard iodine concentration contrast medium (a tube voltage of 80-100kVp, iodine concentration of contrast agent 350 mgI/ml, Group B) within 3 months comprised our study. Advanced virtual monochromatic images (Mono+) were reconstructed at 60 keV. For quantitative analysis, mean attenuation, noise, signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) were compared. Overall image quality was subjectively scored on a 5-point scale. Radiation dose and total iodine load were compared between two examinations.

RESULTS

The mean attenuations of liver and aorta were higher in group B than in group A (131.6 ± 16.4 vs. 120.5 ± 10.1 and 221.2 ± 22.2 vs. 202.1 ± 23.1 , $p = 0.02$ and 0.02 , respectively). Group A showed higher noise than group B (22.5 ± 6.0 vs. 14.1 ± 5.6 at the subcutaneous fat of the anterior abdominal wall, $p < 0.001$). CNR and SNRs of liver, pancreas and aorta showed no significant difference between two groups. Overall image quality scores were similar between two groups (4.50 ± 0.48 vs. 4.16 ± 0.62 , $p > 0.05$). Low-iodine-concentration dual energy CT revealed significantly diminished radiation dose and iodine load (28.9% and 38.6% reduction, respectively), compared with standard-iodine-concentration polychromatic CT.

CONCLUSION

The dual-energy abdominal CT using Mono+ reconstruction algorithm and low iodine-concentration contrast medium can reduce both radiation dose and iodine load, while maintaining image quality in children.

CLINICAL RELEVANCE/APPLICATION

When it comes to contrast-enhanced CT in children, it is desirable to reduce radiation dose and iodine load. In this regard, dual-energy abdominal CT using low iodine concentration contrast media would be a good way to achieve this goal.

RC613-04 Gadoterate Meglumine Pharmacokinetics, Safety and Efficacy in Pediatric Subjects Aged Less Than 2 Years

Thursday, Nov. 30 9:10AM - 9:20AM Room: S102CD

Participants

Mario Scala, MD, Linz, Austria (*Presenter*) Research Grant, Guerbet SA

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PURPOSE

To evaluate the pharmacokinetics profile in plasma of gadoterate meglumine (Dotarem®, Guerbet, France) in children aged <2 years.

METHOD AND MATERIALS

Subjects aged <2 years with normal estimated Glomerular Filtration Rate (eGFR) and scheduled to undergo a gadolinium-enhanced MRI of any body region (dose: 0.1 mmol/kg) were included in this multicenter and open label study. A population pharmacokinetics approach was used. For each subject, blood samples were collected at three time points allocated by randomization, from 10 min to 8 hours after injection. Adverse events were recorded. Efficacy was assessed in subjects who underwent MRI of the Central Nervous System (CNS).

RESULTS

A total of 45 children received gadoterate meglumine (male: 48.9%; mean age: 9.9 months). Five children were <1 month old, 9 were 1 to 3 months old and 31 were >3 to <24 months old. Mean ($\pm$ SD) baseline eGFR was 129.7 $\pm$ 41.5 mL/min/1.73 m². Median area under the curve was 1591 h. μ mol/L and terminal half-life, 1.35 h. Median total clearance and volume of distribution at steady state, both body weight normalized, were 0.06 L/h per kg and 0.047 L/kg, respectively. Only one child (2.2%) experienced one adverse event related to gadoterate meglumine: a moderate rash. No serious adverse reactions were reported. Regarding efficacy evaluation in subjects with CNS indication (n=28), lesion visualization was improved after administration of gadoterate meglumine. Lesions were identified in 15 subjects with pre-contrast images and in 16 subjects with pre- and post-contrast images.

CONCLUSION

At the standard dose of 0.1 mmol/kg, pharmacokinetics, safety and efficacy of gadoterate meglumine in children <2 years old are similar to those observed in older children or adults.

CLINICAL RELEVANCE/APPLICATION

As of today, the pharmacokinetics profile in children aged less than 2 years is not known for gadoterate meglumine

RC613-05 In Vitro Evaluation of Sequential Contrast Media/Saline Injection Using Automatic Contrast Media CT Injector for Contrast Enhanced CT at Any Phase of Injection

Thursday, Nov. 30 9:20AM - 9:30AM Room: S102CD

Participants

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PURPOSE

There is a clear need to reduce both IV Iodine concentration per ml of contrast media (CM) and radiation exposure. The degree of CT contrast enhancement increases proportionally with iodine concentration and the level of x-ray energy (ie, tube voltage). X-ray output energy at low e.g. 80 kVp is closer to the iodine k edge of 33 keV, which helps to improve vascular and parenchymal enhancement while simultaneously reducing radiation absorption. Automatic CT Injectors that can reduce Iodine concentration by mixing saline and CM at any phase of injection without need to replace the contrast. Our aim was to evaluate in vitro the iodine concentration that can be reached during sequential injection of contrast and saline.

METHOD AND MATERIALS

Sequential injections of saline and CM (Omnipaque 350) at flow rates of 2, 5 and 8 ml/sec were performed using CT motion XD 8000 ulrich medical automatic CM injector and collected in volumes of 60 ml each in dilutions from 10 to 90% with 10% difference and undiluted CM. The acquired mixtures were analyzed using Agilent Technologies 1260 Infinity series HPLC chromatograph with Zorbax Eclipse Plus C18 column and UV detector with 5% acetonitrile solution in distilled water. 60ml mix output, 2ml smallest bolus size, pre-heated CM, 1,5m tube. Statistical analysis was performed.

RESULTS

The results of the chromatography were constant according with the desired level of iodine per ml of CM. For instance at the 30% dilution of Omnipaque 350 (desired level of iodine in children of 105 mg/ml) we achieved at 8, 5 and 2 ml/sec injection rates 106.3, 115.1 and 104.8 accordingly. Average relative deviation for all sequences was 8, 5 and 2 ml/sec was 6.8, 7.0 and 5.1% accordingly.

CONCLUSION

Automatic injectors with sequential injection of saline and CM can deliver the desired concentration of iodine per ml of CM. Clinical applications of this method, including pediatric, are under evaluation.

CLINICAL RELEVANCE/APPLICATION

Iodine content changes during the injection of CM improve the workflow in busy CT units.

RC613-06 Prediction of Aortic Enhancement for Pediatric CT Angiography Using Test-Bolus Technique with Diluted Contrast Material

Thursday, Nov. 30 9:30AM - 9:40AM Room: S102CD

Participants

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PURPOSE

One index for image quality in pediatric cardiac CTA(c-CTA) is a contrast noise ratio (CNR). Optimal CNR at actual c-CTA may be achievable by the selecting tube current second corresponding to a predicted contrast arterial enhancement. Therefore it is necessary to increase the prediction accuracy in advance. The purpose of our study was to compare the test-bolus technique with diluted and undiluted contrast material for predicting aortic enhancement on c-CTA and reveal the usefulness of the test-bolus technique with diluted contrast material on c-CTA.

METHOD AND MATERIALS

Between Feb 2015, and Nov 2016, patients were divided into two protocols; Group A, undiluted contrast material (40 patients) and Group B, diluted contrast material (50 patients) were performed test-scan and helical scan using 64-detector CT (GE VCT 80kVp, 50mA-300mA, 64x0.625mm, 0.35s/r, helical pitch 1.375). We calculated contrast enhancement (per gram of iodine: $\Delta\text{HU/gI}$) of the ascending aorta. We compared the contrast enhancement for the test-bolus technique with undiluted and diluted contrast materials. In addition, we also compared the contrast enhancement for the c-CTA and for each test-bolus technique.

RESULTS

The mean contrast enhancement in the ascending aorta was significantly higher in group B than for group A (275.2 vs. 131.9 HU/gI, $p < 0.001$). There was a significant difference in the correlation between the contrast enhancement of the ascending aorta on c-CTA images and images acquired with the test bolus using undiluted- or diluted contrast material ($p < 0.001$). In group B the correlation had very strong positive linear relationship ($r = 0.92$, $p < 0.001$) than group A ($r = 0.78$).

CONCLUSION

We observed that the aortic enhancement obtained at the test-bolus technique with undiluted contrast material is closely correlated to the enhancement of c-CTA. The test-bolus technique with diluted contrast material is therefore useful for predicting the aortic enhancement before scanning c-CTA.

CLINICAL RELEVANCE/APPLICATION

Using diluted contrast material method at c-CTA, Controlling CNR may be a promising method to optimize image quality and radiation dose.

RC613-07 Image Gently Alliance Journey: Lessons Learned about Safety and Quality

Thursday, Nov. 30 9:40AM - 10:00AM Room: S102CD

Participants

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LEARNING OBJECTIVES

1) Understand the fundamental strategies of the Image Gently Alliance. 2) Learn how the Image Gently model exemplifies a culture of safety. 3) Be able to discuss challenges of radiation awareness efforts.

RC613-08 Dose Reduction: Setting Up Size Specific Radiographic Techniques for Pediatric CT

Thursday, Nov. 30 10:20AM - 10:40AM Room: S102CD

Participants

Keith J. Strauss, MSC, Cincinnati, OH (*Presenter*) Consultant, Medical Physics Consultants, Inc; Consultant, Koninklijke Philips NV; Speakers Bureau, Koninklijke Philips NV;

LEARNING OBJECTIVES

1. To understand the limitations of the Computed Tomography Dose Index (CTDI) with respect to estimating pediatric radiation doses during CT scanning. 2. To understand the purpose and strengths of the Size Specific Dose estimate (SSDE) with respect to estimating pediatric radiation doses during CT scanning. 3. To understand how to develop accepted dose levels during CT scanning of patients of all sizes from the newborn infant to the bariatric patient for the variety of examinations performed in a given department. 4. To understand how to estimate the projected patient dose prior to the scan on any available CT scanner within a given department and adjust the radiographic technique prior to the scan if the estimated projected dose is greater than the department's accepted dose levels.

Active Handout: Keith Jerel Strauss

http://abstract.rsna.org/uploads/2017/17000843/Active_RC613-08.pdf

RC613-09 Survey of Pediatric Local Diagnostic Reference Levels Using Patient Weight Ranges During Interventional Cardiac Catheterizations

Thursday, Nov. 30 10:40AM - 10:50AM Room: S102CD

Participants

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PURPOSE

To present a rigorous and exhaustive analysis of dosimetric data to assess Diagnostic Reference Levels (DRLs) in paediatric Interventional Cardiology (IC) procedures, overcoming inconsistencies of previous studies. Our work represents the keystone of an incoming multi-center project to develop National DRLs, missing to date.

METHOD AND MATERIALS

IC procedures were divided in two groups (57 diagnostic, 103 therapeutic) and stratified into five standard body weight (BW) ranges (<5 kg, 5-15 kg, 15-30 kg, 30-50 kg, 50-80 kg). Four dose-related quantities (dose-area product DAP, air-kerma at the reference point $K_{a,r}$, fluoroscopy time FT and number of cine-frames Nf) were extracted from the DICOM Structured Dose Report. Mean, median, σ and 75th (used as DRL definition) values were calculated. Analysis of fluoroscopy and angiography contributions to the total dose was also performed. Correlations between DAP and BW was studied, focusing on specific types of interventions (Pearson's coefficients and linear regression equations calculated). Student's t test (95% c.i.) was used to compare quantities between the groups [diagnostic (D-) vs. therapeutic (T-)] and DAP/BW ratios for different procedure types.

RESULTS

Local DRLs found in this study are aligned to those published in literature: global DRLs for DAP were 19.3 Gy·cm² for D- and 16.7 Gy·cm² for T-cases. Comparison of D- and T-DRLs of DAP and $K_{a,r}$ did not show statistically significant differences (fig.1). As expected, dose resulted to be proportional to BW, particularly for therapeutic group. FT markedly decreased with increasing weight; the longest FT was found for procedures performed on newborns (<5 kg), with T-FT 41% larger than D-FT on average ($p < 0.05$). No significant difference in Nf was observed between D- and T-procedures. Relevant contribution of angiography to the total dose was observed, thus efforts for reduction are needed.

CONCLUSION

Dose to children for IC is largely variable due to differences in body size and procedures. Setting DRLs is recommended in order to optimize exposures and minimize risks. This work represents a pilot study which will be soon extended to the first multi-center National study, aiming to define DRLs for paediatric IC procedures.

CLINICAL RELEVANCE/APPLICATION

Interventional cardiology considerably contributes to expose children to ionizing radiation risks. A standardize methodology is crucial to assess consistent paediatric Diagnostic Reference Levels.

RC613-10 Dose Evaluation in Neonatal X-Ray Imaging Using a Digital Detector: Benchmarking Three Hospitals

Thursday, Nov. 30 10:50AM - 11:00AM Room: S102CD

Participants

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PURPOSE

While x-rays have diagnostic benefit, detrimental effects of ionizing radiation can occur, particularly in preterm infants. Diagnostic Reference Levels (DRLs) expressed in dose-area product (DAP) for x-ray examinations have been published in the Netherlands, for newborns, one-year-old and five-year-old children. However, no DRLs are available for preterm infants. In addition, it is unknown what the achievable DRL would be if digital x-ray systems are used. In this benchmarking study we investigate the DAP for three Dutch Neonatal Intensive Care Units (NICUs) using digital flat panel detectors. Monte Carlo simulations are used to calculate effective dose.

METHOD AND MATERIALS

4461 thorax, thorax-abdomen and abdomen x-ray images from three Dutch NICUs over a two year period were analyzed retrospectively. For each image, DAP, kV and mAs was obtained from DICOM headers. Subsequently, effective dose was calculated per patient weight category using Monte Carlo software (PCXMC, Helsinki, Finland). Calculations of lung doses were experimentally validated with thermoluminescent dosimeter (TLD) measurements in a Gammex 610 Neonatal Chest Phantom on two different mobile x-ray systems.

RESULTS

The figure shows DAP-values (25th/75th percentile) for thorax AP examinations. Hospital A places detector in the incubator tray, B and C place it directly under the patient. Median DAP for thorax AP-exams ranged between 0.05 μGy·m²-0.69 μGy·m² for different weight categories, resulting in mean effective doses between (4±4) μSv and (20±8) μSv per examination. Substantial differences in protocols were observed: positioning of the x-ray detector in the incubator tray instead of directly underneath the patient resulted in a transmission reduction of 13-41% depending on kV and incubator model. The TLD measurements show a lung dose on average 35% lower than the PCXMC calculations for most settings.

CONCLUSION

Although DAP values and effective doses are low compared to literature, this benchmarking study shows that standardization of protocols helps to further lower overall doses in vulnerable preterm infants. Strategies to lower doses (e.g. x-ray detector in the incubator) have to be evaluated in clinical practice and balanced against the disadvantages (hygiene; disturbing sleep).

CLINICAL RELEVANCE/APPLICATION

Digital X-rays result in low effective dose per image and standardization of protocols can help to further lower overall doses in vulnerable preterm infants

RC613-11 Determination of the Best ASIR-V Blending Level for Low Dose Pediatric Chest CT

Thursday, Nov. 30 11:00AM - 11:50AM Room: S102CD

Participants

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PURPOSE

To explore the optimal blending level of adaptive statistical iterative reconstruction V (ASIR-V) in low dose pediatric chest CT.

METHOD AND MATERIALS

20 pediatric patients aging from 1 to 5 years were enrolled and underwent chest scans on wide-coverage volumetric CT scanner (Revolution CT, GE healthcare). The tube voltage was 70kV. Images with six different ASIR-V blending levels (0%, 20%, 40%, 60%, 80% and 100%) were reconstructed. The image quality of lung and standard algorithms were evaluated by two radiologists using 5-point scores, when their scores were inconsistent, averaged score as a result. Image attenuation and noise were measured and signal-to-noise (SNR) was calculated. Data among different ASIR-V levels was compared with Friedman test.

RESULTS

With the increase of ASIR-V blending level, the noise decreased and increased gradually. The subjective scores of two readers had moderate consistency ($\kappa=0.555$, $P=0.059$). Images of ASiR-V60% and ASiR-V80% were rated higher than other levels ($P<0.05$), and images with lung were rated higher than standard algorithms ($\chi^2=7.00$, $P=0.008$). On images with ASiR-V60% and ASiR-V80%, there was no significant difference between lung and standard algorithms ($P>0.05$).

CONCLUSION

ASiR-V60% to 80% is optimal blending level for pediatric chest CT.

CLINICAL RELEVANCE/APPLICATION

Best ASIR-V blending level for low dose pediatric chest CT scan mode has comprehensive advantages in reducing radiation dose while ensuring high image quality, and is of great clinical application value in the pediatric chest CT scan, especially in the observation of fine structures, such as small airways, interstitial tissues, and so on.

RC613-12 Patient-based Image Quality Metrology Program for Pediatric Clinical Chest Projection Imaging

Thursday, Nov. 30 11:10AM - 11:20AM Room: S102CD

Participants

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PURPOSE

Many factors affect radiographic image quality (IQ), such as exposure and post processing. Assessment of quality is limited to one or a few physical measures (e.g., noise, contrast), or time consuming and subjective observer studies. We developed a tool for automated quality assessment in adults that includes 10 perceptual attributes of chest radiographs including: lung grey level, lung detail, lung noise, rib-lung contrast, mediastinum noise, and subdiaphragm-lung contrast. Attributes are characterized as a physical quantity using an automated process along (vertical) lung centerlines, highly dependent on region-of-interest (ROI). The purpose of this project is to expand the computer algorithm to pediatric patients, allowing quantification of measurable perceptual attributes in pediatric chest radiographs to objectively assess IQ.

METHOD AND MATERIALS

With unaltered application of the automated IQ algorithm on pediatric radiography, the results yielded poor registration of ROIs on the smaller patients [Fig 1A]. In this IRB-approved HIPAA compliant retrospective study, 184 consecutive clinical chest radiographs (PA/AP; age range 0-18 years) were collected from our clinical operation to first assess correlation coefficients between rib width,

rib interspace, and vertebral body width with patient age and chest width to properly adapt the size of ROIs for use in the IQ algorithm [Fig 1B].

RESULTS

Based on linear fitting to measured data, the coefficients of determination (R^2) between 5th rib width, 5th rib interspace and 5th vertebral body width with chest width were 0.90, 0.78 and 0.83, respectively [Fig 1C]. The coefficients when age was used as a reference parameter were as follows: 0.85, 0.79 and 0.75, respectively [Fig 1D]. Above data were used to program a size-specific ROI for measuring the physical quantity metrics of chest radiographs. Execution of the program was demonstrated on portable image with improved performance [Fig 1E].

CONCLUSION

Image-based IQ indices from our novel tool, now modified for children, can be readily applied for automated evaluation of perceptual image quality in clinical pediatric chest radiography (phase II).

CLINICAL RELEVANCE/APPLICATION

Our novel automated computer algorithm can quantify measurable perceptual attributes of chest radiographs in children, and ultimately be used for monitoring image quality, and protocol optimization.

RC613-13 Children Centered Care: The Development and Use of a Multi-Faceted Concept for MRI of Children Aged 4-10 with the Aim to Reduce the Need of Anesthesia and Increase Comfort for Children and Parents

Thursday, Nov. 30 11:20AM - 11:30AM Room: S102CD

Participants

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CONCLUSION

Four main interventions were used: An educative app, pediatric MRI Radiographers, a toy scanner and child-friendly environment with lights, graphics and in-bore solution. The CCC concept markedly reduces the need for anesthesia in children aged 4-6 and improves the quality experienced by children in all age groups and their parents.

Background

MRI of younger children often requires general anesthesia to achieve an acceptable image quality. Anesthesia can be unpleasant and anxiety provoking for children and parents. It may induce cognitive disturbances and ADHD. Rare complications include aspiration and death. For non-sedated children an MRI examination itself can be frightening. We developed and tested in a prospective set-up a multi-faceted concept to markedly reduce the need for anesthesia for children aged 4-6 and to increase comfort for children aged 4-10, and their parents: An interactive app for use at home in which the child is introduced to the experience in the scanner and the physical environment, creating comfort and recognizability Selection and communicative training of a dedicated pediatric team of MRI Radiographers Establishment of a children's lounge with a toy-scanner The use of child-friendly environment with lights, graphics and in-bore solution to create positive distraction with movies and themes known from the app during the MRI examination

Evaluation

For children aged 4-6, the use of anesthesia was compared before establishment of the Children Centered Care (CCC) concept and after. For children all ages, patient-experienced quality and comfort was evaluated in a questionnaire including questions for the parents and a visual scale for the children to use.

Discussion

Preliminary data are available. 156 children were included before establishment of the CCC concept and 79 after. Of these, 20/40 (50%) children aged 4-6 had general anesthesia before CCC vs. 1/14 (7%) after. Among children aged 4-10, 103/133 (77%) reported to be comfortable during the examination before CCC vs. 60/71 (85%) after. The parental sense of security during their child's MRI was measured as 'very high' in 104/133 (78%) before and 68/71 (96%) after.

RC613-14 The Value of Child-sized MRI Simulation in the General Anesthetic Pediatric Population: A Single Center Review

Thursday, Nov. 30 11:30AM - 11:40AM Room: S102CD

Participants

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PURPOSE

MRI is a mainstay of pediatric imaging but is frequently challenging due to the associated length of studies and noisy sequences. In patients aged between 4 and 7 years general anesthesia (GA) is often required to allow diagnostic, motion-free images to be

obtained. However, GA is a costly and timely procedure and carries a risk of patient morbidity. Child-sized MRI simulators allow play-based simulation of the MRI experience, including objective evaluation of the child's ability to remain still during life-like sequences. They can also act as a screening tool to identify children who likely able to undergo MRI without general anesthetic through familiarizing them with the environment, sounds, and equipment, while teaching them skills (such as breathing and relaxation) to cope with study.

METHOD AND MATERIALS

Patients between 4 and 7 years underwent MRI simulation using a Playful MRI (DOMED, Lyon, France) immediately prior to imaging when technologist staffing permitted and unless there was underlying patient developmental delay. We retrospectively reviewed all patients who underwent MRI simulation prior to imaging over the period January 2016 to December 2016 at a tertiary referral paediatric hospital. We reviewed whether the end point diagnostic study was diagnostic and whether patients had previously required MRI with general anesthetic. MRI waiting times over the study period were reviewed. MRI costs were estimated based on known departmental costings.

RESULTS

92 patients underwent MRI simulation with 82 patients having diagnostic MRI (88.1%). Increasing the number of walk in patients post-simulation was associated with a significant reduction in the 'routine' GA MRI waiting time from 29 months to 18 months. The cost of MRI without GA was approximately €250 and the cost of MRI with GA was approximately €950, with a GA-specific cost saving of €57,400 over 12 months.

CONCLUSION

MRI simulation was successful in the majority of developmentally normal pediatric patients between 4 and 7 years, who previously would have required general anesthetic. MRI simulation offers many benefits to radiology department through wait time, cost and time savings and also limits the number of general anesthetics performed in this population.

CLINICAL RELEVANCE/APPLICATION

MRI simulation is a cost and time saving measure in paediatric MRI department.

RC613-15 MR Imaging of the Non-Sedated Child

Thursday, Nov. 30 11:40AM - 12:00PM Room: S102CD

Participants

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RC614

Interventional Series: Non-Vascular Interventions

Thursday, Nov. 30 8:30AM - 12:00PM Room: N226

IR

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

FDA

Discussions may include off-label uses.

Participants

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

Sub-Events

RC614-01 Treating Ascites: Paracentesis, TIPs, PleuRx, Denver Shunt - Which One and Why?

Thursday, Nov. 30 8:30AM - 8:45AM Room: N226

Participants

Albert A. Nemcek JR, MD, Chicago, IL (*Presenter*) Consultant, B. Braun Melsungen AG

RC614-02 Transthoracic Biopsy Considerations

Thursday, Nov. 30 8:45AM - 9:00AM Room: N226

Participants

Ramona Gupta, MD, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review basic anatomy and techniques in transthoracic biopsy. 2) Discuss updates in devices and equipment. 3) Discuss complications, methods to prevent, and methods to treat.

RC614-03 Refractory Abscess Management

Thursday, Nov. 30 9:00AM - 9:15AM Room: N226

Participants

Rakesh C. Navuluri, MD, Chicago, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

RNavuluri@radiology.bsd.uchicago.edu

LEARNING OBJECTIVES

1. Various techniques for managing complex collections 2. Management of fistula-abscess complex 3. Management of pancreatic collections

LEARNING OBJECTIVES

1) The learner should have a better understanding of the various etiologies associated with refractory abscesses, as well as treatment strategies that may be employed in such cases.

RC614-04 Metabolic Characterization of Drainage-Resistant Klebsiella Pneumoniae Liver Abscesses by Serum 1H-NMR Spectroscopy

Thursday, Nov. 30 9:15AM - 9:25AM Room: N226

Participants

Zhihui Chang, BMedSc, MMed, Shenyang, China (*Presenter*) Nothing to Disclose
Jiahe Zheng, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Zhaoyu Liu, MD, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

cmuwisdom@126.com

PURPOSE

To explore the metabolic characterization of drainage-resistant Klebsiella pneumoniae liver abscesses(DRKPLAs) by serum 1H-Nuclear magnetic resonance (NMR) spectroscopy.

METHOD AND MATERIALS

This study had medical ethics committee approval, with waiver of informed consent. Hospital records of all patients with a diagnosis of liver abscess between June 2015 and December 2016 were retrieved from an electronic hospital database. Twenty patients with confirmed DRKPLAs were studied. Meanwhile we collected twenty consecutive patients with drainage-sensitive *Klebsiella pneumoniae* liver abscesses (DSKPLAs) as control. Serum samples from the two groups were analyzed by ¹H NMR spectroscopy. ¹H NMR metabolic profiling was analyzed by partial least squares discriminant analysis (PLS-DA). Metabolites were identified using the Human Metabolome Database and pathway analysis was performed.

RESULTS

PLS-DA test was able to discriminate between the two groups. Glucose, lactate and 3-hydroxybutyrate were found to be upregulated in DRKPLAs, however glutamine and alanine were downregulated compared to DSKPLAs. Pathway analysis indicated that amino acid metabolism was significantly different in the DRKPLAs compared with DSKPLAs. D-Glutamine and D-glutamate metabolism have the greatest impact.

CONCLUSION

Glutamine identified in our study may be a potential target for promoting liquidation of DRKPLAs and are worthy of further investigation.

CLINICAL RELEVANCE/APPLICATION

Glutamine may be a potential target for promoting liquidation of DRKPLAs through reverse the impaired macrophage function and increase NK cell activity.

RC614-05 Percutaneous Enterocutaneous Fistula Repair

Thursday, Nov. 30 9:25AM - 9:40AM Room: N226

Participants

Grace Knuttinen, MD, PhD, Phoenix, AZ (*Presenter*) Consultant, Abbott Laboratories

For information about this presentation, contact:

knuttinen.grace@mayo.edu

LEARNING OBJECTIVES

1) To identify relevant anatomy and various causes of enterocutaneous fistulas (ECF). 2) To describe various interventional techniques available for the treatment of ECF. 3) To understand the importance of short and long term follow up.

RC614-06 Celiac Plexus and Other Abdominal Blocks

Thursday, Nov. 30 9:40AM - 9:55AM Room: N226

Participants

Mitchell T. Smith, MD, Golden, CO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify important anatomy for celiac plexus blockade. 2) Describe the appropriate technique and approach for celiac plexus blocks. 3) Recognize the major and minor complications from neurolysis of the celiac plexus.

RC614-07 Primary Biliary Stenting

Thursday, Nov. 30 9:55AM - 10:10AM Room: N226

Participants

Joseph P. Erinjeri, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

RC614-08 Percutaneous Cholecystostomy for Emphysematous Cholecystitis

Thursday, Nov. 30 10:10AM - 10:20AM Room: N226

Participants

Amir Imanzadeh, MD, Shelton, CT (*Presenter*) Nothing to Disclose
Nima Kokabi, MBBS, Atlanta, GA (*Abstract Co-Author*) Nothing to Disclose
Sarvenaz Pourjabbar, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Igor Latic, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Jeffrey S. Pollak, MD, Woodbridge, CT (*Abstract Co-Author*) Nothing to Disclose
Hyun S. Kim, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Gowthaman Gunabushanam, MD, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

To evaluate the safety and efficacy of percutaneous cholecystostomy in treating patients with acute emphysematous cholecystitis that are poor surgical candidates.

METHOD AND MATERIALS

This is a HIPAA-compliant, single center retrospective study. IRB exemption was obtained. We searched our institutional radiology database for patients with emphysematous cholecystitis that were treated using percutaneous cholecystostomy. Ten consecutive patients treated between 2008-2017 were identified, and demographic, clinical, laboratory, imaging, and overall outcome data were

obtained.

RESULTS

Mean patient age was 75 ± 12 years, including 6 men and 4 women. Sixty percent (6/10) of patients had diabetes, of which 5 presented with abdominal pain. Preprocedure imaging was done using ultrasound (US), CT, and both US and CT in 2, 7 and 1 patients respectively. All patients had intraluminal or intramural gas as well as gallbladder wall thickening, and 80% (8/10) had calculi. All patients received broad spectrum antibiotics (Piperacillin-Tazobactam $\pm$ Metronidazole) prior to the procedure. Cholecystostomy was done using combined US-fluoroscopy guidance in all patients. Patients' symptoms resolved at a mean of 2.9 $\pm$ 1.4 days post-procedure. Ninety percent (9/10) of patients were discharged in a stable condition at a median duration of 8 days post-procedure. Survival rate at 30 days after presentation was 90% (9/10). One patient died on the sixth post-procedure day from sepsis. Two other patients died within one-year post procedure from unrelated causes: congestive heart failure and metastatic ovarian cancer. Forty percent (4/10) of patients had elective cholecystectomy at a median interval of 53 days post procedure. In 40% (4/10) patients, cholecystostomy was the definitive treatment, with tube removal at a mean of 152 days post-procedure.

CONCLUSION

Percutaneous cholecystostomy appears to be a safe and effective stabilizing treatment in patients with acute emphysematous cholecystitis that are poor surgical candidates. In a significant proportion (40%) of patients, cholecystostomy serves as the definitive therapy.

CLINICAL RELEVANCE/APPLICATION

Percutaneous cholecystostomy is a valuable temporizing measure, and may even serve as the definitive therapy in patients with emphysematous cholecystitis that are unable to undergo surgery.

RC614-09 Thoracic Duct Embolization

Thursday, Nov. 30 10:35AM - 10:50AM Room: N226

Participants

Ron C. Gaba, MD, Chicago, IL (*Presenter*) Research Grant, Guerbet SA

For information about this presentation, contact:

rgaba@uic.edu

LEARNING OBJECTIVES

1) To recognize standard lymphatic anatomy. 2) To understand the basic principles that underlie thoracic duct embolization. 3) To be familiar with standard technical approaches to thoracic duct embolization.

RC614-10 Nodal Lymphangiogram and Embolization for the Treatment of Postoperative Groin Lymphoceles

Thursday, Nov. 30 10:50AM - 11:00AM Room: N226

Awards

Student Travel Stipend Award

Participants

Resmi Charalel, MD, New York, NY (*Presenter*) Nothing to Disclose

Seung Kwon Kim, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

Olagueke K. Akinwande, MD, St Louis, MO (*Abstract Co-Author*) Nothing to Disclose

Raja Ramaswamy, MD, Saint Louis, MO (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate safety and efficacy of nodal lymphangiogram and embolization as treatment for postoperative lymphoceles.

METHOD AND MATERIALS

Retrospective review of all patients who have undergone nodal lymphangiogram and embolization as treatment for postoperative lymphoceles at single US academic medical center to date from December, 2016 to April, 2017. Prior to nodal lymphangiogram, patients had standard of care treatment with indwelling percutaneous drain placement and alcohol sclerosis with minimal clinical improvement. Patients were evaluated pre-procedure for drain output. Nodal lymphangiogram was performed with lipiodol via most prominent lymph node near lymphocele to demonstrate lymphatic ducts feeding lymphocele. N-butyl cyanoacrylate embolization was performed of prominent ducts feeding lymphocele and node itself. Primary endpoint was time to drain removal. Patients were also monitored for adverse events such as lymphedema.

RESULTS

Four patients underwent nodal lymphangiogram and embolization following prolonged course with indwelling lymphocele drain. The average patient age was 57 years old and three out of four (75%) were male. All patients developed a lymphocele as postoperative complication. Pre-procedure, drains were present for an average time of 28 days and alcohol sclerosis had been performed an average of 1.75 times. The average drain output was 460 mL per day. Post-procedure, the average time for drain removal was 19 days. One patient had a complex pre-procedure course including recurrent lymphocele infections and developed concern for repeat infection post-procedure, treated with antibiotics. There were no other adverse events over an average followup time of 50.5 days.

CONCLUSION

Nodal lymphangiogram and embolization serves as a safe and effective treatment for groin lymphoceles. It can hasten the process of drain removal and warrants further investigation.

CLINICAL RELEVANCE/APPLICATION

Nodal lymphangiogram and embolization may offer an alternative safe and effective treatment to hasten the resolution of

postoperative lymphoceles.

RC614-11 Advanced Feeding Tube Placement

Thursday, Nov. 30 11:00AM - 11:15AM Room: N226

Participants

Adam N. Plotnik, MBBS, FRANZCR, Santa Monica, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

aplotnik@mednet.ucla.edu

LEARNING OBJECTIVES

1) Understanding of the multiple techniques of placement of percutaneous feeding tubes, including Gastrostomy, Gastrojejunostomy and jejunostomy tubes. 2) Essential pre and post procedural management for percutaneous feeding tube placements. 3) Review of the complications of percutaneous feeding tube placements and their management. 4) Tips and tricks for placing percutaneous feeding tubes in more complex anatomy, e.g., post partial gastrectomy, interposition of colon.

RC614-12 Percutaneous Primary Jejunostomy Tubes Inserted Using Fluoroscopic Guidance: Comparison to Laparoscopically Inserted Jejunostomy Tubes

Thursday, Nov. 30 11:15AM - 11:25AM Room: N226

Awards

Student Travel Stipend Award

Participants

Rui Dai, Durham, NC (*Presenter*) Nothing to Disclose

Qi Wang, MD, PhD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

Tony P. Smith, MD, Durham, NC (*Abstract Co-Author*) Nothing to Disclose

Charles Y. Kim, MD, Durham, NC (*Abstract Co-Author*) Consultant, Merit Medical Systems, Inc; Consultant, Cook Group Incorporated

For information about this presentation, contact:

charles.kim@duke.edu

PURPOSE

To evaluate outcomes of primary percutaneous jejunostomy(J)-tubes inserted under fluoroscopic guidance in comparison to surgical J-tubes inserted under laparoscopic guidance.

METHOD AND MATERIALS

A retrospective review was performed on 106 consecutive patients (64 males, mean age 61 years) who underwent percutaneous insertion of a primary J-tube using fluoroscopic guidance. Insertions at prior J-tube sites were excluded. For comparison, 116 consecutive patients (60 males, mean age 59.7 years) undergoing laparoscopic J-tube insertion without concurrent abdominal surgery were reviewed. Technical success, major complications occurring within 30 days, and tube exchange rates were analyzed.

RESULTS

All radiologically inserted J-tubes were performed using moderate sedation, whereas general anesthesia was required for all laparoscopic J-tubes. The technical success rate for both groups was 99% (p=NS, chi square). There were no significant differences in the freedom-from-event interval for J-tube obstruction, leakage, or need for replacement, when comparing radiologically versus surgically inserted J-tubes. The major complication rate was 4% for the radiologic J-tube group versus 6% for the surgical J-tube group (p=NS). In the surgical group, patients who had prior major abdominal surgery had a significantly higher complication rate (15% vs 3%, p=0.05) whereas prior abdominal surgery had no impact on the complication rate in the radiologic j-tube group (3% vs 6%, p=0.60) (chi square).

CONCLUSION

Fluoroscopically inserted primary J-tubes demonstrated a high technical success rate and low major complication rate, which were similar to laparoscopically inserted J-tubes. Prior abdominal surgery was associated with a higher major complication rate for surgical J-tube insertion, whereas no correlation was observed with radiologic insertion.

CLINICAL RELEVANCE/APPLICATION

Radiologic insertion of primary jejunostomy tubes is a safe option for enteral feeding and may be preferable over surgical J-tube insertion in patients with prior abdominal surgery.

RC614-13 Safety and Efficacy of Percutaneous Transesophageal Gastric Tubes for Decompression of Malignant Bowel Obstruction

Thursday, Nov. 30 11:25AM - 11:35AM Room: N226

Awards

Student Travel Stipend Award

Participants

Robert J. Litwin, MD, Charleston, SC (*Presenter*) Nothing to Disclose

Alda L. Tam, MD, Houston, TX (*Abstract Co-Author*) Medical Monitor, Galil Medical Ltd; Research Grant, AngioDynamics, Inc;

Rahul A. Sheth, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

Maria C. Briones, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

Sanjay Gupta, MD, Houston, TX (*Abstract Co-Author*) Nothing to Disclose

Steven Y. Huang, MD, Houston, TX (*Abstract Co-Author*) Scientific Advisory Board, Adient Medical Inc

PURPOSE

Transabdominal gastric decompression is the mainstay of palliation for patients with malignant gastrointestinal obstruction. In patients with limited percutaneous gastric access, percutaneous transesophageal gastrostomy (PTEG) tubes can be placed for decompression. Our purpose was to evaluate the safety and efficacy of PTEG tubes compared to transabdominal percutaneous fluoroscopic gastrostomy (PFG) tubes for decompression.

METHOD AND MATERIALS

Patients with malignant gastrointestinal obstruction underwent placement of either a PTEG or PFG between 2013 and 2017. Procedural indications, technical success, complications, efficacy, and survival were analyzed.

RESULTS

PTEG tubes were successfully placed in 24 (96%) of 25 patients and PFG tubes were successfully placed in 88 (96.7%) of 91 patients during the study period, $P=1.0$. Specific indications for PTEG tubes were ascites anterior to the stomach ($n=17$, 68%), linitis plastica ($n=9$, 36%), intervening bowel ($n=9$, 36%), intervening peritoneal carcinomatosis ($n=8$, 32%), prior partial gastrectomy ($n=4$, 16%), poor gastric distention ($n=1$, 4%), and upper abdominal varices ($n=1$, 4%); 16 patients presented with >1 indication. Four complications occurred in 24 patients (16.7%) following PTEG placement (catheter retraction, $n=3$; catheter obstruction, $n=1$) and 16 complications occurred in 88 patients (18.2%) following PFG placement (catheter obstruction, $n=5$; catheter migration, $n=5$; pericatheter infection, $n=2$; pericatheter leakage, $n=2$; pain, $n=1$; transjejunal access, $n=1$), $P=0.87$. No procedural-related deaths occurred for either cohort. All PTEG patients ($n=24$) described improvement in nausea, vomiting, pain, and tolerated small amounts of clear fluids. The overall survival was 27 days (median, range 13-288) for the PTEG cohort and 35 days (median, range 4-1107) for the PFG cohort, $P=0.26$.

CONCLUSION

PTEG tubes are safe and effective for decompression of malignant gastrointestinal obstruction.

CLINICAL RELEVANCE/APPLICATION

Decompression transesophageal gastric tubes have a similar safety and efficacy profile as transabdominal gastric tubes and should be considered when direct access into the stomach is limited.

RC614-14 Sirolimus-Eluting Biodegradable Poly-L-Lactic Acid Stent for Granulation-Tissue Formation Suppression in the Rat Urethra

Thursday, Nov. 30 11:35AM - 11:45AM Room: N226

Participants

Jung-Hoon Park, PhD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

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

Min Tae Kim, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

Kun Yung Kim, MD, Jeonju-Si, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

Zhe Wang, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

jhparkz1125@gmail.com

PURPOSE

To investigate the use of Sirolimus-eluting biodegradable stents (SEBSs) to suppress granulation-tissue formation after stent placement in a rat urethral model.

METHOD AND MATERIALS

All experiments were approved by the animal research committee. A total of 36 male Sprague-Dawley rats were randomized into three equal groups after SEBS placement. Group A received control biodegradable stents. Groups B and C received 90- $\mu\text{g}/\text{cm}^2$ and 450- $\mu\text{g}/\text{cm}^2$ SEBS stents, respectively. Six rats in each group were sacrificed after 4 weeks; the remaining rats were sacrificed after 12 weeks. The therapeutic effectiveness of SEBS stents was assessed by comparing the results of retrograde urethrography and histological examination. Kruskal-Wallis and Mann-Whitney U tests were used to evaluate statistical differences.

RESULTS

SEBS placement was technically successful in all rats. Urethrographic and histological examinations revealed significantly less granulation-tissue formation at both time points in the rats receiving SEBS stents (groups B and C) compared with group A (all $p < 0.05$). There were no significant differences in urethrographic and histological findings between groups B and C (all $p > 0.05$). However, the mean epithelial-layer number in group B was higher than that in group C at 4 weeks after stent placement ($p < 0.001$). Apoptosis increased in group C compared with groups A and B (all $p < 0.05$).

CONCLUSION

SEBSs suppress granulation-tissue formation secondary to stent placement in a rat urethral model; local therapy with SEBSs may be used to decrease stent-related granulation-tissue formation.

CLINICAL RELEVANCE/APPLICATION

Local therapy via Sirolimus-eluting biodegradable stents may be used to decrease stent-related granulation-tissue formation.

RC614-15 Advanced Genitourinary Procedures

Thursday, Nov. 30 11:45AM - 12:00PM Room: N226

Participants

Emily C. Bendel, MD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1. Improve basic knowledge of Polycystic Kidney Disease and therapies available. 2. Learn about percutaneous therapeutic sclerotherapy available with Interventional Radiology. 3. Discuss patient selection and outcomes after percutaneous sclerotherapy of renal cysts. 4. Discuss role for minimally-invasive genitourinary procedures going forward.

LEARNING OBJECTIVES

1) Improve basic knowledge of Polycystic Kidney Disease and therapies available. 2) Learn about percutaneous therapeutic sclerotherapy available with Interventional Radiology. 3) Discuss patient selection and outcomes after percutaneous sclerotherapy of renal cysts. 4) Discuss role for minimally-invasive genitourinary procedures going forward.

RC615

Interventional Breast Procedures

Thursday, Nov. 30 8:30AM - 10:00AM Room: N227B

BR

AMA PRA Category 1 Credits [™]: 1.50
ARRT Category A+ Credit: 1.75

Participants

Cherie M. Kuzmiak, DO, Chapel Hill, NC (*Moderator*) Nothing to Disclose

Sub-Events

RC615A Sonographic & MRI Directed Procedures

Participants

Amy S. Campbell, MD, Maitland, FL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Determine which procedure is the right choice for their patient. 2) Examine the planning process behind both sonographic and MRI directed procedures. 3) Illustrate how both sonographic and MRI directed procedures are performed. 4) Develop a strategy for management of pitfalls and complications.

RC615B Digital Breast Tomosynthesis Biopsy

Participants

Stamatia V. Destounis, MD, Scottsville, NY (*Presenter*) Hologic, Inc. Scientific Advisory Board

For information about this presentation, contact:

sdestounis@ewbc.com

LEARNING OBJECTIVES

1) Discuss the improvements in cancer detection and biopsy challenges related to the implementation of digital breast tomosynthesis. 2) Review current literature relevant to 3D-guided image biopsy in comparison to traditional stereotactic core biopsy. 3) Provide an overview of the 3D-guided biopsy procedure. 4) Review the advantages and complications.

RC615C Radiology/Pathology Concordance

Participants

Dag Pavic, MD, Charleston, SC (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

pavic@musc.edu

LEARNING OBJECTIVES

1) Describe the radiology-pathology concordance process. 2) Recognize the factors which render a lesion concordant or discordant. 3) Identify high-risk lesions and review their management recommendations.

Active Handout: Dag Pavic

[http://abstract.rsna.org/uploads/2017/17000193/Active RC615C.pdf](http://abstract.rsna.org/uploads/2017/17000193/Active_RC615C.pdf)

RC616

Authorship in Radiology (Sponsored by the RSNA Professionalism Committee)

Thursday, Nov. 30 8:30AM - 10:00AM Room: S403A

PR

AMA PRA Category 1 Credits [™]: 1.50
ARRT Category A+ Credit: 1.75

Participants

Ronald L. Eisenberg, MD, JD, Boston, MA (*Presenter*) Nothing to Disclose
Kate Hanneman, MD, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose
Adrian K. Dixon, MD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose
Philippe A. Grenier, MD, Paris, France (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Define honorary authorship and cite its prevalence in radiology journals. 2) Describe the four criteria required for true authorship, according to the guidelines published by the International Committee of Medical Journal Editors (ICMJE). 3) Identify factors leading to honorary authorship, and strategies for handling authorship properly.

ABSTRACT

Authorship confers credit for published or presented work and is an increasingly important issue in academic radiology departments given the pressure for academic productivity and the significance ascribed to the number and quality of citations and publications for promotion. However, authorship also implies responsibility and accountability for the published work. Determining who should be included as an author and in what order has important professional and ethical implications. Honorary authorship is the intentional misrepresentation of credit to an individual whose contributions to a biomedical article do not meet criteria for authorship. Also known as 'guest' or 'gift' authorship, this practice inflates the bibliography of the honorary author while it dilutes recognition of the input of those authors who meet the criteria for authorship. Honorary authorship is a major ethical problem for biomedical journals, which have taken actions to reduce its incidence. Unfortunately, it has been reported that honorary authorship is prevalent in radiology journals. In order to prevent honorary authorship, many journals now require that each manuscript submission be accompanied by a statement of responsibility that specifies the contribution of every listed author. The first speaker in this session will review the topic of authorship in radiology, and recommend strategies to handle authorship questions on projects that involve more than one academic department. The second speaker will review the prevalence of honorary authorship in radiology, discuss the impact of geographic, political and other factors on honorary authorship, and recommend strategies to decrease its prevalence. The third speaker will examine the unique pressures faced by radiology trainees and junior faculty with respect to authorship, including pressure to award honorary authorship to senior colleagues who have performed only 'non-authorship' tasks.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Ronald L. Eisenberg, MD, JD - 2012 Honored Educator
Ronald L. Eisenberg, MD, JD - 2014 Honored Educator
Kate Hanneman, MD, FRCPC - 2017 Honored Educator

RC617

Emerging Technology: Contrast Enhanced Ultrasound— Opportunities and Challenges

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

GI GU US

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

David T. Fetzer, MD, Dallas, TX (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

David.Fetzer@UTSouthwestern.edu

LEARNING OBJECTIVES

1) Briefly introduce contrast-enhanced ultrasound (CEUS) imaging techniques, and the pharmacology of these unique agents. 2) Discuss how CEUS has been adopted by the ACR LI-RADS as a technique for the definitive diagnosis of HCC. 3) Examine the use of CEUS in trouble-shooting renal masses and in imaging of the genitourinary tract. 4) Explore how CEUS can enhance ultrasound-guided procedures, and may be used to monitor tumors following ablation. 5) Consider the major emerging clinical applications and where current research efforts may be directing these techniques into the future.

ABSTRACT

Contrast-enhanced ultrasound (CEUS) has been recognized world-wide as a robust tool that can be applied in a variety of clinical situations, particularly given its high safety profile. With the recent FDA approval of one agent for use in liver imaging in adults, and hepatic and urological imaging in pediatrics, there has been increased acceptance and use of these techniques throughout the country. However, CEUS is not limited to the liver—the use of ultrasound contrast in a range of pathologies and situations is also possible and with a variety of agents, off-label. This session will cover the opportunities and challenges in CEUS, including a brief introduction into these unique contrast agents and the imaging techniques utilized; how CEUS has been adopted by LI-RADS in the definitive diagnosis of HCC; the growing experience in renal mass characterization and collecting system imaging; how contrast may be used as a problem-solving tool and in ultrasound-guided procedures; and finally where CEUS techniques and agents may be headed in the future.

Sub-Events

RC617A CEUS: A Brief Introduction

Participants

David T. Fetzer, MD, Dallas, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

David.Fetzer@UTSouthwestern.edu

LEARNING OBJECTIVES

1) Briefly introduce ultrasound microbubble agent formulation and pharmacology. 2) Discuss the unique imaging techniques required for contrast-enhanced ultrasound (CEUS). 3) Highlight ultrasound contrast agent safety profile and contraindications.

RC617B CEUS: Liver Imaging & LI-RADS (Liver Imaging Reporting and Data System)

Participants

Yuko Kono, MD, PhD, San Diego, CA (*Presenter*) Equipment support, Toshiba Medical Systems Corporation; Equipment support, General Electric Company; Equipment support, Lantheus Medical Imaging, Inc

For information about this presentation, contact:

ykono@ucsd.edu

LEARNING OBJECTIVES

1) To learn CEUS LI-RADS will standardize technique, data collection interpretation and reporting of CEUS exams on patients at risk for HCC. 2) To learn how to apply CEUS LIRADS v2017 algorithm.

RC617C CEUS: Renal Mass and Collecting System Imaging

Participants

Stefanie Weinstein, MD, San Francisco, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Review common indications and guidelines for performing renal CEUS. 2) Illustrate how CEUS can help troubleshoot and improve diagnosis of renal pathology. 3) Discuss the evolving role of CEUS beyond the kidney in the non-pediatric GU tract.

Active Handout: Stefanie Weinstein

[http://abstract.rsna.org/uploads/2017/17001319/Active RC617C.pdf](http://abstract.rsna.org/uploads/2017/17001319/Active_RC617C.pdf)

RC617D CEUS: Procedure Guidance and Post-Ablation Assessment

Participants

Hisham A. Tchelepi, MD, Los Angeles, CA (*Presenter*) Research Grant, General Electric Company Research Grant, Roper Industries, Inc

LEARNING OBJECTIVES

1) To review clinical applications of contrast-enhanced ultrasound in interventional procedure guidance and post-ablation tumor monitoring.

RC617E CEUS: What Have We Learned and Where are We Heading

Participants

Robert F. Mattrey, MD, Dallas, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Robert.Mattrey@UTSouthwestern.edu

LEARNING OBJECTIVES

1) Recite the major accomplishments since the ultrasound contrast effort began. 2) Understand the dominant interaction of sound and ultrasound contrast media. 3) Understand the source of ultrasound contrast signal. 4) Current salient clinical applications. 5) Future direction and major research efforts.

RC618

Tips, Tricks and Pitfalls in Body Oncological Imaging: Experts Tell All

Thursday, Nov. 30 8:30AM - 10:00AM Room: E353A

CT **MR** **OI** **US**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

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

For information about this presentation, contact:

dsahani@mgh.harvard.edu

LEARNING OBJECTIVES

1) Identify ultrasound features that differentiate between benign and malignant disease, particularly in the female pelvis. 2) Recommend specific scanning techniques and protocols for difficult cases. 3) Develop biopsy strategies for indeterminate masses that need tissue sampling for diagnosis. 4) To discuss newer MRI techniques that are now applied for body oncologic imaging that allows faster, better or more accurate disease diagnosis. 5) To highlight the applications and pitfalls of diffusion-weighted imaging for assessing upper abdominal cancers, peritoneal involvement, pelvic disease and bone marrow involvement (whole body MRI). 6) To survey the applications and limitations of motion insensitive radial-acquisition MR techniques for dynamic contrast enhanced imaging for cancer evaluation. 7) Review the statistics and incidence of common cancers in USA. 8) Discuss the role of CT in oncology practice and value of following optimal oral and IV contrast media protocols. 9) Offer pearls and solutions to overcome the limitations of CT and emerging role of new CT technology.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Active Handout: Dushyant V. Sahani

<http://abstract.rsna.org/uploads/2017/16000397/Active RC618.pdf>

Sub-Events

RC618A US

Participants

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

LEARNING OBJECTIVES

1) Identify ultrasound features that differentiate between benign and malignant disease, particularly in the female pelvis. 2) Recommend specific scanning techniques and protocols for difficult cases. 3) Develop diagnosis and biopsy strategies for indeterminate masses. 4) Review diagnosis strategies for imaging of non-obstetrical pathology in the pregnant patient.

ABSTRACT

The course will focus on benign and malignant masses that mimic each other, particularly in the area of gynecology. Emphasis is placed on the importance of knowing patient history and using good ultrasound technique in order to make accurate diagnoses with ultrasound alone. However, at times, further imaging and tissue sampling is necessary. The participant will be encouraged to "push the envelope" with ultrasound-guided diagnosis and biopsy for appropriate cases. In addition, we will review non-obstetrical diagnoses in pregnant patients with abdominal pathology (i.e. appendicitis, hydronephrosis, pyelonephritis, ovarian torsion, incidental masses found during pregnancy). The radiologist is often called upon by maternal-fetal-medicine providers to guide imaging in this vulnerable population

Active Handout: Roya Sohaey

<http://abstract.rsna.org/uploads/2017/16000398/Active RC618A.pdf>

RC618B CT

Participants

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

For information about this presentation, contact:

dsahani@mgh.harvard.edu

LEARNING OBJECTIVES

1) To review the statistics and incidence of common cancers in USA. 2) To discuss the role of CT in oncology and value of optimal

oral and IV contrast media protocols for best results. 3) Offer pearls and solutions to overcome the limitations of CT and review the potential role of new CT technology.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Dushyant V. Sahani, MD - 2012 Honored Educator Dushyant V. Sahani, MD - 2015 Honored Educator Dushyant V. Sahani, MD - 2016 Honored Educator Dushyant V. Sahani, MD - 2017 Honored Educator

RC618C MRI

Participants

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

LEARNING OBJECTIVES

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

RC621

Advances in CT: Technologies, Applications, Operations-CT Performance

Thursday, Nov. 30 8:30AM - 10:00AM Room: N229

CT PH SQ

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Ehsan Samei, PhD, Durham, NC (*Coordinator*) Research Grant, General Electric Company; ; Research Grant, Siemens AG; ; Advisory Board, medInt Holdings, LLC
Norbert J. Pelc, DSc, Stanford, CA (*Coordinator*) Research support, Koninklijke Philips NV; Research support, General Electric Company; Research support, Siemens AG; Consultant, Varian Medical Systems, Inc; Consultant, NanoX; Scientific Advisory Board, Reflexion Medical Inc; Scientific Advisory Board, Prismatic Sensors AB; Scientific Advisory Board, Theranos, Inc; Medical Advisory Board, OurCrowd, LP

For information about this presentation, contact:

samei@duke.edu

LEARNING OBJECTIVES

1) Understand the basic components of CT performance evaluation. 2) Understand the difference between basic and operational performance of CT. 3) Understand the methods to characterize iterative reconstruction, tube current modulation, and task specific noise and resolution.

Sub-Events

RC621A Dose and Risk Characterization

Participants

Ehsan Samei, PhD, Durham, NC (*Presenter*) Research Grant, General Electric Company; ; Research Grant, Siemens AG; ; Advisory Board, medInt Holdings, LLC

For information about this presentation, contact:

samei@duke.edu

LEARNING OBJECTIVES

1) Understand the metrics of dose and risk in CT imaging. 2) Understand methods to estimate organ dose. 3) Understand the relevance of CT dosimetry to operational performance.

RC621B Image Quality Estimation

Participants

Guang-Hong Chen, PhD, Madison, WI (*Presenter*) Research funded, General Electric Company Research funded, Siemens AG

For information about this presentation, contact:

gchen7@wisc.edu

LEARNING OBJECTIVES

1) To understand the potential consequences of the nonlinear model based image reconstruction on image quality assessment in terms of spatial resolution assessment, noise power spectra, task-based CT protocol optimization.

RC621C Performance Evaluation, TG233

Participants

Ehsan Samei, PhD, Durham, NC (*Presenter*) Research Grant, General Electric Company; ; Research Grant, Siemens AG; ; Advisory Board, medInt Holdings, LLC

For information about this presentation, contact:

samei@duke.edu

LEARNING OBJECTIVES

1) Understand the basic components of CT performance evaluation in terms of basic as well as operational performance. 2) Understand the methods to characterize task based performance of CT. 3) Understand methods to characterize tube current modulation.

RC622

Imaging for Proton Treatment Planning

Thursday, Nov. 30 8:30AM - 10:00AM Room: E263

RO **PH**

AMA PRA Category 1 Credits [™]: 1.50
ARRT Category A+ Credit: 1.75

Participants

Jon J. Kruse, PhD, Rochester, MN (*Moderator*) Research Grant, Varian Medical Systems, Inc

ABSTRACT

Proton therapy has the potential to deliver very conformal dose distributions which may lead to higher cure rates or lower treatment toxicities than conventional or intensity modulated x-ray therapy. Like modern photon modalities, proton therapy relies heavily on advanced imaging techniques for treatment planning and dose calculation. This course will describe imaging requirements which are unique to proton therapy treatment planning. Much of the advantage of proton therapy is derived from the particle beam's finite range, and calculation of proton range within a patient requires a conversion between CT Hounsfield Units (HU) and proton stopping power. This calibration process is significantly different from the HU to electron density conversion which is performed for x-ray dose calculation. Uncertainties in the stopping power conversion are currently managed by expanding normal tissue margins around the clinical target volume and through appropriate beam selection. Improved CT techniques and alternative imaging modalities promise to deliver a more reliable image of stopping power within the patient, allowing for reduced treatment volumes. Tumor motion also presents a unique challenge in proton therapy, as a moving target exhibits not only variable position within a beam's eye view, but varying range as well. Modern proton therapy facilities which deliver treatments via a scanning beam are additionally susceptible to the interplay effect, in which the time dependent dose delivery is altered by motion of the target and surrounding anatomy. Four-dimensional imaging and dose calculation are then critically important in proton therapy to ensure that the treatment plan is robust against tumor motion.

Sub-Events

RC622A **Uncertainties in Imaging for Proton Therapy Dose Calculations**

Participants

Andrew Wroe, PhD, Loma Linda, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the Bragg peak and the impact this has on treatment delivery. 2) Understand proton therapy clinical workflow. 3) Discuss imaging modalities used for proton therapy treatment planning. 4) Describe the CT number to proton stopping power calibration. 5) Understand sources of range uncertainty in proton therapy. 6) Discuss alternate imaging modalities that may impact proton range uncertainty.

RC622B **Uncertainties in Motion for Treatment Planning**

Participants

Heng Li, Houston, TX (*Presenter*) Research funded, Varian Medical Systems, Inc

LEARNING OBJECTIVES

1) Describe the impact of tumor motion on a proton dose distribution. 2) Compare the relative value of various four-dimensional imaging modalities in the evaluation of a proton plan for a mobile target. 3) Explain the process for incorporating four-dimensional imaging into dose calculation.

RC623

Evolving Perspectives on Ultrasound Safety

Thursday, Nov. 30 8:30AM - 10:00AM Room: S504AB

PH **SQ** **US**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

J. Brian Fowlkes, PhD, Ann Arbor, MI (*Director*) Equipment support, Koninklijke Philips NV; Equipment support, General Electric Company; Equipment support, Toshiba Medical Systems Corporation; Research collaboration, Sonetics Inc; Stockholder, HistoSonics, Inc; Founder, HistoSonics, Inc

For information about this presentation, contact:

fowlkes@umich.edu

LEARNING OBJECTIVES

1) Understand the physical principles related to ultrasound safety and the potential for biological effects of ultrasound. 2) Utilize ultrasound in a safe and effective manner in clinical practice. 3) Increase their knowledge and understanding of the regulatory environment associated with medical ultrasound.

Sub-Events

RC623A Ultrasound Safety: Understanding the Potential Bioeffects

Participants

J. Brian Fowlkes, PhD, Ann Arbor, MI (*Presenter*) Equipment support, Koninklijke Philips NV; Equipment support, General Electric Company; Equipment support, Toshiba Medical Systems Corporation; Research collaboration, Sonetics Inc; Stockholder, HistoSonics, Inc; Founder, HistoSonics, Inc

For information about this presentation, contact:

fowlkes@umich.edu

LEARNING OBJECTIVES

1) Understand the physics associated with the potential bioeffects of ultrasound. 2) Increase basic knowledge of the controls and operator feedback related to ultrasound safety. 3) Be sufficiently proficient to utilize on-screen displays related to ultrasound safety. 4) Identify additional resources for understanding the physical effects of ultrasound.

Active Handout: J. Brian Fowlkes

[http://abstract.rsna.org/uploads/2017/17000402/Active RC623A.pdf](http://abstract.rsna.org/uploads/2017/17000402/Active_RC623A.pdf)

RC623B Ultrasound Safety: What You Should Tell the Clinicians

Participants

Jacques S. Abramowicz, MD, Chicago, IL (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jabramowicz@bsd.uchicago.edu

LEARNING OBJECTIVES

View Learning Objectives under main course title

Active Handout: Jacques S. Abramowicz

[http://abstract.rsna.org/uploads/2017/17000403/Active RC623B.pdf](http://abstract.rsna.org/uploads/2017/17000403/Active_RC623B.pdf)

RC623C Diagnostic Ultrasound Regulation: Substantial Equivalence, Novel Technologies, and Reasonable Assurance of Safety and Effectiveness

Participants

Shahram Vaezy, PhD, Silver Spring, MD (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understanding the mission of the Center for Devices and Radiological Health (CDRH). 2) protection and promotion of the public health: Access to safe and effective medical devices, Facilitating medical device innovation. 3) Understanding diagnostic ultrasound premarket review of safety and effectiveness. 4) Elements of regulatory review: Intended use, Technological characteristics, Performance data, Labeling. 5) Class II medical devices and premarket notification (510(k) submissions): Safety and effectiveness for establishing substantial equivalence, Clearance for marketing. 6) Class III medical devices and premarket approval (PMA submissions): Safety and effectiveness, classification regulation, level of risk, Approval for marketing. 7) The de-novo classification

for devices with novel technologies: Not substantially equivalent, Risk-based classification. 8) Understanding post-market activities. 9) Compliance: Medical device report (MDR), Recalls, Facility inspections. 10) Understanding FDA resources/information. 11) Code of Federal Regulation (CFR). 12) Consensus standards. 13) General controls and Special Controls. 14) FDA communications and website. 15) Pre-submissions.

Active Handout: Shahram Vaezy

http://abstract.rsna.org/uploads/2017/17000405/Active_RC623C.pdf

RC624

Paleoradiology: Scanning Mummies and More

Thursday, Nov. 30 8:30AM - 10:00AM Room: S502AB

OT

AMA PRA Category 1 Credits TM: 1.50

ARRT Category A+ Credit: 1.75

Participants

Sahar Saleem, MD, Cairo, Egypt (*Moderator*) Nothing to Disclose

Sahar Saleem, MD, Cairo, Egypt (*Presenter*) Nothing to Disclose

Gerald J. Conlogue, RT, Hamden, CT (*Presenter*) Nothing to Disclose

Andrew J. Nelson, PhD, London, ON (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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anelson@uwo.ca

LEARNING OBJECTIVES

1) Identify paleoradiology as a radiology subspecialty where medical imaging methods are used to document and collect data about human remains (skeletons and mummies) and artefacts from antiquity. 2) Recognize the value of different clinical imaging modalities as non-invasive methods for investigating ancient mummies and objects. 3) Discuss the advantages of radiography in the field setting verses transporting the material to an imaging facility. 4) List the types of data that can be acquired in a field radiography study. 5) Describe how the advances in technology have facilitated field radiography. 6) Apply a schematic analysis for CT study of a mummy using the Royal mummies of Ancient Egypt as a model. 7) Recognize the value of paleoradiology in detection and adding knowledge about the origin of diseases. 8) Recognize that the data provided by CT studies of mummies and related objects in a museum can be used to complete the museum's data base, support conservation processes, and arrange exhibitions. 9) Appreciate how the desiccation of human tissue affects the applicability of imaging modalities and protocols. 10) Recognise the value of the application of different imaging modalities to the study of mummies and archaeological artifacts. 11) Recognize how paleoradiology is different than clinical imaging. 12) Recognize the importance of interdisciplinary collaboration in paleoradiology, involving imaging technologists, radiologists, bioarchaeologists, imaging physicists, museologists, conservators and other experts with interests in this diverse field.

RC625

Quantitative Imaging Mini-Course: Image Modality Specific Issues

Thursday, Nov. 30 8:30AM - 10:00AM Room: S403B

BQ **PH**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Coordinator*) Institutional research agreement, Siemens AG; ; ; ;

Sub-Events

RC625A Quantitative Imaging for Computed Tomography: Applications and Future Directions

Participants

Samuel G. Armato III, PhD, Chicago, IL (*Presenter*) Consultant, Aduro Biotech, Inc

RC625B Quantitative Imaging for PET-CT: Applications and Future Directions

Participants

Robert Jeraj, PHD, Madison, WI (*Presenter*) Founder, AIQ Services

LEARNING OBJECTIVES

1) To learn issues related to quantitative imaging in PET/CT in single and multi-center setting. 2) To learn about uncertainties related to PET/CT quantification. 3) To learn about ways to increase PET/CT quantification.

RC625C Quantitative Imaging for DCE-MRI: Applications and Future Directions

Participants

Yue Cao, PhD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To understand QA, acquisition and quantification processes of DCE MRI to derive physiological parameters. 2) To understand clinical applications of quantitative DCE MRI. 3) To understand limitations of quantitative DCE MRI and future directions.

RC627

Patient Centered Imaging: Research, Dissemination and Practice

Thursday, Nov. 30 8:30AM - 10:00AM Room: S503AB



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

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

For information about this presentation, contact:

rcarlos@umich.edu

Sub-Events

RC627A Patient Engagement and Comparative Effectiveness Research in Imaging

Participants

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

For information about this presentation, contact:

rcarlos@umich.edu

LEARNING OBJECTIVES

1) Summarize the state of comparative effectiveness research (CER) in imaging. 2) Discuss concepts of patient engagement in imaging CER.

Honored Educators

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RC627B Patient Centered Research in Imaging Care Delivery

Participants

Hanna M. Zafar, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Ilana F. Gareen, PhD, Providence, RI (*Presenter*) Nothing to Disclose
Ruth C. Carlos, MD, MS, Ann Arbor, MI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Illustrate patient centered research in care delivery using contemporary examples.

Honored Educators

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RC627C Emerging Topics in Patient Centered Research and Dissemination

Participants

Sheetal M. Kircher, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Bruce J. Hillman, MD, Wake Forest, NC (*Presenter*) Royalties, Oxford University Press;

For information about this presentation, contact:

bjh8a@virginia.edu

LEARNING OBJECTIVES

1) Introduce concepts of financial burden of care. 2) Understand the arguments posed for researchers supplying their raw data as a pre-requisite of publication. 3) Familiarize themselves with how medical journals are dealing with patient demands for greater access to and clarity of research findings.

RC629

Imaging Cancer in the Cirrhotic Liver: What We Need To Know (An Interactive Session)

Thursday, Nov. 30 8:30AM - 10:00AM Room: N228

GI MR OI

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Hero K. Hussain, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

RC629A Imaging Cancer in the Cirrhotic Liver: The Essentials

Participants

Claude B. Sirlin, MD, San Diego, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Bayer AG; Research Grant, Arterys Inc; Research Grant, Koninklijke Philips NV; Consultant, Alexion Pharmaceuticals, Inc; Consultant, AstraZeneca PLC; Consultant, BioClinica, Inc; Consultant, Bristol-Myers Squibb Company; Consultant, Bracco Group; Consultant, Celgene Corporation; Consultant, FibroGen, Inc; Consultant, Galmed Pharmaceuticals Ltd; Consultant, F. Hoffmann-La Roche Ltd; Consultant, sanofi-aventis Group; Consultant, Gilead Sciences, Inc; Consultant, ICON plc; Consultant, Intercept Pharmaceuticals, Inc; Consultant, Ionis Pharmaceuticals, Inc; Consultant, Johnson & Johnson; Consultant, NuSirt Biopharma, Inc; Consultant, Perspectum Diagnostics Ltd; Consultant, Pfizer Inc; Consultant, Profil Institut für Stoffwechselforschung GmbH; Consultant, Shire plc; Consultant, Tobira Therapeutics, Inc; Consultant, Takeda Pharmaceutical Company Limited; Consultant, Virtual Scopics; ;

For information about this presentation, contact:

csirlin@ucsd.edu

LEARNING OBJECTIVES

1) To understand the role of noninvasive imaging liver cancer screening, surveillance, diagnosis, staging, and treatment response assessment. 2) To review the process of carcinogenesis. 3) To understand that the differential diagnosis of malignant liver nodules includes HCC, cholangiocarcinoma, and hepatocholangiocarcinoma. 4) To understand the wide spectrum of lesions and pseudolesions that can be encountered in the cirrhotic liver.

RC629B Imaging Cancer in the Cirrhotic Liver: The Atypical Scenario

Participants

An Tang, MD, Montreal, QC (*Presenter*) Research Consultant, Imagia Cybernetics Inc; Speaker, Siemens AG

For information about this presentation, contact:

an.tang@umontreal.ca

LEARNING OBJECTIVES

1) To review atypical forms of HCC in the cirrhotic liver. 2) To discuss malignancies other than HCC encountered in the cirrhotic liver. 3) To examine strategies to improve diagnosis in the cirrhotic liver.

ABSTRACT

Diagnosis of malignancy in the cirrhotic liver can be challenging, especially in the presence of architectural distortion and innumerable cirrhotic (regenerative) nodules in the background liver. In this refresher course, we will review imaging features of atypical lesions in the cirrhotic liver, including mimickers of HCC, dysplastic nodules in transition to HCC, non-hypervascular HCC, infiltrative HCC, and other unusual forms. We will also discuss malignancy other than HCC, including cholangiocarcinoma, biphenotypic primary liver carcinoma (hepatocholangiocarcinoma), and metastases. We will review strategies to improve diagnostic accuracy in cirrhotic patients, including patient preparation, subtraction imaging, and contrast agents.

RC629C Imaging Cancer in the Cirrhotic Liver: Assessment of Response of Hepatocellular Carcinoma to Locoregional Therapy

Participants

Richard Kinh Gian Do, MD, PhD, New York, NY (*Presenter*) Consultant, Guerbet SA

For information about this presentation, contact:

dok@mskcc.org

LEARNING OBJECTIVES

1) Recognize differences between locoregional therapies for HCC. 2) Compare response criteria used to evaluate HCC treatments. 3) Apply the LI-RADS Treatment Response Algorithm.

RC632

Payment Reform and Getting Paid: A Focus on Value Activities and Metrics

Thursday, Nov. 30 8:30AM - 10:00AM Room: S404CD

HP LM

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

Participants

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

Richard Duszak JR, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

Giles W. Boland, MD, Boston, MA (*Presenter*) Principal, Radiology Consulting Group; Royalties, Reed Elsevier

For information about this presentation, contact:

richard.duszak@emory.edu

LEARNING OBJECTIVES

1) To understand value-focused healthcare imperatives in the evolution of healthcare delivery systems and how they impact medical imaging. 2) To implement practice changes aligned with Imaging 3.0 so as to maximize the relevance of radiology and radiologists in ongoing health system changes. 3) To improve the delivery of imaging care by focusing on value chain opportunities. (This course is part of the Leadership Track)

ABSTRACT

Although radiology's dramatic evolution over the last century has profoundly affected patient care for the better, our current system is fragmented with many providers focusing more on technology and physician needs rather than what really matters to patients: better value and outcomes. This latter dynamic is aligned with current national health care reform initiatives and creates both challenges and opportunities for radiologists to find ways to deliver new value for patients. The American College of Radiology has responded to this challenge with the introduction of Imaging 3.0, which represents a call to action to all radiologists to assume leadership roles in shaping America's future health care system through 5 key pillars: imaging appropriateness, quality, safety, efficiency, and satisfaction. That enhanced value will require modulation of imaging work processes best understood through the concept of the imaging value chain, which will be the focus of this course.

RC650

Vertebral Augmentation (Hands-on)

Thursday, Nov. 30 8:30AM - 10:00AM Room: E260



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

A. Orlando Ortiz, MD, MBA, Mineola, NY (*Presenter*) Nothing to Disclose
Bassem A. Georgy, MD, MSc, San Diego, CA (*Presenter*) Consultant, Johnson & Johnson; Consultant, Merit Medical Systems, Inc; Stockholder, Merit Medical Systems, Inc ; Stockholder, Spine Solutions, Inc; ;
Allan L. Brook, MD, Bronx, NY (*Presenter*) Nothing to Disclose
Todd S. Miller, MD, Bronx, NY (*Presenter*) Nothing to Disclose
Afshin Gangi, MD, PhD, Strasbourg, France (*Presenter*) Proctor, Galil Medical Ltd

For information about this presentation, contact:

afshin.gangi@chru-strasbourg.fr

tmiller@montefiore.org

LEARNING OBJECTIVES

1) Discuss appropriate algorithms for patient selection. 2) Review anatomic and technical considerations for vertebral augmentation. 3) Present an update of the recent advances in vertebral augmentation including sacroplasty. 4) Emphasize safety issues and how to avoid complications. 5) Understand the applications of vertebral augmentation in osteoporotic and neoplastic spine pathology. 6) Update participants with respect to advances in equipment and biomaterials.

ABSTRACT

1. Patient selection for vertebral augmentation Indications and Contraindications 2. New devices and techniques in vertebral augmentation 3. Vertebral augmentation for osteoporotic and pathologic vertebral compression fractures 4. Sacroplasty (sacral augmentation) 5. Complications avoidance 6. Efficacy Vertebral augmentation is an image-guided (fluoroscopy or CT) percutaneous procedure in which a bone needle is inserted into a painful osteoporotic or pathologic fracture within the spinal axis. Biopsy, cavity creation or lesion ablation may then be performed under imaging guidance depending on the nature of the pathology that is being treated. Subsequently a radioopaque implant, usually an acrylic bone cement, is carefully injected into the vertebra or sacral ala under imaging guidance, These procedures have been shown to provide pain relief by stabilizing the fractured vertebra or sacrum. As with any other invasive procedure, they carry a small risk (<<1%) of complication including bleeding, infection, neurovascular injury, or cement embolus. Appropriate patient selection and a detailed understanding of the technical aspects of the procedure along with active clinical patient follow-up are paramount to a successful outcome. This workshop will utilize short lectures, case examples and interactive audience participation in order to further explore critical topics in vertebral augmentation.

Active Handout: Todd Stuart Miller

[http://abstract.rsna.org/uploads/2017/4426453/Active RC650.pdf](http://abstract.rsna.org/uploads/2017/4426453/Active_RC650.pdf)

RC652

Nerve Ultrasound Based on a Regional Approach: Hip to Knee (Hands-on)

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

MK NR US

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Carlo Martinoli, MD, Genova, Italy (*Presenter*) Nothing to Disclose
Jon A. Jacobson, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Kenneth S. Lee, MD, Madison, WI (*Presenter*) Grant, General Electric Company; Research support, SuperSonic Imagine; Research support, Johnson & Johnson; Consultant, Echometrix, LLC; Royalties, Reed Elsevier
J. Antonio Bouffard, MD, Novi, MI (*Presenter*) Nothing to Disclose
Ghiyath Habra, MD, Troy, MI (*Presenter*) Nothing to Disclose
Marnix T. van Holsbeeck, MD, Detroit, MI (*Presenter*) Consultant, General Electric Company; Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder MedEd3D; Grant, Siemens AG; Grant, General Electric Company;
Rachel B. Hulen, MD, Flint, MI (*Presenter*) Nothing to Disclose
Joseph H. Introcaso, MD, Neenah, WI (*Presenter*) Nothing to Disclose
Andrea Klausner, MD, Reith bei Seefeld, Austria (*Presenter*) Nothing to Disclose
Mary M. Chiavaras, MD, PhD, Ancaster, ON (*Presenter*) Nothing to Disclose
Viviane Khoury, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Marina Kislyakova, MD, Moscow, Russia (*Presenter*) Nothing to Disclose
Courtney E. Scher, DO, Detroit, MI (*Presenter*) Nothing to Disclose
Ximena L. Wortsman, MD, Santiago, Chile (*Presenter*) Nothing to Disclose
David P. Fessell, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Matthieu Rutten, MD, Hertogenbosch, Netherlands (*Presenter*) Nothing to Disclose
Sonia Airal, MD, Genova, Italy (*Presenter*) Nothing to Disclose
Etienne Cardinal, MD, Montreal, QC (*Presenter*) Nothing to Disclose
Nicki J. Delves, Guildford, United Kingdom (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Familiarize course participants with the ultrasound appearance of nerves and the scanning techniques used to image them about the hip and knee. 2) Emphasize the ultrasound anatomy of the femoral, sciatic and peroneal nerves and their divisional branches at their common sites of entrapment. 3) Learn the technique to image some minor nerves in their course throughout the proximal lower extremity, such as the lateral and posterior femoral cutaneous, the obturator, the saphenous and the sural. 4) Outline the range of clinical conditions where ultrasound is appropriate as the primary imaging modality for nerve assessment.

ABSTRACT

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

Honored Educators

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RC653

Imaging 3.0: Informatics Tools to Improve Radiologists' Productivity, Quality and Value

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



AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

Participants

J. Raymond Geis, MD, Fort Collins, CO (*Moderator*) Advisor, Nuance Communications, Inc

LEARNING OBJECTIVES

1) Learn how to use IT to gain a competitive advantage. 2) Understand how to use IT solutions to demonstrate your value to hospital administrators, insurers, other health care providers, and patients. 3) Discover Imaging Informatics tools to decrease stress, provide better service, be more efficient, and still get home in time for dinner.

ABSTRACT

Radiologists are under pressure to be faster, cheaper, and better. New IT tools can help you do all this, and also relieve this pressure. This course will discuss not only what are these tools,, but also *how* to implement them. Automated analytics techniques help you collect hard data to demonstrate your value to healthcare enterprises, senior management, payers, and patients. When implemented correctly, new IT approaches can help radiologists decrease stress, be more productive, and deliver better value.

Sub-Events

RC653A ACRSelect — Using Informatics to Complying with PAMA: CDS Image Ordering Legislation

Participants

Keith J. Dreyer, DO, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Be informed of the new federal legislation requiring the use of Clinical Decision Support (CDS) for the ordering of medical imaging required by CMS in 2017. 2) Understand the challenges of implementing CDS in the hospital and imaging center environments. 3) Learn the value of embedding CDS into the EHR and CPOE ordering process. 4) Learn methods to use CDS to manage the utilization of medical image appropriateness. 5) Become familiar with methods to implement CDS in an ACO environment.

RC653B Radiology Assist: Informatics Tools to Produce a More Valuable Report and Still Report Fast

Participants

Tarik K. Alkasab, MD, PhD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the motivations for integrating clinical decision support (CDS) into the clinical practice of radiologists. 2) Understand how CDS modules can be defined for use in radiologist reporting. 3) Understand what it looks like for a CDS system to be integrated with radiologist reporting. 4) Understand the challenges associated with deploying CDS for radiologists.

RC653C Use Your Data to Reduce Costs and Demonstrate Your Value to the Hospital

Participants

Woojin Kim, MD, Burlington, MA (*Presenter*) CIO, Nuance Communications, Inc

LEARNING OBJECTIVES

1) Understand the role of data analytics tools in providing value-based care. 2) Understand how analytics can provide effective monitoring of various components of the imaging value chain, including imaging appropriateness, modality operations, image interpretation and reporting, and report communication. 3) Learn how data mining can improve report quality by ensuring proper documentation and reducing errors. 4) Learn how one should implement a data analytics solution and learn about potential problems to consider.

ABSTRACT

The goals of improving population health at a lower cost and higher quality are placing increased emphasis on value-based care over volume-based approach. Imaging 3.0™ is ACR's call to action for radiologists to take a leadership role in shaping America's future healthcare system through 5 key pillars, which are imaging appropriateness, quality, safety, efficiency, and satisfaction. With the aims of delivering better value to patients, Imaging 3.0 has outlined what it calls "imaging value chain" where each link of this chain represents a discrete number of unique value opportunity activities. The imaging value chain includes following components: imaging appropriateness and patient scheduling, imaging protocols, modality operations, image interpretation and reporting, and report communication and referring physician interaction. In the center of the imaging value chain, inter-connected with every link, lie data mining and business intelligence (BI). Timely analysis and appropriate modification using data mining and BI tools are critical to the effective monitoring of all components of the imaging value chain. As a result, it is a critical component of your Imaging 3.0 informatics toolkit. Effective use of BI will allow access to right information at the right time for right decision. This presentation will discuss the basics of BI and its benefits. Specifically, attendees will learn how data mining and BI can monitor adherence to imaging

appropriateness guidelines, modality capacity, patient throughput, radiation dose exposure, and report standardization and quality including detection of errors and compliance with various reporting requirements including documentation of proper report communication. In addition, attendees will learn how one should implement a BI system, what are some potential problems to consider, and various tips for getting BI right.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Woojin Kim, MD - 2012 Honored Educator

RC653D Using Workflow Software to Improve Efficiency and Profitability

Participants

Bradley J. Erickson, MD, PhD, Rochester, MN (*Presenter*) Stockholder, OneMedNet Corporation; Stockholder, VoiceIt Technologies, LLC; Stockholder, FlowSigma; Researcher, NVIDIA Corporation

For information about this presentation, contact:

bje@mayo.edu

LEARNING OBJECTIVES

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

ABSTRACT

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

RC654

The Use of Business Analytics for Improving Radiology Operations, Quality, and Clinical Performance (In Association with the Society for Imaging Informatics in Medicine)

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

IN LM SQ

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Katherine P. Andriole, PhD, Dedham, MA (*Moderator*) Advisory Board, McKinsey & Company, Inc;

LEARNING OBJECTIVES

1) Understand what is meant by business analytics in the context of a radiology practice. 2) Be able to describe the basic steps involved in implementing a business analytics tool. 3) Learn how business analytics tools can be used for quality assurance in radiology, for maintenance of certification (MOC), and for practice quality improvement. 4) Be introduced to the capabilities of current and potential future business analytics technologies.

ABSTRACT

This course will provide an overview of the use of business analytics (BA) in radiology. How a practice manages information is becoming a differentiator in the competitive radiology market. Leveraging informatics tools such as business analytics can help a practice transform its service delivery to improve performance, productivity and quality. An introduction to the basic steps involved in implementing business analytics will be given, followed by example uses of BA tools for quality assurance, maintenance of certification (MOC) and practice quality improvement. The power of current business analytics technologies will be described, along with a look at potential future capabilities of business analytics tools.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC654A Introduction to Business Analytics Demonstrating Application to Radiology

Participants

Katherine P. Andriole, PhD, Dedham, MA (*Presenter*) Advisory Board, McKinsey & Company, Inc;

LEARNING OBJECTIVES

1) Gain an overview of business analytics tools and understand how they might be used in radiology. 2) Be able to describe the general steps involved in business analytics, including data extraction, transformation, analysis, and presentation or visualization of key performance indicators (KPI). 3) Review several example radiology use cases.

ABSTRACT

This session will provide a general overview of business analytics concepts and how they can be used in radiology. A walk through of the basic steps involved in implementation including identifying, collecting, transforming, and analyzing data, followed by dynamically presenting key performance indicators (KPI) will be demonstrated. Example use cases involving multiple database sources taken from a radiology practice will be shown.

RC654B Operational and Predictive Analytics in Radiology

Participants

Luciano M. Prevedello, MD, MPH, Columbus, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Explain the big data science and radiology. 2) Identify the role of informatics in capturing, extracting, analyzing, and communication quality projects. 3) Illustrate graphical dashboarding examples to support quality efforts.

RC654C Capabilities of Current and Future Business Analytics Technologies

Participants

Tessa S. Cook, MD, PhD, Philadelphia, PA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

tessa.cook@uphs.upenn.edu

LEARNING OBJECTIVES

1) To gain familiarity with currently available business technologies and their relevance to radiology practice. 2) To consider how existing business technologies can support quality assurance in radiology. 3) To learn about business analytics features that may

be available/desirable in the future to augment and support both the practice of radiology.

RCA51

Creating Vector-based Drawings for Presentations and Publications with Adobe Illustrator (Hands-on)

Thursday, Nov. 30 8:30AM - 10:00AM Room: S401AB



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Sarah C. Abate, BS, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Elise Van Holsbeeck, DO, Lima, OH (*Presenter*) Nothing to Disclose
Darren L. Wendt, Rochester, MN (*Presenter*) Nothing to Disclose
Richard Wendt, Grand Meadow, MN (*Presenter*) Nothing to Disclose
Bea Van Holsbeeck, Northville, MI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

sabate@med.umich.edu

MedEd3D@comcast.net

LEARNING OBJECTIVES

1) Discuss why we use vector based programs. 2) Explain how to use the tools. 3) Demonstrate how to import and label an image. 4) Demonstrate how to make one's own line drawing. 5) Demonstrate how to color and shade drawing. 6) Demonstrate how to export an image for print, PowerPoint, and Internet.

Active Handout: Sarah C. Abate

[http://abstract.rsna.org/uploads/2017/16005083/Active RCA.pdf](http://abstract.rsna.org/uploads/2017/16005083/Active_RCA.pdf)

RCC51

Mission Critical: How to Increase Your Value By Mastering the Intersection of Quality Improvement and Informatics

Thursday, Nov. 30 8:30AM - 10:00AM Room: S501ABC



AMA PRA Category 1 Credits [™]: 1.50
ARRT Category A+ Credit: 1.75

Participants

Richard E. Sharpe JR, MD, MBA, Denver, CO (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) The emerging healthcare marketplace demands radiologists focus considerable resources to demonstrating improvements in value, quality, and patient outcomes. Informatics tools are a powerful resources to realize these expected improvements. Process improvement requires mastery of the intersection of quality and informatics. 2) Identify the required structural framework necessary for improving quality, describe the improvements facilitated by a range of commercially available informatics tools, and implement a radiologist based quality improvement process in their own department.

Sub-Events

RCC51A Using Information Systems to Facilitate Improvement While Keeping Your People Engaged

Participants

David B. Larson, MD, MBA, Stanford, CA (*Presenter*) Grant, Siemens AG; Grant, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Understand the organizational aspects of performance improvement. 2) How they complement the use of information systems. 3) How to utilize informatics tools without disrupting the organization.

Honored Educators

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RCC51B What Quality Improvement Tools are Currently Available, and How Can You Leverage Them to Improve Quality and Demonstrate Value?

Participants

Samir B. Patel, MD, Mishawaka, IN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

spatel@rad-inc.com

LEARNING OBJECTIVES

1) Informatics tools can enhance the ability of radiologists to increase the value they provide to patients, referring providers, and administrators. 2) To learn a framework for categorizing radiology value and how commercially available informatics tools can assist in improving the quality of work they provide and the value they bring to healthcare by discussing specific examples of quality and value improvement initiatives in a community hospital practice.

Active Handout: Samir B. Patel

http://abstract.rsna.org/uploads/2017/16005040/Active_RCC51B.pdf

RCC51C Examples of Informatics Quality Project Successes and Future Opportunities

Participants

Alex Towbin, MD, Cincinnati, OH (*Presenter*) Author, Reed Elsevier; Grant, Guerbet SA; Grant, Siemens AG; Consultant, Reed Elsevier; Advisory Board, IBM Corporation;

For information about this presentation, contact:

alexander.towbin@cchmc.org

LEARNING OBJECTIVES

1) Describe how informatics tools can be used to drive quality improvement projects. 2) Give three examples of quality improvement projects enhanced by informatics.

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RCC51D How to Create a Culture of Continuous Quality Improvement Using Existing and Free Resources

Participants

Richard E. Sharpe JR, MD, MBA, Denver, CO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn how to empower radiologists to lead performance, interpretation and system improvements. 2) Create a culture of continuous quality improvement using existing or available free resources.

MSRT52

ASRT@RSNA 2017: Cybersecurity for Medical Imaging

Thursday, Nov. 30 9:15AM - 10:15AM Room: N230B

IN

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

Participants

James A. Seibert, PhD, Sacramento, CA (*Presenter*) Advisory Board, Bayer AG

For information about this presentation, contact:

jaseibert@ucdavis.edu

LEARNING OBJECTIVES

1) Understand the vulnerabilities of imaging system modalities to internal and external cybersecurity threats. 2) Determine ways to protect and secure imaging systems from security and privacy breaches. 3) Describe institutional best-practices to maintain security protection yet provide necessary accessibility for imaging modalities.

ABSTRACT

All digital imaging devices in Radiology contain configurable embedded computer systems vulnerable to cybersecurity attacks that could compromise equipment operation, network and enterprise security, patient privacy, and patient care. Threats of unauthorized access and system security breaches are heightened by introduction of malware, poor or no password control practices, inadequate software update policies, continued use of legacy computers with no capability for security patches, and many other potentially weak or non-existent security firewalls on network connected devices. Mitigating these risks requires an understanding of the threats from 'black-hat' hackers and disgruntled employees, as well as adopting actionable security recommendations by regulators such as the US government (FDA, NIST, Department of Homeland Security) and imaging system manufacturers, including the Medical Imaging Technology Alliance - MITA. This also requires an active effort by users including technologists to confront exploitation from external and internal threats, to identify weaknesses with current systems, and to develop strategies, policies, and procedures to maintain a secure and protected digital imaging environment.

MSCN52

Case-based Review of Neuroradiology (An Interactive Session)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S406A

NR

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Pina C. Sanelli, MD, Manhasset, NY (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the application of basic anatomic, pathologic, and physiologic principles to specific disease processes, and diagnostic and therapeutic procedures in neuroimaging. 2) Analyze imaging and therapeutic techniques and apply this knowledge to protocol development, patient management and safety. 3) Compare indications and contraindications of specific imaging procedures in Neuroradiology.

Sub-Events

MSCN52A Adult Brain

Participants

Pamela W. Schaefer, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View Learning Objectives under main course title

MSCN52B Adult Spine

Participants

Rona F. Woldenberg, MD, Great Neck, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

rwoldenb@northwell.edu

LEARNING OBJECTIVES

1) Access the results of new research and assess the potential applications to imaging of the adult spine. 2) Review and reinforce basic knowledge and skills relevant to interpretation of adult spine imaging. 3) Assess the potential developing technology and advanced imaging techniques to enhance clinical practice and problem solving as it relates to spine imaging. 4) Sharpen critical thinking skills to enhance peer interaction in the radiologic sciences as they relate to spine imaging.

MSCN52C Adult Head & Neck

Participants

Laurie A. Loevner, MD, Gladwyne, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View Learning Objectives under main course title

MSCN52D Adult Interventional

Participants

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

For information about this presentation, contact:

oortiz@winthrop.org

LEARNING OBJECTIVES

View Learning Objectives under main course title

MSCS52

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

Thursday, Nov. 30 10:30AM - 12:00PM Room: S100AB

MK

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

FDA

Discussions may include off-label uses.

Participants

Stacy E. Smith, MD, Weston, MA (*Director*) Nothing to Disclose

Sub-Events

MSCS52A Arthritis

Participants

Carl S. Winalski, MD, Cleveland, OH (*Presenter*) Institutional service agreement, Medical Metrics, Inc; Institutional service agreement, BioClinica, Inc ; Institutional service agreement, PAREXEL International Corporation ; Institutional service agreement, CartiHeal Ltd; Shareholder, Pfizer Inc; Spouse, Shareholder, General Electric Company

For information about this presentation, contact:

winalsc@ccf.org

LEARNING OBJECTIVES

1) Recognize imaging characteristics of arthritides and how to differentiate them from other entities. 2) Learn features that help differentiate types of arthritides. 3) Select imaging modalities most appropriate for specific clinical questions.

ABSTRACT

Arthritides can have varied clinical presentations that simulate other diseases. Through the recognition of these image patterns, the radiologist can play an important role in diagnosis and management of these patients. Through case presentations, we will review the appearances of various arthritides and demonstrate the importance of imaging for these diseases.

Active Handout: Carl Scherman Winalski

[http://abstract.rsna.org/uploads/2017/17000477/Active MSCS52A.pdf](http://abstract.rsna.org/uploads/2017/17000477/Active_MSCS52A.pdf)

MSCS52B Pediatric Musculoskeletal Imaging: What is Normal?

Participants

Kirsten Ecklund, MD, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

kirsten.ecklund@childrens.harvard.edu

LEARNING OBJECTIVES

1) Learn to recognize normal developmental patterns, age-dependent physiologic findings, and congenital lesions of the musculoskeleton, some of which persist into adulthood. 2) Key features which distinguish these entities will be reviewed.

LEARNING OBJECTIVES

1) Learn to recognize normal developmental patterns, age-dependent physiologic findings, and congenital lesions within the pediatric musculoskeleton. some of which persist into adulthood. Key features which differentiate these entities from pathology will be reviewed.

MSCS52C Hip

Participants

Donna G. Blankenbaker, MD, Madison, WI (*Presenter*) Consultant, Reed Elsevier; Royalties, Reed Elsevier

For information about this presentation, contact:

dblankenbaker@uwhealth.org

LEARNING OBJECTIVES

1) Recognize the imaging appearance for different hip conditions. 2) Improve diagnostic skill and apply principles for developing a differential diagnosis.

MSCS52D Bone Lesions

Participants

Mark D. Murphey, MD, Berkeley, CA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize imaging appearances of common soft tissue neoplasms. 2) Identify imaging features that suggest an aggressive bone neoplasm. 3) Apply the imaging appearance of neoplasm to help guide biopsy and improve diagnostic performance.

ABSTRACT

Important imaging features in evaluation of both bone and soft tissue tumors will be reviewed with key features that may allow diagnostic differentiation emphasized.

Honored Educators

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MSES52

Essentials of GI Imaging

Thursday, Nov. 30 10:30AM - 12:00PM Room: S406B



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Sub-Events

MSES52A US and CT of Acute Gallstone Disease

Participants

Julien B. Puylaert, MD, PhD, The Hague, Netherlands (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To familiarize radiologists with the clinical, US and CT pitfalls leading to delay in cholecystectomy and sphincterotomy. 2) To familiarize radiologists with the clinical, US and CT pitfalls leading to the incorrect diagnosis of symptomatic gallstone disease resulting in ill-advised cholecystectomy and sphincterotomy. 3) To familiarize radiologists with the diagnosis and treatment of complicated gallstone disease.

ABSTRACT

The clinical diagnosis of acute gallstone disease is relatively easy. Episodes of colicky pain in the (right) upper abdomen, waking up patients from their sleep, are often quite typical. If followed by brown coloured urine and elevated liver enzymes, they are even virtually characteristic for obstruction of the common bile duct (CBD) due to a stone. Nevertheless, there are many pitfalls that on one hand may lead to delay of cholecystectomy or sphincterotomy, and on the other hand may lead to ill-advised surgery or ERCP. -An acute obstruction of the gallbladder due to a gallstone in gallbladder neck or cystic duct, quickly leads to hydrops. From this point, in about 15 % of patients acute cholecystitis develops, with all its possible sequelae: abscess formation, free perforation, obstruction of the CBD due to extrinsic pressure (Mirizzi syndrome) and fistulization to colon or duodenum which may lead to gallstone ileus or Bouveret's syndrome. These complications can all be diagnosed reliably by US, CT or a combination of them. -An acute obstruction due to a stone within the CBD, in 15 % of cases will lead to cholangitis or biliary pancreatitis, which are the most feared complications of symptomatic gallstone disease and largely responsible for gallstone related mortality. In symptomatic CBD stones the clinical and laboratory findings are often so specific, that US and CT have a little role in deciding whether sphincterotomy is indicated. If the gastroenterologist is unsure about the presence of a CBD stone, endosonography is more reliable than transabdominal US and MRCP. -US scanning during an episode of pain is very helpful. US performed during an acute biliary colic, either shows a hydropic gallbladder or dilated biliary ducts. And if US is performed within 12-24 hours after a colic, transient contraction of the gallbladder, transient reperfusion edema of the gallbladder wall and transient sludge may be found as silent witnesses of the recent colic. If CRP starts rising in a patient with acute hydrops, this means that acute cholecystitis is developing. CRP elevation usually precedes fever and wall thickening at US, and pain is also less prominent than during the colic. -When acute cholecystitis is present for 3 to 6 days, the inflammatory changes may impede a safe cholecystectomy. Then, percutaneous drainage is the treatment of choice. In such cases the gallbladder is always walled-off by omentum, so that direct puncture via the gallbladder fundus is a safe procedure. When possible, transhepatic drainage should be avoided because of a higher chance for hemorrhage, septicemia and contamination of pleural cavity and subphrenic space.

MSES52B Hypervascular Lesions of the Pancreas

Participants

Valerie Vilgrain, MD, Clichy, France (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

valerie.vilgrain@aphp.fr

LEARNING OBJECTIVES

1) To know the differentials of hypervascular lesions of the pancreas. 2) To be aware of the most important imaging findings. 3) To understand the respective role of CT and MRI in the diagnosis of hyper vascular lesions of the pancreas.

MSES52C Liver Imaging Reporting and Data System: The Basics

Participants

Claude B. Sirlin, MD, San Diego, CA (*Presenter*) Research Grant, General Electric Company; Research Grant, Siemens AG; Research Grant, Bayer AG; Research Grant, Arterys Inc; Research Grant, Koninklijke Philips NV; Consultant, Alexion Pharmaceuticals, Inc; Consultant, AstraZeneca PLC; Consultant, BioClinica, Inc; Consultant, Bristol-Myers Squibb Company; Consultant, Bracco Group; Consultant, Celgene Corporation; Consultant, FibroGen, Inc; Consultant, Galmed Pharmaceuticals Ltd; Consultant, F. Hoffmann-La Roche Ltd; Consultant, sanofi-aventis Group; Consultant, Gilead Sciences, Inc; Consultant, ICON plc; Consultant, Intercept Pharmaceuticals, Inc; Consultant, Ionis Pharmaceuticals, Inc; Consultant, Johnson & Johnson; Consultant, NuSirt Biopharma, Inc; Consultant, Perspectum Diagnostics Ltd; Consultant, Pfizer Inc; Consultant, Profil Institut für Stoffwechselforschung GmbH; Consultant, Shire plc; Consultant, Tobira Therapeutics, Inc; Consultant, Takeda Pharmaceutical Company Limited; Consultant, Virtual Scopics; ;

For information about this presentation, contact:

csirlin@ucsd.edu

LEARNING OBJECTIVES

1) To understand the need for LI-RADS. 2) To review basic LI-RADS concepts, terminology, and categories. 3) To become familiar with LI-RADS algorithms. 4) To learn how to contribute to the future development of LI-RADS.

MSES52D Imaging Non-alcoholic Fatty Liver Disease: Fat, Fibrosis, Inflammation

Participants

Amir Borhani, MD, Pittsburgh, PA (*Presenter*) Consultant, Guerbet SA; Author, Reed Elsevier

For information about this presentation, contact:

borhaniiaa@upmc.edu

LEARNING OBJECTIVES

1) Explain epidemiology and natural history of non-alcoholic fatty liver disease. 2) Explain different non-invasive methods for detection and assessment of steatosis. 3) Apply non-invasive methods for detection of fibrosis.

ABSTRACT

Non-alcoholic fatty liver disease (NAFLD) is the most common form of liver disease in developed countries and is expected to be the leading cause of cirrhosis in near future. Spectrum of disease ranges from isolated steatosis to steatohepatitis (NASH) and fibrosis. Since performing tissue biopsy on all NAFLD patients is impossible, imaging (along with other non-invasive laboratory tests) plays a critical role in detection and assessment of stage and severity of disease in these patients. Since majority of patients with NAFLD do not progress to cirrhosis, detection of patients at risk has important clinical and financial value. Specifically, correct detection of inflammation and fibrosis is of paramount value since these two factors are the most important predictors of cirrhosis and mortality. Ultrasound, CT, and MRI have role for detection of significant steatosis, albeit with different sensitivity and specificity profiles. Emerging elastography techniques (using ultrasound and MRI) are very promising modalities to grade severity of fibrosis in subgroup of patients who are at risk of cirrhosis. Radiologists should be familiar with the epidemiology and clinical spectrum of disease in NAFLD and be familiar with imaging findings in the disease spectrum to be able to better detect the subset of patients at risk of cirrhosis.

MSRT53

ASRT@RSNA 2017: High-Field vs Low-Field MR Scanners: What Is the Best Use?

Thursday, Nov. 30 10:30AM - 11:30AM Room: N230B

MR

AMA PRA Category 1 Credit™: 1.00

ARRT Category A+ Credit: 1.00

FDA

Discussions may include off-label uses.

Participants

Subhendra N. Sarkar, PhD, Brookline, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ssarkar@citytech.cuny.edu

LEARNING OBJECTIVES

1) To utilize the benefits of scanning in a high field MR scanner with desirable increase in signal and understand some of the unavoidable changes in tissue contrast at high fields. 2) To understand, for routine clinical applications, the usefulness of strong gradients, usually available at 3T, to obtain high quality MR diffusion, perfusion and 3D imaging. 3) To substitute Gadolinium contrast tumor perfusion imaging in body or brain imaging in compromised kidney function patients by perhaps non-contrast ASL perfusion at, e.g. 3T. 4) To utilize low field magnets if high field ones are not available or in departments with a combination of scanners, and select the best upgrade options to low field scanners to maximize clinical image quality. 5) To clearly distinguish for which indications low field scanners will produce lesser image quality than high field ones and when do low field ones may not alter the diagnosis. 6) To identify the risk of increased tissue heating, signal voids and electronic malfunctions at higher fields for active conditional implants even when those are turned off. 7) To appreciate the benefits of imaging within conservative/conditional guidelines when there exist implant related safety risks but alternative modalities are not adequate. 8) To appreciate that RF coil design and usable physics at high fields may not be the best at this time and hence the high field benefits may be limited. 9) To predict which MRI sequences will work almost equal at 3T and 1.5T while which sequences will work better at high fields. 10) To appreciate some of the advanced applications that clearly produce superior results just due to higher field strength, for example MR spectroscopy, DTI and fMRI.

Active Handout: Subhendra Nath Sarkar

http://abstract.rsna.org/uploads/2017/17001475/Active_MSRT53.pdf

RCA52

3D Printing (Mimics) (Hands-on)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S401AB

IN

AMA PRA Category 1 Credits [™]: 1.50
ARRT Category A+ Credit: 1.75

Participants

Adnan M. Sheikh, MD, Ottawa, ON (*Moderator*) Nothing to Disclose
Adnan M. Sheikh, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Dimitris Mitsouras, PhD, Boston, MA (*Presenter*) Research Grant, Toshiba Medical Systems Corporation;
Leonid Chepelev, MD, PhD, Ottawa, ON (*Presenter*) Nothing to Disclose
Taryn Hodgdon, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Carolina A. Souza, MD, Ottawa, ON (*Presenter*) Consultant, Pfizer Inc; Consultant, Boehringer Ingelheim GmbH ; Consultant, F. Hoffmann-La Roche Ltd; Speaker, Pfizer Inc; Speaker, Boehringer Ingelheim GmbH; Speaker, F. Hoffmann-La Roche Ltd
Waleed M. Althobaity, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Nicole Wake, MS, New York, NY (*Presenter*) In-kind support, Stratasys, Ltd
Peter C. Liacouras, PhD, Bethesda, MD (*Presenter*) Nothing to Disclose
Jonathan M. Morris, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Jane S. Matsumoto, MD, Rochester, MN (*Presenter*) Nothing to Disclose
Elizabeth George, MD, Boston, MA (*Presenter*) Nothing to Disclose
Satheesh Krishna, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Carlos H. Torres, MD, FRCPC, Ottawa, ON (*Presenter*) Nothing to Disclose
Olivier Miguel, BEng, Ottawa, ON (*Presenter*) Nothing to Disclose
Shannon T. Lee, BEng, Ottawa, ON (*Presenter*) Nothing to Disclose
Ekin P. Akyuz, BSc, Ottawa, ON (*Presenter*) Nothing to Disclose
Andy Christensen, BS, Littleton, CO (*Presenter*) Consultant, 3D Systems, Inc; Consultant, Integrum AB; Board Member, Integrum AB
Amy E. Alexander, BEng, Rochester, MN (*Presenter*) Nothing to Disclose
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LEARNING OBJECTIVES

1) To become familiar with the computational processing of cross-sectional images required to enable 3D printing using practical examples from diverse organ systems and pathologies. 2) To learn to use software to identify and extract anatomical parts from cross-sectional images using manual and semi-automated segmentation tools, including thresholding, region growing, and manual sculpting. 3) To gain exposure to techniques involving model manipulation, refinement, and addition of new elements to facilitate creation of customized models. 4) To learn the application of tools and techniques, including 'wrapping' and 'smoothing' to enable the accurate printing of the desired anatomy, pathology, and model customizations using Computer Aided Design (CAD) software. 5) To become exposed to Standard Tessellation Language (STL) file format and interfacing with a 3D printer.

ABSTRACT

3D printing is gaining traction and momentum in the clinical setting, with constantly evolving advances in printing and software technologies. Recently, the RSNA 3D Printing Special Interest Group has adopted a position statement reflecting the FDA recommendation for FDA-approved software to be used where 3D printed models used for clinical applications are created. This course covers the use of industry-standard FDA-cleared software for the design and fabrication of 3D printed models for a diverse range of pathologies. Musculoskeletal, body, neurological, and vascular systems and related pathologies will be segmented as part of this course and practically usable models will be created as part of this course to reflect the expanding applications of 3D printing. The purpose of this hands-on course is to convert a set of DICOM files into a 3D printed model through a series of simple steps. Some of the initial post-processing steps may be familiar to the radiologist, as they share common features with 3D visualization tools that are used for image post-processing tasks such as 3D volume rendering. However, some are relatively or completely new to radiologists, including the manipulation of files in Standard Tessellation Language (STL). It is the STL format that is read by the 3D printer and used to reproduce a part of the patient's anatomy by depositing material in a layer-by-layer fashion. This 90 minute session will begin with a DICOM file and review the commonest tools and techniques required to create a customized printable STL model. An extensive training manual will be provided before the meeting. It is highly recommended that participants review the training manual to optimize the experience at the workstation.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality

educational content in their field of study. Learn how you can become an honored educator by visiting the website at:
<https://www.rsna.org/Honored-Educator-Award/> Carlos H. Torres, MD,FRCPC - 2017 Honored Educator

RCB52

RSNA Diagnosis Live Interactive and Mobile Device Integrated Audience Response: Tips, Tricks, and How to Get Started (Hands-on)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S401CD



AMA PRA Category 1 Credits [™]: 1.50

ARRT Category A+ Credit: 0

Participants

Christopher G. Roth, MD,MS, Philadelphia, PA (*Moderator*) Nothing to Disclose

Christopher G. Roth, MD,MS, Philadelphia, PA (*Presenter*) Nothing to Disclose

Sandeep P. Deshmukh, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

RCC52

What's New in IHE: Recent Radiology Profiles to Enhance Practice

Thursday, Nov. 30 10:30AM - 12:00PM Room: S501ABC



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

David S. Mendelson, MD, Larchmont, NY (*Moderator*) Spouse, Employee, Novartis AG Advisory Board, Nuance Communications, Inc Advisory Board, General Electric Company Advisory Board, Toshiba Medical Systems Corporation Advisory Board, Bayer AG
Michael A. Bohl, RT, Davenport, IA (*Presenter*) Owner, Dose Registry Support Services
Teri M. Sippel Schmidt, MS, Hartland, WI (*Presenter*) Employee, Toshiba Medical Systems Corporation; ;
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LEARNING OBJECTIVES

1) What problems these profiles address. 2) What values these profiles provide. 3) Provide an overview regarding how these profiles address the technical issue.

ABSTRACT

The goal of IHE is to provide practical standard-based integration profiles that address real world healthcare interoperability problems. In this session, we will present a number of profiles published recently by the Radiology domain that can enhance your clinical practices. The profiles to be presented are: - Clinical Decision Support Order Appropriateness Tracking o how to propagate the Clinical Decision Support and Appropriate Use Criteria information to various systems in a Radiology reporting workflow - Management of Acquisition Protocol o supports the collection of scan protocols from acquisition modalities, their review, approval, archival and re-distribution to modalities - Web-based Image Access o Defines methods for image sharing and interactive viewing of imaging studies using RESTful services. The method can be used standalone or enhance existing infrastructure such as XDS-I or MHD This session will also describe the two profiles on which work has just started. Publication of these two is expected in mid-2018. - Import and Display of External Priors o supports the ability to locate, access and view external priors from outside the reading institution for direct comparison. This profile focuses on a pragmatic solution that can enhance existing installed PACS without significant upgrades or modifications. - Encounter-based Imaging Workflow o Specify how to integrate image capture devices with appropriate encounter-based contextual metadata automatically such that these images are easily accessible throughout the enterprise

SSQ01

Breast Imaging (MRI Diagnostics)

Thursday, Nov. 30 10:30AM - 12:00PM Room: E450A

BR **MR**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Wendy B. Demartini, MD, Stanford, CA (*Moderator*) Nothing to Disclose
Bonnie N. Joe, MD, PhD, San Francisco, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSQ01-01 Prospective and Randomized Intra-individual Comparison of Gadoterate Meglumine versus Gadobenate Dimeglumine at 3 Tesla: Evaluation with a Reduced Dose of Gadobenate Dimeglumine

Thursday, Nov. 30 10:30AM - 10:40AM Room: E450A

Participants

Paola Clauser, MD, Vienna, Austria (*Presenter*) Nothing to Disclose
Thomas H. Helbich, MD, Vienna, Austria (*Abstract Co-Author*) Research Grant, Medisor, Inc Research Grant, Siemens AG Research Grant, C. R. Bard, Inc
Claudio Spick, MD, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Panagiotis Kapetas, Vienna, Austria (*Abstract Co-Author*) Nothing to Disclose
Maria Bernathova, MD, Wien, Austria (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To compare a standard dose of Gadoterate Meglumine (Gd-DOTA 0.15 mmol/kg) to a half dose of a high relaxivity contrast agent (Gadobenate Dimeglumine, Gd-BOPTA 0.075 mmol/kg) for breast lesion detection and characterization at 3 Tesla.

METHOD AND MATERIALS

Eligible for this IRB-approved prospective, randomized, intra-individual comparison study were patients with suspicious findings (BI-RADS 4 or 5) on conventional breast imaging (i.e. mammography, tomosynthesis or ultrasound) undergoing additional 3T MR imaging of the breast including high spatiotemporal resolution DCE (TWIST), T2w-TSE and DWI according to international recommendations. Two repeated, identical examinations at least 24h apart from each other were performed with both contrast agents being administered in a randomized order. Histology was defined as standard of reference. Three blinded breast radiologists, not affiliated with the site of enrollment, evaluated the examinations off-site. Lesion detection rate, sensitivity, specificity and accuracy were calculated per-lesion and per-region, and compared using the McNemar test. Multivariate analysis was used to control for inter-reader performance.

RESULTS

109 patients were prospectively recruited. Excluded were 5 patients due to technical problems or lack of reference standard. Finally, 104 women with 142 histologically verified breast lesions (109 malignant and 33 benign) were enrolled. Detection rate with Gd-BOPTA (84.5-88.7%) was not inferior to Gd-DOTA (84.5%-90.8%), $P>0.165$. In the per-region analysis, Gd-BOPTA had a significantly higher specificity (96.4%-98.7% vs 92.6-97.3%) and accuracy (96.3-97.8% vs 93.6-96.1%) as compared to Gd-DOTA for all three readers. Multivariate analysis demonstrated a reader-independent superior accuracy with Gd-BOPTA.

CONCLUSION

A reduced dose of Gd-BOPTA 0.075 mmol/kg is not inferior to a standard dose of Gd-DOTA 0.15 mmol/kg in breast lesion detection, and superior in lesion characterization at 3T breast MRI.

CLINICAL RELEVANCE/APPLICATION

A reduced dose of Gd-BOPTA (0.075 mmol/kg) achieves breast MRI lesion detection comparable to a standard dose of Gd-DOTA, with a superior diagnostic performance. A reduced dose of Gd-BOPTA can be safely used in clinical practice at 3T breast MRI.

SSQ01-02 American College of Radiology Imaging Network (ACRIN) 6702 Diffusion-Weighted Breast MRI Trial: Image Quality and Factors Associated with Lesion Evaluability

Thursday, Nov. 30 10:40AM - 10:50AM Room: E450A

Participants

Averi Kitsch, BS, Seattle, WA (*Abstract Co-Author*) Nothing to Disclose

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Jennifer Whisenant, PhD, Nashville, TN (*Presenter*) Nothing to Disclose
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PURPOSE

Diffusion-weighted imaging (DWI) has potential to improve conventional breast MRI specificity. Most DWI sequences use a single-shot echo planar imaging-based readout, which is prone to artifacts that may limit breast DWI reliability. The ACRIN 6702 multisite trial investigated DWI performance for diagnosing breast lesions. Here we describe DWI quality and factors affecting evaluability of apparent diffusion coefficient (ADC) values in breast lesions in the trial.

METHOD AND MATERIALS

The IRB-approved trial was performed at ten institutions on multiple 1.5T and 3T MRI platforms (Philips, GE, and Siemens). Women with MRI-detected BI-RADS 3, 4, or 5 lesions were enrolled in the study (from 3/2014 to 4/2015). Multi b-value (0, 100, 600, 800 s/mm²) DWI was performed in clinical breast MR exams. Each DWI scan was reviewed for image quality factors: fat suppression, signal-to-noise ratio (SNR), artifacts (magnetic susceptibility distortion, aliasing, chemical shift), and misregistration (from eddy-current-induced distortion). Lesions were considered not evaluable if significant image quality factors and/or lack of lesion visibility (due to partial volume averaging) prevented ADC measurement. Associations between image quality factors, field strength, lesion type (mass vs. non-mass), size, and evaluability were explored by Fisher's exact test.

RESULTS

ACRIN 6702 included 103 women with 142 lesions, of which 42 (41%) exams were performed at 1.5T and 61 (59%) at 3T. Poor or incomplete fat suppression affected 21% (22/103) of DWI scans, poor SNR 20% (21/103), artifacts 31% (32/103), and misregistration 20% (21/103). Exams at 1.5T were more prone to misregistration ($p=0.002$), while 3T exams exhibited more aliasing artifacts ($p=0.003$). ADC was evaluable for 100/142 (70%) lesions; factors associated with non-evaluability ($p<0.05$) included poor SNR, misregistration, and small lesion size $<10\text{mm}$ (most common factor), but not lesion type or magnetic field strength.

CONCLUSION

This multisite breast DWI trial shows image quality remains a challenge, precluding measurement of 30% of lesions. Protocol optimization and technical advancements are needed to improve reliability and potential for widespread clinical implementation.

CLINICAL RELEVANCE/APPLICATION

Given strong data from this ACRIN 6702 trial that DWI can reduce false-positive breast MRIs, further research investment to improve image quality is warranted to facilitate clinical translation.

SSQ01-03 Contralateral Parenchymal Enhancement on Dynamic Contrast-Enhanced MRI is Complemented by Genomic ER-Pathway Data in Stratifying Outcome of ER+HER2 - Breast Cancer Patients

Thursday, Nov. 30 10:50AM - 11:00AM Room: E450A

Participants

Bas H. van der Velden, MSc, Utrecht, Netherlands (*Presenter*) Nothing to Disclose
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PURPOSE

High contralateral parenchymal enhancement (CPE) on dynamic contrast-enhanced MRI in the healthy breast of patients with ER+HER2- breast cancer receiving hormonal therapy has been associated with superior overall survival (OS). For patients with intermediate CPE, results have been inconclusive. The purpose of this retrospective study was to explore whether estrogen receptor (ER)-pathway activity derived from genomic data of the primary tumor is able to complement CPE in patient risk stratification.

METHOD AND MATERIALS

Between 2000 and 2008, 415 patients with ER+HER2- breast cancer eligible for breast-conserving therapy based on conventional imaging and physical examination received a preoperative MRI in study context. 181 Patients received hormonal therapy. Fresh-frozen tumor tissue of 104 patients was available for RNA sequencing. CPE was calculated using previously reported method. In short, parenchyma was automatically segmented, after which CPE was calculated as the mean of the top-10% relative signal increase. The ER-pathway activity of the tumor was assessed using unsupervised clustering of RNA, protein, and DNA copy number data from the TCGA database [Bismeyer et al.], and re-applied on the current dataset. The assay is strongly associated with activation of ESR1 targets. CPE and ER-pathway were each split in three groups (high, intermediate, low). OS was analyzed using Cox's models between CPE groups, ER-pathway groups, and combinations thereof.

RESULTS

The average patient age was 57 years (range: 32-84). The median follow-up was 87 months (range: 34-146). An event occurred in

11/104 (11%) patients. Patients with high CPE (n=38, 1 event) showed superior OS compared to those with low CPE (n=31, 7 event, $P=.043$), while for intermediate CPE (n=35, 33%) the test was inconclusive ($P=.13$). Differences in OS were observed between high and low ER-pathway, although not significant ($P=0.12$). When combined, patients with low CPE and low ER-pathway activity (n=52, 10 events) showed significantly worse survival than other patients (n=52, 1 event, $P=.027$).

CONCLUSION

CPE appears to be complemented by genomic-derived ER-pathway activity in stratifying patient survival.

CLINICAL RELEVANCE/APPLICATION

Combination of preoperative parenchymal enhancement on MRI of the healthy breast and ER-pathway activity in the primary tumor may predict therapy outcome more efficiently than either one alone.

SSQ01-04 Quantitative Measurement of Background Parenchymal Enhancement in Postmenopausal Women

Thursday, Nov. 30 11:00AM - 11:10AM Room: E450A

Awards

Student Travel Stipend Award

Participants

Eugene Won, MD, New York, NY (*Presenter*) Nothing to Disclose
Alana A. Lewin, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Sunghoon G. Kim, PhD, New York, NY (*Abstract Co-Author*) Nothing to Disclose
Linda Moy, MD, New York, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate MRI contrast material-enhancement kinetics of breast background parenchyma (BPE) in postmenopausal women with benign and malignant lesions using a semiautomatic method of segmenting fibroglandular tissue for quantitative measurement.

METHOD AND MATERIALS

The institutional review board approved this retrospective HIPAA-compliant study, and informed consent was waived. From January 1, 2013 to December 31, 2013, 83 postmenopausal women who had undergone contrast-enhanced MRI at 3T (90 s/frame) were identified. BPE in 53 malignant cases (age 61.57 ± 8.39 ; range 50-83) and 30 benign cases (age 60.43 ± 7.60 ; range 50-76) were analyzed. A method based on principal component analysis (PCA) was used to semi-automatically segment the fibroglandular tissues. The primary eigen component was used for quantitative analysis of signal enhancement in the breast parenchyma in terms of the percentage of enhancement (PE) for the initial (90 s) and delayed (360 s) post-contrast time points. Lesion-PE was measured using manually drawn regions of interest. Statistical analyses were performed using the Mann-Whitney U test.

RESULTS

53 malignant cases, of which 37 were invasive ductal carcinoma (IDC), 11 invasive lobular carcinoma (ILC), and 5 other invasive malignancies, were identified. 30 benign cases of which 11 were fibrocystic changes, 11 stable findings on imaging, and 8 others, were identified. There was no statistical difference in age and lesion size among these 3 groups. No statistical difference existed between initial and delayed BPE-PE in malignant cases compared to benign cases ($p=0.051$; $p=0.09$). In women with ILC, the initial and delayed BPE-PE values were significantly higher than in women with IDC ($p=0.022$ and $p=0.02$, respectively) and in women with benign lesions ($p=0.006$ and $p=0.01$, respectively). Lesion-PEs were not significantly different between IDC and ILC cases.

CONCLUSION

Higher BPE-PEs were seen in cases with malignant lesions compared to those with benign lesions. The sub-group analysis showed that cases with ILC have higher BPE-PE than those with IDC and with benign lesions.

CLINICAL RELEVANCE/APPLICATION

Significantly increased BPE in postmenopausal ILC cases, compared to IDC and benign cases, may be associated with ILC development in the absence of progesterone after menopause.

SSQ01-05 Impact of a Novel Abbreviated Breast MRI Protocol on Kinetic Analysis of Benign and Malignant Lesions

Thursday, Nov. 30 11:10AM - 11:20AM Room: E450A

Participants

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Shinnhuey S. Chou, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ken Chang, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Jayashree Kalpathy-Cramer, MS, PhD, Charlestown, MA (*Abstract Co-Author*) Consultant, Infotech Software Solution
Constance D. Lehman, MD, PhD, Boston, MA (*Abstract Co-Author*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company

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PURPOSE

To compare kinetic analyses and discrimination of benign and malignant lesions based on a novel abbreviated breast MRI (AB-MRI) versus a traditional extended dynamic contrast-enhanced MRI (DCE-MRI) protocol.

METHOD AND MATERIALS

This IRB-approved retrospective study included 162 patients with 177 lesions (84 imaged with AB-MRI and 93 imaged with DCE-MRI) assessed as BI-RADS category 4, 5, and 6 between 10/1/2015-8/31/2016. Traditional DCE-MRI included one pre and three post-

contrast phases: initial phase at 60-75 seconds and the third phase at 420-450 seconds post contrast (45 minutes total scan time). AB-MRI included one pre and two post-contrast phases: initial phase at 60-75 seconds and the second phase at 180-205 seconds post contrast (<10 minutes total scan time). Computer-aided kinetic analyses of lesions included delayed-phase volume percentages of washout, predominant curve type, and worst curve type, which were compared using Wilcoxon rank-sum test and Chi-Square test. Receiver operating curve (ROC) analyses for discrimination of benign and malignant lesions were performed.

RESULTS

The AB-MRI group consisted of 21 benign, 2 high risk, and 61 malignant lesions; the traditional DCE-MRI group consisted of 19 benign, 8 high risk, and 66 malignant lesions. Mean delayed-phase percentages of washout were 8% [range 0-45%] versus 9% [range 0-62%] ($p=0.36$) for benign lesions and 19% [range 0-92%] versus 17% [range 0-71%] ($p=0.66$) for malignancies in the AB-MRI and DCE-MRI groups respectively. No significant differences were found in the predominant and worst curve types for malignant and benign lesions between protocols ($p>0.05$). There were no significant differences between the AB-MRI and DCE-MRI in areas under the ROC curves (AUC) for delayed-phase percent washout (AUC 0.67 vs. 0.69, $p=0.81$), predominant curve type (AUC 0.62 vs. 0.55, $p=0.45$), or worst curve type (AUC 0.50 vs. 0.56, $p=0.53$).

CONCLUSION

Our study suggests that our novel AB-MRI protocol does not negatively impact the kinetic analyses and discrimination of benign and malignant lesions compared to traditional DCE-MRI, with malignant lesions demonstrating higher percentages of washout than benign lesions with both protocols.

CLINICAL RELEVANCE/APPLICATION

Abbreviated breast MRI protocol can improve patient comfort and workflow without the loss of diagnostic kinetic information.

SSQ01-06 Diagnostic Value of Electronic Property Tomography (EPT) For Differentiating Benign from Malignant Lesions: Comparison with Standard Dynamic Contrast-Enhanced MRI

Thursday, Nov. 30 11:20AM - 11:30AM Room: E450A

Participants

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David V. Schacht, MD, Chicago, IL (*Abstract Co-Author*) Nothing to Disclose
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Norihisa Nitta, MD, Kyoto, Japan (*Abstract Co-Author*) Nothing to Disclose
Kiyoshi Murata, MD, Otsu, Japan (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To compare diagnostic utility of EPT to standard DCE-MRI for differentiating benign from malignant lesions.

METHOD AND MATERIALS

Between January 2014 and December 2015, consecutive 67 patients with 83 breast lesions (33 benign and 50 malignant) underwent an IRB-approved 3T-MRI, including 3D turbo spin echo (TSE) sequence and standard dynamic contrast-enhanced (DCE)-MRI scans. Given the transverse phase Φ of a TSE image, EPT estimates tissue conductivity via $\sigma=(\Delta\Phi)/(2\mu_0\omega)$ with Δ the Laplace operator, μ_0 the magnetic permeability (assumed to be constant), and ω the Larmor frequency. The lesions were segmented semi-automatically using subtraction DCE-MR images (post-pre-contrast), and the segmented volume of the lesions was registered to the phase images. Conductivity reconstruction was performed only inside lesion volumes, and the mean conductivity of the lesion was obtained. From the standard DCE-MRI, a single voxel within each lesion that had the highest signal intensity on the early image was selected, and the initial enhancement rate and the signal enhancement ratio (SER) were calculated as follows: the initial uptake = $(S_{\text{early}} - S_{\text{pre}})/S_{\text{pre}}$, $SER = (S_{\text{early}} - S_{\text{pre}})/(S_{\text{delayed}} - S_{\text{pre}})$. The parameters from EPT and standard DCE-MRI were compared between benign and malignant lesions. $P<0.05$ was considered significant. After Bonferroni correction of 4 multiple comparisons, the critical value became $<0.0125(0.05/4)$.

RESULTS

The mean conductivity of malignant lesions ($1.32\pm1.21S/m$) was significantly higher than benign lesions ($-0.09\pm1.77S/m$) ($p<0.0001$). The SER of malignant lesions (1.19 ± 0.27) was significantly higher than benign lesions ($0.89\pm0.32S/m$) ($p<0.0001$), whereas the initial uptake did not show significant difference between benign and malignant lesions ($p=0.027$). Receiver operating curve (ROC) analysis revealed that the area under the curve (AUC) of the mean conductivity and SER was 0.76 and 0.82, respectively. There was no significant difference in AUC between the mean conductivity and SER ($p=0.41$).

CONCLUSION

The mean conductivity might be comparable to standard DCE-MRI for differentiation between benign and malignant lesions.

CLINICAL RELEVANCE/APPLICATION

The mean conductivity measured by EPT might be comparable to standard DCE-MRI for differentiation between benign and malignant lesions.

SSQ01-07 Prediction of Low-Risk Ductal Carcinoma in Situ using Whole-Lesion Histogram Analysis of the Apparent Diffusion Coefficient

Thursday, Nov. 30 11:30AM - 11:40AM Room: E450A

Participants

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PURPOSE

To investigate the value of histogram-derived apparent diffusion coefficient (ADC) metrics obtained from whole-lesion assessment of diffusion-weighted imaging (DWI) for predicting a low-risk ductal carcinoma in situ (DCIS).

METHOD AND MATERIALS

The institutional review board approved this retrospective study, and waived informed consent. The authors identified 93 women (mean age, 51.9 years; range, 32-76 years) with pure DCIS, who had undergone preoperative MR imaging and DWI from 2013 to 2016. Histogram analysis of pixel-based ADC data of the whole tumor volume and conventional measurement of the mean ADC by placing regions of interest were performed by two radiologists. The mean, median, and 5th and 95th percentile ADCs obtained from whole-lesion histogram and the ROI-based mean ADC were compared between low-grade and non-low-grade DCIS. Associations of whole-lesion histogram ADC metrics with low-grade DCIS were evaluated by receiver operating characteristics (ROC) curve and logistic regression analyses.

RESULTS

In whole-lesion histogram analysis, the mean, median, and 5th and 95th percentile ADCs were significantly different between low-grade and non-low-grade DCIS (1.522, 1.536, 1.207, and $1.854 \times 10^{-3} \text{ mm}^2/\text{s}$ versus 1.270, 1.261, 0.917, and $1.657 \times 10^{-3} \text{ mm}^2/\text{s}$, respectively; $P=0.004$, $P=0.004$, $P=0.003$, and $P=0.024$, respectively). However, ROI-based mean ADC was not significantly different ($P=0.278$). ROC curve analysis for the differentiation between low-grade and non-low-grade DCIS groups revealed that the most effective threshold for the 5th percentile ADC was $> 1.078 \times 10^{-3} \text{ mm}^2/\text{s}$ (sensitivity 80%, specificity 75.9%, area under the curve [AUC] 0.786, $P=0.001$). No differences in the AUC were found among the ADC metrics of whole-lesion histogram. Multivariate regression analysis revealed that a higher 5th percentile ADC ($> 1.078 \times 10^{-3} \text{ mm}^2/\text{s}$; odds ratio [OR]=10.494, $P=0.016$), smaller tumor size ($\leq 2 \text{ cm}$; OR=12.692, $P=0.008$), and low Ki-67 status ($< 14\%$; OR=10.879, $P=0.046$) were significantly associated with low-grade DCIS.

CONCLUSION

Assessment with whole-lesion histogram analysis of the ADC could be helpful for identifying patients with low-risk DCIS.

CLINICAL RELEVANCE/APPLICATION

Whole-lesion histogram ADC metrics may serve as DWI biomarkers of DCIS biology, which could help to reduce overtreatment in patients with low-risk DCIS.

SSQ01-08 Unenhanced Breast MRI during Pregnancy Using Diffusion Tensor Imaging (DTI) Parametric Maps: A Feasibility Study

Thursday, Nov. 30 11:40AM - 11:50AM Room: E450A

Participants

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Shani Paluch-Shimon, MD, Tel Hashomer, Israel (*Abstract Co-Author*) Nothing to Disclose
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Anat Shalmon, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
Michael Gotlieb, MD, Ramat Gan, Israel (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To investigate the feasibility and clinical utility of DTI parametric maps in the diagnostic workup of pregnancy-associated breast cancer

METHOD AND MATERIALS

This prospective study was approved by our institutional IRB, and a signed informed consent was obtained from all participants. Since November 2016, thirteen pregnant patients (median gestational age: 17 weeks, range: 8-30w) were examined by unenhanced breast MRI protocol. Indications included: newly diagnosed pregnancy-associated breast cancer (PABC) (n=5), follow-up on high-risk patients (n=7) and on neoadjuvant-chemotherapy (NAC) treated patient (n=1). MRI protocol included T2-weighted and DTI sequences, recorded at 1.5T (GE) using a breast coil, with total scan duration of ~12min. DTI was acquired using 32 directional diffusion gradients and 0, 700 s/mm² b-values. DTI parametric maps of the principal diffusion coefficients ($\lambda_1, \lambda_2, \lambda_3$), mean diffusivity (MD), fractional anisotropy (FA) and maximal anisotropy index ($\lambda_1 - \lambda_3$) were generated and analyzed at pixel resolution using a proprietary software. Regions of interest (ROIs) of lesions and the normal fibroglandular tissue were delineated on λ_1 maps and were statistically compared using Student's t-tests.

RESULTS

All scans were completed. One patient complained on positional discomfort during the scan which was endured with extra supports but still ended up with significant artifacts. All other scans were in diagnostic quality and artifact-free. All five known tumors were detected by DTI maps of $\lambda_1, \lambda_2, \lambda_3$, MD and $\lambda_1 - \lambda_3$ in agreement with their localization based on clinical/mammographic/sonographic findings, exhibiting substantial contrast compared with the ROIs of the apparently-normal surrounding tissue ($p < 0.001$, for all). Representative images of 36 y patient diagnosed with IDC at the 17th week of pregnancy are presented in Fig1. FA ROIs did not help in differentiating malignant and normal tissues ($p=0.48$). Scans of high risk patients did not

reveal any new suspicious finding, in agreement with US exam. Residual tumor was not identified in the scan of the patient receiving NAC, in agreement with DCE MRI, performed several weeks later after delivery.

CONCLUSION

DTI examination is safe, non-invasive, fast and well-tolerated by pregnant patients and DTI parametric maps helped in characterizing PABC.

CLINICAL RELEVANCE/APPLICATION

DTI appears to have a promising diagnostic value in breast imaging during pregnancy

SSQ01-09 Texture Analysis for Non-Mass Enhancement on Breast MRI: A Preliminary Experience

Thursday, Nov. 30 11:50AM - 12:00PM Room: E450A

Participants

Mariko Goto, MD, Kyoto, Japan (*Presenter*) Nothing to Disclose

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Koji Sakai, Kyoto, Japan (*Abstract Co-Author*) Research funded, Siemens AG; Speaker, Terumo Corporation; Author, Medical View Co, Ltd

Maki Kiba, Kyoto-Shi, Japan (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To evaluate the usefulness of texture analysis for diagnosis of non-mass enhancement (NME) on breast dynamic contrast enhanced (DCE) magnetic resonance imaging (MRI).

METHOD AND MATERIALS

84 patients with 86 NME lesions on breast MRI (from March 2010 to March 2013) were enrolled in this retrospective study (35 benign and 51 malignant with 33 invasive breast cancers (IBC) and 18 ductal carcinomas in situ (DCIS)). Three-dimensional histogram analysis and gray-level co-occurrence matrix (GLCM) based textural features were extracted from lesions' volume of interest (VOI) depicted on both early and delayed phases of DCE-MRI acquired by a 1.5T MRI scanner. In each NME, two different VOIs were placed; VOI-1 was carefully set to include only the enhancing areas, and VOI-2 was placed to cover the whole enhancing region including intervenient non-enhancing areas. Mann-Whitney U-test with false discovery rate control was applied for two groups to compare the extracted textural features in VOI-1; 1) benign and malignant lesions, 2) IBC and DCIS. Several diagnostic models were constructed with elastic net using VOI-1 and -2 data. Receiver operating characteristic (ROC) analysis was performed to evaluate these models. Then the models from 1.5T MRI were validated by comparing it with 3T DCE-MRI data sets (10 benign and 20 malignant with 10 IBC and 10 DCIS).

RESULTS

Total of 138 textural features were derived from VOI-1, and some of them showed statistical significant difference in benign vs malignant and in IBC vs DCIS. By the ROC analysis of benign vs malignant NME, area under curves (AUC) with best performance were 0.854 and 0.849, respectively for VOI-1 and -2. Analysis of IBC vs DCIS were 0.936 and 0.933, respectively for VOI-1 and -2. Diagnostic performance between different VOI settings did not show statistically significant differences neither in benign vs malignant ($p = 0.891$), nor in IBC vs DCIS ($p = 0.933$). The AUCs of 1.5T were comparable to the results of 3T DCE-MRI.

CONCLUSION

Texture analysis using breast DCE-MRI for NME showed good diagnostic performance for the differentiation of malignant vs benign lesions, and of DCIS vs IBC, regardless of the VOI settings.

CLINICAL RELEVANCE/APPLICATION

Texture analysis of breast MRI may be one of the promising tools to improve the diagnostic performance and may provide us with quantitative measures of internal structure for non-mass enhancement.

SSQ02

Science Session with Keynote: Cardiac (Coronary Artery Disease: General II)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S502AB

CA CT

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Konstantin Nikolaou, MD, Tuebingen, Germany (*Moderator*) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG
Gregory Kicska, MD, PhD, Seattle, WA (*Moderator*) Nothing to Disclose

Sub-Events

SSQ02-01 Cardiac Keynote Speaker: Coronary Artery Stent Evaluation by CT Angiography

Thursday, Nov. 30 10:30AM - 10:50AM Room: S502AB

Participants

Gregory Kicska, MD, PhD, Seattle, WA (*Presenter*) Nothing to Disclose

SSQ02-03 Head-To-Head Comparison between Coronary CT Angiography and OCT for In-Stent Restenosis after Drug-Eluting Stent Implantation

Thursday, Nov. 30 10:50AM - 11:00AM Room: S502AB

Participants

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PURPOSE

To evaluate characteristics of coronary computed tomography angiography (CCTA) findings of neointimal hyperplasia in patients diagnosed coronary stent failure and compare the quantitative measurements of CCTA with optical coherence tomography (OCT) defined in-stent neoatherosclerosis in section-to-section-level.

METHOD AND MATERIALS

Total number of 370 CCTA and OCT cross-sections (18 coronary stent lesions in 18 consecutive patients who diagnosed stent failure from Aug 2008 to Dec 2013 and underwent both pre-procedural OCT and CCTA) were included. Stent area, lumen area, in-stent intimal hyperplasia (IH) area, IH% (IH area/lumen area $\times$ 100), lipid quadrant, and presence of thin-cap fibroatheroma (TCFA), rupture and thrombus were evaluated using OCT. CT measurements (stent area, lumen area, IH area and IH%) were compared with OCT-derived parameters. Lumen and IH attenuation were measured on CT. CT parameters were analyzed according to lipid quadrant (sections with $\leq$ 2 lipid quadrants (n=146) vs. 3 or 4 quadrants (n=117)) or presence of TCFA (n=39).

RESULTS

Stent area ($r=0.66$, $p<0.001$) and lumen area ($r=0.43$, $p<0.001$) showed moderate correlation, however, IH area ($r=0.34$, $p<0.001$) and IH% ($r=0.19$, $p<0.001$) showed mild or weak correlation between CT and OCT. Sections with high lipid quadrant (3 or 4) showed low IH attenuation (395 Hounsfield unit [HU]) on CT compared to those with $\leq$ 2 lipid quadrant ($p<0.001$). Neointimal rupture (n=15) or thrombi (n=17) were noted only in sections with high lipid quadrant (each, $p<0.001$). In multivariate logistic analysis, high lipid quadrant was significantly associated with lumen attenuation (OR, 0.994; 95%CI 0.989 - 1.00; $p=0.04$), IH% (OR, 1.046; 95%CI 1.004 - 1.090; $p=0.03$) and IH attenuation (OR, 0.996; 95%CI 0.992 - 0.999; $p=0.01$) measured on CT. Sections with TCFA presented larger IH area (3.7mm²) and smaller lumen area (1.8 mm²) than those without TCFA (3.2 mm² and 2.1 mm²). Presence of TCFA was associated with IH% (OR, 1.057; 95%CI 1.006 - 1.111; $p=0.03$) on CT.

CONCLUSION

Stent area and lumen area were moderately correlated between CT and OCT. High lipid quadrant in OCT is associated with lumen attenuation, IH attenuation and IH% on CT. TCFA is associated with IH% measured on CT.

CLINICAL RELEVANCE/APPLICATION

Quantitative parameters for in-stent restenosis measured on CCTA may be helpful to assess the presence of high lipid quadrant or

SSQ02-04 Non-invasive Evaluation of Soft-Plaque-Restenosis in Coronary Artery Stents: Initial In-vitro Comparison of a Spectral Photon Counting CT and a Spectral Dual-Layer CT System

Thursday, Nov. 30 11:00AM - 11:10AM Room: S502AB

Participants

Tilman Hickethier, MD, Cologne, Germany (*Presenter*) Nothing to Disclose
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Salim Si-Mohamed, Lyon, France (*Abstract Co-Author*) Nothing to Disclose
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Monica Sigovan, PhD, Lyon, France (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Even when compared to the latest spectral dual layer CT systems (SDLCT) future spectral photon counting detector CT systems (SPCCT) promise an improved spatial resolution as well as decreased stent related blooming artifacts, two likely beneficial characteristics for the challenging task of evaluating in-stent restenosis. Therefore, we investigated the influence of different conventional (Conv) and monoenergetic (MonoE) reconstructions from a SDLCT and a SPCCT on the delineation of soft-plaque-restenosis in coronary stents.

METHOD AND MATERIALS

Artificial stenosis (~30HU) were implanted into 10 different coronary stents (diameter 3mm) embedded in plastic tubes filled with Iohexol-based contrast agent (~400HU). CT data was acquired with a 128-slice SDLCT (IQon, Philips, 120kV, 100mAs, 0.2x0.2x0.67mm³ voxel size (VS)) and a 9-slice SPCCT (Prototype, Philips, 120kV, 100mAs, 0.2x0.2x0.25mm³ VS). Sharp FBP kernels were used for reconstructions with Conv and MonoE at 50, 70, 100 and 140keV. Visibility of the stenosis and the remaining lumen was evaluated by 2 readers for each stent and reconstruction using a 5-point Likert scale: 1= image quality impedes lumen assessment; 2=lumen appears stenosed, extent unclear; 3=stenosis and extent clear, remaining lumen undistinguishable; 4=stenosis clear and remaining lumen slightly distinguishable; 5= stenosis and remaining lumen clear.

RESULTS

Interrater agreement was very good (weighted kappa=0.9). Stenosis delineation was best in Conv, 50 and 70keV MonoE SPCCT images (median score 5). Differentiation was significantly more difficult in the corresponding SDLCT images (median score 3; p<0.01). Despite visibly lower stent blooming artifacts, 100 and 140keV MonoE images showed significantly poorer results compared to the corresponding 50keV MonoE images due to reduced contrast enhancement resulting in impaired visualization of the unaltered stent lumen (median score of 2 for 100keV and 1 for 140keV on both scanners; p<0.01).

CONCLUSION

Evaluation of soft-plaque-restenosis can be significantly improved by using conventional and low keV MonoE reconstructions of future SPCCT. High keV MonoE reconstructions are not recommended for coronary stent assessment with SPCCT or SDLCT due to impeded stenosis delineation.

CLINICAL RELEVANCE/APPLICATION

SPCCT will have the potential to significantly improve the important but still challenging non-invasive evaluation of coronary stents and possible restenosis.

SSQ02-05 Low-Dose Coronary CT Angiography with 30 ml Contrast Medium And Monochromatic Imaging Using Dual-Layer Spectral Detector CT

Thursday, Nov. 30 11:10AM - 11:20AM Room: S502AB

Participants

Man Wang, Beijing, China (*Presenter*) Nothing to Disclose
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Zheng Yu Jin, MD, Beijing, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate the feasibility of monochromatic imaging for coronary CT angiography (CCTA) with 30 ml contrast medium and low radiation dose.

METHOD AND MATERIALS

Thirty patients with suspected ischemic heart disease underwent CCTA on a dual-layer spectral detector CT. All images were acquired with step-and-shoot mode using 120 kVp, 104.4 ± 27.6 mAs with automatic current modulation. Due to the nature of dual-layer detector, the conventional and spectral image data were acquired within the same scan. The conventional and monochromatic 50 keV images were reconstructed. The objective image quality (IQ) was evaluated by placing region-of-interest (ROI) on aorta root (AO), left main artery (LM), distant segment of left anterior descending (LAD), left circumflex (LCX) and right coronary artery (RCA). The attenuation, noise and signal-to-noise ratio (SNR) were measured on conventional and monochromatic images. The subjective IQ was assessed by 2 raters independently using a 4-point scale (1 - excellent, 4 - undiagnostic).

RESULTS

The attenuation of AO, LM, LAD, LCX and RCA was 311.9 ± 73.9, 297.4 ± 77.3, 210.6 ± 45.3, 214.8 ± 61.1 and 233.1 ± 82.1 HU on conventional images, 634.5 ± 173.2, 569.9 ± 175.7, 353.5 ± 80.9, 372.9 ± 105.4 and 410.5 ± 153.7 HU on monochromatic images. The noise and SNR of AO was 24.8 ± 3.7 and 12.9 ± 4.3 on conventional images, 20.9 ± 2.4 and 30.8 ± 9.6 on monochromatic

images. The attenuation, noise and SNR were significantly better on monochromatic images than those on conventional images (all $p < 0.01$). The subjective IQ score was 2.1 ± 0.5 and 1.2 ± 0.4 in two groups. The volume CT dose index, dose length product and effective dose was 12.3 ± 3.3 mGy, 142.9 ± 44.7 mGy $\times$ cm, and 2.0 ± 0.6 mSv.

CONCLUSION

The monochromatic 50 keV images provide superior image quality with 30 ml contrast medium and 2 mSv radiation dose in CCTA study compared with conventional 120 kVp images.

CLINICAL RELEVANCE/APPLICATION

It is feasible to apply spectral imaging in CCTA study with low dose of contrast medium and radiation.

SSQ02-06 Accuracy of Virtual Non-Contrast Image of Coronary CT Angiography with Fast Kilo Voltage Switching Dual-Energy CT (DECT): Compared With Non-Contrast Image of Single-Energy CT (SECT)

Thursday, Nov. 30 11:20AM - 11:30AM Room: S502AB

Participants

Satoshi Inada, Hiroshima, Japan (*Presenter*) Nothing to Disclose
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PURPOSE

The virtual non-contrast (VNC) images technique in fast kilo voltage switching single-source dual-energy CT (ssDECT) is useful to reduce scan dose. The purpose of this study was to evaluate the accuracy of CT-values in VNC images reconstructed from dual-energy coronary CT angiography using the fast kilo voltage switching technique performed on a ssDECT scanner, compared with non-contrasted single-energy CT (SECT) images for true non-contrast images (TNC).

METHOD AND MATERIALS

Twenty patients with coronary artery disease (between February 22nd, 2016 and April 4th, 2016) had non-contrasted SECT (120 kilovoltage) for calcium score and ssDECT for coronary angiography using fast kilovoltage switching dual-energy CT technique (Revolution GSI, GE Healthcare). TNC images were reconstructed from non-contrasted SECT for calcium score, and VNC images were reconstructed from ssDECT for coronary angiography. We measured CT-values of, right atrium (RA), right ventricle (RV), pulmonary artery (PA), left atrium (LA), left ventricle (LV), and ascending aorta (A-Ao) in TNC images and VNC images on an Advantage Workstation ver.4.7 (GE Healthcare). CT-values were compared between TNC images and VNC images.

RESULTS

In TNC images, mean CT-values for RA, RV, PA, LA, LV, and A-Ao were 42 ± 6 Hounsfield Unit (HU), 44 ± 4 HU, 40 ± 4 HU, 40 ± 3 HU, 42 ± 6 HU, and 41 ± 4 , respectively. In VNC images, mean CT-values for RA, RV, PA, LA, LV, and A-Ao were 40 ± 6 , 43 ± 6 , 46 ± 9 , 47 ± 10 , 53 ± 11 , and 47 ± 10 , respectively. There was a no significant difference between CT-values of RA in TNC images and RA in VNC images ($P=0.333$), and between RV in TNC images and RV in VNC images ($P=0.923$). In VNC images, mean CT-values for PA, LA, LV, and A-Ao were about 6 to 11 HU higher than that in TNC ($P<0.05$).

CONCLUSION

CT-values in VNC reconstructed from fast kilo voltage switching ssDECT for coronary angiography were close to that in non-contrasted SECT images.

CLINICAL RELEVANCE/APPLICATION

The virtual non-contrast images (VNC) technique of ssDECT is useful for low DOSE clinical application.

SSQ02-07 Feasibility of Combining Coronary with Carotid and Cerebrovascular CT Angiography using CT with High Temporal Resolution and Wide Detector Coverage

Thursday, Nov. 30 11:30AM - 11:40AM Room: S502AB

Participants

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PURPOSE

To explore the feasibility of combining coronary with carotid and cerebrovascular CT angiography (CCCTA) using CT system with high temporal resolution and wide detector coverage.

METHOD AND MATERIALS

60 patients with suspected cardiovascular and cerebrovascular disease were randomly divided into groups A and B. Group A ($n=30$) with integrated CT workflow: CCTA immediately followed by CCCTA after 1.1s delay with one injection of contrast agent. Group B used the traditional CT workflow: CCTA after contrast injection; patient rested for 30min, and contrast re-injection for CCCTA. The amount of the contrast in each injection was weight-dependent at 0.8ml/kg (370mgI/ml) and the flow rate was 5ml/s. The subjective image quality of CTA was assessed by two senior radiologists using a 4-point system for blind assessment (4=best). The

CT values and SD values of the aortic root, right coronary artery opening, left anterior descending branch opening, left rotation opening and fat in the anterior chest wall; and of the aortic arch, carotid cartilage median layer, internal carotid artery M1 segment and muscle at the same level were used to evaluate the objective image quality of CCTA and CCCTA, respectively. SNR and CNR for vessels were calculated. The effective dose was calculated. The corresponding image quality and radiation dose between groups A and B were compared.

RESULTS

The average contrast amount in group A was 51ml, significantly smaller than the 105ml in group B. The examination time was reduced from 40min in group B to 5min in group A. Group B had slightly better SNR and CNR values than group A in CCTA. However, There was no difference in the subjective score between the two groups (3.40 ± 0.67 vs. 3.50 ± 0.63) ($P=0.56$) and all CCTA images were diagnostic. There was no difference in both objective and subjective image quality of CCCTA between the two groups ($P>0.05$). There was no difference in total radiation dose between group A ($2.42 \pm 1.10\text{mSv}$) and group B ($2.94 \pm 1.25\text{mSv}$) ($P>0.05$).

CONCLUSION

It is feasible to combine CCTA with CCCTA using a 256-row, 16cm wide-detector CT system to simplify workflow, reduce contrast dose and maintain diagnostic images of the heart and head.

CLINICAL RELEVANCE/APPLICATION

Atherosclerotic plaques usually occur in coronary artery, carotid and cerebrovascular arteries simultaneously. Combining CCTA with CCCTA may show all the lesions with one scan.

SSQ02-08 Radiologists Now Predominate in Use of Coronary CT Angiography

Thursday, Nov. 30 11:40AM - 11:50AM Room: S502AB

Participants

David C. Levin, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
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PURPOSE

Controversy has long existed between radiologists and cardiologists over who should perform cardiac imaging, and this has extended to the recently-developed technique of coronary CT angiography (CCTA). Our purpose was to compare recent trends in use of CCTA between the 2 specialties.

METHOD AND MATERIALS

HCPCS codes for CCTA have existed since 2006. We reviewed the Medicare Physician/Supplier Procedure Summary (PSPS) Master Files for 2006-2015 and selected the codes for CCTA. Medicare's physician specialty codes identified the specialty of the provider. The PSPS files provide procedure volume for each code each year and we then calculated utilization rates per 100,000 Medicare fee-for-service beneficiaries (37.5 million in 2015) in all places-of-service. We studied the long term utilization trends for CCTA and also for 2 competing modalities, stress echo and myocardial perfusion imaging (MPI).

RESULTS

The total Medicare utilization rate per 100,000 of CCTA was 99 in 2006, rising to 210 in 2007. However, the rate dropped sharply in subsequent years and reached a nadir of 107 in 2012 and 2013. It then increased the next 2 years to 117 in 2015 (+9.3% compared with nadir). Among cardiologists, the rate went from 59 in 2006 to 126 in 2007. It then dropped continuously, reaching a nadir of 47 in both 2014 and 2015. Among radiologists, the rate increased from 31 in 2006 to 67 in 2007, but then declined to a nadir of 44 in 2010. However, since then, radiologists' rate has increased steadily to 65 in 2015. In that final year, radiologists' utilization rate was 38% higher than that of cardiologists. Total utilization rate trends for stress echo and MPI were down in recent years but the levels remained far higher than that for CCTA.

CONCLUSION

In 2007 (the second year in which codes were available for CCTA), cardiologists did almost twice as many CCTAs as radiologists. However, by 2015, radiologists did substantially more than cardiologists. Nevertheless, utilization of both MPI and stress echo is far higher than that for CCTA. Low reimbursement rates and frequent denials by payers may have contributed to the abrupt CCTA declines in the early years.

CLINICAL RELEVANCE/APPLICATION

The utilization rate of CCTA has seen a small increase in the most recent years for which data are available.

SSQ02-09 Improving Specificity of Coronary CT Angiography for the Detection of Functionally Significant Coronary Artery Disease: A Deep Learning Approach

Thursday, Nov. 30 11:50AM - 12:00PM Room: S502AB

Participants

Robbert W. van Hamersvelt, MD, Utrecht, Netherlands (*Presenter*) Nothing to Disclose
Majd Zreik, MSc, Utrecht, Netherlands (*Abstract Co-Author*) My wife works for Philips HealthTech, Philips quality management systems
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PURPOSE

Coronary computed tomography angiography (CCTA) is an increasingly important diagnostic tool for the detection of coronary artery disease (CAD). However, due to calcium blooming and beam hardening, specificity for diagnosing functionally significant CAD is limited. The purpose of this study was to evaluate to what extent the specificity of CCTA for detection of functionally significant CAD could be improved by combining simple stenosis grading with deep-learning based analysis of left ventricular myocardium (LVM).

METHOD AND MATERIALS

We retrospectively included 126 patients (77% male, 58.7±9.5 years) who underwent CCTA prior to invasive fractional flow reserve (FFR). Functionally significant CAD was defined as an invasively measured FFR value below 0.78. First, the presence and degree of coronary artery stenosis was analyzed using the CAD-RADS system. Patients without a significant stenosis reported on CCTA scans were scored as functionally non-significant. For the remaining patients, fully automatic deep learning analysis of the LVM was used to identify presence of functionally significant CAD. LVM was first segmented using a convolutional neural network and then characterized by a convolutional auto-encoder (CAE). Based on the encodings generated by the CAE a support vector machine classifier identified patients with functionally significant stenosis. Diagnostic performance of this combined analysis was evaluated and compared with patient identification based only on ≥50% stenosis degree as measured in CCTA.

RESULTS

FFR was significant in 64 (51%) of the patients. Sensitivity and specificity of stenosis degree reported on CCTA alone were 91% and 18%, respectively. Adding deep-learning based analysis of LVM to stenosis detection resulted in improved specificity with a slight decline in sensitivity. The combined evaluation resulted in a sensitivity of 83% and a specificity of 73%.

CONCLUSION

Our results show that, at the expense of only a mild sensitivity decrease, a combination of clinical stenosis evaluation and automatic LVM analysis in CCTA led to substantial increase of the specificity.

CLINICAL RELEVANCE/APPLICATION

Adding deep learning analysis of LVM to stenosis assessment holds the potential to substantially increase specificity of CCTA and to decrease number of patients unnecessarily referred to invasive FFR.

SSQ03

Cardiac (MRI)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S504AB

CA **MR**

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Hildo J. Lamb, MD, PhD, Leiden, Netherlands (*Moderator*) Nothing to Disclose
Pamela K. Woodard, MD, Saint Louis, MO (*Moderator*) Research agreement, Siemens AG; Research, Eli Lilly and Company; Research, F. Hoffmann-La Roche Ltd; ; ; ;
Belinda D'Souza, MD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSQ03-01 Multicenter Study Comparing PSIR Motion Correction Late Gadolinium Enhancement Sequence with TurboFLASH and TrueFISP Late Gadolinium Enhancement Sequences

Thursday, Nov. 30 10:30AM - 10:40AM Room: S504AB

Participants

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PURPOSE

The Phase-Sensitive Inversion Recovery with Motion Correction (PSIRMoCo) is an improved single-shot rapid LGE sequence, which has higher spatial resolution compared to the traditional TrueFISP sequence and shorten acquisition time compared to the TurboFLASH sequence. This study aims to investigate a PSIRMoCo prototype against TurboFLASH and TrueFISP in terms of acquisition time and image quality.

METHOD AND MATERIALS

Inclusion criteria was patients/volunteers undergoing LGE CMR. Exclusion criteria was patients who did not have late gadolinium enhancement images. A total of 70 subjects (70% male, 17% had arrhythmia, 2% were poor breath-holders) were recruited in two hospitals. Patients were recruited consecutively for a 6-month period. Data was all acquired on 1.5T MAGNETOM Avanto scanner (Siemens Healthcare, Erlangen, Germany). MRI TurboFLASH images were acquired first at 8 minutes post contrast injection followed by the PSIRMoCo sequence and the TrueFISP PSIR sequence. Images with poor contrast differentiation between the myocardium and blood pool were excluded from the analysis. Acquisition time was measured based on the timings from the MRI times stated on the images. Image quality was assessed by 2 doctors separately without access to the image information, using a 4-point Likert scale (4 for the best, 1 for the worst). A P-value<0.05 was regarded as statistically significant. ANOVA, Kruskal-Wallis H test and Mann-Whitney U test were used for comparing the three groups.

RESULTS

The total scan times for PSIRMoCo, TurboFLASH and TrueFISP were 187±43 sec, 636±144 sec, and 164±37sec, respectively (p<0.001). There was no statistically significant difference in scan time between PSIR MoCo and TrueFISP. Image quality scores of the three groups were 3.8±0.26, 3.3±0.47, and 3.5±0.31, respectively (p=0.0001). Separately, PSIRMoCo showed a statistically higher image quality score compared to TurboFLASH (p<0.0001) and TrueFISP (p=0.008).

CONCLUSION

PSIR MoCo shows statistically significant time saving compared to TurboFLASH and better image quality compared to TurboFLASH and TrueFISP.

CLINICAL RELEVANCE/APPLICATION

PSIR MoCo should be considered for routine use instead of TurboFLASH as it saves approximately just under 8 minutes in scan time with improved image quality.

SSQ03-02 Detection of Patients with High-Risk Coronary Artery Disease Using Coronary Flow Velocity Reserve:

3T-MRI Fast Velocity-Encoded Cine Study

Thursday, Nov. 30 10:40AM - 10:50AM Room: S504AB

Participants

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PURPOSE

We previously developed a method to measure coronary flow velocity reserve (CFVR) in the left main trunk (LM) during stress (ATP (0.16mg/kg/min)) and at rest non-invasively mainly using healthy volunteers. The purpose of this current study is to evaluate the method's diagnostic value in detecting patients with high-risk coronary artery disease (CAD).

METHOD AND MATERIALS

Fifty-nine patients with suspected CAD (age; 67 ± 11 yr, male; $n = 36$) who underwent 3.0-tesla (T) magnetic resonance imaging (MRI) and angiography were studied. Coronary flow velocity in LM was measured with breath-hold velocity-encoded cine using 3.0-T MRI during ATP stress and at rest. CFVR was calculated by dividing peak-velocity during stress by that at rest. The extent and severity of angiographic disease of LM, left anterior descending artery (LAD), and left circumflex artery (LCx) were estimated with the use of the Leaman score (LS) which is able to stratify the risk of coronary artery using angiography.

RESULTS

Among the patients evaluated, 24 had 1-vessel disease (LAD ($n = 17$), LCx ($n = 7$)) and 18 patients had 2-vessel disease. Four patients had $\geq 50\%$ stenosis in LM. Fifty-one out of 59 patients showed low LS (0-10) and 8 had high LS (≥ 10.5 (equivalent to proximal LAD = 90-99%)). CFVR of CAD patients with high LS which means high-risk CAD was significantly lower than that of patients with low LS (1.57 ± 0.31 vs. 2.18 ± 0.73 , $p < 0.05$) (Figure). In receiver operating characteristic (ROC) analysis of CFVR for detection of high-risk CAD patients, the area under the ROC curve was 0.79 ($p = 0.0296$). Sensitivity was 100% and specificity was 62.8% using a cutoff of 1.98 for detection of high-risk CAD patients.

CONCLUSION

Low CFVR in LM derived by velocity-encoded cine using 3.0-T MRI can predict downstream coronary atherosclerotic burden. This method is a simple and reliable index to detect patients with high-risk CAD without radiation exposure.

CLINICAL RELEVANCE/APPLICATION

Coronary flow velocity reserve measured using 3.0-T MRI is able to evaluate severity of coronary artery disease with high sensitivity.

SSQ03-03 Gadolinium-enhanced Cardiac MR Exams of Human Subjects are Associated with Significant Increases in the DNA Repair Marker 53BP1 but Not the Damage Marker γ H2AX

Thursday, Nov. 30 10:50AM - 11:00AM Room: S504AB

Participants

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PURPOSE

To examine whether MR exams cause double-strand (ds) DNA damage by analyzing changes in the DNA damage and repair markers γ H2AX and 53BP1 in patients who underwent a cardiac magnetic resonance (MR) exam.

METHOD AND MATERIALS

Our prospective study of outpatients scheduled for a 1.5 T gadolinium-enhanced cardiac MR exam was subject to Institutional Review Board approval. Patients with history of malignancy or who were receiving chemotherapy, radiation therapy, or steroids were excluded. MR sequence data were recorded for each patient. Blood samples were obtained from immediately before and after MR exposure. An automated immunofluorescence assay quantified γ H2AX or 53BP1 foci number in isolated peripheral blood mononuclear cells. Changes in foci number were analyzed within patients using the Wilcoxon signed-rank test. Clinical and MR procedural characteristics were compared between patients who had a $>10\%$ increase in γ H2AX or 53BP1 foci numbers and patients who did not.

RESULTS

Sixty patients (median age: 55 years, 39 males) were enrolled in our study. The number of γ H2AX foci did not significantly change following cardiac MR (median foci per cell pre-MR=0.11, post-MR=0.11, $p=0.90$), but the number of 53BP1 foci significantly increased following MR (median foci per cell pre-MR=0.46, post-MR=0.54, $p=0.0140$). Clinical and MR characteristics did not differ significantly between patients who had at least a 10% increase in foci per cell and those who did not.

CONCLUSION

MR exposure leads to a small (median 17%) increase in 53BP1 foci, suggesting increased DNA repair. Accordingly, a lack of increase in number of foci of the ds DNA damage marker γ H2AX does not necessarily indicate an absence of DNA damage.

CLINICAL RELEVANCE/APPLICATION

1. Elevated DS DNA repair marker levels suggest that cardiac MR may cause DS DNA damage, and further study using both γ H2AX and 53BP1 is necessary.

SSQ03-04 Detection of Myocardial Scar by Late Gadolinium Enhancement Cardiac MR using Gadoterate Meglumine

Thursday, Nov. 30 11:00AM - 11:10AM Room: S504AB

Awards

Student Travel Stipend Award

Participants

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PURPOSE

To compare the efficacy of late gadolinium enhancement cardiac MR (LGE-CMR) for myocardial scar detection between 2 macrocyclic GBCAs (gadoterate meglumine vs. gadobutrol).

METHOD AND MATERIALS

40 subjects (61 ± 11 years, 67.5% men) who were referred for evaluation of cardiomyopathy with LGE-CMR performed using standard of care 0.2mmol/kg gadobutrol were recruited prospectively within an 8-week period for a research CMR scan using 0.2mmol/kg gadoterate meglumine. Both clinical and research CMR scans were performed at 1.5T. All subjects underwent a standard CMR protocol consisting of multiplanar cine steady state free precession (SSFP) and post contrast delayed enhanced PSIR SSFP and PSIR TurboFlash sequences. Myocardial scar quantification was performed on short-axis PSIR-TurboFlash images using commercially available software (Circle 5.3, Calgary, Canada) and myocardial scar percentage mass was calculated. Qualitative scar analysis was performed by 2 observers using the 16-segment AHA model and the area of scar per segment (0=none, 1=1-25%, 2=26-50%, 3=51-75%, 4=76-100% of the segment area) was scored. Segmental ratings were summed across all 16 segments to derive a global scar score for each scan. Reader confidence in visualizing the scar tissue for each agent was recorded on a 5-point scale (1=poor, 2=fair, 3=good, 4=very good, 5=excellent).

RESULTS

With PSIR SSFP technique, percentage myocardial scar mass averaged $5.9 \pm 9.8\%$ and $5.2 \pm 7.2\%$ for gadobutrol and gadoterate meglumine, respectively ($p > 0.05$, ICC=0.89, 95% CI:0.78-0.94). With PSIR TurboFlash technique, percentage myocardial scar mass was 7.19 ± 11 and 6.03 ± 8.51 for gadobutrol and gadoterate meglumine, respectively ($p > 0.05$, ICC=0.96, 95% CI:0.93-0.98). Global qualitative segmental LGE scores showed comparable scar detection using gadobutrol vs. gadoterate meglumine (5.3 ± 7.5 vs. 5.4 ± 7.2 , $p > 0.05$). Reader confidence for scar visualization was similar between gadobutrol and gadoterate meglumine (4.35 ± 0.7 vs. 4.22 ± 0.6 , $p > 0.05$).

CONCLUSION

Gadoterate meglumine is comparable to gadobutrol for identifying myocardial scar on LGE-CMR both qualitatively and quantitatively and can detect scar with a similar degree of diagnostic confidence as Gadobutrol.

CLINICAL RELEVANCE/APPLICATION

Gadoterate Meglumine, an alternative macrocyclic GBCA to the more routinely used Gadobutrol, has recently become available in the U.S. and may have comparable efficacy for detecting myocardial scar on routine LGE-CMR

SSQ03-05 Diffuse Myocardial Fibrosis in Diabetes Mellitus: Findings From t1 Mapping Imaging and Cardiac MRI Strain

Thursday, Nov. 30 11:10AM - 11:20AM Room: S504AB

Participants

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PURPOSE

To investigate diffuse myocardial fibrosis and the relationship between cardiac MRI strain in diabetes mellitus (DM) using T1 mapping and cardiac tissue tracking.

METHOD AND MATERIALS

Thirty-one patients with DM without impairment of renal function (Group1), 21 cases of DM with impairment of renal function (Group2) and 23 normal control individuals were enrolled. All patients underwent cardiovascular magnetic resonance (CMR), including cardiac cine sequence and T1 mapping MOLLI sequence. Cardiac function indexes, tissue tracking and T1 mapping were all measured by cvi42 and compared statistical. Pearson's correlation between the T1 mapping parameters and the left cardiac strain parameters were also investigated.

RESULTS

All the patients recruited finished CMR and the baseline characteristics were recorded. Group2 presented with higher pre-contrast T1 value than Group1 and control group (Group2: $1314.80 \pm 43.72\text{ms}$; Group1: $1259.12 \pm 42.48\text{ms}$; control group: $1264.25 \pm 47.45\text{ms}$, both $P < 0.05$). Regarding the post-contrast T1 value, lower post-contrast T1 value were observed in Group2 but the differences were not statistically significant (Group2: $490.25 \pm 58.59\text{ms}$; Group1: $521.61 \pm 70.50\text{ms}$; control group: $508.20 \pm 35.82\text{ms}$, both $P > 0.05$). Compared with control group, Group1 and Group2 had significantly higher ECV (Group1: $31.02 \pm 2.97\text{ms}$; Group2: 34.09 ± 4.23 ; control group: $27.39 \pm 2.40\text{ms}$, both $P < 0.05$). Negative correlation was showed between the circumferential peak diastolic strain rate and ECV in Group1 and Group2 ($r = -0.459$, $r = -0.459$, $P < 0.05$).

CONCLUSION

T1 mapping is an alternative sequence for the evaluation of diffuse myocardial fibrosis in DM patients. Myocardial fibrosis is correlated with circumferential peak diastolic strain rate in DM patients.

CLINICAL RELEVANCE/APPLICATION

(dealing with T1 mapping imaging and cardiac MRI strain) ' T1 mapping is an alternative sequence for the evaluation of diffuse myocardial fibrosis in DM patients.'

SSQ03-06 Subclinical Left Ventricle Dysfunction in Diabetes Mellitus Patient: Assessed by Cardiac MRI Strain Analysis

Thursday, Nov. 30 11:20AM - 11:30AM Room: S504AB

Participants

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PURPOSE

Cardiovascular disease is the key cause of mortality of diabetes mellitus (DM), for which in-time detection of dysfunction and early intervention can significantly improve the prognosis. The aim of this study is to evaluate the subclinical left ventricle (LV) dysfunction in DM patient and whether the patient with good glycemic control have decreased cardiac function with time using cardiac magnetic resonance (CMR) strain analysis.

METHOD AND MATERIALS

In total, 23 DM patients with normal LVEF, including 13 patients diagnosed not more than 10 years and 10 patients diagnosed more than 10 years, and 25 healthy subjects, underwent CMR examination. LV global myocardial strain parameters including peak strain, peak systolic strain rate and peak diastolic strain rate, as well as global radial, circumferential and longitudinal analysis were calculated and compared among the three patient groups.

RESULTS

DM group had a significantly lower longitudinal peak strain (-15.32 ± 5.18 vs. -19.53 ± 2.76 , $p = 0.007$) and peak diastolic strain rate (1.22 ± 0.29 vs. 1.50 ± 0.28 , $p = 0.000$), circumferential peak diastolic strain rate (1.20 ± 0.39 vs. 1.50 ± 0.26 , $p = 0.000$), and higher radial peak systolic strain (2.59 ± 0.81 vs. 2.0 ± 0.61 , $p = 0.033$) compared with the normal subjects. The DM patient diagnosed more than 10 years have lower peak systolic strain rate [radial (2.03 ± 0.52 vs. 2.61 ± 0.77 , $p < 0.000$), circumferential (-0.89 ± 0.19 vs. -1.02 ± 0.20 , $p < 0.000$) and longitudinal (-0.79 ± 0.11 vs. -0.97 ± 0.13 , $p < 0.000$), respectively], lower radial peak strain (38.18 ± 9.89 vs. 43.47 ± 10.88 , $p < 0.000$) and lower circumferential peak diastolic strain rate (1.01 ± 0.26 vs. 1.24 ± 0.21 , $p = 0.004$) compared with diagnosed not more than 10 years.

CONCLUSION

Cardiac MRI strain is sensitive to early dysfunctional of heart, which might help with better management for the DM patients with

normal LVEF. Moreover, the cardiac function is gradually reduced with time, even though the blood glucose controlled well, especially the systolic function.

CLINICAL RELEVANCE/APPLICATION

Cardiac MRI strain is sensitive to early dysfunctional change of DM patients than traditional heart function evaluation parameters, which might help with better management for the DM patients with normal LVEF

SSQ03-07 Aortic Stiffness, Myocardial Fibrosis, Left Ventricular Strain and Epicardial Fat in Hypertension and Diabetes Mellitus

Thursday, Nov. 30 11:30AM - 11:40AM Room: S504AB

Participants

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PURPOSE

A combined assessment of aortic stiffness, left ventricular (LV) fibrosis, LV strain and epicardial fat volume (EFV) may decrease risk in patients with cardiovascular risk factors such as hypertension (HTN) or diabetes mellitus (DM). Using a MRI approach these parameters were assessed in 63 patients and related to the presence of HTN and DM.

METHOD AND MATERIALS

20 healthy controls (57.2±8.2years[y]; 26.2±3.9kg/m²), 31 hypertensive patients without DM (HTN-Pts; 59.6±6.7y; 28.4±4.7kg/m²) and 12 with DM (DM-Pts; 58.8±9.9y; 30.7±6.3kg/m²) were examined at 1.5Tesla. No patients had coronary artery disease; all patients had a normal LV ejection fraction. Aortic stiffness was evaluated by velocity encoded MRI to determine pulse wave velocity (PWV) of the aortic arch (Fig. A), EFV by a 3D-Dixon sequence with acquisition of fat-only images and fat-fraction maps (Fig. B&C), LV T1 relaxation times (T1) to detect fibrosis using a MOLLI scheme, and, longitudinal & circumferential systolic strain (LS; CS) by feature tracking software.

RESULTS

Age and gender did not differ significantly; BMI was higher in DM-PTs compared to controls. Results were adjusted for BMI. EFV was highest in DM-PTs followed by HTN-PTs and controls (EFV = 78.4±28.0 vs. 64.2±27.3 vs. 50.3±22.7ml/m²; P<0.05). T1 was higher in DM-PTs and HTN-PTs than in controls (T1 = 994.0±43.2 resp. 991.6±35.5 vs. 964.6±40.3ms; P<0.05). PWV was significantly higher in DM-PTs and LV strain lower compared to HTN-PTs and controls (PWV = 9.8±3.3 vs. 8.6±1.7 resp. 8.1±1.9m/s; LS = -20.9±5.1 vs. -24.7±4.6 resp. -25.5±3.8%; CS = -24.4±5.7 vs. -27.1±5.0 resp. -28.3±4.1%). Fig. D illustrates a healthy male with a lower T1 compared to a HTN-Pt (Fig. E) and Fig. F with a higher LS compared to a DM-PT.

CONCLUSION

Hypertension and diabetes mellitus are associated with LV fibrosis; cardiac remodeling as well as metabolic and inflammatory mechanisms of an increased EFV may play a role. EFV and aortic stiffness are further increased and LV strain reduced in DM-PTs possibly due to an increased metabolic and inflammatory burden associated with DM. A multi-parametric assessment of these parameters can easily be integrated into a routine MRI exam and may be supportive for a more accurate cardiovascular risk evaluation.

CLINICAL RELEVANCE/APPLICATION

MRI is an accurate tool for evaluation of cardiovascular risk and prognostic parameters in patients with risk factors, such as hypertension or diabetes mellitus.

SSQ03-08 Strain of Ascending Aorta on Cardiac Magnetic Resonance in 1,027 Patients: Relation with Age, Gender, and Cardiovascular Disease

Thursday, Nov. 30 11:40AM - 11:50AM Room: S504AB

Participants

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PURPOSE

To evaluate aortic strain (AS) with cardiac magnetic resonance (CMR) in a large series of consecutive patients with different cardiovascular diseases (CVDs).

METHOD AND MATERIALS

Two-dimensional phase-contrast gradient-echo sequences of the ascending aorta were retrospectively selected in 1,027 patients (726 males, 301 females). In all images, aortic lumen area was segmented using a semi-automatic approach to calculate AS values. Subgroup analysis was performed for patient with normal CMR, Tetralogy of Fallot (ToF), and ischemic heart disease (IHD). Multivariate and post-hoc analyses were performed to evaluate the effect of age, gender and CVDs on AS values. In order to consider also the age factor, the subjects were grouped into 7 age bins of 10 years (0-9, 10-19, 20-29, 30-39, 40-49, 50-59 and ≥ 60 years).

RESULTS

Taking into account the whole sample, the AS resulted inversely correlated with age ($\rho = -0.51$, $P < .001$). Multivariate analysis showed significant differences in AS among decades of age ($P < .001$), genders ($P = .007$) and CVD subgroups ($P < .001$) without interaction among these factors. Post-hoc analysis showed significantly lower AS in ToF and IHD patients compared to subjects with normal CMR ($P < .001$). Gender-related differences were significant in ToF subjects ($P = .008$), in particular men with ToF showed a lower AS when compared with men with normal CMR ($P = .005$). In IHD patient, AS was lower compared to normal CMR subjects (men: $P < .001$, women: $P = .016$), without significant difference between genders ($P = .732$). Aortic strain reduction during aging was observed in all CVD groups.

CONCLUSION

Differences in age, gender, and CVD independently affect AS. The lower AS observed in ToF fosters its assessment during follow-up in adulthood. The gender-related difference gives the basis for future studies focused on its possible causes and clinical implications. Nevertheless, further investigations on elderly patients and, in particular, in adults with congenital heart disease are advised.

CLINICAL RELEVANCE/APPLICATION

Our results showed that age, gender, and CVDs independently affect the ascending AS, highlighting the importance of its follow-up assessment, especially in patients with congenital cardiac diseases.

SSQ03-09 Effectiveness of Multiparametric Structure-Function Cardiac MRI in Detection of Acute Cardiac Allograft Rejection

Thursday, Nov. 30 11:50AM - 12:00PM Room: S504AB

Awards

Student Travel Stipend Award

Participants

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PURPOSE

Acute cardiac allograft rejection (ACAR) is a leading cause of morbidity and mortality in heart transplant (Tx) recipients. Non-invasive screening with cardiac magnetic resonance imaging (CMR) is promising given its ability for comprehensive characterization of acute myocardial injury and subtle left ventricular (LV) structural and functional changes. We hypothesized that CMR-derived T2, T1, extracellular volume fraction (ECV), and LV velocities will differ between 1) healthy controls and Tx recipients without history of ACAR and 2) Tx recipients with and without current evidence of ACAR.

METHOD AND MATERIALS

CMR at 1.5T (Magnetom Aera/Avanto, Siemens, Erlangen, Germany) was performed prospectively on 76 Tx recipients (49.9 ± 15.9 yrs, 45% female) and 14 controls (47.7 ± 16.7 yrs, 36% female) for 131 total studies. Analyses were stratified based on myocardial biopsy grade: Controls (N=14), No ACAR (no history of ACAR, N=68), Past ACAR (history of ACAR, N=34), ACAR+ (active grade ≥ 1 ACAR, N=15). CMR included T2-mapping, pre- and post- contrast T1-mapping (to calculate ECV), and tissue phase mapping (TPM; to generate myocardial velocities).

RESULTS

T2 was significantly higher in No ACAR patients compared to controls (49.4 ± 3.4 ms vs. 45.2 ± 2.3 ms, $P < 0.01$). Compared to No ACAR patients, patients with Past ACAR (51.7 ± 4.1 ms vs. 49.4 ± 3.4 ms, $P < 0.01$) or current ACAR+ (53.8 ± 4.9 ms vs. 49.4 ± 3.4 ms,

P<0.01) had greater T2 values. ECV was significantly elevated in ACAR+ patients compared to recipients without ACAR ($31.6\pm3.6\%$ vs. $26.7\pm3.2\%$, P<0.01) regardless of history of ACAR (No ACAR and Past ACAR). ROC analysis for the detection of ACAR+ revealed AUC of 0.80 and 0.85 for T2 and ECV respectively. TPM identified lower peak systolic longitudinal velocities and higher peak diastolic radial velocities in No ACAR patients compared to controls (2.8 ± 1.0 cm/s vs. 4.9 ± 1.1 cm/s, P<0.01; -3.7 ± 0.8 cm/s vs. -2.9 ± 0.7 cm/s, P<0.01).

CONCLUSION

CMR parameters are sensitive to structural and functional change in Tx recipients. T2 and ECV are effective at detecting ACAR, supporting further development of CMR for ongoing surveillance post Tx.

CLINICAL RELEVANCE/APPLICATION

CMR-derived T2 and ECV are effective in detecting acute cardiac allograft rejection (ACAR) following heart transplant, promoting use of multiparametric CMR as an alternative ACAR screening tool.

SSQ04

Chest (Interventional/Ablation)

Thursday, Nov. 30 10:30AM - 12:00PM Room: E351

CH CT IR MR

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

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Sub-Events

SSQ04-01 Analysis of Risk Factors for Hemoptysis after Percutaneous Transthoracic Needle Biopsies in 4,172 Cases: Focusing on the Effects of Diametrical Enlargement of the Main Pulmonary Artery

Thursday, Nov. 30 10:30AM - 10:40AM Room: E351

Participants

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PURPOSE

To evaluate risk factors for hemoptysis after cone-beam computed tomography (CBCT)-guided percutaneous transthoracic needle biopsy (PTNB) and, in particular, to determine whether the enlargement of main pulmonary artery diameter (mPAD) is a risk factor for PTNB-related hemoptysis.

METHOD AND MATERIALS

After approval from the Institutional Review Board, 4,172 cases of CBCT-guided PTNBs in 3,840 patients (2299 men and 1541 women; mean age, 63.64 years, ranging from 7-to-94 years) were retrospectively included in this study. Various clinical, radiological, and biopsy-related data including mPAD were evaluated using univariate and multivariate logistic regression analyses to figure out significant risk factors for both hemoptysis and severe hemoptysis. Severe hemoptysis was designated when blood transfusion, vascular embolization, or cardiopulmonary resuscitation were required to manage patients with the diagnosis.

RESULTS

Hemoptysis occurred in 5.78% (n=241) of all PTNB procedures, while severe hemoptysis occurred in 0.18% (n=7). Female sex (Odds ratio [OR]=2.703, P<0.001), history of anti-platelet or anti-coagulative drugs (OR=2.362, P=0.002), prolonged activated partial thromboplastin time (OR=1.951, P=0.042), subsolid nodules (OR=3.529, P<0.001), cavitory nodules (OR=3.205, P=0.038), and long pleura-to-target distance (P<0.001) were independent risk factors for hemoptysis, while mPAD enlargement was not a significant risk factor. Regarding severe hemoptysis, however, mPAD enlargement (OR=5.004, P=0.037) was a significant independent risk factor in combination with subsolid (OR=6.648, P=0.046) and cavitory target nodules (OR=20.284, P=0.008).

CONCLUSION

mPAD enlargement was not a significant risk factor for PTNB-related hemoptysis. However, it was a significant risk factor for severe PTNB-related hemoptysis.

CLINICAL RELEVANCE/APPLICATION

mPAD enlargement was a significant risk factor for severe PTNB-related hemoptysis, along with subsolid and cavitory nodule features.

SSQ04-02 Active Targeting Theranostic Iron Oxide Nanoparticles for MRI and Magnetic Resonance-Guided Focused Ultrasound Ablation of Lung Cancer

Thursday, Nov. 30 10:40AM - 10:50AM Room: E351

Participants

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PURPOSE

To evaluate an active targeting and nano-sized SPIO platform for the enhancement of imaging sensitivity and tumor-ablative efficacy in MRgFUS, and applications of a series of MRI approaches for non-invasive monitoring treatment response were demonstrated using nude rat lung tumor models.

METHOD AND MATERIALS

PEGylated SPIO nanoparticles was further decorated with high affinity anti-EGFR monoclonal antibody to form a nanocomposite (anti-EGFR-PEG-SPIO), and in vitro and vivo MRI was performed. 24 rats were then randomly divided into positive control group (n=6), negative control group (n=6), PEGylated SPIO group (n=6), and anti-EPS group (n=6). The nude rats tumors were sonicated after injection of the PEGylated SPIO and anti-EPS solution (1ml) via tail vein at 4.0 h. Prior to sonication, T2W SE were acquired. For each nude rat, two to five sonications were planned. The treated areas were about 0.5 cm² according to the pretreatment plan. Each dynamic temperature was monitored by real-time MRI temperature mapping of the treated area.

RESULTS

The T2 values for the anti-EGFR-PEG-SPIO and PEGylated SPIO contrast agents at 3.0 T MRI were 10.3ms and 11.2ms, respectively. T2 relativity values were 97.1 s-1mM⁻¹ and 89.3 s-1mM⁻¹, respectively. The T2 SI in targeting group decreased significantly compared with non-targeting group. The rate of SI change was -58.2%, -82.7%, -94.4%, and 98.3% respectively, at the iron concentrations. Thirty minutes after the injection of anti-EPS, the T2 SNR in the lung tumor started to decrease. The T2 SNR at the tumor region decreased more significantly at 4 hours post-injection of anti-EPS compared with the nontargeting group (p<0.01). The energy of the targeting group was even lower than that of the control (low energy) group (32W vs 54 W, P<0.01), Peak temperature significantly higher than control group. T2W SI and ADC significantly after ablation higher than before ablation in targeting, and nontargeting, control group

CONCLUSION

We have successfully developed anti-EGFR modified PEGylated SPIO nanoparticles as targeted MR imaging contrast agents and the synergistic agents for MRgFUS lung carcinoma thermotherapy. After tumor ablation, tumor therapeutic efficiency monitored by the clinical MRI equipment can be applied as an attractive potential noninvasive strategy.

CLINICAL RELEVANCE/APPLICATION

Applications of a series of MRI approaches can be applied as an attractive potential noninvasive strategy.

SSQ04-03 Non-Diagnostic CT-Guided Percutaneous Needle Biopsy (PTNB): Predictive Factors and Final Diagnoses

Thursday, Nov. 30 10:50AM - 11:00AM Room: E351

Participants

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PURPOSE

To investigate the final diagnosis of pulmonary lesions with an initial non-diagnostic result on CT-guided percutaneous transthoracic needle biopsy (PTNB) and the predictive factors for a non-diagnostic result.

METHOD AND MATERIALS

All PTNB performed over a 4-year period were retrospectively reviewed. The initial pathological results were classified into 3 categories as malignant or suspicious for malignant, benign specific, and non-diagnostic. The demographic data of patients, lesion characteristics, technique, complications, initial pathological results and final diagnosis were reviewed. Statistical analysis was performed using Pearson's X² test or Fisher's exact test.

RESULTS

Out of a total of 894 consecutive biopsies, 690 (77.2%) were positive or suspicious for malignancy, 55 (6.2%) were specific benign, and 149 (16.7%) were non-diagnostic. Significantly higher non-diagnostic rates were found in cases where the lesion was less than 15mm, the needle tract traversed emphysema, the introducer needle was outside the lesion, total time was greater than 60 minutes and when alveolar hemorrhage was present during the procedure. 122 of 149 non-diagnostic cases had a subsequent diagnosis made by repeat biopsy, surgery or follow-up; and malignancy was confirmed in 44 cases (44/122, 36%). There were statistically significant differences in non-diagnostic biopsy rates for patients with malignant lesions (44/734, 6%) and benign lesions (78/133, 59%) (p=0.001). In the non-diagnostic group, patients with history of prior malignancy and patients with atypical cells present in the initial pathological report were more likely to have a final diagnosis of malignancy (p=0.043 and p=0.001, respectively)..

CONCLUSION

The predictive factors for non-diagnostic results were lesion size less than 15mm, needle tract traversing emphysema, introducer needle outside the lesion, procedure time greater than 60 minutes, presence of alveolar hemorrhage, and a final benign diagnosis. Although the majority of the non-diagnostic cases yielded a benign diagnosis, 36% were malignant. In cases with a history of malignancy or the presence of atypical cells in the biopsy sample repeat biopsy or surgical resection should be considered.

CLINICAL RELEVANCE/APPLICATION

The management of a non-diagnostic PTNB result is difficult, however, the 36% rate of malignancy in this group underscores the need for further diagnostic evaluation in these patients.

SSQ04-04 Evaluation of Rabbit Lung VX2 Tumor after Radiofrequency Ablation by Multi-B Value Based MR Diffusion Weighted Imaging

Thursday, Nov. 30 11:00AM - 11:10AM Room: E351

Participants

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PURPOSE

To explore the multi-b value based diffusion weighted imaging (DWI) on evaluation of lung VX2 tumor after radiofrequency ablation (RFA).

METHOD AND MATERIALS

Fifty-three lung VX2 tumor models were examined by multi-b value DWI ($b=0,10,20,50,100,150,200,500,800, 1000,2000$ s/mm²) at 1 day before RFA, and 1, 3, 7, 14 days after RFA. Both mono-exponential and bi-exponential model (including intravoxel incoherent motion imaging, diffusion kurtosis imaging (DKI) and stretched exponential model (SEM)) were used to calculate corresponding parameters (ADC, D, D*, f, Dk, K, DDC and A) based on ROIs of the maximal cross-sectional tumor before and after RFA by two thoracic radiologists, blindly. The parameters were compared between pre-RFA and post-RFA groups; the complete and incomplete RFA groups based on H&E and TUNEL staining, and correlated with MVD. The t test, Wilcoxon test, or Mann-Whitney U test was used in two-group comparisons. The area under curve (AUC) was used to assess the diagnostic performance. The Spearman correlation was used to analyze the correlation. Bland-Altman method was used to assess the intraobserver repeatability, and the coefficient of variation (CV) <5% was in good repeatability.

RESULTS

ADC, D, Dk, DDC and a values increased after RFA (all $p<0.02$), while K values decreased at day 3 and day 7, postoperatively ($p=0.03; 0.01$). ΔADC , ΔD , ΔDk , ΔDDC , Δa and ΔK of the complete RFA group was higher than that of the incomplete RFA group (all $p<0.03$) at day3; day7; day1-14; day7; day7 and day3, postoperatively, respectively, and the AUC of $\Delta ADC \geq 0.44 \times 10^{-3} \text{mm}^2/\text{s}$; $\Delta D \geq 0.18 \times 10^{-3} \text{mm}^2/\text{s}$; $\Delta Dk \geq 0.50, 0.37, 0.19$ and $0.19 \times 10^{-3} \text{mm}^2/\text{s}$; $\Delta DDC \geq 0.16 \times 10^{-3} \text{mm}^2/\text{s}$; $\Delta a \geq 0.05$; $\Delta K \geq 0.23$ in determination of tumor with complete ablation, was 0.93; 1.00; 1.00, 0.98, 1.00 and 0.96; 0.88; 0.88; 0.95, respectively. No difference of D* and f value changes was noticed, postoperatively (all P value > 0.09). No difference of AUC and no correlation of parameters with MVD (all P values > 0.05). The CV of ADC, DDC, a, Dk, K and D at baseline was 2.18%, 3.33%, 3.45%, 7.18%, 8.65% and 18.62 %, respectively.

CONCLUSION

DKI could be used to evaluate the efficacy of RFA at day 1, postoperatively; ADC ($b = 0, 500 \text{s/mm}^2$) and DKI could be utilized to evaluate it at day 3, postoperatively; both the DKI and SEM-DWI could evaluate it at day 7 and day 14, postoperatively.

CLINICAL RELEVANCE/APPLICATION

DKI and ADC could be used to early assess the lung tumor after RFA.

SSQ04-05 Risk of Pleural Recurrence after Percutaneous Transthoracic Needle Biopsy in Stage I Non-Small Cell Lung Cancer: A Large Center Experience

Thursday, Nov. 30 11:10AM - 11:20AM Room: E351

Participants

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PURPOSE

To determine whether percutaneous transthoracic needle biopsy (PTNB) increase the risk of (a) isolated pleural recurrence and (b) concomitant pleural seeding and metastasis in stage I non-small cell lung cancer (NSCLC).

METHOD AND MATERIALS

In this institutional review board-approved retrospective study, medical records of total of 830 consecutive patients with stage I NSCLC who underwent curative resection between 2004 and 2010 were reviewed. Median duration of follow-up was 1843 days (interquartile range, 1006-2734). Multiple logistic regression analyses were performed to identify risk factors of pleural recurrence.

RESULTS

Of 830 patients, 540 patients (65.1%) underwent PTNB before surgery, while 290 patients (34.9%) underwent non-PTNB procedures including bronchoscopic biopsy or exploratory thoracotomy. An isolated pleural recurrence was found in 26 patients (3.1%, [95%CI, 2.1-4.6%]) (20 in PTNB group, 6 in non-PTNB group). There was no significant association between PTNB and isolated pleural recurrence ($P=0.197$). Concomitant pleural recurrence occurred in 42 patients (5.1%, [95%CI, 3.8-6.8%]) (34 in PTNB group, and 8 in non-PTNB group). Subpleural location ($p=0.007$), tumor consistency (solid, part-solid, nonsolid) ($p=0.046$), PTNB ($p=0.027$), pathologic T stage ($p<0.001$), microscopic pleural invasion ($p<0.001$) and microscopic lymphatic invasion

($p=0.019$) were associated with concomitant pleural recurrence. The most significant factor of pleural recurrence was only microscopic pleural invasion (Odds Ratio, 4.28; 95% CI, 2.20 to 8.29) ($P<0.001$) on multiple logistic analysis. Among 540 patients undergoing PTNB, transfissural approach did not have significant association with pleural recurrence ($P=0.220$), while the most sole significant factor was microscopic pleural invasion (Odds Ratio, 3.40; 95% CI, 1.54 to 7.51) ($P=0.002$).

CONCLUSION

PTNB did not increase the risk of isolated or concomitant pleural recurrence in early stage NSCLC. Higher incidence of concomitant pleural seeding in PTNB group was presumably attributed to peripheral lung cancer, potentially accompanying microscopic pleural invasion.

CLINICAL RELEVANCE/APPLICATION

PTNB can be performed for confirmatory diagnosis of early stage lung cancer without raising the risk of isolated or concomitant pleural recurrence.

SSQ04-06 Genomic Profiling of Non-Small Cell Lung Cancer (NSCLC) for Personalized Therapy

Thursday, Nov. 30 11:20AM - 11:30AM Room: E351

Participants

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PURPOSE

Genomic profiling for personalized targeted therapy is emerging for NSCLC. Systematic testing for mutations in BRAF, ERBB2, PIK3CA and ALK translocations, in addition to EGFR and KRAS was introduced in our institution in July 2009. We report the utility, efficacy and safety of CT guided trans-thoracic needle biopsy (TTNB) in this cohort.

METHOD AND MATERIALS

Patients with stage IV/relapsed NSCLC who underwent CT guided TTNB to identify driver mutations prior to therapy were reviewed. Pathology specimens were evaluated for tumor adequacy, then manually dissected and analyzed by a variety of methods, including next generation sequencing for mutations in selected exons of EGFR, KRAS, BRAF, PIK3CA and ERBB2. ALK rearrangements were detected with fluorescence in-situ hybridization (FISH) and/or immunohistochemistry. Complications (pneumothorax, hemorrhage and admission) were recorded.

RESULTS

Between 6/12/2009 and 12/30/2016, 764 patients with NSCLC underwent TTNB. The median age was 67 years. 454(59%) were female, 426(56%) were former/current smokers and 580(75%) had stage IIIB/IV disease. 492(64%) of all TTNB performed were profiled for genomic analysis, of which 426(87%) had sufficient tissue on core biopsies for genomic profiling; 75(10%) of the 492 patients failed analysis for ALK rearrangements due to less than 50 tumor cells on the hybridized slide. The number of samples obtained ranged from 1-10 (2 cm 18-20G). Lesions biopsied ranged in size from 0.6-9.9 cm. PET guidance was used in 323(42%) patients. Targetable alterations were identified in 172/426(40%) patients (EGFR:139(18%); KRAS:101(13%);ALK:10(1%);BRAF:9(1%)). 216(28%) had pneumothoraces:137(<10% in size), 42 (10-30%) and 37(>30%). 79(10%) were admitted post procedure. 85(11%) had pulmonary hemorrhage. There was no statistically significant difference in pneumothorax rate by needle size ($p=0.8$). Pneumothorax rate significantly correlated with distance from the pleura and emphysema. Treatment strategy was changed in 183(24%) patients based on the biopsy result.

CONCLUSION

CT guided TTNB is a feasible, safe and efficacious technique for genomic profiling for targeted therapy, enabling the acquisition of sufficient tissue for gene mutation analyses.

CLINICAL RELEVANCE/APPLICATION

Personalized medicine has increased the need for rebiopsy in NSCLC; the ability to acquire sufficient tissue with minimal morbidity will help design clinical trials and inform management decisions.

SSQ04-07 Repeat Biopsy for the Patients with Acquired Resistance to EGFR TKIs: Implication of Biopsy-related Factors on Detection of T790M Mutation

Thursday, Nov. 30 11:30AM - 11:40AM Room: E351

Participants

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PURPOSE

Identification of T790M resistance mutation through repeat biopsy is essential to determine eligibility of the potential candidate patients for the third-generation epidermal growth factor receptor (EGFR) tyrosine kinase inhibitors (TKIs). We aimed to investigate predictors for the successful repeat biopsy specimen acquisition for mutational analysis and T790M mutation detection.

METHOD AND MATERIALS

We retrospectively reviewed 90 advanced non-small cell lung cancer patients harboring EGFR mutation who underwent repeat cone-beam CT-guided transthoracic needle biopsy. Clinical characteristics as well as repeat biopsy-related factors were compared between the patients with and without adequate biopsy specimen acquisition and between the patients with and without T790M mutation. After univariate analysis, multivariate logistic regression analysis was performed to reveal independent predictors.

RESULTS

Appropriate biopsy specimen was obtained in 90% (81/90) and T790M mutation was found in 61.7% (50/81) of the study population. None of the analyzed variables was significantly associated with successful biopsy specimen acquisition. For the T790M mutation detection, duration of EGFR TKI treatment ($P=0.066$), duration of total chemotherapy treatment ($P=0.026$), tumor size ($P=0.066$), and metastatic lesion as a biopsy target ($P=0.029$) showed P values less than 0.10. Multivariate analysis revealed that smaller target tumor size (odds ratio, 0.765; 95% confidence interval: 0.600, 0.975; $P=0.031$) and metastatic lesion as a biopsy target (odds ratio, 4.194; 95% confidence interval: 0.997, 17.637; $P=0.050$) were significant independent predictors of T790M mutation detection.

CONCLUSION

Detection of T790M mutation at repeat biopsy was associated with smaller target tumor size and selection of metastatic lesion as a biopsy target.

CLINICAL RELEVANCE/APPLICATION

Selection of biopsy target can affect detection of T790M mutation in patients undergoing repeat biopsy (PTNB) as candidates of third-generation EGFR TKIs.

SSQ04-08 Single Institution Experience in Pre-Operative Pulmonary Lesion Marking Using Fiducial Markers and Micro-Coils in Preparation for Fluoroscopic Wedge Resection: Rates of Success, Complications, and Comparison of Two Labeling Devices

Thursday, Nov. 30 11:40AM - 11:50AM Room: E351

Participants

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PURPOSE

Evaluate the use of either Fiducial Marker (FM) or Microcoils (MC) to aid image-assisted wedge surgical resection of small pulmonary nodules and explore associations between patient/nodule characteristics and development of complications.

METHOD AND MATERIALS

IRB approved, HIPAA compliant database search identified patients who had CT-guided FM or MC implantation for wedge resection of pulmonary nodules from 01/01/95 - 01/22/2016. EMR was searched to extract patient's demographics including age, gender and body mass index. CT images prior to FM/MC insertion were reviewed by a single radiologist for nodule characteristics including size, location and depth. Post procedure CT images were read to measure distance of FM/MC to the nodule and to assess for complications including hemorrhage, pneumothorax and marker migration. Chi squared analysis at <0.05 was used to explore associations between patient/nodule characteristics and the development of complications.

RESULTS

We identified 136 nodules in 127 patients (67M:60F). Preoperatively, 130 FMs and 33 MCs were inserted to aid wedge resection in 112 and 15 patients respectively. 97% [124/127] of patients had successful same day resection as planned, two were delayed due to complications and a single patient needed a lobectomy due to lesion location. 68% of patients [88/127] had complications following FM/MC insertion including hemorrhage [32%], pneumothorax [24%], a combination of hemorrhage and pneumothorax [9%] and marker migration/emolization [3%]. Depth of lesion from skin was significantly associated with developing a complication. No other patient of nodular characteristic was associated with developing a complication. We observed a smaller percentage of patient complications in MC as compared to FM placement and these were of less severity, although statistical significance was not reached ($p=0.06$).

CONCLUSION

CT-guided pulmonary marking of pulmonary lesions is effective at aiding wedge resection. Complications are relatively common but mild with no significant effect on patient clinical management. Use of MC rather than FM may improve the safety profile of lesion marking.

CLINICAL RELEVANCE/APPLICATION

Mild complications are relatively frequent but should not deter FM or MC placement for wedge resection of pulmonary nodules. Our

data suggests MC may have a better safety profile as compared to FM.

SSQ04-09 Rebiopsy of Non-Small Cell Lung Cancer with Acquired Resistance to EGFR Tyrosine Kinase Inhibitor: Clinical and CT Characteristics of Patients with T790M Mutation

Thursday, Nov. 30 11:50AM - 12:00PM Room: E351

Awards

Student Travel Stipend Award

Participants

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PURPOSE

Re-biopsy for T790M mutation analysis of non-small cell lung cancer (NSCLC) after EGFR-tyrosine kinase inhibitor (TKI) treatment failure is important to determine further chemotherapy regimen. However, little is known regarding the clinical and radiologic differences among patients with or without T790 mutation.

METHOD AND MATERIALS

Between Jan 2011 and Jan 2017, 370 lung cancer patients underwent re-biopsy after TKI failure, and among them, 362 were assessed with adequate specimen. Clinical course, serial CT scans and pathologic reports were retrospectively reviewed. Re-biopsy methods are varied: CT or fluoroscopy-guided lung biopsy (n=130), EBUS or BFS-guided (n=71) biopsies, US-guided lymph node (n=40) or liver (n=20) biopsy, pleura biopsy (n=9), other sites (n=48) biopsies including surgical lung resection and pleural fluid analysis (n=44). CT scans obtained at the time of initial diagnosis and re-biopsy were compared between patients with and without T790M mutation.

RESULTS

Among 362 patients, 150 (41.4%) presented T790M mutation on re-biopsy. Two patients who were negative T790M mutation on pleural fluid analysis finally diagnosed as positive T790M mutation by following CT-guided biopsy or surgical lung resection. Mean interval between initial TKI failure and rebiopsy was longer in T790M positive group than negative group ($p=0.01$). On initial CT, the presence of pleural metastasis was significantly higher in T790M positive group ($p=0.006$). On CT obtained at the time of rebiopsy, pleural retraction adjacent to primary lung cancer and pleural metastasis were significantly noted, and number of metastatic sites is also higher in patients with positive T790M mutation ($p < 0.01$).

CONCLUSION

T790M mutation may be related to the interval between initial TKI failure and rebiopsy. Pleural retraction adjacent to primary lung cancer and pleural metastasis on CT at the time of rebiopsy were significantly associated factors to positive T790M mutation in NSCLC patients with TKI failure.

CLINICAL RELEVANCE/APPLICATION

On CT at the time of rebiopsy, pleural retraction and pleural metastasis were significantly noted in patients with positive T790M mutation after TKI failure. Negative T790M on pleural fluid analysis could not give a guarantee for true negative, and further core biopsy might be recommended.

SSQ05

Chest (Lung Cancer Screening)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S402AB

CH CT OI

AMA PRA Category 1 Credits [™]: 1.50
ARRT Category A+ Credit: 1.75

Participants

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Sub-Events

SSQ05-01 Performance of Deep Learning Model in Detecting T1 Lung Cancer with Chest Radiographs

Thursday, Nov. 30 10:30AM - 10:40AM Room: S402AB

Participants

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PURPOSE

The conventional chest radiograph (CXR) is one of the most widely available modality, but detecting small nodules on CXR remains a demanding task for radiologists. The purpose of this study was to evaluate diagnostic performance of deep convolutional neural network model (Deep learning model, DLM) for detecting a T1 lung cancer.

METHOD AND MATERIALS

For the training set, we collected CXRs from 19,927 individuals at our hospital (M:F = 11,082:8,845; mean age, 55 yrs) including 14,579 normal subjects and 5,348 patients with CT proven lung nodules. We adopted an augmented training method to create a training set of 280,000 images, then developed and trained DLM using a 50-layer deep residual network. For the test set, we collected 2,509 consecutive patients with a surgically-proven T1 lung cancer (M:F = 1,167:1,347; mean age, 60 yrs) between years 2010 and 2015. Inadequate cases (e.g., missing presurgical CXR, long interval between CT and CXR, nodules < 10 mm) were excluded. Two expert radiologists, who reached decisions by consensus, marked and scored nodule visibility on CXR on four levels: 1 (invisible) ~ 4 (obvious). The final test set included 1,483 patients with a lung nodule ≥ 10 mm. For human observer study, we selected 200 patients from the test set (100 with a nodule of subtlety 3 and 100 with subtlety 4) and 300 matching normal images. Six radiologists (experience of CXR reading ranging from 4 to 21 years) participated as observers. The radiologists marked lesion candidates and scored the confidence of nodule presence from 1 to 10. The detection performance of DLM and observers were evaluated using FROC analysis.

RESULTS

DLM showed sensitivities of 75% for all T1 lung cancers and 88% for subtlety levels 3 and 4, respectively at FPPI 0.3. When compared with human observers, DLM showed sensitivity 82.5% at FPPI 0.1 and 88% at FPPI 0.3. Observers showed mean sensitivity 78% (68 ~ 83%) at FPPI 0.1 and 85% (80 ~ 89%) at FPPI 0.3. Observers showed mean AUC 0.819 (0.754 ~ 0.862) in the FPPI range from 0.03 to 0.44, while DLM showed AUC of 0.858 in the same FPPI range.

CONCLUSION

A DLM developed for the detection of lung nodules on CXR yields high diagnostic performance in detecting T1 lung cancers.

CLINICAL RELEVANCE/APPLICATION

A diagnostic system based on a deep learning model shows promise for the future development of a CR-based, mass screening device for lung cancer identification.

SSQ05-02 Extrapulmonary Malignancy as a Cause of Death in the CT Arm of the National Lung Screening Trial: A Retrospective Analysis of CT Evidence of Disease

Thursday, Nov. 30 10:40AM - 10:50AM Room: S402AB

Participants

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PURPOSE

To explore CT findings associated with "other neoplasms", which were the cause of death (COD) in 22% of deaths in the National Lung Screening Trial (NLST).

METHOD AND MATERIALS

Three board-certified cardiopulmonary radiologists retrospectively reviewed low-dose screening CTs of the 263 NLST participants whose CODs were one of the 10 most common extrapulmonary malignancies (EPM), either on the death certificate or in the endpoint verification process, and in whom CT images were available. Two readers each reviewed ½ the cases, and a 3rd reader reviewed all 263 cases. The readers were aware of COD in each case. The scans were classified as negative, indeterminate or positive for findings that could be correlated with the EPM listed as the COD. For discrepant reads, the case was reviewed by all three readers to develop a consensus opinion.

RESULTS

The most common EPMs to cause death in the CT arm of the NLST population were pancreas (N = 76), esophagus (N = 35), colorectal (N = 34), brain (N = 21), leukemia (N = 21), bladder (N=19), liver (N = 18), breast (N=14), multiple myeloma (N=13) and lymphoma (N = 12). Of these, the CT scans were positive for EPMs with visualization of the primary tumor or metastatic disease in 15.6% (41/263) of cases. The EPMs that were most likely to be detected on the CT were esophageal (37.1%, 13/35), breast (35.7%, 5/14) and pancreatic (13.1%, 10/76) cancers. In all three tumors, the primary tumor was visible as a solid mass. In colorectal cancer, however, the disease was detected as metastatic to the liver in 11.8% (4/34) cases. The CT scans were classified as indeterminate for detection of the primary malignancy or metastasis in an additional 9.9% (26/263) of cases, but the findings could potentially have prompted additional work-up ultimately leading to the detection of the EPM.

CONCLUSION

Extrapulmonary malignancy is the third most common cause of death in the lung cancer screening population. Findings related to the primary tumor or metastatic disease are present in 15.6% of the most common tumors. The primary tumor was most likely to be seen in esophageal, breast and pancreatic cancers, and appeared as a solid mass.

CLINICAL RELEVANCE/APPLICATION

Detection of an EPM on lung cancer screening CT may help reduce mortality in this high risk population. Esophageal, breast and pancreatic cancers may be visible as solid masses.

SSQ05-03 Outcome of Lung-RADS Category 3 and 4 on Initial Lung Cancer Screening Exams

Thursday, Nov. 30 10:50AM - 11:00AM Room: S402AB

Participants

Milena Petranovic, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To determine the follow-up course and clinical outcome of lung cancer screening exams for patients whose studies were designated as Lung-RADS category 3 and 4 on the initial screening exam.

METHOD AND MATERIALS

The reports of all initial lung cancer screening chest CT exams performed at a major tertiary center between 2/1/2013 and 12/31/2016 were reviewed. Detailed chart review was performed for all patients assigned as category 3 and 4, including reports of any subsequent imaging, diagnostic procedures and complications, pathology and microbiology. We compared our findings with those estimated and predicted by ACR Lung-RADS version 1.0.

RESULTS

Our IRB approved study included 1567 adult patients (M:F 826:741, Age:64±6) and identified 20% (317/1567) exams as Lung-RADS category 3 or 4. 18% (58/317) of category 3 and 4 patients underwent some type of invasive procedure (CT-guided biopsy (7), bronchoscopy (6), surgery (43), other (2)). 4% (7/181) of category 3 and 32% (43/136) of category 4 patients were diagnosed with malignancy. Median time from initial screening exam to tissue diagnosis for malignancy was 11 weeks (range 2-154weeks). Majority of patients who underwent an invasive procedure went directly to either wedge resection or lobectomy without prior tissue diagnosis. Complications were seen in 7% (4/58) of patients, all related to surgery and included air leak (3) and chyle leak (1). 2% (8/317) of patients who underwent an invasive procedure yielded benign pathology. 8% (26/317) patients did not have any imaging follow-up, including 6% (20/181) of category 3 and 2% (6/136) of category 4. 51% (93/181) of category 3 and 41% (56/146) of category 4 patients were downgraded to category 2. The average number of CT exams performed prior to downgrading was 1.3.

CONCLUSION

We found our patient population had greater percentage of category 3 and 4 patients than the estimated population prevalence. A

higher percentage of category 3 and 4 patients ultimately had a malignant diagnosis than predicted. A small proportion of patients had procedures performed for benign diagnosis. Complications among all groups were low.

CLINICAL RELEVANCE/APPLICATION

The high percentage of malignancy diagnosed in Lung-RADS category 4 and, to a lesser extent, category 3 patients emphasizes the importance of adhering to the guidelines in the management of these patients.

SSQ05-04 Assessment of the Vancouver Risk Calculator Compared to ACR Lung Rads Applied to National Lung Screening Trial Nodules

Thursday, Nov. 30 11:00AM - 11:10AM Room: S402AB

Participants

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PURPOSE

To compare the efficacy of the Vancouver Risk Calculator (VRC) with ACR LungRADS in determining malignancy among solid nodules identified in the National Lung Screening Trial (NLST).

METHOD AND MATERIALS

The study received approval from the IRB and NCI CDAS system to use NLST data. All nodules detected in the CT arm of the NLST were considered for inclusion. After exclusions due to inability to determine malignant vs benign nodule status (no gold standard), incomplete data sheets preventing the use of the risk calculator, and subsolid nodule type, 4078 nodules were available for evaluation. The 4078 solid nodules were scored using the VRC consisting of 9 nodule and patient parameters (output = % likelihood of malignancy, malignancy threshold tested at >5% likelihood) and LungRADS (output = Category 2-4B, malignancy defined as 4A or 4B, malignancy defined as >5% likelihood as noted in LungRADS table on ACR website). Comparison was performed between LungRADS and the VRC to determine their respective sensitivity, specificity and accuracy to distinguish between benign and malignant solid nodules.

RESULTS

For ACR LungRADS category 2 (non-malignant), there were 2,141 nodules of which 3 were malignant. The VRC designated 0 malignant with 0 False Positives (FP) for the 5% threshold. For LungRADS category 3 (non-malignant) there were 1,136 nodules of which 7 were malignant. The VRC designated 3 malignant, with 31 false positives. For LungRADS category 4A (malignant), there were 630 nodules of which 26 were malignant. The VRC designated 25 malignant with 244 FP. For LungRADS category 4B (malignant), there were 171 nodules of which 64 were malignant. VRC designated 64 malignant with 107 FP. Overall sensitivity, specificity and accuracy for LungRADS was 90.0%, 82.1% and 82.3%, respectively and for VRC 5% threshold, it was 92.0%, 90.4% and 90.4%, respectively.

CONCLUSION

In comparison with ACR LungRads, the Vancouver risk model demonstrated higher sensitivity, specificity and accuracy in determining malignancy among solid nodules in the NLST.

CLINICAL RELEVANCE/APPLICATION

For solid nodules, risk models such as the Vancouver risk calculator may provide a superior assessment of the likelihood of malignancy than the ACR LungRads categories.

SSQ05-05 Management of New Solid Nodules at First Follow-Up after Detection in Incidence Screening Rounds of Low-Dose CT Lung Cancer Screening

Thursday, Nov. 30 11:10AM - 11:20AM Room: S402AB

Participants

Joan E. Walter, BSc, Groningen, Netherlands (*Presenter*) Nothing to Disclose
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Rozemarijn Vliegenthart, MD, PhD, Groningen, Netherlands (*Abstract Co-Author*) Institutional Research Grant, Siemens Healthineers
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PURPOSE

Low-dose CT (LDCT) lung cancer screening is recommended by US guidelines for high-risk individuals. New solid nodules detected after baseline screening have a high lung cancer probability and their management is crucial for the success of a screening program. Currently, there is no evidence for the management of nonresolving new solid nodules at first follow-up after detection.

METHOD AND MATERIALS

In this ongoing, multicenter, randomized controlled trial, 15,822 participants were randomly assigned to screening with LDCT (n=7,915) or no screening (n=7,907). In total, 7,557 individuals underwent baseline screening and 7,295 participants underwent subsequent screening rounds. We included all participants with solid non-calcified nodules, registered by the radiologists as new or

<15mm³ (study detection limit, ca. 3mm) at previous screens, that received a follow-up scan after detection. High-risk nodules (>500mm³) which led to immediate referral at first detection were excluded. Nodule volume was generated semiautomatically by software.

RESULTS

Overall, 680 participants with 1,020 low-intermediate risk new solid nodules were included. A total of 562 (55%) new solid nodules were resolving and in 321 (47%) participants all detected new solid nodules were resolving nodules. In 356 (52%) participants a new solid nodule persisted as solid nodule, with 25 (7%) participants being diagnosed with lung cancer in such a nodule. At follow-up, volume doubling time (VDT) (area under the curve [AUC]: 0.913, 95%CI 0.861-0.965), volume (AUC: 0.875, 95%CI 0.822-0.928), and VDT combined with a previously established $\geq 200\text{mm}^3$ volume cutoff (AUC: 0.939, 95%CI 0.904-0.974) had high discriminatory power for lung cancer. The combination of $\leq 590\text{days}$ VDT or $\geq 200\text{mm}^3$ volume at follow-up provided 100% (95%CI 84-100%) sensitivity, 84% (95%CI 80-87%) specificity, and 27% (95%CI 19-37%) positive predictive value for lung cancer.

CONCLUSION

More than half of new solid nodules identified in LDCT lung cancer screening are resolving nodules. At first follow-up, a cutoff combination of $\leq 590\text{days}$ VDT or $\geq 200\text{mm}^3$ volume can be used for risk stratification.

CLINICAL RELEVANCE/APPLICATION

Management of new nodules detected after baseline determines the success of a screening program. Appropriate risk stratification by VDT and volume at follow-up could prevent delayed cancer diagnosis.

SSQ05-06 Use of a Risk Model Combining Clinical Information and CT Findings to Customize Follow-Up Intervals in Lung Cancer Screening

Thursday, Nov. 30 11:20AM - 11:30AM Room: S402AB

Awards

Trainee Research Prize - Fellow

Participants

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PURPOSE

The U.S. has launched an annual CT lung cancer screening program, irrespective of individual participants' malignancy risk. We developed a risk model based on information from the baseline CT and clinical information to calculate the trade-off between cost savings by omitting one year follow-up scans in low risk individuals and the number of delayed cancer diagnoses.

METHOD AND MATERIALS

We used data from the National Lung Screening Trial. We selected all subjects who underwent a baseline scan and a one year follow up scan, those diagnosed with lung cancer after the baseline scan were excluded. Using baseline clinical data and baseline scan variables, various models were developed to estimate the risk of developing lung cancer after the one year follow-up scan, using backward stepwise regression. The full model included both clinical and scan variables. Additionally we tested a clinical-only model and a nodule-only model, the latter including the largest nodule diameter as the only variable. Furthermore, the published Brock and Patz models were validated on the same data set.

RESULTS

174 of 24,542 participants were diagnosed with lung cancer in the year after the first annual follow up. Best predictors included in the full model were older age, higher smoking duration and intensity, shorter smoking quit time, previous COPD and cancer diagnosis, emphysema, longest and perpendicular diameter of the largest nodule, presence of subsolid nodules, presence of an upper lobe nodule, and presence of a spiculated nodule. Using our full model, 9,972, 16,298, 19,726, and 21,158 of the cancer-free persons could have safely avoided the one year follow-up scan, at the expense of delaying the diagnosis of 17, 44, 70, and 88 of the lung cancer patients, respectively. The area under the ROC curve ranged from 0.79 with our full model to 0.73 with the Brock model to 0.67 in the Patz model.

CONCLUSION

Predictive models based on clinical and baseline scan information can be used to personalize follow up intervals in lung cancer screening, saving radiation and costs. Results differed substantially depending on the risk model used.

CLINICAL RELEVANCE/APPLICATION

Our model can be used to improve lung cancer screening efficiency by selecting a substantial proportion of participants for a two year follow-up interval, while delaying lung cancer diagnosis in only very few cases. This can greatly reduce costs, radiation burden and radiologist's work-load.

SSQ05-07 A Novel DeepWise CAD System for Detection of Pulmonary Nodules

Thursday, Nov. 30 11:30AM - 11:40AM Room: S402AB

Participants

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PURPOSE

To validate a novel DeepWise computer-aided detection (CAD) system for automated detection of pulmonary nodules.

METHOD AND MATERIALS

The DeepWise CAD system designed by means of a specialized deep neural network is a novel and more intelligent CAD system to detect pulmonary nodules automatically. A public data set LIDC-IDRI and an in-house data set (a total of about 7,000 nodules) were used as the development data set. One hundred consecutive low-dose CT (LDCT) scans in a screening program and 100 specified and matched nodules in another 60 LDCT scans were independently evaluated by two radiologists (Radiologist 1, 2) and the DeepWise CAD system to identify nodules larger than or equal to 2 mm in average diameter. All the nodules detected by both the radiologists and the system were reviewed jointly by another two chest radiologists, who were experienced in LDCT lung cancer screening, and a "true" nodule count was determined. The performance of the two radiologists and the DeepWise CAD system were compared.

RESULTS

Radiologist 1, 2 and the DeepWise CAD system detected 193, 115 and 271 nodules, respectively. Of the 325 separate nodules detected by the three techniques, 282 were classified as true nodules on consensus review. Of the true nodules present, the detection rate of the Radiologist 1, 2 and the DeepWise CAD system were 66.3% (187/282), 40.8% (115/282) and 83.0% (234/282), respectively. And the 48 nodules missed by the DeepWise CAD included 41 solid nodules with an average diameter of less than 5 mm and 7 ground glass nodules. 187 (96.9%) of 193 Radiologist 1-detected nodules were true nodules, all 115 Radiologist 2-detected nodules were true nodules, and 234 (86.3%) of 271 of the DeepWise CAD-detected nodules were true nodules. The DeepWise CAD system identified 37 lesions that on consensus review were false-positive nodules, a rate of 0.23 (37/160) per patient.

CONCLUSION

The novel DeepWise CAD system detected 83.0% of true nodules, which was significantly superior to radiologists. And its false positive rate, 0.23 per patient, was significantly cut down.

CLINICAL RELEVANCE/APPLICATION

With the popularity of MDCT, the detection rate of lung nodules was significantly improved, which brought great pressure to radiologists. And the false positive nodules detected by traditional CAD software were so much that the clinical application was limited. So we need a more intelligent CAD system to detect pulmonary nodules accurately.

SSQ05-08 Lung-RADS Performs Well in a Diverse and Underserved Lung Cancer Screening Population

Thursday, Nov. 30 11:40AM - 11:50AM Room: S402AB

Awards

Student Travel Stipend Award

Participants

Hannah Milch, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
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Jeffrey M. Levsky, MD, PhD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
Linda B. Haramati, MD, MS, Bronx, NY (*Presenter*) Spouse, Board Member, Kryon Systems Ltd

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PURPOSE

To evaluate the performance of Lung-RADS in a clinical setting that markedly differs from the Lung-RADS score derivation populations.

METHOD AND MATERIALS

Our low dose CT (LDCT) lung cancer screening program is referral based and relies on a bilingual coordinator. LDCTs were interpreted by subspecialized chest radiologists using Lung-RADS. 30% (356/1181) were interpreted prior to Lung-RADS release and assigned an internally derived 1-5 score that was later converted to Lung-RADS as follows: scores of 1 and 2 to Lung-RADS 1 and 2, scores 3 and 4 to Lung-RADS 3, scores 5a and 5b to Lung-RADS 4a and 4b. Data were obtained by patient interview and electronic medical records.

RESULTS

1181 patients were screened between 2012 and 2016. Of these, 356 (30%) were screened prior to Lung-RADS release. The remaining 825 (70%) were screened after Lung-RADS release. The overall Lung-RADS score distribution was as follows: 1 (1.2%), 2 (1.2%), 3 (1.2%), 4a (1.2%), 4b (1.2%), 5a (1.2%), 5b (1.2%), 6 (1.2%), 7 (1.2%), 8 (1.2%), 9 (1.2%), 10 (1.2%).

1181 patients were screened from December 2012- December 2016, median age was 63 [IQR 59-67], 49% (569) men, 75% non-white (31% black, 31% Hispanic, 13% other), 55% (651) Medicaid/Medicare insured, 71% current smokers (median pack-years 45), median socioeconomic status -2.26. Comorbidities: 69% overweight/obese (32%/37%), 68% hypertension, 67% chronic lung disease, 35% diabetes, 17% heart disease, 2.1% HIV positive. Lung-RADS performance: 87% (1030/1181) of baseline LDCTs were negative (Lung-RADS 1 or 2)- lung cancer rate 0.2%(2/1030); 10% (119) Lung-RADS 3- cancer rate 3.4%(4/119); 1.2% (14) Lung-RADS 4a- cancer rate 43% (6/14); 1.5% (18) Lung-RADS 4b- cancer rate 83% (15/18). The overall positive rate (Lung-RADS 3, 4a, and 4b) was 12.8% (151/1181), false positive rate 10.9%, and positive predictive value (PPV) 16.6% (CI 14.0-19.5). Sensitivity was 92.6%. Mortality in lung cancer patients was 27% vs 0.6% in non-lung cancer patients.

CONCLUSION

Although Lung-RADS was derived and retrospectively validated primarily via the NLST and I-ELCAP screening cohorts, it performs well clinically in a predominantly poor, ethnically diverse population, meeting or exceeding benchmarks.

CLINICAL RELEVANCE/APPLICATION

In clinical practice Lung-RADS increased the PPV of the LDCT exam to 16.6% versus 3.8% in the NLST and significantly exceeded ACR cancer diagnosis benchmarks for Lung-RADS 4a-43% and 4b-83% (benchmarks: 4a- 10-15%, 4b- >15%). .

SSQ05-09 Access to Lung Cancer Screening Services: Preliminary Analysis of Geographic Service Distribution Using the ACR Lung Cancer Screening Registry

Thursday, Nov. 30 11:50AM - 12:00PM Room: S402AB

Awards

Student Travel Stipend Award

Participants

Paniz Charkhchi, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose

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PURPOSE

Lung cancer has the highest mortality rate among all types of cancer in the United States. NLST demonstrated low dose CT (LDCT) for lung cancer screening decreases both lung cancer related mortality and all-cause mortality. Currently, the only CMS approved lung cancer screening registry is the Lung Cancer Screening Registry (LCSR) administered by the American College of Radiology (ACR). We aim to show the availability of facilities, participated in the LCSR, in the each state to provide lung cancer screening services to those who are screen-eligible and to assess if facility availability is proportionate to state-level demographic and lung cancer related outcome.

METHOD AND MATERIALS

The ACR LCSR list of participating lung cancer screening facilities was used as a proxy for the availability of lung cancer screening facilities in each state. Additionally, we normalized the number of facilities by state by the number of screening-eligible individuals using BRFSS data. State-level demographics were obtained from the 2015 BRFSS: poverty level, insured population, unemployed, Black and Latino. We obtained data on lung cancer incidence and death, number of active physician per 100,000 and Medicare expenditure. We performed linear regression models to examine the influence of the covariates on state-level screening facility number by state using Stata 11.

RESULTS

As of 11/18/2016, 2,423 facilities participated in the LCSR, with a median number of 32 facilities per state (interquartile range 63) with highest number in the Florida (n=198) and the lowest number in the District of Colombia and Montana (n=3). Figure 1 graphically represents the location and distribution of lung cancer screening facilities by proportion of screen-eligible individuals. There was a positive independent effect (OR=12.90, 95% CI =11.01- 14.79) between state-level number of screening facility and rate of screen-eligible individuals rate per 100,000. There were no significant correlations between numbers of facility and lung cancer outcomes, state demographic characteristics, or physician supply and Medicare expenditure.

CONCLUSION

Although there was a positive relation between facility number and screening eligible rate, there is a further need to evaluate the geographic access of these facilities.

CLINICAL RELEVANCE/APPLICATION

Screen eligible by state remains additional work define if other access barriers exist.

SSQ06

Science Session with Keynote: Emergency Radiology (Torso Trauma)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S405AB

CT ER GI VA

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Jamlik-Omari Johnson, MD, Atlanta, GA (*Moderator*) Research Grant, Koninklijke Philips NV; Royalties, Cambridge University Press
Savvas Nicolaou, MD, Vancouver, BC (*Moderator*) Institutional research agreement, Siemens AG

Sub-Events

SSQ06-01 Emergency Radiology Keynote Speaker: Role of Split Bolus Contrast Infusion for Trauma CT

Thursday, Nov. 30 10:30AM - 10:40AM Room: S405AB

Participants

Johann B. Dormagen, MD, Oslo, Norway (*Presenter*) Nothing to Disclose

SSQ06-02 Impact of Whole-Body CT in Non-Severely Injured Patients: Role of Split Bolus versus Delayed Arterial Phase as a Diagnostic Tool in Potential Medicolegal Controversies

Thursday, Nov. 30 10:40AM - 10:50AM Room: S405AB

Participants

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PURPOSE

Whole body CT in non-severely injured patients is frequently a cause of dispute between referring trauma physicians and vetting radiologists. On the other hand, missing a potentially treatable injury is equally unacceptable and may lead to lawsuits. This study aims to determine whether the use of split bolus versus delayed arterial phase might be of value in the assessment of non-severely injured trauma patients.

METHOD AND MATERIALS

A retrospective sample of 72 polytrauma whole-body CT scans, performed from January 2015 to March 2017 at a major trauma centre was analysed. All patients with an ISS less than or equal to 16, represented our inclusion criteria. One pass poly trauma CT scans were performed by a delayed arterial phase acquisition (bolus-triggering technique starting after 20sec. from peak enhancement) or by the split bolus technique (1th bolus with 65ml of contrast at 2mL/s, following by 10sec. delay, 2th bolus with 85mL of contrast at 3.5 mL/s following by a flush of 40ml of saline at 3.5 mL/sec, initiate scan at 77 sec.). Differences in attenuation values of the liver, spleen, pancreas and kidneys between the two acquisition protocols were expressed in Hounsfield Units. Statistical comparison between the two groups was determined by using the Chi-square test.

RESULTS

Forty patients were scanned using the split bolus protocol, whereas the remaining 32 patients received the delayed arterial phase protocol. Overall, 10 patients had bone fractures, 3 had pneumothoraces, 3 had renal contusions, 1 had renal, adrenal, and hepatic contusions and 3 had vascular injuries. There was no significant statistical difference in regard to overall attenuation values of the liver in both groups: (117 vs 123 HU, p=0.18) and pancreas (112 vs 131 HU, p=0.46), whereas differences were statistically significant in regard to the spleen (143 vs 119 HU, p=0.04), and kidneys (205 vs 225 HU, p=0.03).

CONCLUSION

Our results show that split bolus acquisition technique is associated with more homogeneous contrast enhancement of the spleen and kidneys and can be implemented as a standard acquisition protocol in non-severely injured patients.

CLINICAL RELEVANCE/APPLICATION

The integration of a low radiation dose technique such as split bolus in daily clinical practice in patients in whom the indications for standard whole-body CT are 'borderline', can reduce disputes between referring trauma physicians and vetting radiologists and avoid lawsuits.

SSQ06-03 Imaging of Delayed Manifestations of Abdominopelvic Trauma

Thursday, Nov. 30 10:50AM - 11:00AM Room: S405AB

Participants

Mohammed F. Mohammed, MBBS, Vancouver, BC (*Abstract Co-Author*) Speaker, Siemens AG; Employee, X-Ray Teleradiology Services
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PURPOSE

Abdominal injuries presenting to hospital emergency departments often warrant an initial modality of imaging to screen for injuries from the initial traumatic incident. A handful of traumatic injuries may not be identified or fail to manifest on the initial CT, resulting in delayed manifestations of abdominal trauma. This may lead to subsequent readmission, delayed management, and possibly severe complications. No studies have investigated this topic in a holistic, whole-body approach. As such, our study aims to quantify the frequency and type of delayed abdominal injuries, and to determine the etiology behind the delayed manifestation and diagnosis.

METHOD AND MATERIALS

For this IRB-approved retrospective study, the hospital trauma registry was queried for patients with multi-trauma and ISS ≥ 16 between January 2010 and August 2016 and had initial Abdominopelvic CT on admission, yielding 3735 studies. Patients who received a follow-up abdominopelvic CT within 6 months from the initial scan were included in our study (203). The clinical indication and radiological findings were reviewed, clinical indications for repeating CT study, presence or absence of a new radiological finding, organ-related abnormality and clinical management accordingly.

RESULTS

203 patients (5.44%) received follow up CTs. The average elapsed time between the initial and follow-up CT was 15 ± 27 days. Individual clinical indications (n=243) included evaluation for abdominal collection (n=97), 39.92%; solid organ injury (n=85), 34.98%; Bowel-Related abnormalities (n=31), 12.76% and miscellaneous indications (n=30), 12.35%. Delayed manifestations and complications of trauma were found in 41 cases (20.1 %) and were attributed to 46 abnormalities related to new abdominal collections and hematoma (n=17) ; solid organ injury (n=19); bowel and mesentery (n=6); diaphragmatic injury (n=3) and urinary bladder injury (n=1). Based on the radiological findings on follow up CT studies, 8 Surgical and 16 interventional procedures were performed.

CONCLUSION

A small percentage of traumatic injuries may not be identified on the initial CT, resulting in delayed traumatic manifestations, leading to an increase in morbidity.

CLINICAL RELEVANCE/APPLICATION

Understanding the frequency and pattern of delayed abdominal injuries increases the awareness of radiologists to injuries that require scrutiny on initial trauma imaging and closer follow up.

SSQ06-04 A 2017 National Survey to Assess Blunt Trauma CT Protocols at U.S. and Canadian Trauma Centers

Thursday, Nov. 30 11:00AM - 11:10AM Room: S405AB

Awards

Student Travel Stipend Award

Participants

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PURPOSE

To our knowledge, there are no published societal or national guidelines for blunt trauma CT imaging protocols, including on the use of whole-body CT (WBCT). Our goal was to survey trauma radiologists in the United States and Canada in order to determine if there is any consensus on indications for WBCT, the algorithms used in blunt trauma patients, and the most common protocols used.

METHOD AND MATERIALS

With IRB approval, an anonymous 17 question survey was distributed via email link to 78 radiology departments at 78 trauma centers in the U.S. and Canada. The study was open for a two-week period in March 2017. A commercially available website that allows subscribers to create and analyze surveys was used for analysis.

RESULTS

31 respondents from 31 institutions completed the survey (response rate 40%). 52% use WBCT protocol for blunt abdominal trauma. For those that use WBCT, half report that a single radiologist interprets the entire scan. The most common blunt trauma chest CT protocol is single phase, contrast-enhanced arterial phase imaging (72%). The most common blunt trauma abdomen/pelvis CT protocol is a single IV contrast injection followed by portal venous phase imaging (48%). 76% reported not routinely obtaining delayed phase abdominal and pelvic images. Spine reconstructed images are always created at 52% of institutions. When asked if trauma CT images are routinely reviewed by a radiologist before the patient is moved from the CT table, the two most common answers were "no" (55%) and "yes, a majority are reviewed by a radiology resident" (28%). 86% of institutions routinely use filtered-back projection or iterative reconstruction with trauma CTs. When asked who interprets trauma CTs performed during what would be considered after hours, the most common answer was "after-hours interpretations are provided by an in-house or remotely situated attending radiologist who is a full-time staff physician at the institution" (72%). 50% of institutions do not routinely assess renal function prior to blunt trauma CT imaging.

CONCLUSION

There is substantial variation across U.S. and Canadian-based institutions regarding the current use of whole-body CT in blunt trauma, how trauma CT scans are protocolled, and who interprets them.

CLINICAL RELEVANCE/APPLICATION

There is a lack of uniformity in how patients with blunt trauma are currently scanned with CT across U.S. and Canadian trauma centers.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Douglas S. Katz, MD - 2013 Honored Educator Douglas S. Katz, MD - 2015 Honored Educator

SSQ06-05 Traumatic Vascular Injuries of Abdominal Solid Organs: Is Split-Bolus Really That Bad?

Thursday, Nov. 30 11:10AM - 11:20AM Room: S405AB

Participants

Maarten J. Graumans, BSC, Amsterdam, Netherlands (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To evaluate the accuracy of the single-pass split-bolus whole body CT protocol compared to the conventional segmented multi-pass protocol for traumatic vascular injuries of solid abdominal organs.

METHOD AND MATERIALS

745 trauma patients were retrospectively included; 350 patients in the conventional segmented multi-pass whole body CT group and 395 patients in the split-bolus single-pass whole body CT group. Radiology reports were analyzed for presence of contrast extravasation, hemorrhage and vascular injuries. Electronic patient records were analyzed for subsequent hemorrhagic events during follow-up either in clinical records or follow-up imaging radiology. Mortality analysis was performed on patients who died since their presentation in the hospital.

RESULTS

In total, 79 patients suffered hemorrhages of which 35(10%) in the conventional group and 44(11.1%) in the split-bolus group. There were no missed hemorrhages found in either group. There was no statistically significant difference of the incidence of vascular injuries between groups. No cases of mortality were found to be related to missed vascular injuries.

CONCLUSION

Using the split-bolus single-pass whole body CT protocol for the initial evaluation of trauma patients does not lead to clinically significant missed vascular injuries of abdominal solid organs.

CLINICAL RELEVANCE/APPLICATION

Our work suggests that the split-bolus protocol does not underperform compared to the conventional protocol and should be considered as a method of radiation dose reduction in the trauma population.

SSQ06-06 Emergency Department Imaging Super-users: Utilization Characteristics of the Most Resource Intense Patients

Thursday, Nov. 30 11:20AM - 11:30AM Room: S405AB

Participants

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PURPOSE

To identify and characterize the most frequent users of emergency department (ED) imaging ("Super-users").

METHOD AND MATERIALS

All patients with at least 1 ED visit in 2016 within a four-hospital healthcare system were retrospectively identified. Characteristics of those encounters and all associated radiology examinations were then analyzed.

RESULTS

Overall, 126,940 unique patients presented for 187,603 separate ED visits which resulted in a total of 192,142 imaging examinations. Mean annual ED visits per patient were 1.48 ± 1.66 (range: 1-294). The top 0.32% (n=408) of patients visited the ED >10 times in the year and accounted for 3.8% of all ED visits; the top 1.7% (n=2,158) of patients visited the ED >5 in the year and accounted for 10.48% (n=19,667) of all ED visits. 73,672 ED patients (58%) underwent at least 1 ED imaging examination, with a mean of 2.6 exams per patient (SD 2.69; range: 1-60). 2,124 patients (1.67% of the total ED patients) underwent ≥ 10 imaging examinations, and accounted for 15.01% of the total annual ED imaging volume. ED imaging volume consisted of CT (n=68,370; 35.6% of imaging volume; range per patient 0-21), radiography (n=67,409; 35.1%; range 0-39), ultrasound (n=29,985; 15.6%; range 0-27), MRI (n=15,433; 8.03%; range 0-13), with far fewer numbers of all other modalities.

CONCLUSION

A tiny fraction (1.67%) of all ED patients account for a disproportionately large percentage (15%) of all ED imaging volume. Further study of these Super-users may catalyze targeted interventions to control unnecessary ED imaging volume growth, contain costs, and decrease per-patient radiation exposure.

CLINICAL RELEVANCE/APPLICATION

Further characterization of this vulnerable patient population may facilitate informed targeted interventions to optimize ED imaging, restrain costs, and decrease per-patient radiation exposure.

SSQ06-07 Have We Gone Too Far? Active Arterial Bleeding: Not as Bad as We Thought

Thursday, Nov. 30 11:30AM - 11:40AM Room: S405AB

Participants

Joaquin P. Moran Marsili SR, MD, Madrid, Spain (*Presenter*) Nothing to Disclose
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PURPOSE

The presence of active bleeding in computed tomography (CT) is usually related to failure of conservative treatment in the context of a traumatic hemorrhage. Our goal is to evaluate if all patients with a traumatic active arterial extravasation should be managed aggressively or not, and if there is any predictor factor in the therapeutic decision-making.

METHOD AND MATERIALS

We performed a retrospective analysis of CT angiographies with active arterial extravasation ("blush") in adult trauma patients admitted from January 2013 to March 2017 at the emergency department. Patients with intestinal, aortic or spontaneous bleeding were excluded. All studies were reviewed in a posterior second lecture. We reviewed the management performed and analyzed several clinical, laboratory, and radiological parameters before the treatment. We made a descriptive, univariate and multivariate study with the software SPSS Statistics v.20.

RESULTS

Out of 152 patients included in the study, 41 were removed in the review and the analysis was performed on a final population of 111 patients. We followed two different groups: patients who required surgical or radiologic intervention (75), and the remaining patients who were managed conservatively (36), both with a good outcome. Between the conservative and aggressive management groups, we found statistically significant differences in hemodynamic stability (83% vs. 42%; $p < 0.001$), lactate level (mean 2 vs. 4.2 mmol / L; $p < 0.001$), arterial blush measurement (mean 12 vs. 19 mm; $p = 0.05$) and localization (55% vs. 36% with peripheral location; $p = 0.03$). The area under the ROC curve for lactate level and arterial blush size like predictor factors was 0.7 in both cases. The combination of statistically significant variables had a sensitivity of 80%, a specificity of 64%, a positive predictive value of 86% and a negative predictive value of 52% to predict the need of aggressive management.

CONCLUSION

Some patients with traumatic active arterial extravasation in a CT angiography can be managed conservatively based on clinical, laboratory and radiological data. We consider that lactate level and arterial blush size are good predictor factors. An exhaustive investigation that defines solid criteria for therapeutic decision-making is necessary.

CLINICAL RELEVANCE/APPLICATION

Several of the traumatic active arterial extravasation detected in emergency CT angiography can be treated conservatively, without any intervention.

SSQ06-08 Unidentified Bright Objects of Spleen on Arterial Phase CT: Differentiating features of this Mimicker of

Splenic Vascular Injury in Blunt Abdominal Trauma

Thursday, Nov. 30 11:40AM - 11:50AM Room: S405AB

Participants

Naren Hemachandran, MBBS, New Delhi, India (*Presenter*) Nothing to Disclose
Shivanand R. Gamanagatti, MBBS, MD, New Delhi, India (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

We describe Unidentified Bright Objects of Spleen (UBOS) as hyperdense areas around splenic lacerations on arterial phase (AP) CT which are isodense on portal venous phase and have no abnormal correlate on digital subtraction angiography (DSA). They need to be differentiated from splenic vascular injuries like active contrast extravasation (AE) and pseudoaneurysms (PA) as it has management implications. We describe a few signs and their diagnostic accuracy to differentiate PA/AE from UBOS

METHOD AND MATERIALS

Retrospective analysis of patients of blunt abdominal trauma who had undergone dual phase CT & DSA was done. All hyperdense lesions on AP were evaluated for their margins (well defined/ill-defined), presence of the lesion on adjacent/parallel walls of the laceration (wall sign), presence of normal parenchyma in relation to at least one side of the lesion (adjacent parenchyma sign) and string of beads appearance. The difference between the mean CT Hounsfield unit (HU) of the lesion and aorta was also noted in the AP. The diagnostic accuracy of these signs for distinguishing from UBOS was calculated with DSA as gold standard.

RESULTS

In the 43 patients included, 54 hyperdense lesions were detected on AP, which included 22 vascular injuries (11 PA, 11 AE) and 32 UBOS based on DSA. The presence of ill-defined margins had a low sensitivity and specificity (37%, 18% respectively). The adjacent parenchyma sign had a sensitivity of 84% and specificity of 77%. The wall sign and a beaded appearance had a sensitivity of 50% and 65% and a high specificity of 95% and 86% respectively. ROC curve analysis done for the difference in HU between the aorta and the lesion showed that a difference of over 50 HU had a sensitivity of 88.9% and specificity of 90.6% (AUC - 0.896).

CONCLUSION

A difference of over 50 HU between the lesion and aorta & the adjacent parenchyma sign had highest diagnostic accuracy while the wall sign and beaded appearance had a high specificity but a low sensitivity for identifying UBOS

CLINICAL RELEVANCE/APPLICATION

Accurate differentiation of unidentified bright objects of spleen from splenic vascular injuries has management implications and is possible with the above described signs

SSQ06-09 Radiology in the Midst of the Opioid Epidemic: 12-year Analysis of Imaging Findings, Mortality and Opioid Prescription History among Patients with Intravenous Substance Use Disorders (IV-SUDs) Presenting to Emergency Radiology

Thursday, Nov. 30 11:50AM - 12:00PM Room: S405AB

Participants

Renata R. Almeida, Boston, MA (*Presenter*) Nothing to Disclose
Mohammad Mansouri, MD, MPH, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Ajay K. Singh, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lev, MD, Boston, MA (*Abstract Co-Author*) Consultant, General Electric Company; Institutional Research Support, General Electric Company; Stockholder, General Electric Company; Consultant, MedyMatch Technology, Ltd ; Consultant, Takeda Pharmaceutical Company Limited; Consultant, D-Pharm Ltd
Efren J. Flores, MD, Boston, MA (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To assess the prevalence and type of IV-SUDs imaging complications, mortality rate, and history of opioid prescriptions (OP) and in patients presenting to Emergency Radiology (ER).

METHOD AND MATERIALS

HIPAA compliant-IRB approved retrospective study of 1031 patients who presented to ER (2005 to 2016) to assess IV-SUDs complications. Demographics, clinical symptoms, imaging diagnosis, history of OP, and dates of death were recorded. Exams were categorized by imaging diagnosis, modality and specialty. Analyses for significant differences were done.

RESULTS

In 1031 patients (65% men; mean age 36 yrs; 78% white; 95% English speakers), 1673 exams (779 X-rays, 544 CT, 292 MRI and 58 US) were performed (1-13 exams per patient, mean 1), accounting for 0.2% (1673/854299) of all ER studies in the same period. 52% of patients had 1 or more studies with IV-SUDs complications. The rates of positive imaging per imaging specialty were: GI 77% (113/146), MSK 52% (419/802), Vascular 48% (77/162), Neuro 47% (97/206), and chest 25% (90/356). Most frequent clinical symptoms were local complications of injections (27%, 450/1673), respiratory (15%, 251/1673) and back pain (13.4%, 224/1673). History of OP before the first imaging was present in 30% (310/1031) of cases (mean 10 prescriptions per patient); significantly more often in women (37%, 128/348), than men (27%, 182/673, p=0.008). Mean time from OP to first imaging was 51 months (SD

39); significantly shorter in men (45 months) than women (51 months, $p=0.01$). Overall death was recorded in 11.7% (121/1031) of patients; significantly higher in patients with positive imaging diagnosis of IV-SUDs complications (14%, 73/534) than in those without (10%, 48/449, $p=0.04$). 5-yr mortality rates were: 7% (73/1031) overall; higher in patients with prior opioid prescription (9%, 29/310) than in those without (6%, 44/721, $p=0.06$); higher in patient with imaging complications (6%, 33/534) than in those without (4%, 21/427, $p=0.2$).

CONCLUSION

There is a high prevalence of multisystem IV-SUDs imaging complications among patients presenting to the ER. Patients with positive imaging findings and prior OP have a higher overall mortality rate compared to patients with negative imaging.

CLINICAL RELEVANCE/APPLICATION

Understanding factors associated with IV-SUDs imaging complications is fundamental to designing responsive patient care models that can better support the health and survival of this vulnerable population.

SSQ07

Gastrointestinal (Multimodality)

Thursday, Nov. 30 10:30AM - 12:00PM Room: E350

CT **GI** **MR**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Olga R. Brook, MD, Boston, MA (*Moderator*) Nothing to Disclose
Janio Szklaruk, MD, PhD, Houston, TX (*Moderator*) Nothing to Disclose
Aoife Kilcoyne, MBBCh, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSQ07-01 Trauma Related Pseudopneumoperitoneum-Costochondral Vacuum Phenomenon

Thursday, Nov. 30 10:30AM - 10:40AM Room: E350

Participants

Gregory P. Tarr, MBChB, PhD, Auckland, New Zealand (*Presenter*) Nothing to Disclose
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PURPOSE

To determine the typical anatomical distribution of anterior ectopic gas resembling pneumoperitoneum and to determine the relationship of this finding with trauma and clinical outcomes using archival CT.

METHOD AND MATERIALS

In total, 492 consecutive trauma patients between two separate geographical centres were included to be screened. One hundred and eighty-six patients with recognised causes for ectopic gas were excluded, leaving 306 patients (211 male, mean age 44.5) for analysis by dual consensus between the two centres. A further 200 non-trauma CT scans were consecutively selected as a control group.

RESULTS

The pseudopneumoperitoneum was related to trauma ($p=0.0001$) and identified in 5.2% of patients after exclusions. Pseudopneumoperitoneum occurred bilaterally and consistently found to be adjacent to the lower 6 anterior ribs near the costochondral junction. Pseudopneumoperitoneum was independently associated with high velocity trauma. There were no significant differences between sides, gender or injury severity score. None of the patients with pseudopneumoperitoneum had evidence for hollow viscus perforation at laparotomy or clinical examination.

CONCLUSION

Pseudopneumoperitoneum is a post traumatic phenomenon centred near the costochondral junction of the lower 6 anterior ribs. These findings have potentially significant clinical implications and are therefore important to recognise in order to prevent unnecessary laparotomy in the trauma setting.

SSQ07-02 Misty Mesentery Is Not Associated With Baseline or New Diagnosis of Cancer: A Matched Cohort Study

Thursday, Nov. 30 10:40AM - 10:50AM Room: E350

Awards

Student Travel Stipend Award

Participants

Sivan G. Marcus, BS, San Francisco, CA (*Presenter*) Nothing to Disclose
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Marc D. Kohli, MD, San Francisco, CA (*Abstract Co-Author*) Nothing to Disclose
John Mongan, MD, PhD, San Francisco, CA (*Abstract Co-Author*) Spouse, Employee, Thermo Fisher Scientific Inc
Ronald J. Zagoria, MD, San Francisco, CA (*Abstract Co-Author*) Consultant, ReCor Medical, Inc
Spencer C. Behr, MD, Burlingame, CA (*Abstract Co-Author*) Research Grant, General Electric Company Consultant, General Electric Company Consultant, Navidea Biopharmaceuticals, Inc Grant, Navidea Biopharmaceuticals, Inc
Derek Sun, MD, Bronx, NY (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To compare the prevalence of a known diagnosis of cancer in patients with and without misty mesentery (MM) at baseline imaging, and to determine its association with the development of a new diagnosis of cancer.

METHOD AND MATERIALS

This was a retrospective, HIPAA compliant, IRB approved study of patients with and without MM on CT scans acquired from January 1, 2000 to December 31, 2010. We searched our RIS database for reports that included keywords associated with MM. All scans were reviewed to confirm the presence of MM. 4:1 age- and gender-matched controls without MM were identified. Medical records were reviewed and the following data noted: date of CT, use of iodinated IV contrast, CT protocol (noncon, single, or multiphase), baseline nonmalignant diagnoses, history of abdominal malignancy known at the time or identified on the CT scan, subsequent diagnosis of cancer, and date of the new diagnosis or last encounter. Data was analysed with Pearson's chi-square test, two-sample Student's t-test, and Cox proportional hazard models (only patients who did not yet have a baseline diagnosis of cancer). We used STATA® for statistical analysis. An α of 0.05 was considered statistical significance.

RESULTS

Our sample consisted of 148 patients with MM (60 women, 40.54%) and 600 patients without it (236 women, 39.3%) . The mean age of patients were 63.5 years and 61.9 years for patients with and without MM, respectively. No statistically significant difference in any non-malignant diagnoses. Patients with MM were less likely to have a malignancy at baseline (RR = 0.764, absolute difference 12.3% $p=0.008$). Patients with MM had a longer mean follow-up duration than controls (1742 days, standard deviation = 1545.0 versus 1391 days, standard deviation = 1467.4; $P = 0.01$). On survival analysis, we observed an increased risk of developing any cancer in MM patients, but this effect was not statistically significant (HR = 1.71, 95% CI 0.93-3.15, $p=0.083$)

CONCLUSION

We found no clear evidence that patients with MM are more likely to have cancer at the time of baseline imaging or to be later diagnosed with cancers previously thought to be associated with misty mesentery, such as lymphoma.

CLINICAL RELEVANCE/APPLICATION

Further testing is not necessary following the diagnosis of MM, and perhaps its identification on cross-sectional reports should be omitted or at least not emphasized to minimize patient and provider anxiety.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Antonio C. Westphalen, MD - 2017 Honored Educator Spencer C. Behr, MD - 2017 Honored Educator

SSQ07-03 Can Quantitative and Semi-quantitative Computed Tomography Analysis Predict Outcomes of Complex Ventral Hernia Repair?

Thursday, Nov. 30 10:50AM - 11:00AM Room: E350

Awards

Student Travel Stipend Award

Participants

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PURPOSE

Component separation is a commonly used technique allowing for sufficient fascial approximation during complex ventral hernia repair (VHR). However, in certain cases, despite component separation, fascial apposition is not possible resulting in bridged VHR. Prior studies have suggested a role for computed tomography (CT) in preoperative planning for VHR. We hypothesized that CT characteristics of abdominal wall musculature may correlate with the defect size and outcomes of fascial approximation during surgery.

METHOD AND MATERIALS

Consecutive patients who underwent complex VHR using component separation technique and available operative note and pre-operative abdominal CT scans were retrospectively recruited in this IRB-approved study. Specific parameters such as defect size, abdominal wall fat thickness; thickness and mean attenuation of abdominal wall muscles including rectus abdominis (RA), external oblique (EO) and internal oblique (IO) were measured in multiple levels on axial planes using Osirix software (Pixmeo, Bemex, Switzerland) and used for further analysis.

RESULTS

Forty patients meeting inclusion criteria were included. Twenty patients had successful fascial approximation (unbridged group) while in the other 20 patients fascial bridging was used for hernia repair (bridged group). The defect width had a positive correlation with mean EO thickness (Correlation Coefficient (CC)= 0.43, $p=0.006$), IO thickness (CC=32, $p=0.43$), abdominal wall fat thickness (CC=0.35, $p=0.03$) and EO/IO mean attenuation ratio (CC=0.45, $p=0.004$). Mean defect width on axial plane (15.0 ± 5.2 vs. 9.3 ± 3.7 cm, $p<0.001$) and EO/IO mean attenuation ratio (1.17 ± 1.9 vs. 0.24 ± 1.12 , $p=0.02$) were significantly higher for patients who

required bridging technique for fascial closure. However, abdominal wall fat thickness did not significantly differ between groups.

CONCLUSION

Characterization of abdominal wall musculature thickness and fat composition by computed tomography might predict the success of fascial approximation in patients undergoing complex VHRs.

CLINICAL RELEVANCE/APPLICATION

Upon validation in larger prospective studies, these findings might enable preoperative planning and intervening to improve the outcomes in this patient population.

SSQ07-04 Role of High Resolution Transperineal Sonography and Its Comparison with MRI in Peri-Anal Fistulous Disease

Thursday, Nov. 30 11:00AM - 11:10AM Room: E350

Participants

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Harinder Yant, Sonapat, India (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To describe the high resolution transperineal sonographic findings in perianal fistulous diseases and to compare its efficacy with MRI, considering surgical results as gold standard.

METHOD AND MATERIALS

This prospective study included 180 patients with clinical suspicion of perianal fistulous disease. These patients were subjected to 2-D high resolution transperineal sonography which was performed in lithotomy position using 8MHz linear array transducer, after which they underwent MRI of the perineum on 1.5T Magnet. The results of sonography and MRI were interpreted by two separate radiologists. The preoperative sonographic and MRI findings were compared with the findings of surgical exploration taken as reference standard and the sensitivity, specificity, positive predictive value and negative predictive values of sonography and MRI were calculated and compared.

RESULTS

Transperineal sonography showed a high sensitivity of 91.5%, specificity of 72% and positive predictive value of 92.7% in detection of primary tract. MRI had comparable sensitivity of 93.2% and specificity of 81%, with positive predictive value of 95.6%. MRI showed a higher diagnostic accuracy in detection of secondary tracts, supralelevator extension, whilst sonography and MRI had comparable results in detecting intersphincteric collection, crypto glandular abscesses and internal opening. In multiple fistulae, post operative recurrence and associated abscesses both sonography and MRI showed comparable diagnostic efficacy.

CONCLUSION

Transperineal sonography is a highly effective tool in pre-operative assessment and classification of perianal fistulous disease. It has a high sensitivity in detection of primary tract and can accurately identify the secondary tracts, abscesses and internal opening. It is also useful in assessing recurrence in post operative cases.

CLINICAL RELEVANCE/APPLICATION

Transperineal sonography, being a relatively cheap and time saving procedure, can be established as a highly useful alternative to MRI perineum, in view of comparable diagnostic accuracy in cases with perianal fistulous disease.

SSQ07-05 An MR-Derived Standardized Visceral Adipose Tissue Index (VATI) for Prediction of Insulin Sensitivity

Thursday, Nov. 30 11:10AM - 11:20AM Room: E350

Participants

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Malte N. Bongers, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
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Hans-Ulrich Haring, Tuebingen, Germany (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, Tuebingen, Germany (*Abstract Co-Author*) Speakers Bureau, Siemens AG; Speakers Bureau, Bracco Group; Speakers Bureau, Bayer AG
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PURPOSE

Quantification of visceral adipose tissue (VAT) by MRI is currently performed in many cross-sectional, interventional and epidemiological studies and has shown to be of stronger metabolic relevance compared to other adipose tissue compartments in the human body. However, considering the absolute volume of VAT bears inaccuracies as this has to be interpreted different for subjects with different size. Thus, a VAT-index is introduced - comparable to body mass index, BMI - correcting the VAT-volume by

the square of body height.

METHOD AND MATERIALS

VAT volume was assessed between femoral heads and thoracic diaphragm by axial T1-weighted MRI on a 1.5T whole-body imager (Magnetom Sonata, Siemens Healthcare, Germany). Automatic segmentation of VAT and subcutaneous adipose tissue (SCAT) was performed by a fuzzy-clustering algorithm. In total 952 subjects (603f/349m, mean age 44.6 years) at increased risk for metabolic diseases were included in this prospective analysis. Anthropometrics and insulin sensitivity (IS, by oral glucose clamp) were determined immediately after the MR-session. VAT index (VATI) was calculated by dividing VAT volume (given in l) by the squared body height (cm²).

RESULTS

VAT volume was in a range between 0.25l and 13.9l and the mean value was twice as much for males (5.6l) compared to females (2.8l). Mean BMI was comparable for males (30.6kg/m²) and females (29.9kg/m²). VATI was calculated to 1.76l/m² for males and 1.02l/m² for females and IS was in a broad range. By applying a stepwise multivariate linear regression analyses (IS as dependent variable) to adjust the effects of covariates (including age, BMI, WHR) and to identify independent relationships, VATI remained as the only significant predictive parameter for IS.

CONCLUSION

MRI has been established as a reliable tool for non-invasive phenotyping. In order to correctly interpret the amount of VAT in the framework of metabolic imaging, the absolute volume should be corrected for body height. It has to be mentioned that these results do not reflect the general population and cut-off values for VATI regarding differentiation of insulin sensitive and insulin resistant subjects remain to be determined.

CLINICAL RELEVANCE/APPLICATION

For a correct interpretation of visceral adipose tissue volume assessed by abdominal MRI, standardization and correction for body height - comparable to body mass index - is advisable.

SSQ07-06 Effect of Hepatobiliary MR Contrast Agent Administration on the Signal Intensity of Peritoneal and Pleural Fluid Effusions

Thursday, Nov. 30 11:20AM - 11:30AM Room: E350

Participants

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PURPOSE

To describe the effect of hepatobiliary-specific MR imaging contrast agent (HBCA) administration on the signal intensity of peritoneal and pleural fluid effusions on T1-weighted MR images.

METHOD AND MATERIALS

From October 2015 to May 2016 all consecutive patients with peritoneal or pleural effusions who underwent HBCA-MRI (Gd-BOPTA or Gd-EOB-DTPA) at 1.5T and 3T were retrospectively included from two centers. The signal intensity of peritoneal and pleural fluids was classified as hypo/iso/hyperintense compared to the splenic parenchyma, before and after HBCA administration. The relative signal enhancement (RE) and the signal-to-noise ratio (SNR) were calculated on pre and contrast-enhanced sequences.

RESULTS

139 patients with peritoneal/pleural effusions without biliary or vascular leakage (mean 60±10-yo, 96 males, 69%) were included. MR imaging was performed for chronic liver disease (n=105), cancer staging (n=21), and other causes (n=15). On T1-weighted hepatobiliary phase (HBP) MR images, the peritoneal fluid appeared hyper/isointense in 88-100%, and pleural effusions in 100% of the patients following Gd-BOPTA administration. On T1-weighted HBP images, all effusions remained hypointense following Gd-EOB-DTPA. The signal intensity of fluids increased with both types of HBCA but RE was significantly higher following Gd-BOPTA than Gd-EOB-DTPA (p=0.002 and <0.001 for peritoneal and pleural fluids, respectively), whatever the field strength. RE was significantly correlated with the HBP acquisition time (r=0.42, p<0.001 and r=0.50, p = 0.033 for peritoneal and pleural fluids, respectively). It was significantly higher in patients with chronic liver disease following Gd-BOPTA administration (p=0.009).

CONCLUSION

The signal intensity of pleural and peritoneal fluids progressively increases following HBCA administration, independently of field strength and in the absence of biliary or vascular leakage. Because most patients who underwent Gd-BOPTA enhanced MR imaging had hyperintense fluid effusion during HBP, we do not recommend this contrast agent to diagnose biliary leakage.

CLINICAL RELEVANCE/APPLICATION

Because most patients who underwent Gd-BOPTA enhanced MR imaging show hyperintense fluid effusion during HBP, we do not recommend this contrast agent to diagnose biliary leakage.

SSQ07-07 Utility of the MDCT Scan Measurement of Gas Distended Gastric Volume Pre and Post Sleeve Gastrectomy and Its Correlation with 1-Year Weight Loss

Thursday, Nov. 30 11:30AM - 11:40AM Room: E350

Awards

Student Travel Stipend Award

Participants

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PURPOSE

Measure gastric volume pre and postoperatively, and see its evolution over time. Correlate these volumes with weight loss. Determine if the resected or the residual stomach are predictors of weight loss.

METHOD AND MATERIALS

80 patients with BMI >40 kg/m² or >35 kg/m² and medical comorbidities underwent LSG between January 2012 and November 2016 and were analysed prospectively. 207 multislice computed tomography data sets acquired in those patients (52 female and 27 male) were evaluated for gastric volume with a dedicated examination protocol. In each CT scan, the patient took diluted oral gastrograffin (Sodium Amido-trizotate) mixed with sodium bicarbonate, to produce the gastric distension (from liquid plus air), until they feel repleted. Then the CT scan is performed with a thickness of 2mm and a max FOV, a specific 3D software is used for the reconstruction. CT scans were performed preoperatively and 2 months and 1 year after surgery. Parameters were compared to percentage of excess weight loss (%EWL) at 1 year.

RESULTS

Mean preoperative BMI of patients was 47.25 kg/m², and mean preoperative stomach volume was 690.5 ml. A significant correlation was observed between preoperative gastric volume and preoperative weight ($p=0,019$, $r=0,401$). One year after surgery the mean %EWL was 63.1% and the mean BMI was 35.5kg/m². A significant correlation was found between the differences in volume of the stomach (preoperatively and 2 months and preoperatively and 1 year) and the %EWL. At 2 months after surgery, the mean difference in gastric volume was 567.8 ml with statistical correlation with the %EWL at 1 year ($p=0,013$ and $r=0,504$). At 1 year after surgery the mean difference in gastric volume was 499.5 ml, also with statistical correlation with %EWL at that moment ($p=0,021$ and $r=0,444$). No differences were found between the %EWL at 1 year and the remnant volume at 2 months ($p=0,467$ and $r=0,182$) or at 1 year ($p=0,309$ and $r=0.198$).

CONCLUSION

1. CT Scan pre and postoperatively, proved to be useful and of great utility measuring the volume of the gas distended stomach.
2. There is a correlation between the differences in the volume of the stomach and the %EWL 1 year after surgery.
3. Gastric remnant volume changes over time.

CLINICAL RELEVANCE/APPLICATION

MDCT Scan can demonstrate in a precise way the changes in gastric volume over time and this data can help the surgeon to decide the best surgical approach.

SSQ07-08 Imaging of Gangrenous Appendicitis: Do Dual Energy Iodine Overlay Images Add Clinical Value?

Thursday, Nov. 30 11:40AM - 11:50AM Room: E350

Participants

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PURPOSE

Appendicitis remains the most common acute surgical condition of the abdomen. One unique form of this disease is gangrenous appendicitis. This form carries a very high perforation risk which leads to an increase in morbidity and mortality. There have been numerous publications on the role of CT in the diagnosis of acute appendicitis, however the accuracy of CT in diagnosing gangrenous appendicitis is less established. In our study, we propose that the use of Dual Energy (DE) and spectral imaging techniques can improve diagnostic accuracy of acute gangrenous appendicitis.

METHOD AND MATERIALS

For this retrospective, IRB-approved study, the hospital RIS was queried for all abdominopelvic CT scans performed in the emergency department between January 1, 2013 to December 31, 2016 that were positive for appendicitis on histopathology. Non DECT studies and those with frank perforation, phlegmon or peri-appendicular abscess formation were excluded. A total of 236

cases were included in our study. 120 kVp simulated images and iodine overlay (IO) images were reviewed by two abdominal radiologists in a randomized fashion who were blinded to the results of the histopathology for presence of gangrene. Sensitivity, specificity, positive and negative likelihood ratios and interobserver agreement were calculated for each set of images. Confidence was rated on a 5 point Likert scale with 1 being completely uncertain and 5 being absolutely confident.

RESULTS

59.7 % (141) of patients were male. The mean age of patients was 43.5 ± 1.2 years. 51 patients (21.6 %) were positive for gangrenous appendicitis on histopathology. The sensitivity, specificity, positive and negative likelihood ratios, confidence and interobserver agreement for IO images were 100 %, 79.5 %, 4.6, 0, 5 and 0.99 respectively ($p < 0.0001$), compared to 21.6 %, 95.1 %, 4.4, 0.82, 3.75 and 0.98 respectively ($p < 0.0001$) for 120 kVp simulated images.

CONCLUSION

Review of IO images adds significant clinical value to the DECT of the abdomen and pelvis for assessment of acute appendicitis as well as the presence of gangrene within the appendix.

CLINICAL RELEVANCE/APPLICATION

IO images should be reviewed along side the simulated 120 kVp in cases of suspected appendicitis to diagnose or exclude presence of gangrenous appendicitis.

SSQ07-09 Dual Energy and Spectral CT Utilization Rates in Acute Abdominopelvic Imaging

Thursday, Nov. 30 11:50AM - 12:00PM Room: E350

Participants

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PURPOSE

The clinical applications of Dual Energy CT (DECT) in the abdomen and pelvis is well established. However, the actual utilization rates of DE/Spectral analysis are less well documented, specifically in the acute setting. Our study aims to assess the utilization rates of DECT in acute abdominopelvic imaging in the emergency department and the clinical value added by DE/spectral interrogation methods.

METHOD AND MATERIALS

For this retrospective, IRB-approved study, the hospital RIS was queried for all abdominopelvic DECT scans performed in the emergency department between January 1 to December 31, 2016. A total of 1238 studies were performed and were included in our study. The reports were reviewed for mention of DE/spectral interrogation as part of the interpretation of the study. Note was made of the number of times DE/spectral interrogation techniques altered management (by changing the diagnosis or detection of an unexpected, clinically relevant finding), confirmed an observation and increased confidence in the definitive diagnosis, provided additional relevant information or characterized an incidental finding - thus avoiding the need for further investigation.

RESULTS

DE/spectral analysis was utilized in 243 studies out of 1238 (19.63 %). DE/spectral analysis altered management in a significant way 10.3 % of interrogated cases, confirmed suspected observations and increased diagnostic confidence in 21 % of cases, provided relevant information on an observation in 66.7 % of cases and characterized an incidental finding in 18.1 % of cases. DE/spectral analysis was most commonly utilized in assessment of the genitourinary tract (68.5 %) followed by the gastrointestinal tract (20.6 %), the hepatobiliary system (7 %), the musculoskeletal system (2.25 %) and the vascular system (1.5 %).

CONCLUSION

There is good utilization of DE/spectral analysis in the acute setting, with nearly 1 out of 5 abdominopelvic DECT studies undergoing DE interrogation, adding clinical value to the examination by providing information that would have otherwise required additional imaging or other investigations. DE interrogation altered clinical management in 10 % cases.

CLINICAL RELEVANCE/APPLICATION

Routine utilization of DE/spectral techniques can impact management, improve diagnostic confidence and provide definitive clinically relevant diagnostic information only capable by DECT/spectral techniques.

SSQ08

Gastrointestinal (Oncology Imaging)

Thursday, Nov. 30 10:30AM - 12:00PM Room: E353A



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Vahid Yaghmai, MD, Chicago, IL (*Moderator*) Nothing to Disclose
Steven S. Raman, MD, Santa Monica, CA (*Moderator*) Nothing to Disclose

Sub-Events

SSQ08-01 Comparison of Guidelines for the Diagnosis of Hepatocellular Carcinoma Using Multidetector CT in Patients Undergoing Liver Transplantation

Thursday, Nov. 30 10:30AM - 10:40AM Room: E353A

Participants

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PURPOSE

To compare the diagnostic performance of multidetector CT (MDCT) among the guidelines based on the American Association for the Study of Liver Diseases (AASLD), the Liver Imaging Reporting and Data System (LI-RADS) 2014v, the Organ Procurement and Transplant Network (OPTN) system, and the Korean Liver Cancer Study Group-National Cancer Center (KLCSG-NCC) for the diagnosis of hepatocellular carcinoma (HCC) and allocation of liver transplantation (LT) candidates.

METHOD AND MATERIALS

From 2007 to 2014, 78 patients who underwent preoperative MDCT and subsequent LT for suspected HCC were included in this retrospective study. Two radiologists independently reviewed the CT images and evaluated focal hepatic lesions according to each guideline. Patients were allocated into one of three groups: beyond Milan criteria (MC), within MC with priority, or within MC without priority. The sensitivity and specificity of each guideline for detecting HCC, and accuracy of patient allocation were compared using logistic regression with the generalized estimating equation.

RESULTS

Fifty of 78 patients had 87 HCCs. For the detection of HCCs smaller than 1 cm ($n = 24$) and HCCs equal to or greater than 2 cm ($n = 24$), per-lesion sensitivity was not significantly different among four guidelines ($P > 0.05$). However, the sensitivity for detecting 1-2-cm HCCs ($n = 39$) was significantly higher when using the AASLD or the KLCSG-NCC guidelines (30.8-41.0%) than that using the LIRADS or the OPTN system (15.4-18.0%) ($P = 0.030$ for reader 1 and $P = 0.005$ for reader 2). Per-patient specificity was 92.3-96.2% using the AASLD or the KLCSG-NCC guidelines, and 92.3% using the LIRADS or the OPTN system without significant differences among four guidelines ($P > 0.05$). The accuracy for patient allocation was 74.4% in reader 1, and 71.8% in reader 2 without any difference among four guidelines in both readers.

CONCLUSION

The AASLD and the KLCSG-NCC guidelines can provide higher sensitivity than LIRADS and the OPTN system for the detection of 1-2-cm HCCs with MDCT. The accuracy for patient allocation was comparable among four guidelines.

CLINICAL RELEVANCE/APPLICATION

The AASLD and the KLCSG-NCC guidelines can improve the sensitivity for detecting 1-2-cm HCCs using CT compared with other two systems. Any of the four guidelines can be used for patient allocation.

SSQ08-02 Predicting HCC Microvascular Invasion (MVI) Using Imaging Morphological Criteria: Still a Lot to Know

Thursday, Nov. 30 10:40AM - 10:50AM Room: E353A

Participants

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Andrea Giovagnoni, MD, Ancona, Italy (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Predicting HCC MVI using TC and MRI morphological criteria.

METHOD AND MATERIALS

This study received the necessary IRB approval. From September 2009 to December 2015, 208 patients underwent to curative resection for HCC at our institution. Subsequently we excluded 73 patients without imaging at PACS, 25 patients without MVI information at the pathology report and 18 patients that underwent to surgery more than 90 days after performing CT or MRI. The final cohort was made up of 92 patients that performed 56 CT and 36 MRI. For each patient we reviewed retrospectively the imaging studies evaluating number of lesions, size of the biggest lesions, lesions margin, presence of capsule and peripheral enhancement. Therefore we compared these characteristics with the presence or the absence of MVI stated in the pathology report.

RESULTS

Of the 92 patients 31(33.7%) presented MVI at the pathology report. The retrospective review of the imaging studies showed that the 92 patients presented 1.4 ± 0.9 nodules, the average size of the biggest lesion was of 4.9 ± 4.3 cm, 48 (52,2%) had irregular margins, 45 (48,9%) had capsule and 45 (48,9%) had peripheral enhancement. Size ($p=0.003$) and capsule ($p=0.004$) demonstrated correlation, using a univariate analysis, with MVI. Other criteria like number of lesions, margins and peripheral enhancement didn't show any correlation with MVI. Multivariate analysis confirmed these results showing odds ratio of 4.5 and 6.8 for capsule and size >6 cm respectively.

CONCLUSION

Size >6 cm and presence of capsule are associated with MVI.

CLINICAL RELEVANCE/APPLICATION

MVI is an important prognostic factor for recurrence in patients with HCC: its imaging prediction can be useful for identifying patients with better survival after liver transplant.

SSQ08-03 Multiparametric PET/MRI of Hepatocellular Carcinoma: Synergy of Redundancy?

Thursday, Nov. 30 10:50AM - 11:00AM Room: E353A

Participants

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PURPOSE

To quantify multiparametric FDG-PET/MRI parameters in hepatocellular carcinoma (HCC) and to assess the correlation between mpMRI and FDG-PET SUV parameter values in liver parenchyma and HCC lesions.

METHOD AND MATERIALS

This prospective study, approved by the institutional review board, enrolled 15 HCC patients (M/F 12/3, mean age 61 years). The mpMRI protocol, performed simultaneously with an 18F-FDG-PET examination, consisted of BOLD-MRI, IVIM-DWI and DCE-MRI measurements. Quantitative parameter maps were generated [BOLD: $R2^*$ pre and post O₂, $\Delta R2^*$ (post-pre); IVIM: pseudodiffusion coefficient D^* , diffusion coefficient D , perfusion fraction PF , ADC ; DCE-MRI: K_{trans} (Tofts model TM and shutter-speed model SSM), v_e (TM&SSM), kep (TM&SSM), arterial fraction ART (TM&SSM), mean intracellular water molecule lifetime τ_i (SSM) and ΔK_{trans} (SSM-TM), the latter two potentially reflective of tissue metabolism]. Mean mpMRI parameters and PET parameters (SUVmean and SUVmax) in HCC lesions and liver parenchyma and SUV tumor/liver ratios SUVmean T/L and SUVmax T/L were calculated. Differences between PET/MRI parameters in liver and HCC were assessed using Wilcoxon signed-rank tests. Spearman correlations between PET and mpMRI parameters in liver, all HCC lesions and FDG-avid (SUVmean HCC $>$ SUVmean liver) HCC lesions were determined.

RESULTS

21 lesions were analyzed [mean size 4 (range 2-13) cm] of which 11 were FDG-avid. Significantly higher ART (TM and SSM) and lower $R2^*$ (pre and post O₂) values were found in HCC vs. liver ($P<0.008$). PET and MRI parameters did not correlate in liver. In HCC, K_{trans} TM and SUVmax ($r=-0.467$, $P=0.033$) and $\Delta R2^*$ and SUVmax ($r=0.586$, $P=0.013$) showed significant correlations. IVIM parameters significantly correlated with PET parameters in FDG-avid HCC lesions [D and SUVmean ($r=-0.767$, $P=0.021$); ADC and SUVmean ($r=-0.800$, $P=0.014$)]. SSM parameter ΔK_{trans} showed significant correlation with SUVmean T/L and SUVmax T/L ($r=0.438-0.536$, $P<0.047$).

CONCLUSION

Multiparametric PET/MRI seems synergistic for liver parenchyma characterization, while quantitative mpMRI showed significant correlations with FDG-PET SUV values in HCC.

CLINICAL RELEVANCE/APPLICATION

Multiparametric PET/MRI can potentially provide improved characterization of HCC lesions compared to the individual modalities.

SSQ08-04 Improper Timing of Portal Venous Phase Acquisition Causes Variability in Observed Tumor Density and Impacts Treatment Response Assessment: Metastatic Colorectal Cancer as a Paradigm

Thursday, Nov. 30 11:00AM - 11:10AM Room: E353A

Participants

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PURPOSE

New tumor response patterns to anticancer drugs have led to a response criteria shift from size to density. Choi criteria categorize response to anti-angiogenic therapies by a decrease in tumor density greater than 15% at the portal venous phase (PVP). We compared this threshold to the variability caused by both biology and image acquisition (improper PVP-timing) using liver metastases (LM) from colorectal cancer (CRC) as a paradigm.

METHOD AND MATERIALS

Pretreatment PVP CT images from a total of 291 LM-CRC patients from a single precision medicine trial were included. Four experienced radiologists independently scored the PVP timing and reached a consensus according to a 3-point scoring system: early/optimal/late PVP. Using radiologists' consensus, we trained a proprietary computer-aided quantitative quality control method to monitor PVP-timing. The reference standard was a computer-refined consensus. For each patient, we contoured target liver lesions and calculated their average density.

RESULTS

The PVP-timing was early, optimal and late in 52, 194 and 45 patients, respectively. The average (95CI) accuracy of the four radiologists for the detection of an optimal PVP-timing was 81.7% (78.3-85.2) and was outperformed by the 88.6% (84.8-92.4) computer-accuracy. The mean $\pm$ SD LM-CRC density was 68 $\pm$ 15HU overall and 59.5 $\pm$ 14.9HU, 71.4 $\pm$ 14.1HU, 62.4 $\pm$ 12.5HU at early, optimal and late PVP-timing, respectively. LM-CRC density was thus decreased at non-optimal PVP-timing by 16.7% at early-PVP ($p=8.9e-08$) and 12.6% at late-PVP ($p=1.8e-04$) compared to that of optimal-PVP.

CONCLUSION

The 15%-threshold defined by Choi criteria is very sensitive for the detection of tumor response because non-optimal PVP-timing induces a similar decreased tumor density. Therefore, non-optimal PVP alters treatment response assessment and caution should be exercised in interpreting the significance of small density changes. Computer-aided quantitative PVP-timing scoring system outperforms radiologists' visual assessments and could improve the monitoring of anticancer therapy efficacy at patient and clinical trial level.

CLINICAL RELEVANCE/APPLICATION

Non-optimal PVP-timing causes variability in observed tumor density that can impact treatment response assessment defined by Choi criteria. We designed, by machine-learning, a computer-aided system for an optimized monitoring of anticancer drug efficacy.

SSQ08-05 One-Step Spectral and Perfusion CT Scan: Monitoring the Therapeutic Efficacy of VEGF Receptor Kinase Inhibitor AG-013736 in Rabbit VX2 Liver Tumors

Thursday, Nov. 30 11:10AM - 11:20AM Room: E353A

Awards

Student Travel Stipend Award

Participants

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PURPOSE

To develop a spectral contrast-enhanced CT protocol from perfusion CT data obtained with the same scan based on the time-attenuation curves and to evaluate its value in assessing the therapeutic efficacy of a vascular endothelial growth factor (VEGF) receptor inhibitor AG-013736 in rabbit VX2 liver tumors.

METHOD AND MATERIALS

The institutional animal care and use committee approved this study. In 31 VX2 liver tumor-bearing rabbits, a spectral CT protocol

The institutional ethics committee approved this study. Prior to the liver tumor imaging results, a spectral CT protocol was reconstructed to evaluate the maximum contrast of liver tumors by using time-attenuation curves from the perfusion CT data in the same scan. The iodine concentrations (ICs) of tumors derived from spectral CT normalized to aorta (nICs) at different time points (baseline, 2, 4, 7, 10 and 14 days after treatment) were compared within the treated group (n = 23) by using the Friedman test as well as between the control (n = 8) and treated groups by using the Mann-Whitney test. Correlations between nICs and perfusion parameters, and between nICs and the tumor size, Bax, Bcl-2, VEGFR and VEGF mRNA were analyzed by using the Spearman rank test.

RESULTS

The optimal timing for maximum contrast of liver tumors in spectral CT was 15 seconds $\pm$ 2 in the arterial phase (AP) with the tumor CT values of 175-343HU. In AP, moderate correlations were found between nICs and time to peak ($r=-0.588$, $P=0.001$) while substantial correlations were found between nICs and mean slope of increase ($r=0.672$, $P<0.001$). The difference for nICs between each time point after treatment and baseline were significantly lower in the treated group than in the control group at 2 days after treatment. The greater decrease of nICs in tumors at 2 days in AP were positively correlated with smaller increase in tumor size at 14 days ($r=0.69$, $P<0.05$). The tumor nIC values in AP had positive correlations with Bcl-2, VEGFR and VEGF mRNA (r values ranging from 0.58 to 0.76) and negative positive correlations with Bax ($r=-0.56$) ($P<0.05$ for all).

CONCLUSION

Iodine concentrations from spectral CT derived from perfusion CT data in AP were well correlated with perfusion CT parameter, which allowed early treatment monitoring the therapeutic effect of AG-013736 to liver tumors.

CLINICAL RELEVANCE/APPLICATION

Spectral CT can quantify the arterial tumor perfusion at a substantially lower radiation dose, and have good correlations with perfusion CT and histopathological findings.

SSQ08-06 Clinical Significance of T2* For Differentiating Tumor KRAS Mutation Status in Rectal Cancer

Thursday, Nov. 30 11:20AM - 11:30AM Room: E353A

Awards

Student Travel Stipend Award

Participants

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PURPOSE

To investigate the characteristics and potential differences of T2* in rectal cancers with different KRAS status.

METHOD AND MATERIALS

Totally, 119 patients, including 83 men and 36 women with histologically proved rectal cancer underwent pelvis MRI examination including T2 fast field echo (T2 FFE) sequence using five echoes. T2* values were automatically calculated after region of interest (ROI) being selected along the outline of whole tumor. Patients were stratified into two groups-KRAS wild-type and mutant by amplification refractory mutation system (ARMS) method. According to different mutation locations, patients with KRAS mutant were divided into codon 12 and codon 13 two subgroups. The T2* values between KRAS wild-type group and KRAS mutant group, codon 12 subgroup and codon 13 subgroup, were compared by using independent samples t test. Receiver operating characteristic (ROC) analysis of discrimination between KRAS wild-type and KRAS mutant rectal cancer was performed for T2* values. Intra- and interobserver agreement were evaluated using the intraclass correlation coefficient (ICC).

RESULTS

Our study included 76 KRAS wild-type, 43 KRAS mutant, and the latter group were then divided into 38 codon 12 patients and 5 codon 13 patients. Intra- and inter-observer reproducibility were relatively good to excellent for T2* (ICC_{Intra}=0.8705, 95% confidence interval 0.8139~0.9099; ICC_{Inter}=0.7914, 95% confidence interval 0.7133~0.8501). T2* values were significantly higher in KRAS mutant group ([44.20 $\pm$ 12.18]ms) than that in KRAS wild-type group ([36.27 $\pm$ 11.96]ms) ($t=-3.452$, $P=0.001$). However, T2* values showed no significant differences between codon 12 and codon 13 subgroups ([44.42 $\pm$ 12.20]ms vs [36.27 $\pm$ 11.96]ms; $t=-0.325$, $P=0.741$). According to ROC curve, T2* values showed diagnostic significance with the AUC values of 0.706. The optimal cutoff values of 40.73ms for T2* resulted in (T2* value of KRAS mutant rectal cancers were greater than this value) accuracy rate of 69.75%, sensitivity of 76.74%, specificity of 65.79%, positive predictive value of 55.93%, negative predictive value of 83.33%.

CONCLUSION

T2* values derived from T2 FFE sequence, as a promising biomarker, demonstrated potential clinical value in differentiating rectal cancers with different KRAS status.

CLINICAL RELEVANCE/APPLICATION

T2* values may be a useful imaging biomarker for differentiating rectal cancers with different KRAS status.

SSQ08-07 Preoperative N Stage Evaluation in Gastric Cancer Patients by MDCT: Can the Sum of the Short Axis Diameter of the Lymph Nodes be used for N Stage Evaluation?

Thursday, Nov. 30 11:30AM - 11:40AM Room: E353A

Participants

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PURPOSE

N staging is important in deciding the appropriate surgical treatment and in determining the prognosis of gastric cancer. In the N stage of gastric cancer, the accuracy of previous reports varies from 51% to 84%, because the definition of metastatic lymph node (LN) is different between studies using MDCT, and various cut-off values have been applied. In addition, the number of LNs seen in pathologic specimens tends to be higher than the number of LNs seen in CT. We have estimated that the sum of the sizes of LNs in CT can be proportional to the number of pathologic metastatic LNs. The purpose of this study was to compare the diagnostic performance of the sum of short axis diameter of lymph nodes (LN-sum) and the CT N stage of gastric cancer.

METHOD AND MATERIALS

Between January 2012 and December 2012, 127 consecutive patients who underwent preoperative MDCT and gastrectomy for gastric cancer were identified. We defined metastatic LN on MDCT as LN with a short axis ≥ 8 mm. Regardless of size, LNs showing morphologic features such as central necrosis, heterogenous enhancement, nearly round shape (longitudinal/transverse diameter ratio <1.5), and clustered nodules were also considered as metastasis. We then calculated the LN-sum. The diagnostic value of LN-sum for distinguishing N stages was assessed by calculating the area under the receiver operating characteristic (ROC) curve. Sensitivity and specificity of N stage using LN-sum were generated using the optimal cut-off values. Also, conventional CT N stages of gastric cancer were made.

RESULTS

LN-sum showed significant correlation with the pathological N stage of gastric cancer ($\rho=0.70$, $p<0.001$). **CONCLUSION**

Significant correlations exist among LN-sum in the N stage of gastric cancer. The LN-sum would be useful in the preoperative N staging of gastric cancer.

CLINICAL RELEVANCE/APPLICATION

The precise preoperative N stage in gastric cancer is of great importance in planning therapeutic strategies, so LN-sum could be used as a noninvasive imaging method for pre-operative N staging of gastric cancer.

SSQ08-08 Prediction of Intrahepatic Distant Recurrence after Radiofrequency Ablation of Hepatocellular Carcinoma: Role of CT Findings Indicating Portal Hypertension

Thursday, Nov. 30 11:40AM - 11:50AM Room: E353A

Participants

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PURPOSE

The purpose of this study is to determine whether the degree of portal hypertension(PH) assessed by CT findings could also predict intrahepatic distant recurrence(IDR) in patients with hepatocellular carcinoma(HCC) who received radiofrequency ablation(RFA).

METHOD AND MATERIALS

From August 2012 and April 2016, 78 patients who received RFA as initial treatment of HCC with available liver stiffness measurement(LSM) values prior to RFA were included, and the presence of IDR was reviewed. Two radiologists evaluate CT features : tumor size, multiplicity of tumors, and the sign of PH such as the diameter of main portal vein, splenic volume, the presence of gastroesophageal varices at risk of recurrence(GEV-R), and the amount of ascites. GEV-R was defined as the presence of esophageal varix and/or large gastric varix(>10 mm) on CT. A LSM value and the fibrosis indices such as APRI and FIB-4 scores were also investigated. Recurrence free survival rate was calculated using Kaplan-Meier curve, and each parameter was evaluated using uni- and multivariate Cox proportion hazards regression analysis. For validation of model, we also performed the validation study with the patients who underwent RFA without the result of LSM during the same period($n=89$).

RESULTS

During a median follow-up of 407 days, IDR was identified in 38.5% of the subject(30/78). On univariate analysis, tumor size, LSM, APRI score, and GEV-R were significantly associated with IDR. Subsequent multivariate analysis including all variables identified that tumor size and LSM were significant independent predictors of IDR. However, among the CT features only, GEV-R was significant independent predictor of IDR($HR=3.907$; $p=0.002$) as well as tumor multiplicity($HR=2.790$; $p=0.030$). On validation study, tumor multiplicity($HR=2.86$; $p=0.006$) was the only significant independent predictor of IDR after RFA. GEV-R shows increased tendency of recurrence($HR=1.68$; $p=0.083$).

CONCLUSION

GEV-R and tumor multiplicity on CT could be a non-invasive predictor of recurrence after RFA as well as LSM.

CLINICAL RELEVANCE/APPLICATION

Portal hypertension sign on CT scan, such as GEV-R, might be useful as non-invasive predictor for IDR after RFA for HCCs.

SSQ08-09 Quantitative Analysis of Diffusion-Weighted MRI and Contrast-Enhanced MRI for Estimating Histopathological Grade of Hepatocellular Carcinomas

Thursday, Nov. 30 11:50AM - 12:00PM Room: E353A

Participants

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PURPOSE

Diffusion-weighted MR images (DWI) and Contrast-enhanced MR images (CE-MR) have been reported to be helpful for estimating the histological differentiation of hepatocellular carcinoma (HCC). However, the clinical relevance of DWI and CE-MR for estimating histopathological grade of HCCs has not yet been comparatively assessed in a quantitative routine. The purpose of this study is to quantitatively assess the performance of the ADC value in DWI and the mean intensity value in arterial phase of CE-MR in estimating the grade of malignancy of HCC.

METHOD AND MATERIALS

Thirty-five pathologically confirmed HCC lesions from July 2012 to October 2015 were included in this retrospective study. Sixteen low grade tumor corresponds to Edmondson grade I and II, and nineteen high grade tumor corresponds to Edmondson grade III and IV. DWI and CE-MR were retrieved for each subject (Signa Excite HD 3.0T, GE Healthcare, Milwaukee, WI, USA). Single-shot echo-planar DW imaging acquisitions were performed in the axial view with three b values (0,100,600 sec/mm²). ADC map was calculated by the mono-exponentially fitting model. The region of interest (ROI) extraction of HCCs in DWI and CE-MR was manually performed by an experienced radiologist (10 years of experience in abdominal radiology), using a free-form curve fitting technique. The performance of texture feature and ADC value in differentiating the biological aggressiveness of HCC was assessed using Receiver Operating Characteristic (ROC) analysis. $P < 0.05$ was considered statistically significant.

RESULTS

Low grade HCCs showed a higher mean intensity value ($p = 0.001$) and a comparable ADC ($p > 0.05$), as compared with high grade HCCs. AUC, Accuracy, Sensitivity and Specificity were 0.714, 0.743, 0.688, and 0.789 for ADC in DWI, corresponding to 0.924, 0.914, 1.000, and 0.842 for the mean intensity value in CE-MR, respectively.

CONCLUSION

The Mean intensity of arterial phase images in CE-MR proves to be superior to the ADC value of DWI in the prediction of the histopathological grade of HCC.

CLINICAL RELEVANCE/APPLICATION

Our quantitative study indicates that the mean intensity in arterial phase of CE-MR is much better than the ADC value of current DWI in the performance of predicting the histopathological grade of HCC, which may aid clinical decisions and help with patient management in clinical practice.

SSQ09

Science Session with Keynote: Gastrointestinal (Liver Fibrosis)

Thursday, Nov. 30 10:30AM - 12:00PM Room: E353C

GI MR

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Kumaresan Sandrasegaran, MD, Indianapolis, IN (*Moderator*) Consultant, Guerbet SA
An Tang, MD, Montreal, QC (*Moderator*) Research Consultant, Imagia Cybernetics Inc; Speaker, Siemens AG
Sudhakar K. Venkatesh, MD, FRCR, Rochester, MN (*Moderator*) Nothing to Disclose

Sub-Events

SSQ09-01 Gastrointestinal Keynote Speaker: Status of Liver Fibrosis Imaging

Thursday, Nov. 30 10:30AM - 10:40AM Room: E353C

Participants

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ABSTRACT

LEARNING OBJECTIVES 1. To review the histological staging of liver fibrosis. 2. To discuss the classification of imaging-based techniques for assessment of liver fibrosis. 3. To highlight key unmet needs and potential future directions in liver fibrosis imaging. **ABSTRACT** Liver fibrosis is characterized by the accumulation of collagen and other extracellular matrix proteins as a result of repeated injury to the tissue due to chronic liver disease. In this keynote lecture, we will review challenges inherent to using liver biopsy for staging of liver fibrosis, including existence of numerous staging systems, sampling variability, and declining acceptance. We will provide a classification of imaging techniques implemented on US, CT, and MRI which evaluate changes in physical or physiological properties that accompany liver fibrosis. We will highlight key unmet needs in this field, including standardization of biomarkers across imaging systems, need for head-to-head comparison between techniques, and concomitant assessment of biological confounders (such as inflammation and steatosis).

SSQ09-02 Can "Simultaneous Multi-Angular Relaxometry of Tissue" and "Modified Look-Locker Inversion Recovery" T1 Mapping Magnetic Resonance Imaging Sequences Predict the Histopathologic Degree of Liver Fibrosis in Chronic Liver Disease?

Thursday, Nov. 30 10:40AM - 10:50AM Room: E353C

Awards

Student Travel Stipend Award

Participants

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PURPOSE

Determination of the severity of the chronic liver disease (CLD) has a great importance for the decision of the management plan and to predict the prognosis. In this study, we aimed to introduce new magnetic resonance imaging (MRI) sequences for T1 mapping, Modified Look-Locker Inversion Recovery (MOLLI) and Simultaneous Multi-Angular Relaxometry of Tissue (SMART) sequences to predict the degree of liver fibrosis in patients with histopathologically proven CLD.

METHOD AND MATERIALS

Ninety-one cases (51 CLD and 40 control group) were prospectively enrolled in the study, and an MRI of the liver was performed by using a 32-channel body coil with a 1.5T MRI scanner (MR 450w, GE, Chicago, USA). SMART and MOLLI sequences were acquired to create T1 maps. Following the MRI study, a percutaneous ultrasound-guided core biopsy was performed from the parenchyma of the liver to determine the histopathological grade of liver fibrosis in the patient group. T1 mapping values of the liver were measured separately by two different observers independently by using nine separate circular "region of interests" and compared with the histopathological fibrosis grades. Intraclass correlation coefficient (ICC) method was used to assess the variability on

SMART and MOLLI sequences statistically.

RESULTS

ICC for assessing T1 values of the liver on SMART and MOLLI MRI sequences were excellent, yielding 0.982 and 0.960, respectively. SMART and MOLLI values in patients with CLD were significantly higher than the control group ($p < 0.001$). SMART and MOLLI values were positively and significantly correlated with the grade of fibrosis (Table 1). Receiver operating curve analysis showed that SMART sequence was superior to MOLLI sequence for the determination of the grade of the fibrosis (Table 2). The difference between ROC analysis of SMART and MOLLI measurement of observers were statistically significant ($p = 0.042$ and $p = 0.003$).

CONCLUSION

Both SMART and MOLLI sequences can be used for predicting the liver fibrosis in patients with CLD. However, SMART sequence has better diagnostic performance and ICC when compared to MOLLI sequence values.

CLINICAL RELEVANCE/APPLICATION

SMART and MOLLI T1 mapping MRI sequences may have a role for the noninvasive determination of the degree of liver fibrosis which will improve the management plan.

SSQ09-03 Grading of Hepatic Fibrosis using Iodine Map of Spectral Liver CT

Thursday, Nov. 30 10:50AM - 11:00AM Room: E353C

Participants

Jeong Hee Yoon, MD, Seoul, Korea, Republic Of (*Presenter*) Grant, Bayer AG Speaker, General Electric Company Speaker, Koninklijke Philips NV Speaker, Bayer AG
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Joon Koo Han, MD, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To determine whether iodine map from spectral computed tomography (CT) is able to provide hepatic extracellular volume fractions (fECVs) for grading hepatic fibrosis (HF).

METHOD AND MATERIALS

A total of 57 patients (M:F=42:15, mean age, 54.3 ± 11.9 years) histologically diagnosed with HF underwent quadruphase liver CT at the scanner with spectral detector (IQon, Philips Healthcare) at 120kVp. Delayed phase was obtained 3 minutes after standard dose of contrast media administration. On the generated iodine maps of iodine, approximately 0.8-1cm² round regions of interest (ROIs) were drawn avoiding focal lesion and vessels in the liver, and aorta for calculating fECV as follows: $fECV (\%) = \text{Iodine concentration liver (mg/ml)} / \text{Iodine concentration aorta (mg/ml)} \times (100 - \text{Hematocrit } [\%])$. Correlation between fECV and HF stage was evaluated using Spearman's correlation coefficient. fECVs, iodine concentration and effective Z were compared between F0-1 ($n=7$), F2-3 ($n=17$) and F4 ($n=33$), and between F0-3 and cirrhosis (F4).

RESULTS

fECVs showed a moderate correlation with pathologic HF staging ($r=0.55$, $P<0.0001$). fECV was higher in F4 than F2-3 ($36.0 \pm 8.0\%$ vs. 26.4 ± 4.1 , $P<0.01$) but there was no significant difference between F2-3 and F0-1 ($28.8 \pm 3.7\%$, $P>0.05$). In comparison between F0-3 and F4, F4 showed significantly higher fECV than F0-3 ($36.0 \pm 8.0\%$ vs. $27.7 \pm 4.2\%$, $P<0.0001$). In addition, iodine density of the liver (mg/ml^*) was significantly higher in F4 than F0-3 (1.87 ± 0.28 vs. 1.63 ± 0.33 , $P=0.006$). Effective Z was also higher in F4 than F0-3 (8.42 ± 0.16 vs. 8.31 ± 0.20 , $P=0.026$), but there was a substantial overlap of the values.

CONCLUSION

Iodine map of delayed phase from the spectral CT enables to estimate fECV and fECV increased as HF progressed and F4 showed significantly higher fECV than F0-3.

CLINICAL RELEVANCE/APPLICATION

Iodine map can be generated from single phase of routine exam at spectral CT, and it can provide quantitative information regarding HF, without additional contrast media use or scan acquisition.

SSQ09-04 Two-dimensional Shear Wave Elastography for Grading Liver Fibrosis using a Confidence Map: Are Liver Stiffness Measurements Accurate without Breath-holding?

Thursday, Nov. 30 11:00AM - 11:10AM Room: E353C

Participants

Isabelle Durot, MD, Stanford, CA (*Presenter*) Nothing to Disclose
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PURPOSE

Ultrasound elastography of the liver for grading liver fibrosis needs to be performed in a resting respiratory position as forceful inspiration or expiration can falsify values. However, in patients with comorbidities optimal breath-holding can be challenging despite coaching. The aim of this study was to assess whether liver stiffness measurements using two-dimensional (2D) shear wave

elastography (SWE) along with a novel confidence map yield similar results in patients with and without breath-holding.

METHOD AND MATERIALS

Liver stiffness measurements were performed in 25 consecutive patients with chronic liver disease (7 non-alcoholic fatty liver disease, 5 hepatitis B, 4 hepatitis C, 4 alcoholic cirrhosis, 2 hemochromatosis; 3 others) by using 2D SWE (prototype software ElastQ; EPIQ7; Philips). In the same imaging session and in each patient, two 6-sec cine loops were obtained each either in resting respiratory position or during free quiet breathing. For each data set, 10 circular regions of interest (ROI; 0.791cm²) were drawn at 2 cm below the liver capsule in the middle of the field of view. A confidence map that automatically highlights areas without breathing artifacts was used to guide ROI placements. The mean and median shear wave velocities obtained by the two methods were compared using the Bland-Altman methodology and concordance correlation.

RESULTS

In both groups, the median shear wave velocity was 1.23 m/s with a concordance correlation of 97% (95%CI: 94-98%) and Bland-Altman 95% limits of agreement of -0.17 and 0.12. The mean velocity in the breath-hold group was 1.36 m/s and in the free-breathing group 1.34 m/s with a concordance correlation of 97% (95%CI: 94-99%) and Bland-Altman 95% limits of agreement of -0.17 and 0.12.

CONCLUSION

In 2D SWE using a confidence map for ROI placements, liver stiffness measurements are comparable with and without breath-holding.

CLINICAL RELEVANCE/APPLICATION

The possibility of free breathing makes 2D SWE exams more robust and clinically practical, in particular in patients with difficulties holding their breath in a resting respiratory position.

SSQ09-05 A Prediction Model for Survival in Patients with Cirrhosis by Using Abdominal CT Findings: Compared with MELD Scoring System

Thursday, Nov. 30 11:10AM - 11:20AM Room: E353C

Participants

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PURPOSE

Model for End-stage Liver Disease (MELD) score was developed as a disease severity index for patients with liver cirrhosis (LC) awaiting liver transplantation. Although MELD score is known to be better than Child-Turcotte-Pugh score for predicting survival, there are still some limitations. Imaging study contains important information of LC and portal hypertension, and there have been attempts to measure the related imaging parameters. We have tried to establish a new model with abdominal CT for prediction of survival in patients with LC and compare it with MELD score.

METHOD AND MATERIALS

145 patients diagnosed with LC and underwent abdominal CT were included retrospectively. Two radiologists measured the imaging parameters, such as maximum diameters of main portal vein (ϕ MPV), superior mesenteric vein (ϕ SMV), splenic vein (ϕ SV), and estimated splenic volumes. The grade of esophageal, paraesophageal, gastric varices and amount of ascites were also evaluated. Statistically significant CT features related to overall survival were used to establish a model to calculate risk scoring system using multivariate Cox proportional hazard regression and validated this system with data (n=88) of another hospital. To compare the accuracy of two scoring systems, time-dependent C statistics was used.

RESULTS

ϕ SMV/ ϕ SV, splenic volume, esophageal varices grade and amount of ascites were significant predictors of survival, and risk score was calculated by following formula: $0.79 \times \phi$ SMV/ ϕ SV + $0.001 \times$ splenic volume + $1.00 \times$ grade 1 esophageal varix (EV) + $0.57 \times$ grade 2EV + $1.32 \times$ grade 3EV + $1.45 \times$ moderate ascites + $2.16 \times$ large ascites - 2.07. Patients with same or higher risk scores than 1.74 had significantly poor overall survival rates ($p < 0.001$), with median survival of 7 months. Also in validation set, patients with high risk scores (≥ 1.74) had significantly poor overall survival rates ($p = 0.02$). Time-dependent AUC showed MELD score was superior to imaging model for the first 20 months, but after 50 months, imaging model was better (c-index of imaging and MELD score, 0.768 and 0.735, respectively). Also, in validation set, imaging score was superior to MELD score after 20 months (c-statistics, 0.732 and 0.681, respectively).

CONCLUSION

In patients with LC, this imaging model may be useful in predicting long-term survival compared to MELD score.

CLINICAL RELEVANCE/APPLICATION

A prediction model with abdominal CT may be useful in predicting long-term survival in patients with LC.

SSQ09-06 Point Shear Wave Elastography for Grading Liver Fibrosis: Can the Number of Measurements be Reduced?

Thursday, Nov. 30 11:20AM - 11:30AM Room: E353C

Participants

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PURPOSE

To assess whether the number of point shear wave elastography (pSWE) measurements of the liver could be reduced to 5 vs. the currently recommended 10 measurements in patients with chronic liver diseases.

METHOD AND MATERIALS

In 1412 patients with chronic liver disease (694 hepatitis B, 499 hepatitis C, 62 non-alcoholic fatty liver disease, 35 primary biliary cholangitis, 24 post liver transplantation, 18 autoimmune hepatitis, 15 alcoholic cirrhosis, 14 cardiac cirrhosis, 51 others) pSWE measurements were performed on a S2000 scanner (Siemens) following the protocol recommended by the Society of Radiologists in Ultrasound (SRU) with 10 consecutive valid measurements obtained in liver segment 8. Liver fibrosis grading using published cut-off values were compared using 10 vs. 5 measurements with Kendall's tau coefficient and the exact test of symmetry.

RESULTS

The median shear wave velocities using 5 measurements was 1.27 m/s compared to 1.26 m/s using 10 measurements. Overall fibrosis grading highly correlated when using 5 vs. 10 measurements ($\tau=0.96$; $P<0.001$). Similarly, there was high correlation when grading clinically significant ($\geq F2$) vs. non-significant ($F0/1$) fibrosis ($\tau=0.95$; $P<0.001$). A change in grading was observed in 34/1412 patients (2.4%; 95%CI: 1.7-3.3%) of exams when classifying clinically significant from non-significant fibrosis. Changes in grading occurred primarily when velocities ranged between 1.1 and 1.5 m/s. When the median values from 5 measurements were either <1.1 or >1.5 m/s (in 794 patients; 56%), a change of grading was observed in 0/1412 measurements (0%; 95%CI: 0-0.4%).

CONCLUSION

Clinically significant changes in grading liver fibrosis using only 5 measurements was observed in only a small portion of patients. In patients with known $F0$ or $F4$ fibrosis, 5 measurements may be sufficient on surveillance ultrasound elastography exams.

CLINICAL RELEVANCE/APPLICATION

Five instead of 10 measurements may decrease scanning time, cost, and discomfort in both sonographers and patients.

SSQ09-07 Novel Mapping of Fibrosis and Hepatic Inflammation in NASH Patients with Dual R2 MRI Relaxometry

Thursday, Nov. 30 11:30AM - 11:40AM Room: E353C

Participants

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PURPOSE

Hepatic inflammation and fibrosis are two of the most important factors for the stratification, treatment and prognosis of patients with liver disease. Our objective is to evaluate a MRI multi-component relaxometry (MCR) technique to map fibrosis and inflammation in patients with non-alcoholic steatohepatitis (NASH). The extracellular water fraction (ECWF) was investigated for fibrosis, and the ratio of the transverse relaxation rate ($R2$) between intra and extra-cellular water ($R2I/E$) was assessed for inflammation.

METHOD AND MATERIALS

101 NASH diagnosed patients with liver biopsy were selected within 6 months for MRI exam. A 3T Philips Achieva was used with a multi-spin echo sequence. The images were analysed by a radiologist and physicist with over 12 years experience in abdominal imaging. The biopsies were reviewed by a pathologist with 14 years experience using the NASH-CRN score. 15 volunteers with normal lab results and no known liver disease were used for control.

RESULTS

The mean ECWF for the 101 NASH patients was $24.5(\pm 3.1)\%$ and $18.7(\pm 1.6)\%$ for the 15 volunteers. There was a significant correlation between ECWF and fibrosis stage ($r_s=0.83$, $p<1.0\cdot 10^{-6}$). In distinguishing healthy from fibrotic patients we achieved an AUROC of 0.98, with a sensitivity of 93% and specificity of 94% for a threshold ECWF of 20.6%. There was a significant difference between all stages of fibrosis by ECWF ($p<0.001$). The mean $R2I/E$ for the 101 NASH patients was $3.2(\pm 0.6)$ and $2.4(\pm 0.3)$ for the 15 volunteers. For distinction of normal parenchyma from any lobular inflammation we achieved an AUROC of 0.91, with sensitivity of 83% and specificity of 83% at an $R2I/E$ threshold of 2.7.

CONCLUSION

ECWF demonstrated very good performance in quantifying all stages of fibrosis, whereas $R2I/E$ correlated more strongly with inflammation. The maps and distributions of ECWF and $R2I/E$ also allow assessment of heterogeneity in liver pathology.

CLINICAL RELEVANCE/APPLICATION

The excellent performance of MRI ECWF in quantifying the earliest stage of NASH promises better selection of patients for biopsy.

Assessing inflammation with R2I/E offers an additional tool for patient selection. ECWF and R2I/E offer biomarkers of liver fibrosis and inflammation that are independent of field strength, are obtained without contrast or radiation, and help in the diagnostic and follow-up of NASH patients.

SSQ09-08 Reversibility of HCV-Related Liver Disease and Sustained Virology Response after Interferon-Free Antiviral Therapy

Thursday, Nov. 30 11:40AM - 11:50AM Room: E353C

Awards

Student Travel Stipend Award

Participants

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PURPOSE

The aim of this study was to assess: the evolution of hepatitis C-related liver disease by comparing analytical and elastography data before and after treatment with new antiviral agents.

METHOD AND MATERIALS

For this prospective study, we conducted a randomized sampling of patients with hepatitis C virus (HCV) who had completed treatment with new drugs between May 2015 and March 2016. It was required that all patients included had undergone blood tests, viral load, liver B-mode ultrasonography and ARFI elastography with the determination of shear wave velocity (SWV) before starting treatment. These tests were repeated after a year of the completion of treatment for comparing results. The criteria for exclusion were as follows: coinfection with other hepatitis viruses or human immunodeficiency virus, liver transplant, alpha-1 antitrypsin deficit, metal deposition diseases and alcohol consumption of greater than 20g/day. Finally, we obtained 100 patients. Comparisons of means were performed using Student t-test for matching data. A p value of <0.05 was considered significant.

RESULTS

It was verified: a significant decrease of liver ARFI values since the average shear wave velocity declined from 1.98 to 1.66 m/s ($p < 0.01$), which meant an improvement of liver parenchymal injury associated to HCV. Furthermore, it was determined reversibility in METAVIR stages, specially in $F \geq 3$ and $F \geq 4$ levels, in which more than half of patients improved their METAVIR stage after treatment ($p < 0.05$). Moreover, sustained viral response was confirmed in all patients as well as an improvement of analytical data with hepatic profile (Alanine aminotransferase- ALT-, Aspartate aminotransferase -ALT-) ($p < 0.05$).

CONCLUSION

It has been verified a significant improvement of analytical and structural liver parameters in patients with HCV-related hepatic fibrosis who underwent treatment with interferon-free antiviral therapies.

CLINICAL RELEVANCE/APPLICATION

Reversibility of liver stiffness after treatment might be monitored with ARFI elastography and it is essential for prognosis and management of these patients.

SSQ09-09 A Deep Convolutional Neural Network for the Prediction of METAVIR Score Using B-Mode Ultrasonography Images

Thursday, Nov. 30 11:50AM - 12:00PM Room: E353C

Participants

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Jonghyon Yi, PhD, Kyunggi-Do, Korea, Republic Of (*Abstract Co-Author*) Employee, Samsung Electronics Co Ltd

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PURPOSE

Liver fibrosis is one of the most important prognostic factors in patients with chronic liver disease. We developed a deep convolutional neural network (CNN) for the prediction of METAVIR score using B-mode ultrasonography (US) images.

METHOD AND MATERIALS

Among 7,273 patients with 140,605 B-mode US images, who had undergone either histopathologic examination or transient elastography, 2,798 patients with 5,517 B-mode US images were used for training the CNN. METAVIR score of the specimens, determined by pathologists specializing in liver pathology, and estimated METAVIR score derived from transient elastography were used as reference standards. Our training model (S-Detect for liver quantification) was based on the Visual Geometry Group-16 neural network with image appearance normalization technique. Two-class (F0, F1, F2, F3 vs. F4) and four-class (F0 vs. F1 vs. F2 vs. F3 vs. F4) models were developed. After training, 675 patients' images were tested to evaluate the models' performance in classifying the images to the correct METAVIR score.

RESULTS

Performance of the two-class model was as follows: sensitivity 81.6%, specificity 96.4%, and accuracy 88.3%. Performance of the four-class algorithm was as follows: sensitivity 64.5%, specificity 89.0%, and accuracy 72.7%. The expected METAVIR score was

displayed in the application within 2 seconds of analysis on average.

CONCLUSION

The engineered deep CNN-based METAVIR score prediction system revealed remarkable diagnostic accuracy using B-mode US images.

CLINICAL RELEVANCE/APPLICATION

This technology can assist radiologists in identifying the degree of liver fibrosis in a convenient fashion, leading to reduction in time and labor costs, while also providing a means for objective evaluation of liver fibrosis.

SSQ10

Science Session with Keynote: Genitourinary (Imaging of Gynecological Malignancy)

Thursday, Nov. 30 10:30AM - 12:00PM Room: E353B

GU MR OI

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Elizabeth A. Sadowski, MD, Madison, WI (*Moderator*) Nothing to Disclose
Evis Sala, MD, PhD, New York, NY (*Moderator*) Nothing to Disclose

Sub-Events

SSQ10-01 Genitourinary Keynote Speaker: The Added Value of MRI in Evaluation of Gynecological Malignancies

Thursday, Nov. 30 10:30AM - 10:40AM Room: E353B

Participants

Evis Sala, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

SSQ10-02 Clinical Application of PET/MR in Staging of Cervical Cancer and Diagnosis of Pelvic Lymph Node Metastasis

Thursday, Nov. 30 10:40AM - 10:50AM Room: E353B

Participants

Hongzan Sun, Shenyang, China (*Presenter*) Nothing to Disclose
Jin Shang, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
Jun Xin, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

The present study aimed to evaluate the clinical value of PET/MR in the staging of cervical cancer and diagnosis of pelvic lymph node metastasis.

METHOD AND MATERIALS

Seventy patients with cervical cancer were prospectively enrolled. Pelvic PET/MR scan and whole-body PET scan were performed before treatment. All images were evaluated by two experienced radiologists using a randomized, double-blind method. The diagnostic consistency of PET/MR staging, clinical staging, and gold standard staging of cervical cancer was evaluated with the Kappa consistency test, and the diagnostic consistency between each two methods was calculated. The difference between PET/MR staging and clinical staging was evaluated with the paired chi-square test ($P < 0.05$). The value of PET/MR in the diagnosis of pelvic lymph node metastasis of cervical cancer was analyzed using diagnostic consistent rate, sensitivity, specificity, positive predictive value, and negative predictive value. The statistical software SPSS 19.0 was used in the analyses.

RESULTS

The consistency between PET/MR staging and the gold standard method for the diagnosis of cervical cancer was 91.43%. Kappa analysis indicated that the consistency between PET/MR staging and gold standard staging was satisfactory ($\kappa = 0.908$). The consistency between clinical staging and gold standard staging of cervical cancer was fair ($\kappa = 0.542$). There was a significant difference between pre-treatment PET/MR staging and clinical staging ($\chi^2 = 9.278$, $P < 0.05$). In the patient-based analysis, the accuracy of PET/MR diagnosis of pelvic lymph node metastasis was 95.71%, sensitivity was 95.65%, and specificity was 95.74%. In the lymph node-based analysis, the accuracy, sensitivity, and specificity of PET/MR diagnosis were 97.61%, 92.16%, and 98.13%, respectively.

CONCLUSION

The diagnostic value of PET/MR for the staging of cervical cancer is significantly superior to clinical staging, and the former can be used as a one-stop diagnostic method for cervical cancer by accurately diagnosing and identifying pelvic lymph node metastasis.

CLINICAL RELEVANCE/APPLICATION

PET/MR without gadolinium administration will stage cervical cancer and identify pelvic lymph node metastasis accurately, and is strongly recommended as a one-stop diagnostic method in cervical cancer.

SSQ10-03 How to Differentiate Benign Atypical Myomas from Malignant Uterine Sarcomas Using MR Imaging

Thursday, Nov. 30 10:50AM - 11:00AM Room: E353B

Participants

Cendos Abdel Wahab, Paris, France (*Presenter*) Nothing to Disclose
Anne-Sophie Jannot, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Camille Bourillon, Paris, France (*Abstract Co-Author*) Nothing to Disclose
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Alexandre Bellucci, Ile De France, France (*Abstract Co-Author*) Nothing to Disclose
Anne Sophie Bats, MD, PhD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Laure S. Fournier, MD, PhD, Paris, France (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To retrospectively evaluate MRI characteristics to differentiate malignant uterine sarcomas from benign myomas with atypical presentation on MRI.

METHOD AND MATERIALS

IRB-approved monocentric case-control study including 113 women (51 sarcomas and 62 atypical myomas) with an atypical uterine mass on MRI were underwent before surgery. Clinical and MRI data (heterogeneity on T2-weighted and diffusion sequences, ADC and perfusion curves relative to outer myometrium) were collected and compared with pathological findings.

RESULTS

Only 50% of sarcomas presented as a single uterine mass. Predictive criterias for malignancy were age (64 vs 48 years, $p < 0.0001$), menopausal status (84% vs 20%, $p < 0.0001$, OR = 20.82), irregular contours (73% vs 5%, $p < 0.0001$; OR = 46.69), intra-tumoral hemorrhage (38% vs 13%, $p = 0.003$), high signal greater than the endometrium on DWI (100% vs 16%, $p < 0.0001$ OR = 12.01), ADC (0.7 vs $1, 2.10-3 \text{ mm}^2 / \text{s}$, $p < 0.0001$). Conversely, the presence of a portion, even partial, with low T2 signal or a type I perfusion curve had a VPN of 100% ($p < 0.0001$).

CONCLUSION

Beyond the previously known clinical and morphologic criteria, adding functional sequences on MRI better differentiates malignant sarcomas from atypical myomas.

CLINICAL RELEVANCE/APPLICATION

Diffusion and perfusion MRI sequences may allow better predicting malignancy when facing an atypical uterine mass, to guide optimal therapeutic management.

SSQ10-05 Accuracy of Time Intensity Curves Generated From 4-Point DCE MRI in Differentiating Benign and Malignant Adnexal Lesions

Thursday, Nov. 30 11:10AM - 11:20AM Room: E353B

Participants

Vi Thuy Tran, MD, Montreal, QC (*Presenter*) Nothing to Disclose
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Maria Tsatoumas, MD, Outremont, QC (*Abstract Co-Author*) Nothing to Disclose
Sameh Saif, Ottawa, ON (*Abstract Co-Author*) Nothing to Disclose
Benoit P. Gallix, MD, PhD, Montpellier, France (*Abstract Co-Author*) Nothing to Disclose
Anthony Dohan, MD, PhD, Montreal, QC (*Abstract Co-Author*) Nothing to Disclose
Caroline Reinhold, MD, MSc, Montreal, QC (*Abstract Co-Author*) Consultant, GlaxoSmithKline plc

PURPOSE

To assess the accuracy of time intensity curves (TIC) generated from 4-point dynamic contrast-enhanced magnetic resonance imaging (DCE MRI) in differentiating benign and malignant ovarian lesions with solid tissue.

METHOD AND MATERIALS

Patient consent was waived by the Ethics Review Board for this retrospective study. From April 2006 to January 2017, 98 patients with ovarian DCE MRI studies with evidence of solid tissue at MRI were included (45 benign, 10 borderline and 43 malignant lesions). Semiquantitative analysis of signal intensity (SI) over time curves was performed using region-of-interest on the most enhancing solid tissue. TICs were classified according to three patterns of enhancement: a minimal increase with no well-defined shoulder "type 1, benign." A moderate initial rise in the SI of solid tissue relative to myometrium "type 2, borderline." An initial rise in the SI of solid tissue that was equal or steeper than myometrium "type 3, malignant". In patients with hysterectomy ($n=11$), the lesion SI was normalized to psoas and compared to a standard normalized myometrium curve. Standard of reference was histopathology in all patients.

RESULTS

Accuracy, sensitivity, specificity, PPV, and NPV of TIC for differentiating benign from malignant/borderline lesions was 85.9%, 96.2%, 74.5%, 80.6% and 94.6% respectively. TIC yielded comparable results to prospective clinical radiological diagnosis using standard morphological assessments (acc 85.7%, sens 93.9%, spec 80.0%, PPV 76.7%, NPV 94.9%). However, out of the 12 misdiagnosed patients during the clinical reads, (2 false negatives, 10 false positives), TIC was able to accurately reclassify 6 of them, resulting in an overall acc 93.9%, sens 100%, spec 87.5%, PPV 89.3%, NPV 100%.

CONCLUSION

The enhancement patterns of ovarian lesions on 4-point DCE MRI can help distinguish between benign and borderline/malignant tumors. Although pharmacokinetic parameters have been proposed by research-based groups, they have not been widely adopted or validated in the clinic. TIC based on 4-point DCE MRI can be a useful adjunct to standard qualitative morphological reads, with

the potential to improve diagnostic accuracy.

CLINICAL RELEVANCE/APPLICATION

Time intensity contrast-enhanced curves generated from 4-point DCE MRI are a useful adjunct to standard morphological imaging and can improve the accuracy for discriminating between benign and malignant ovarian lesions.

SSQ10-06 Amide Proton Transfer Imaging of Early Radiotherapy Response in High-Risk HPV+ Gynecologic Cancer

Thursday, Nov. 30 11:20AM - 11:30AM Room: E353B

Participants

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PURPOSE

HPV-associated gynecologic cancers are treated primarily with radiation, with cervical cancer being the most common cancer among women in the developing world. Anatomical MRI can be challenging to interpret following radiation when the morphological appearance of residual or early recurrent tumor tissue mimics post-radiotherapy inflammation and/or fibrosis. Amide proton transfer (APT) MRI, a subset of chemical exchange saturation transfer (CEST) MRI, has the potential to provide molecular information regarding tissue pH and mobile protein content, which may be beneficial in distinguishing radiation necrosis from recurrent disease. Necrotic lesions should demonstrate less cytosolic protein and peptide content as a result of the loss of cytoplasm compared to viable tumor tissue. We investigated the prognostic value of APT MRI following radiotherapy in a murine model of high risk HPV+ cervical cancer.

METHOD AND MATERIALS

A clinically relevant HPV+ orthotopic cervical cancer model was developed that expresses the E6 and E7 oncogenes of HPV-16 and the Ras oncogene. 4 animals received 9 Gy radiation and were imaged on days -1 and +1. A CEST-RARE pulse sequence was used with a 3 second saturation period consisting of a 2.0 uT continuous wave saturation pulse. 40 saturation frequencies between +5 and -5 ppm were acquired to generate a CEST spectrum in 8 minutes on a 7T Bruker MRI (Bruker Corporation, Billerica MA). Pixelwise analyses of magnetization transfer asymmetry (MTRasym) was performed to measure mobile protein content.

RESULTS

Preliminary results show that MTRasym measurements decreased the day after radiation treatment indicating a decrease in mobile protein content. This result supports the hypothesis that necrotic lesions have less cytosolic protein content than viable tumor, which can be detected with APT MRI.

CONCLUSION

Initial results indicate that as early as one day after radiation treatment, APT MRI can be used to distinguish necrotic tissue vs. viable tumor through a decrease in MTRasym. Additional mice will be imaged to confirm this trend and determine statistical significance.

CLINICAL RELEVANCE/APPLICATION

These findings may be beneficial to clinicians in identifying a new functional MRI technique to monitor early radiotherapy response of HPV+ gynecologic cancers.

SSQ10-07 Preoperative Tumor Texture Analysis from MRI Predicts High-Risk Status and Reduced Survival in Endometrial Carcinomas

Thursday, Nov. 30 11:30AM - 11:40AM Room: E353B

Participants

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Ingrid S. Haldorsen, MD, Bergen, Norway (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Tumor heterogeneity is a key feature of malignant disease. Heterogeneity at MRI can be quantified by texture analysis. We aimed to explore whether high-risk clinical and histological features in endometrial cancer are reflected in tumor texture parameters from preoperative MRI, and to assess the prognostic value of tumor texture parameters.

METHOD AND MATERIALS

Preoperative pelvic MRI (1.5T) including contrast-enhanced (CE) T1-weighted, T2-weighted and diffusion-weighted imaging was

Preoperative pelvic MR (T2WI, including contrast-enhanced T2WI, T2-weighted and diffusion-weighted imaging) was performed in 180 patients with histologically confirmed endometrial carcinomas. Using the software TexRAD, tumor regions of interest (ROIs) were manually drawn on the slice displaying the largest cross-section tumor area. Histogram based texture parameters (standard deviation, entropy, mean of positive pixels (Mpp), skewness and kurtosis) were calculated from these tumor ROIs on non-filtered and filtered images. The derived texture parameters were included in multivariate logistic regression models assessing their predictive value for identifying high tumor grade, deep myometrial invasion (DMI), cervical stroma invasion (CSI) and lymph node metastases. Preoperative histological risk from biopsy, conventional MRI findings and MRI-measured tumor volume were included as covariates, and the best cutoff values of texture parameters were determined by ROC curve analysis. Multivariate Cox regression was used for survival analysis.

RESULTS

High entropy in ADC-maps independently predicted DMI (OR 5.1, $p=0.001$), low Mpp in T2 images independently predicted CSI (OR 3.5, $p=0.01$) and high Mpp in CE T1 images independently predicted high grade (OR 3.5, $p=0.005$). High kurtosis in CE T1 images independently predicted reduced recurrence- and progression-free survival (HR 1.5, $p<0.001$). Different levels of filtration, including no filtration, were represented among the high ranked texture parameters.

CONCLUSION

MRI derived tumor texture parameters, reflecting tumor heterogeneity, independently predict high tumor grade, deep myometrial invasion, cervical stroma invasion and reduced survival in endometrial carcinomas. Thus, tumor texture parameters based on MRI represent promising biomarkers to aid preoperative tumor characterization for risk stratified surgical treatment.

CLINICAL RELEVANCE/APPLICATION

Tumor texture features at MRI are associated with high-risk phenotype and may aid preoperative risk classification for stratified surgery in endometrial cancer.

SSQ10-09 Machine Learning to Differentiate Uterine Sarcoma from Leiomyoma with High Signal Intensity on T2-Weighted Imaging Based on Multi-Parametric Magnetic Resonance Quantitative Imaging Features

Thursday, Nov. 30 11:50AM - 12:00PM Room: E353B

Participants

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PURPOSE

To determine whether a prediction model using machine learning based on quantitative multi-parametric magnetic resonance imaging (MRI) features has adequate diagnostic performance for differentiating uterine sarcomas from benign leiomyomas with high signal intensity on T2-weighted imaging (T2WI).

METHOD AND MATERIALS

This retrospective study was approved by the institutional review board. The need for informed consent was waived. We included 62 patients who underwent pelvic 3T MRI examination for evaluation of uterine myometrial smooth muscle masses with high signal intensity on T2WI. Of the 62 patients, 38 had benign leiomyoma and 24 had uterine sarcoma. Age, tumor size, and 12 histogram and texture parameters (minimum, mean, standard deviation of, and maximum normalized signal; skewness; kurtosis; homogeneity; energy; contrast; correlation; entropy; and dissimilarity) were assessed on T1WI, T2WI, ADC maps, and contrast-enhanced T1WI. We developed a prediction model with machine learning (extreme gradient boosting) and calculated the area under the receiver operating characteristic curve (AUC) of this model by 10-fold cross validation, and compared the performance of this model with two board-certified radiologists.

RESULTS

Age had the highest importance (myoma, 43.8 ± 9.9 ; sarcoma, 59.2 ± 15.5 ; $p=0.0001$), followed by the minimum normalized T2 signal (myoma, 0.35 ± 0.45 ; sarcoma, 0.82 ± 0.54 ; $p=0.0009$), ADC skewness (myoma, 0.33 ± 0.85 ; sarcoma, 0.86 ± 0.89 ; $p=0.0237$), mean ADC (myoma, 1.56 ± 0.40 ; sarcoma, 1.29 ± 0.33 ; $p=0.0057$), and T2WI correlation (myoma, 0.86 ± 0.08 ; sarcoma, 0.91 ± 0.04 ; $p=0.0041$). In the validation analysis, the AUC of the machine learning is significantly higher than two radiologists (0.92 vs. 0.75 and 0.64, respectively; $p<0.001$).

CONCLUSION

Age was the most important factor for differentiation of uterine sarcoma from myoma with high-signal intensity on T2WI. The performance of machine learning was superior to that of experienced radiologists.

CLINICAL RELEVANCE/APPLICATION

Machine learning based on patient age and the texture of multi-parametric MRI has adequate diagnostic performance for differentiating uterine sarcoma from myoma with high signal intensity on T2WI.

SSQ11

Informatics (Radiomics and Quantitative Imaging)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S403A

BQ IN

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Asim F. Choudhri, MD, Memphis, TN (*Moderator*) Nothing to Disclose

Sub-Events

SSQ11-01 Variation in Algorithm Implementation between Quantitative Texture Analysis Software

Thursday, Nov. 30 10:30AM - 10:40AM Room: S403A

Participants

Joseph J. Foy, BSC,MSc, Chicago, IL (*Presenter*) Nothing to Disclose
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PURPOSE

Several open-source texture analysis software packages have recently been developed to address the increased need for quantitative image analysis. This study quantifies the variation in these features due to differences in algorithm implementation.

METHOD AND MATERIALS

Forty regions of interest (ROI) were extracted from digital mammography scans of 39 patients, and 39 ROIs were extracted from head and neck (HN) computed tomography (CT) scans of 39 patients. Mammography ROIs (256 x 256) contained normal breast parenchyma while each HN ROI (174 to 2819 total pixels) contained a manually delineated tumor. Two in-house software packages and two open-source packages (MaZda and IBEX) were used to calculate 6 first-order features (max, min, mean, standard deviation, skewness, kurtosis) and 4 gray-level co-occurrence matrix (GLCM) features (contrast, entropy, difference entropy, sum average) in each ROI. GLCM parameters (gray-level limits, binning, directionality) were modified to provide the greatest consistency across packages. The mean and standard deviation of each feature value across all ROIs were calculated. Non-parametric tests were used to compare feature pairs of corresponding features across software, and significance was determined using $p < 0.001$ to correct for multiple comparisons.

RESULTS

For the mammography and HN cases, first-order features agreed to within $1.13 \pm 0.10\%$ and $2.49 \pm 0.24\%$, respectively, except for kurtosis, which varied by $101 \pm 20\%$ and $71.0 \pm 30.7\%$. Kurtosis was the only first-order feature to show statistically significant differences among the packages. The means of all second-order features differed significantly among all four packages by up to one order of magnitude and two orders of magnitude for the mammography and HN cases, respectively. Possible reasons for the increased differences in feature values for the HN cases include the reduced range in pixel values in the tumor and the non-rectangular ROIs, which warrant further investigation.

CONCLUSION

The large variation in calculated texture values among software packages as well as anatomic sites indicates that analysis should be customized to accommodate the imaging modality and clinical task of interest.

CLINICAL RELEVANCE/APPLICATION

Many research institutions have used open-source texture analysis software in a one-size-fits-all approach without considering the variations in the texture algorithms or their implementation.

Honored Educators

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

SSQ11-02 Quantifying Echogenicity of Solid Benign and Malignant Thyroid Nodules

Thursday, Nov. 30 10:40AM - 10:50AM Room: S403A

Awards

Student Travel Stipend Award

Participants

Zachary M. Nuffer, MD, Rochester, NY (*Presenter*) Nothing to Disclose
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Sudhanshu Srivastava, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose
Thomas Marini, East Syracuse, NY (*Abstract Co-Author*) Nothing to Disclose
Shweta Bhatt, MD, MBBS, Rochester, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The Thyroid Imaging, Reporting and Data System (TIRADS) is designed to improve ultrasound characterization of thyroid nodules for effective clinical management of malignancy risk. The ACR TIRADS white paper identified six features for nodule categorization with diagnostic merit: composition, echogenicity, shape, size, margins, and echogenic foci. In this study, we present and validate method to quantify the echogenicity of solid nodules in order to predict malignancy risk.

METHOD AND MATERIALS

We evaluated 35 biopsy-proven malignant and 34 biopsy-proven benign solid thyroid nodules from thyroid ultrasound exams from 2013 to 2016. The nodules were segmented and the mean intensity of each nodule was calculated by averaging the mean intensities of representative sections in both the sagittal and transverse planes. The mean intensity of a sample of background thyroid parenchyma adjacent to each nodule was also obtained. A ratio was calculated between nodule intensity and adjacent thyroid parenchyma intensity. The resulting means were compared using a t test and the agreement between transverse and sagittal ratios was assessed with Bland Altman analysis.

RESULTS

The mean ratio of malignant nodule intensity to background thyroid intensity was 0.73. The mean ratio of benign nodule intensity to background thyroid intensity was 0.86. Two-tailed t-test demonstrated significance with a P value of 0.0015. Bland Altman demonstrated good agreement between sagittal and transverse ratios.

CONCLUSION

A ratio of thyroid nodule intensity to background thyroid parenchymal intensity is a useful predictor of malignancy in solid nodules, and calculating this ratio at the workstation may aid in accurate assessment of echogenicity.

CLINICAL RELEVANCE/APPLICATION

Quantification of solid thyroid nodule intensity at the workstation can help predict malignancy risk.

SSQ11-03 Diagnostic Accuracy of Radiomics-based Hepatic Venous Pressure Gradient for Clinically Significant Portal Hypertension

Thursday, Nov. 30 10:50AM - 11:00AM Room: S403A

Awards

Trainee Research Prize - Fellow

Participants

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Jie Tian, Beijing, China (*Abstract Co-Author*) Nothing to Disclose
Group Chess, Guangzhou, China (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To investigate whether a radiomics-based hepatic venous pressure gradient (rHVPG) could be as accurate as the direct HVPG measurement in diagnosing clinically significant portal hypertension (CSPH).

METHOD AND MATERIALS

A training cohort of patients with portal hypertension (n = 71) was retrospectively recruited in 3 high-volume liver centers in China between August 2016 and March 2017. Computed tomography (CT) images were analyzed for radiomic features extraction. A LASSO regression model was used for data dimension reduction, feature selection, and radiomics signature building. Besides, a predictive model, which combined the radiomic signatures, liver volume and spleen volume, was developed using the two-class logistic regression analysis. To assess the diagnostic performance of rHVPG for CSPH with the invasive HVPG measurement as reference standard, receiver operating characteristic (ROC) curves were constructed. A validation was conducted on another cohort consisting of 12 patients with portal hypertension.

RESULTS

A total number of 10324 imaging features were extracted [Figure 1A, 1B]. A radiomics signature that consisted of 34 selected features, was highly correlated to the presence of CSPH ($P < 0.001$ for both training and validation cohorts). The predictive model containing variables of radiomics signature, liver volume and spleen volume [Figure 1C], demonstrated high accuracy with an area under ROC curve (AUC) of 1.000 (1.000-1.000). Additionally, the model provided an excellent prediction in the validation cohort with an AUC of 0.778 (0.512-1.000).

SSQ11-04 Investigation of Arterial Enhancement Fraction (AEF) In Functional Imaging of Hepatocellular Carcinoma (HCC) and Its Correlation with Alpha-Fetoprotein (AFP)

Thursday, Nov. 30 11:00AM - 11:10AM Room: S403A

Participants

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Qiyong Guo, MD, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose
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Jialin Ji, Shenyang, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

To investigate the correlations between AEF and AFP and to discuss the clinical application value of AEF in the functional imaging of HCC.

METHOD AND MATERIALS

IRB approval was secured for this prospective study with informed consent obtained. 25 patients with pathologically proved HCC who underwent tri-phasic contrast-enhanced CT exam between May 2015 and September 2016 were enrolled (21 males and 4 females, 46y~68y), and divided into "Positive" (P) and "Negative" (N) group based on AFP levels (P group: AFP>200ng/ml). All scans were performed on a 128 row multi-detector CT (iCT 256, Philips) with following parameters: tube voltage 100kVp, automatic tube current modulation, pitch 0.993, rotation time 0.5s, collimation 128×0.635, FOV 350×350mm, slice thickness 3mm. Tri-phasic enhanced CT was acquired with 1.2ml/kg body weight of Iodixanol (Visipaque 270, GE Healthcare, Ireland) injection at a rate of 4.5ml/s, followed by 20ml saline flush. On the basis of unenhanced, arterial, portal venous and delay phases of CT images, AEF color map was obtained with CT-Kinetics software (GE Healthcare), the corresponding texture features were automatically generated after the regions of interest (ROIs) defined by two 11-year experienced radiologists. Mann Whitney U test and boxplot were used to compare the difference between P and N group. Spearman correlation test and linear regression were applied to evaluate the correlation between texture features with AFP.

RESULTS

Significant differences ($P < 0.05$) were found between two groups in several parameters, including StdDeviation, Variance, Uniformity, Inertia, Cluster Prominence and Haralick Correlation with 0.080 vs 0.147, 0.007 vs 0.023, 0.855 vs 0.750, 3.715 vs 8.373, 3.808 vs 21.530, and 56.210 vs 122.500 in N and P group, respectively. While mean value of AEF showed no statistical difference ($P = 0.22$). All above parameters had significant correlations with AFP (StdDeviance was taken for an example shown in Figure 1).

CONCLUSION

AEF texture features reflected the distribution of HCC's blood supply, which had strong correlation with AFP level, and would be regarded as an option to predict the biological activity of HCC.

CLINICAL RELEVANCE/APPLICATION

AEF texture analysis method which combined morphological with functional imaging without additional invasive procedure or radiation exposure, could promisingly reflect pathological AFP level and provide more scientific basis efficiently for clinicians.

SSQ11-05 A Size-independent Radiomics Model for Classification of Indeterminate Pulmonary Nodules Seen at CT

Thursday, Nov. 30 11:10AM - 11:20AM Room: S403A

Participants

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PURPOSE

While radiomic signatures to classify lung nodules as malignant or benign exist, an effective classifier that is independent of size features has not been established. We hypothesized that we could derive a parsimonious set of radiomic features useful for classification independent of nodule size.

METHOD AND MATERIALS

96 Nodules (33 benign; 63 malignant) in CT scans of patients (70 M; 26 F; mean age = 67, range = 47-85) from our institution were considered for this study. Inclusion criteria were: confirmed tissue diagnosis and nodule size of 4-30 mm. Patients with screen-detected nodules, ground glass opacities, metastatic lung nodules, contrast-enhanced scans or scans with slice thickness > 3 mm were excluded. Segmentations were created in the Definiens Developer XD™ environment, followed by generation of 222 radiomic features per nodule characterizing tumor size, shape, location, intensity and texture. We built two linear classifiers, one using the full set of radiomic features, and one excluding 13 size-related features, using a sparse linear regression technique (LASSO) and cross-validation.

RESULTS

Mean nodule size was 18 mm (interquartile range [IQR] 11-23 mm), 22 mm (IQR 17-26 mm) and 14 mm (IQR 9-15 mm) for all 96, with 63 malignant, and 33 benign nodules, respectively. Upper lobe nodules constituted 29% and 6% of malignant and benign nodules respectively. 19% of malignant nodules had a spiculated margin compared to 9% of benign nodules. For both models developed, two texture features were most frequently selected by LASSO, indicating the importance of nodule texture as a predictor. The size-independent classifier had an Area Under the ROC Curve (AUC) of 0.812 (Confidence Interval (CI)=0.73-0.91), while including size features added only a modest improvement (AUC: 0.838 (CI=0.755-0.92)). In contrast, a clinical risk calculator consisting of age, smoking status, nodule size and location gave inferior performance (AUC: 0.524 (CI=0.4-0.65)).

CONCLUSION

Texture features were most informative for differentiating between benign and malignant pulmonary nodules, independent of clinical information and size-based features.

CLINICAL RELEVANCE/APPLICATION

Size-independent radiomic-based models have the potential to separate benign from malignant nodules when nodule sizes are similar.

SSQ11-06 Comparison of RECIST 1.1, irRC, irRECIST and WHO Criteria in Patients with Renal Cell Cancer Receiving Immune Therapy

Thursday, Nov. 30 11:20AM - 11:30AM Room: S403A

Participants

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PURPOSE

While tumor response assessment by WHO and RECIST 1.1 have been broadly used to predict the outcome of patients under conventional chemotherapy, alternative criteria such as irRC and irRECIST have been designed to consider the specific response patterns of certain tumor entities treated with immunotherapy such as pseudo-progression and tumor flare. Therefore, this study aims to determine the difference between these criteria in a selected cohort of 32 patients with renal cell cancer treated with immunotherapy.

METHOD AND MATERIALS

MINT Lesion software (Mint Medical GmbH, Dossenheim, Germany) was used to assess tumor response in all cases. A total of 141 image studies were evaluated using the 4 response criteria. The software produced an assessment of Complete Response (CR), Partial Response (PR), Stable Disease (SD)/No Change (NC) or Progressive Disease (PD) for each image study. Cohen's unweighted kappa statistic was used to evaluate agreement between criteria assessments.

RESULTS

Comparison of irRC and WHO (kappa=0.6948, 95% CI: 0.5999-0.7897) showed substantial agreement and comparison of RECIST 1.1 and irRECIST criteria showed almost perfect agreement (kappa=0.8917, 95% CI: 0.8303-0.9531). In 20 cases irRC produced an assessment of SD when WHO produced an assessment of PD. In 11 cases irRC produced an assessment of PR when WHO produced an assessment of PD. Additionally, there were 5 cases where irRECIST produced an assessment of SD when RECIST 1.1 produced PD and 6 cases where irRECIST produced PR when RECIST 1.1 produced PD. Application of irRECIST produced the least number of cases assessed as PD (n=32), followed by RECIST and irRC (n=43) and WHO (n=74).

CONCLUSION

This study found variation between all criteria, especially regarding assessment of progressive disease. irRECIST led to the fewest assessments of PD, likely because these criteria best consider the phenomenon of tumor flare and pseudo-progression that has been observed under immunotherapy. Further studies are needed to confirm if irRECIST also best predicts clinical outcome.

CLINICAL RELEVANCE/APPLICATION

Since our study has shown that irRECIST criteria best consider pseudo-progression and flare of RCC under immunotherapy, they may be best suited to follow these patients.

SSQ11-07 Radiomics of Multi-parametric MRI for Pre-treatment Prediction of Progression-Free Survival in Advanced Nasopharyngeal Carcinoma

Thursday, Nov. 30 11:30AM - 11:40AM Room: S403A

Participants

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PURPOSE

This study aimed to identify MRI-based radiomics for the pre-treatment prediction of progression-free survival (PFS) in patients with advanced nasopharyngeal carcinoma (NPC) (stage III-IVb).

METHOD AND MATERIALS

One-hundred and eighteen patients (training cohort: $n = 88$; validation cohort: $n = 30$) with advanced NPC were enrolled. A total of 970 radiomics features were extracted from T2-weighted (T2-w) and contrast-enhanced T1-weighted (CET1-w) MRI. Least absolute shrinkage and selection operator (LASSO) regression was applied to select features for progression-free survival (PFS) nomograms. Nomogram discrimination and calibration were evaluated. Associations between radiomics features and clinical data were investigated using heat maps.

RESULTS

Eight MRI-based radiomics signature that significantly associated with PFS was identified from 970 features. The prognostic value of radiomics signature derived from joint CET1-w and T2-w images performed better than that from CET1-w or T2-w images alone. The TNM staging system yielded a C-index of 0.514 (95%CI: 0.432 to 0.596). The radiomics nomogram integrated radiomics signature from joint CET1-w and T2-w images with the TNM staging system showed a significant improvement of the TNM staging system in predicting PFS in the training cohort (C-index, 0.761 vs 0.514; $p < 2.68 \times 10^{-9}$). The clinical nomogram yielded a C-index of 0.649 (95%CI: 0.552 to 0.746). The radiomics nomogram integrated radiomics signature with clinical data outperformed the clinical nomogram (C-index, 0.776 vs 0.649; $p < 1.60 \times 10^{-7}$). The calibration curves showed the good agreements between nomogram-predicted and actual survival. These results were further confirmed in the validation cohort. Radiomics heatmaps suggested associations between radiomics features with tumor stages.

CONCLUSION

Multiparametric MRI-based radiomics nomogram shows more accurate than the traditional TNM staging system and clinical nomogram in predicting individualized PFS in advanced NPC, which epitomizes the pursuit of precision medicine and may affect patient treatment strategy.

CLINICAL RELEVANCE/APPLICATION

This present study developed and validated multi-parametric MRI-based radiomics as a convenient approach to predict individual PFS pre-treatment in patients with advanced NPC.

SSQ11-08 Radiophenomics: A Machine Learning Approach to Radiological Exploration of Atherosclerosis

Thursday, Nov. 30 11:40AM - 11:50AM Room: S403A

Participants

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CONCLUSION

Radiophenomics results in a promising unsupervised stratification of atherosclerotic cardiovascular burden, with the promise of addressing the heterogeneity and the progression of the disease.

Background

Atherosclerosis is a complex, heterogeneous and multi-district disease, whose progression can be conveniently assessed by a plethora of radiological measurements. Aim of this work is the integration of a group of radiological measurements, in order to single out some meaningful phenotypes and explore the disease.

Evaluation

The considered sample was constituted by 1283 subjects from the asymptomatic general population of a screening study (age:

60.7 +/- 8.3 years; males=46%). For each subject, who underwent an MSCT examination, mitral and aortic valve volumetric calcium, coronary volumetric calcium, Agatston calcium score, left and right carotid intima thickness, number of carotid plaques, pulmonary trunk diameter and pulmonary artery diameter were computed. The lipidic profiles were also assessed by measuring total cholesterol, LDL and HDL cholesterol, triglycerides; age, gender and BMI were also reported. On the basis of the 9 considered radiological measurements, the similarity between each couple of subjects was evaluated by the proximities obtained with an unsupervised random forest approach. Successively, a multidimensional scaling procedure was used to map each subject on a plane. Finally, a fuzzy c-means algorithm was used to identify the clusters of subjects in the similarity map (optional figure); to identify the correct number of clusters, the Xie-Beni index was computed.

Discussion

Three distinct phenotypes were singled out: A (n=219), B (n=845), C (n=219). Passing from phenotype A to B and C: Agatston score, pulmonary diameters, intima thickness and number of plaques of carotid arteries significantly increased. Contemporaneously, HDL cholesterol significantly decreased, while age, percentage of male gender and triglycerides increased; moreover, phenotypes B and C showed a BMI value significantly greater than A.

SSQ11-09 Nodule Interface Sharpness Radiomics Distinguishes Benign From Malignant Nodules on Non-Contrast CT Scans

Thursday, Nov. 30 11:50AM - 12:00PM Room: S403A

Participants

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PURPOSE

Many people with benign lung nodules are subjected to unnecessary surgical procedures due to the inability in making confident diagnostic predictions regarding nodule pathology on routine non-contrast CT scans. Interestingly, many malignant nodules are associated with lymphocytic infiltration which may manifest in the perinodular space and hence result in a differential textural appearance between the interior to exterior of the nodule. The aim of this study is to evaluate the role of Nodule Interface Sharpness (NiS), a new radiomic feature that aims to capture the textural transition going from the inside to the outside of the nodule.

METHOD AND MATERIALS

Our study comprised of CT scans of 290 patients from multiple institutions, one cohort for training (N=145) and the other (N=145) for independent validation. All patients had previously undergone surgical wedge resection for a suspicious nodule. A set of 48 NiS features from the nodules margins on 2D slices were extracted. The features pertain to the spiculations and intensity transitions along the nodule interface going from the inside to the outside of the nodule. A Support Vector Machine (SVM) based classifier was trained to distinguish benign from malignant nodules using the most informative NiS features identified on the training set via the Minimum Redundancy, Maximum Relevance (mRMR) feature selection algorithm. The model then applied to predicting presence of malignancies on the validation set.

RESULTS

The most informative NiS features identified were mean gray profile and entropy of the gradient magnitude of the voxels along the margin. The SVM classifier yielded an AUC=0.83 on the independent validation set. In comparison, two human readers with 13 and 3 years of experience had AUC's of 0.69 and 0.73.

CONCLUSION

Our results appear to suggest that the NiS radiomic features associated with lung nodules interface on non-contrast CT scans capture the transitional intensity profiles from the intra- to the peri-nodular space and are thus able to distinguish between benign and malignant nodules on CT scans.

CLINICAL RELEVANCE/APPLICATION

The combination of radiomic features based off NiS with human interpretations could allow for improved discrimination of benign from malignancy nodules and could help reduce unnecessary surgical interventions for pathologic confirmation of nodule diagnosis and also reduce the number and frequency of follow on CT scans for indeterminate findings.

SSQ12

Molecular Imaging (Theranostics)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S505AB

CT **MR** **MI** **NM**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Gabriel C. Fine, MD, Seattle, WA (*Moderator*) Nothing to Disclose
Pedram Heidari, MD, Boston, MA (*Moderator*) Nothing to Disclose

Sub-Events

SSQ12-01 HIF-Prolyl Hydroxylase 2 Silencing Using siRNA Delivered by MRI-Visible Nanoparticles Improves Therapy Efficacy of EPCs for Ischemic Stroke

Thursday, Nov. 30 10:30AM - 10:40AM Room: S505AB

Awards

Trainee Research Prize - Medical Student

Participants

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PURPOSE

Stroke is a leading cause of death and disability worldwide. Stem cell therapy has brought substantial benefits to patients as an important restorative therapeutics. However, its efficacy was limited by poor migration and survival ability. In this study, we aimed to enhance therapy efficacy of EPCs for ischemic stroke via PHD2 silencing using siRNA delivered by MRI visible nanoparticles.

METHOD AND MATERIALS

Human umbilical cord blood derived EPCs was transfected with siRNA targeting PHD2 delivered by MRI visible nanoparticles. Expression of CXCR4 and HIF-1 α was detected by western blot 48h after siRNA transfection. In vitro transwell assay and H₂O₂ apoptosis assay was used to detect the migration and survival ability of EPCs respectively. 5 $\times$ 10⁵ EPCs with or without PHD2 silencing (siPHD2-EPCs, siCON-EPCs) were transplanted intracardially 1 day after photothrombotic model of stroke was induced in nude mice. Functional recovery was assessed with mNSS and foot-faults test at 1 day before ischemic stroke induction and 1, 3, 7, 14 days after EPCs implantation. MRI and Bioluminescent imaging (BLI) were carried out at 1, 3, 7 days after EPCs transplantation. Prussian blue and GFP staining were carried out at 1 day and 7 day after EPCs transplantation. Angiogenesis, neurogenesis and white matter recovery were assessed at 7 days and 14 days respectively.

RESULTS

PHD2 silencing increased expression of CXCR4 and HIF-1 α of EPCs. Both in vivo and in vitro results suggested that PHD2 silencing increased migration and survival ability of EPCs. Mice treated with siPHD2-EPCs showed significantly decreased infarct volume and increased fractional anisotropy (FA) in the ipsilesional corpus callosum than the other groups. Improved functional recovery was observed in the siPHD2-EPCs treated mice. At 7 days, increased BDNF expression was observed in the siPHD2-EPCs treated group. Histological analysis showed that angiogenesis, neurogenesis and white matter recovery were increased after siPHD2-EPCs treated than the other groups.

CONCLUSION

PHD2 silencing increased therapy efficacy of EPCs for ischemic stroke due to increased migration and survival ability.

CLINICAL RELEVANCE/APPLICATION

Our study provides an effective solution for the limitations of clinical stem cell therapy for ischemic stroke.

SSQ12-02 Tracking Stem Cell Transplants in Femoral Osteonecrosis of Pediatric Patients

Thursday, Nov. 30 10:40AM - 10:50AM Room: S505AB

Participants

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PURPOSE

To monitor stem cell transplants in osteonecrotic lesions of pediatric cancer survivors with ferumoxytol-enhanced MRI and correlate T2* signal kinetics with outcomes.

METHOD AND MATERIALS

In an ongoing prospective clinical trial (NCT02893293), we performed serial MR imaging studies of seven hip joints of six cancer survivors before and after decompression surgery for osteonecrosis (ON) treatment. We injected ferumoxytol prior to the surgery to label mesenchymal stem cells (MSC) in the bone marrow before their transplantation into osteonecrotic bone. We hypothesized that MR tracking of stem cells in the osteonecrotic bone would enable differentiation of successful and failed cell therapies. We compared T2* values of cell transplants with presence or absence of joint collapse at 12 months using a Student t-test.

RESULTS

Pre-surgical MRI scans of the patients' hip joints confirmed an osteonecrosis (ON) in the epiphysis of the femur, with an intact joint surface (eligibility criteria for the decompression procedure). Ferumoxytol administration lead to hypointense bone marrow enhancement on pre-surgical T2-FSE sequences. Following decompression surgery and transplantation of iron labeled MSC from the iliac crest into the ON, iron-labeled cells could be seen in the access canal. Five ON remained stable over 12 months after decompression surgery. Two ON showed a decreasing volume over time, ultimately collapsed and required artificial joint replacement. At 1-3 weeks after decompression surgery, T2* values of cell transplants in stable ON (2.797 ± 0.07) were significantly shorter ($p < 0.05$) compared to T2* values of cell transplants in ON that ultimately collapsed (3.498 ± 0.2383).

CONCLUSION

Stem cell transplants in pediatric cancer survivors can be monitored with ferumoxytol-enhanced MRI. T2* signal kinetics of MSC in osteonecrotic lesions predict clinical outcomes. This immediately clinically applicable stem cell imaging test could become a powerful tool to diagnose success or failure of stem cell transplants in osteonecrotic bone in pediatric patients, monitor engraftment non-invasively and predict bone repair outcomes.

CLINICAL RELEVANCE/APPLICATION

This is the first study that shows the feasibility of tracking in vivo labeled stem cells in patients. The rapid disappearance of the cell transplant, as indicated by the iron signal on MR images, correlates with unfavorable clinical outcomes.

SSQ12-03 Integrin-Targeted Quantitative Multispectral Optoacoustic Tomography with MRI Correlation for Monitoring a BRAF/MEK Inhibitor Combination Therapy in Experimental Human Melanoma Xenografts in Mice

Thursday, Nov. 30 10:50AM - 11:00AM Room: S505AB

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PURPOSE

To investigate a multimodal imaging protocol of $\alpha v\beta 3$ -integrin-targeted multispectral optoacoustic tomography (MSOT) and MRI for monitoring a BRAF/MEK inhibitor combination therapy in a murine model of human melanoma.

METHOD AND MATERIALS

Human BRAF V600E-positive melanoma xenografts (A375) were implanted subcutaneously in the lateral flank of $n=10$ balb/c nude mice. Imaging was performed before (day 0) and after (day 7) a BRAF/MEK inhibitor combination therapy (encorafenib, 0.03 mg/d; binimetinib, 0.012 mg/d, Array BioPharma Inc., therapy $n=5$) or placebo treatment (control $n=5$), respectively. MSOT was conducted on a preclinical system (inVision 256-TF, iThera Medical GmbH) unenhanced and 5 h after i.v. injection of a $\alpha v\beta 3$ -integrin-targeted fluorescent probe (IntegriSense 750, Perkin Elmer, 4 nmol). For tumor volume assessments, T2w MRI data sets were subsequently acquired on a clinical 3 Tesla scanner (Magnetom Skyra, Siemens Healthineers). MSOT data acquired at multiple wavelengths was spectrally unmixed to derive the $\alpha v\beta 3$ -integrin-specific signal. Imaging results were validated by ex vivo immunohistochemistry with regard to microvascular density (CD31).

RESULTS

A significant decrease of $\alpha v\beta 3$ -integrin specific tumor signal was observed in the therapy group (-79 %, from 7.98 ± 2.22 to 1.67 ± 1.30 , $p=0.030$), whereas no significant change was detected in the control group (-55 %, from 6.60 ± 6.51 to 3.69 ± 1.93 , $p=0.348$). Immunohistochemistry demonstrated a significant decrease in microvascular density under therapy (CD31; therapy: 119 ± 15 , control: 312 ± 62 , $p=0.008$). Tumor volumes increased in both groups with no significant intergroup difference (therapy: $+107 \pm 42$ mm³; control $+112 \pm 44$ mm³, $p > 0.05$). Competitive in vivo blocking studies using $\alpha v\beta 3$ -integrin receptor antagonist cilengitide (Selleck Chemicals) confirmed the selective binding of the targeted fluorescent probe.

CONCLUSION

Quantitative MSOT allowed for the early non-invasive monitoring of a BRAF/MEK inhibitor combination therapy in BRAF V600E-

positive human melanoma xenografts in mice, adding molecular information on tumor $\alpha\beta 3$ -integrin receptor status to morphology-based tumor response assessments.

CLINICAL RELEVANCE/APPLICATION

Quantitative MSOT with targeted probes may generate additional clinical imaging biomarkers of early tumor response in human melanoma under novel targeted treatment regimens.

SSQ12-04 Why Iron Oxide Labeling Matters for Stem Cell Mediated Cartilage Repair: Insights from a Large Animal Model

Thursday, Nov. 30 11:00AM - 11:10AM Room: S505AB

Awards

Student Travel Stipend Award

Participants

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PURPOSE

The success or failure of matrix associated stem cell implants (MASI) in cartilage defects is evaluated on MR images at 6-12 months after MASI, based on the degree of cartilage repair. We evaluated if iron oxide nanoparticle labeling could accelerate this diagnosis based on different iron signal kinetics of successful and failed implants.

METHOD AND MATERIALS

Studies were performed in seven Göttingen minipigs with artificially created cartilage defects of the distal femur. We aspirated and isolated mesenchymal stromal cells from the iliac crest and labeled the cells with ferumoxytol (Feraheme), using a clinically translatable, transfection agent-free protocol. We implanted viable and apoptotic ferumoxytol-labeled MSCs into 22 cartilage defects and monitored the signal of the implants with a clinical 3T MRI scanner at week 1, 2, 4, 8, 12 and 24, using a proton density sequence (3700/34/90 TR/TE/ α) and a multiecho spin echo sequence (3500/45 TR/TE). Implants without ferumoxytol label served as controls. Quantitative T2 relaxation times were compared for significant differences between labeled and unlabeled as well as viable and apoptotic MASI using Student t-tests.

RESULTS

Iron oxide labeled MASI showed significant T2 shortening compared to adjacent normal cartilage and unlabeled implants. At week 1, viable and apoptotic MASI did not show significant differences in T2 relaxation times (20.91 ± 2.12 ms versus 20.97 ± 2.07 ms). At week 2, T2 relaxation times of viable ferumoxytol-labeled implants (21.79 ± 2.59) ms were significantly lower compared to apoptotic ferumoxytol-labeled implants (27.93 ± 3.49 ms, $p < 0.05$). The label disappeared in both groups at 4 weeks. Histological correlation at 24 weeks showed complete defect repair of viable MASI and incomplete defect repair of apoptotic MASI.

CONCLUSION

Rapid loss of iron signal early after MASI indicates cell death and predicts incomplete defect repair many weeks later. To our knowledge, this is the first study to detect early engraftment failure of MASI with MRI in a large animal model.

CLINICAL RELEVANCE/APPLICATION

MRI of ferumoxytol-labeled MASI represents an easily clinically translatable method for detection of early engraftment failure in arthritic joints.

SSQ12-05 A Case Series of NSCLC Patients Performing both C-11 Erlotinib and F-18 FDG PET/CT Comparing with EGFR Mutation Status

Thursday, Nov. 30 11:10AM - 11:20AM Room: S505AB

Participants

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PURPOSE

To evaluate the ability of C-11 erlotinib PET/CT as a non-invasive approach to identify EGFR mutation status and to study various PET parameters that may serve as a potential proxy for selecting the patient who could benefit from erlotinib treatment.

METHOD AND MATERIALS

We performed PET/CT in 5 NSCLC patients, each with both C-11 erlotinib and F-18 FDG. All had EGFR mutation status of the

tumors. There were two patients who had wild-type EGFR and three patients who had EGFR mutation i.e., exon 21 mutation (L858R), exon 19 insertion and exon 19 deletion. Three experienced nuclear medicine physicians, unknown of the patients' EGFR status, read the C-11 erlotinib PET/CT by visual analysis and gave the result as positive or negative. PET parameters i.e., SUVmax, SUVavg, MTV, TLG, Tumor to background ratio were analysis in both C-11 erlotinib and FDG studies.

RESULTS

There was a wide range of C-11 erlotinib uptake in primary tumor and metastatic sites. By visual analysis, 67% correction was observed (10/15). The average SUVmax and tumor to background mediastinal blood pool ratio were 2.04 ± 0.68 vs 2.18 ± 1.45 ($p = 0.77$) and 3.44 ± 1.63 vs 1.56 ± 1.10 ($p = 0.02$) in EGFR mutation positive vs EGFR mutation negative, respectively. Sub-group analysis of SUV parameters in primary tumor, lymph node and distant metastases including adrenal, bone, brain and muscle showed no significant difference between each group. There was no significant correlation between FDG parameters (SUVmax, SUVavg, MTV, TLG) and C-11 erlotinib parameters as well as EGFR mutation status.

CONCLUSION

Our study confirmed the tumor heterogeneity of C-11 erlotinib binding in primary tumor and each metastatic sites. The tumor to mediastinal blood pool ratio of C-11 erlotinib uptake was the only parameter that seems to be significantly different between EGFR mutation positive vs negative group.

CLINICAL RELEVANCE/APPLICATION

C-11 erlotinib PET/CT confirmed the tumor heterogeneity of erlotinib binding in primary NSCLC and metastatic sites in the same patient as well as different patients with different EGFR mutation status.

SSQ12-06 MR Molecular Imaging and Tumor Theranostic 2D Ultrathin MnO₂ Nanosheets with Fast Responsibility to Endogenous Tumor Microenvironment and Exogenous NIR Irradiation

Thursday, Nov. 30 11:20AM - 11:30AM Room: S505AB

Participants

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PURPOSE

To study the feasibility of using two-dimensional (2D) ultrathin MnO₂ nanosheets with ultra-sensitivity to tumor microenvironment (TME) to enhance MR molecular imaging and photothermal therapy (PTT).

METHOD AND MATERIALS

The fabrication of ultrathin 2D MnO₂ nanosheets were based on an exfoliation strategy. The surface of MnO₂ nanosheets were modified by Soybean phospholipid (SP) to enhance stability in physiological environments without significant toxicity. The MnO₂ nanosheets and MnO₂-SPs were characterized by various methods. The murine breast cancer cell line (4T1) and Kunming mice were cultured to evaluate *in vitro* cell and *in vivo* biological toxicity. Importantly, we investigated *in vitro* and *in vivo* MR imaging evaluations and photothermal therapy on mice breast tumor xenografted tumor model.

RESULTS

These ultrathin 2D MnO₂ nanosheets show the intriguing characteristic of disintegration and releasing of Mn²⁺ in response to the mild acidic and elevated reducing conditions of TME, which has successfully realized the pH- and reducing-responsive T1-weighted magnetic resonance imaging of tumor without obvious biological toxicity. *In vivo* MRI, it has been found that the positive T1-weighted MRI signal increased significantly after the intravenous administration of MnO₂-SPs nanosheets into mice bearing the breast 4T1 cancer xenograft. Furthermore, the high PTT efficiency of 2D MnO₂ nanosheets responsive to exogenous NIR irradiation have been systematically demonstrated both *in vitro* and *in vivo* for suppressing the tumor growth.

CONCLUSION

For the first time, we have successfully demonstrated that the exfoliated ultrathin 2D MnO₂ nanosheets feature the high intrinsic photothermal-conversion capability for PTT against tumor, which are also the first paradigm of inorganic photothermal agents with the ultra-sensitivity to the endogenous TME, including mild acidic and reducing conditions. This tumor sensitivity could not only realize the pH- and reducing-responsive T1-weighted MR imaging, but also possibly facilitate the metabolism and excretion of the MnO₂ nanosheets after the tumor theranostics.

CLINICAL RELEVANCE/APPLICATION

2D MnO₂ nanosheets can serve as powerful MR imaging-guided photothermal agents for excellent tumor ablation.

SSQ12-07 Non-Invasive Imaging of Transplanted Therapeutic Cells in the Inflamed Rat Brain by Spectral Photon Counting Computed Tomography (SPCCT)

Thursday, Nov. 30 11:30AM - 11:40AM Room: S505AB

Participants

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PURPOSE

Cell therapy holds promise for treatment of ischemic stroke in the chronic phase. To foster translation into the clinic, there is a need for non-invasive techniques that enable long-term follow-up of cell fate. Our purpose is to provide proof of concept of specific and quantitative in vivo imaging of therapeutic cells by an innovative, translational technique: K-edge imaging by spectral photon counting computed tomography (SPCCT).

METHOD AND MATERIALS

M2-polarized anti-inflammatory macrophages were labelled with gold nanoparticles (AuNPs, 0.1 mg/mL, 15 h) and gold/cell quantified by mass spectroscopy. Rats underwent intracerebral (IC) injection of lipopolysaccharide to induce chronic neuroinflammation. Two weeks after, the same rats were scanned in vivo using a pre-clinical SPCCT prototype after IC delivery of 5×10^5 AuNPs-labelled or control unlabeled cells. A phantom with a concentration range of AuNPs (0 to 8 mg/mL) was scanned for calibration of in vivo quantification. Anode tube voltage of 120 kVp and current of 100 mA were used. The same phantom and rats (ex-vivo) were then scanned by μ CT and K-edge imaging by synchrotron X-rays (SXR) as gold standards for validation. Gold K-edge images were reconstructed and gold signal was manually delineated for quantification.

RESULTS

K-edge imaging of gold with SPCCT detected gold-labelled cells within the brain, in agreement with μ CT and SXR. Mass spectroscopy detected an amount of 165 gold pg/cell, corresponding to 82.5 μ g of gold injected within cells. The measured concentrations in phantom linearly correlated with the known concentrations ($R^2 = 0.99$, slope: 0.82, intercept: 0.19), supporting the potential for accurate in vivo gold-cell quantification, which is currently in progress.

CONCLUSION

Our initial results provide proof-of-concept for non-invasive in vivo imaging of AuNPs-labelled therapeutic cells by SPCCT, which has the advantage of being specific and quantitative.

CLINICAL RELEVANCE/APPLICATION

SPCCT may be valuable to improve cell therapy in chronic stroke patients.

SSQ12-08 PET/CT Imaging of the Alkylphosphocholine Analog 124I-CLR1404 in High and Low-Grade Brain Tumors

Thursday, Nov. 30 11:40AM - 11:50AM Room: S505AB

Participants

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PURPOSE

CLR1404 is a cancer-selective alkyl phosphocholine (APC) analog that can be radiolabeled with ^{124}I for PET imaging, ^{131}I for targeted radiotherapy and/or SPECT imaging, or ^{125}I for targeted radiotherapy. Studies have demonstrated avid CLR1404 uptake and prolonged retention in a broad spectrum of preclinical tumor models. The purpose of this pilot trial was to demonstrate avidity of ^{124}I -CLR1404 in human brain tumors and develop a framework to evaluate this uptake for use in larger studies.

METHOD AND MATERIALS

12 patients (8 men and 4 women; mean age of 43.9 ± 15.1 y; range 23 - 66 y) with 13 tumors were enrolled. Eleven patients had suspected tumor recurrence and 1 patient had a new diagnosis of high grade tumor. Patients were injected with $185 \text{ MBq} \pm 10\%$ of ^{124}I -CLR1404 followed by PET/CT imaging at 6-, 24-, and 48-hours. ^{124}I -CLR1404 PET uptake was assessed qualitatively and compared with MRI. After PET image segmentation SUV values and tumor to background ratios were calculated.

RESULTS

There was no significant uptake of ^{124}I -CLR1404 in normal brain. In tumors, uptake tended to increase to 48 hours. Positive uptake was detected in 9 of 13 lesions: 5/5 high grade tumors, 1/2 low grade tumors, 1/1 meningioma, and 2/4 patients with treatment related changes. ^{124}I -CLR1404 uptake was not detected in 1/2 low grade tumors, 2/4 lesions from treatment related changes, and 1/1 indeterminate lesion. For 6 malignant tumors, the average tumor to background ratios (TBR) were 9.32 ± 4.33 (range 3.46 to

15.42) at 24 hours and 10.04 ± 3.15 (range 5.17 to 13.17) at 48 hours. For 2 lesions from treatment related change, the average TBR were 5.05 ± 0.4 (range 4.76 to 5.33) at 24 hours and 4.88 ± 1.19 (range 4.04 to 5.72) at 48 hours. PET uptake had areas of both concordance and discordance compared with MRI.

CONCLUSION

124I-CLR1404 PET demonstrated avid tumor uptake in a variety of brain tumors with high tumor-to-background ratios. There were regions of concordance and discordance compared with MRI, which has potential clinical relevance. Expansion of these studies is required to delineate the clinical significance of these PET findings.

CLINICAL RELEVANCE/APPLICATION

124-CLR1404 PET provides unique molecular imaging properties in brain tumors and may add complementary diagnostic information to MRI and thus has potential to improve diagnostic certainty.

SSQ12-09 Early Stage Detection of Stem Cell Transplant Rejection with a Ferumoxytol-Based Dual-Modality Imaging Probe

Thursday, Nov. 30 11:50AM - 12:00PM Room: S505AB

Participants

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PURPOSE

Limited survival of transplanted stem cells represents a significant bottleneck for successful tissue regeneration. The goal of this study was to develop a novel dual-modality imaging probe, composed of a superparamagnetic nanoparticle backbone for cell detection and a fluorescent apoptosis marker.

METHOD AND MATERIALS

We immobilized caspase-3 cleavable peptides (KKKKDEVD-AFC) on the surface of the FDA approved nanoparticle compound ferumoxytol to prepare ferumoxytol-AFC nanoparticles (Feru-AFC NPs). Size distribution and Zeta potential of Feru-AFC NPs were measured by Dynamic Light Scattering (DLS). Mesenchymal stem cells (MSCs) were incubated with Feru-AFC NPs or ferumoxytol (control group) and underwent Prussian blue stains and ICP mass spectrometry as well as in vitro fluorescent and MR imaging. Then, intravital microscopy (IVM) was performed on matched (syngeneic) or mismatched (porcine-derived) MSCs, implanted in skull defects of six C57BL/6J mice. The mice underwent MR and fluorescent imaging on day 1, 3, 6, and 9. T2 relaxation time and fluorescent signal of the two groups were compared with a Student's t-test, using a $p < 0.05$.

RESULTS

Feru-AFC NPs could be efficiently internalized into MSCs, as confirmed by Prussian blue stains and ICP mass spectrometry. Labeled MSC showed a significantly shorter T2-relaxation time compared to unlabeled MSCs ($p < 0.05$). Feru-AFC NPs did not show significant fluorescence, however, in the presence of recombinant human caspase-3 or extract of apoptotic MSCs, Feru-AFC NPs showed significant green fluorescence due to cleavage of DEVD and release of AFC fluorophores. Accordingly, viable Feru-AFC NP-labeled MSCs showed no detectable fluorescence, while apoptotic Feru-AFC NP-labeled MSCs showed significant green fluorescence. In vivo, MR imaging enabled localization of cell transplants in skull defects. Mismatched MSC implants showed significantly higher fluorescent signal compared to matched MSC implants three days after implantation ($p < 0.05$).

CONCLUSION

Feru-AFC NPs represent a novel tool for long-term stem cell tracking through MRI and early diagnosis of cell apoptosis through simultaneous fluorescence imaging.

CLINICAL RELEVANCE/APPLICATION

The described dual-modality contrast agent could improve monitoring of the localization and early diagnosis of cell rejection/apoptosis and direct patients with failed implants to repeated interventions.

SSQ13

Science Session with Keynote: Musculoskeletal (Metal Artifact Reduction Techniques)

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

CT **MK** **MR**

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Kenneth A. Buckwalter, MD, Indianapolis, IN (*Moderator*) Research Grant, Siemens AG
Naveen Subhas, MD, Cleveland, OH (*Moderator*) Research Grant, Siemens AG

Sub-Events

SSQ13-01 Musculoskeletal Keynote Speaker: Update on Metal Artifact Reduction Techniques

Thursday, Nov. 30 10:30AM - 10:40AM Room: E451A

Participants

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SSQ13-02 Quantitative Evaluation of Fracture Healing After Internal Fixation of Spinal Fractures by Dual-Energy Technology

Thursday, Nov. 30 10:40AM - 10:50AM Room: E451A

Participants

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PURPOSE

Objective: To investigate the value of dual-energy technology in the treatment of fracture healing after internal fixation of spinal fractures.

METHOD AND MATERIALS

Methods: 60 cases of spine (cervical spine 5 cases, thoracic vertebrae 25 cases, lumbar vertebrae 30 cases) were collected and examined by dual-energy X-ray absorptiometry (DXA). The bone mineral density (BMD) measurements were performed at the same time by gemstone spectral imaging (GSI) scan for patients with spinal fractures, before operation, after metal internal fixation, and after removal of metal internal fixation. The data used in the analyzing were obtained by the energy spectrum analysis software. The single energy images at different energy levels of 40-140 keV, the base substance diagram of calcium and water were obtained. The ROIs were measured by different parameters among 40-140 keV (with interval 10 keV) and the CT values of different energy levels, the calcium and water based material density, and the bone density values were calculated.

RESULTS

Results: The best single energy image was obtained at 60 keV. Before operation, there was statistical significance ($P < 0.05$) between the bone mineral densities getting from GSI (0.440 ± 0.056 g / cm³) and QCT (0.404 ± 0.069 g / cm³), and the former was greater than that of the QCT. The GSI measurement was (0.360 ± 0.026 g / cm³) in the 6 patients healing well, (0.281 ± 0.032 g / cm³) in the 8 patients delayed healing, and (0.121 ± 0.021 g / cm³) in the 8 patients nonunion.

CONCLUSION

Conclusion: The energy spectrum CT scanning technique can effectively remove metal artifacts and ray beam hardening artifacts, and clearly show the fine structure after metal fixation for fracture, and the image quality is higher. The best single energy image was achieved at the 60keV. By using of calcium-water-based substance pairs, the bone density could be measured more accurately than by QCT, and can be used as a new bone density measurement method to predict the degree of fracture healing.

CLINICAL RELEVANCE/APPLICATION

can be used as a new bone density measurement method to predict the degree of fracture healing.

SSQ13-03 The Value of a New Single Energy Metal Artifact Reduction (SEMAR) Algorithm in Post-Surgery Follow-Up of Patients with Knee Tumor Prostheses

Thursday, Nov. 30 10:50AM - 11:00AM Room: E451A

Participants

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PURPOSE

To evaluate the effect of a new single energy metal artifact reduction (SEMAR) algorithm with a 320 Multidetector computed tomography (MDCT) volume scanner in post-surgery follow-up of patients with knee tumor prostheses.

METHOD AND MATERIALS

From November 2015 to February 2017, 95 consecutive patients (59 males, 36 females; mean age, 24.2 years; age range, 9-64 years) with a tumor prosthesis of knee joint underwent a 320-MDCT scan. The images were reconstructed using two different methods: conventional iterative reconstruction (IR) alone and IR associated with SEMAR. Four radiologists visually graded the whole image quality at articular level on a 6-point scale from 0 (periprosthetic anatomic structures are completely obscured by metal artifacts) to 5 (periprosthetic structures are recognized with high confidence). Additionally, the readers assessed the presence of periprosthetic complication on a similar 6-point scale from 0 (extensive artifacts, prosthetic complications are unable to be recognized) to 5 (minimal artifacts, prosthetic complications are recognized with high confidence). Wilcoxon matched-pairs signed rank test and Intra-class correlation coefficients (ICCs) were used for the scores of image quality and prosthetic complications.

RESULTS

Visualization of periprosthetic structures were significantly improved by the SEMAR algorithm (3.8~4.3 vs. 1.2~1.6, $P<0.05$). In 66 of 95 patients, prosthetic complications were confirmed by other imaging examination, clinical or pathology. and prosthetic complications. The new algorithm also increased diagnostic confidence of prosthetic complications (4.3~4.7 vs 1.3~1.9, $P<0.05$). The sensitivity of diagnostic confidence of prosthetic complications was increased (98.5% vs. 45.5%, $P<0.05$).

CONCLUSION

The SEMAR visibly reduces the metal artifact and can increase diagnostic confidence of prosthetic complications in patients with knee tumor prostheses.

CLINICAL RELEVANCE/APPLICATION

The SEMAR can visibly reduces the metal artifact and increase diagnostic confidence of prosthetic complications in patients with knee tumor prostheses.

SSQ13-04 Cross-sectional Imaging of the Bone-Implant Interface of Total Ankle Arthroplasty Implants: CS-SEMAC MRI versus IMAR CT

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

Participants

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PURPOSE

Imaging evaluation of the bone-implant interfaces of total ankle arthroplasty is helpful for the assessment of osseous implant integration; however, it is unclear which imaging modality performs best. Therefore, we evaluated the visibility of the bone-implant interface of total ankle arthroplasty implants by comparing two state-of-the-art metal artifact reduction MRI and CT techniques.

METHOD AND MATERIALS

After institutional review board approval, a total ankle arthroplasty system (TMTA, Titanium and Cobalt-Chromium alloy, Zimmer, Warsaw, Indiana) was implanted into 6 fresh frozen human cadaver ankles. Each specimen underwent cross-sectional imaging using Compressed Sensing (CS) SEMAC MRI at 1.5T and Iterative Metal Artifact Reduction (IMAR) CT at 120 keV. A total of 12 studies (6 CT, 6 MRI) were created, which consisted of axial, sagittal and coronal images with 3 mm slice thickness and similar slice orientations. The blinded and randomized data sets were subsequently independently analyzed by two experienced observers. After three months, both observers analyzed the data sets again. Using a four quadrant scheme, the visibility of the bone-implant

interface was evaluated on each slice orientation using equidistant 5-point Likert scales. Descriptive statistics, ICC, and Mann-Whitney U test were used for analysis. A p-value of <0.05 was considered significant.

RESULTS

The inter-observer agreement (kappa 0.815, 95%-CI 0.729-0.874) and intra-observer agreement (kappa intra-observer 1 0.904, 95% CI 0.859-0.934; kappa intra-observer 2 0.835, 95%-CI 0.758-0.887) were high with > 80% exact matching ratings for each image orientation, quadrant and imaging modality. The average 4-quadrant visibility score was 18 for CS-SEMAC MRI and 15 for IMAR CT (p < 0.001). Additionally, CS-SEMAC MRI consistently showed significantly higher scores for matched slice orientation and cadavers (axial: p<0.001, sagittal: p<0.001, coronal: p<0.001, cadaver 1: p<0.001, cadaver 2: p=0.011, cadaver 3: p<0.001, cadaver 4: p=0.001, cadaver 5: p<0.001, cadaver 6: p<0.001).

CONCLUSION

CS-SEMAC MRI is superior to IMAR CT for the visualization of the bone-implant interface of total ankle arthroplasty implants.

CLINICAL RELEVANCE/APPLICATION

CS-SEMAC metal artifact reduction MRI technique substantially improves the visibility of the host bone-implant interfaces of total ankle arthroplasty implants, suggesting a change of postoperative imaging from CT toward MRI.

SSQ13-05 Reduction of Metallic Artefacts from Spinal Fusions Using Virtual Monoenergetic Imaging by Dual Layer Spectral Computed Tomography

Thursday, Nov. 30 11:10AM - 11:20AM Room: E451A

Participants

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PURPOSE

To evaluate the clinical potential of virtual monoenergetic images generated with a dual-layer spectral Computed Tomography (CT) system and determine the optimal settings for reduction of metallic artefacts from posterior spinal fusions.

METHOD AND MATERIALS

Twenty patients with posterior spinal fusion who underwent a spectral CT scan (IQon Spectral CT, Philips Healthcare, USA) for various clinical indications were included in this study. Two independent readers evaluated axial 0.9 mm slides with soft tissue and bone window settings. Image quality of the conventional scan was compared with virtual monoenergetic images at 40, 60, 80, 100, 120, 140, 160, 180 and 200 keV. A four point Likert-scale was used to document subjective impression of overall and specific diagnostic image quality for either the implant inheriting bone, muscle, spinal canal or retroperitoneal vessels. The Hounsfield Units of the area with the most pronounced streak artefact as well as the Hounsfield Units of a reference area containing fat and muscle was documented for every keV-setting.

RESULTS

Quantitative analysis showed statistically significant artefact reduction for higher monoenergetic levels compared to conventional images (p<0.05). Analogously, qualitative analysis revealed significant improvement of overall image quality (p<0.05) and benefit for all tissues separately compared to the original images in the range from 80 to 200 keV (p<0.05). Optimal overall keV-setting was 180 keV and ranged from 160 to 200 keV for the implant inheriting bone, the spinal canal, adjacent muscle and retroperitoneal vessels. Our results reveal high inter-reader agreement for qualitative evaluations (ICCs >0.927; p<0.05).

CONCLUSION

Dedicated keV-settings to evaluate either the implant inheriting bone, the spinal canal, adjacent muscle or retroperitoneal vessels - structures which are frequently of peculiar interest after posterior spinal fusions - are recommended.

CLINICAL RELEVANCE/APPLICATION

Virtual monoenergetic images of higher energies provide significant reduction of metallic artefacts from posterior spinal fusions.

SSQ13-06 SMART (Sequences for Metal Artifact Reduction around a Tumor Prosthesis) MRI: Diagnostic Performance for Detection of Recurrence and Complications around a Tumor Prosthesis

Thursday, Nov. 30 11:20AM - 11:30AM Room: E451A

Participants

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PURPOSE

To assess the feasibility and performance of an MRI protocol including conventional and fast metal-reduction anatomic (T1/STIR, contrast-enhanced) and functional (dynamic contrast-enhanced (DCE)) imaging for the surveillance of patients who have undergone limb-salvage reconstruction with a tumor prosthesis.

METHOD AND MATERIALS

Following IRB approval and informed consent, 15 subjects with tumor prostheses, underwent 17 MRIs at 1.5T. MRI included two-plane anatomic imaging (T1-weighted/STIR, post-contrast T1-weighted, subtraction of pre-contrast from post-contrast) with both conventional WARP and fast compressed-sensing (CS)-SEMAC sequences, and functional imaging (DCE-MRI with 7-second resolution). One observer recorded the quality of each sequence (1=>75%, 2=25-75%, 3=10-25%, 4=no substantial-artifacts) adjacent to and remote from the prosthesis, and the presence of recurrence by three interpretation sessions (WARP, WARP+CS-SEMAC, WARP+CS-SEMAC+DCE) using a 5-point confidence scale (definitely-not, probably-not, possibly-present, probably-present, definitely-present). ROC analysis was performed, using histology as the reference for positive recurrence, and minimum 6-month stability for absence of recurrence.

RESULTS

Of 17 studies, there were 4 histologically-proven intramuscular recurrences. Average image quality was different adjacent to the prosthesis compared with remote from the prosthesis on T1, STIR and contrast-T1 sequences (WARP:1.2 vs 3.9, CS-SEMAC: 2.9 vs 3.4, respectively). ROC analysis revealed improved diagnostic performance for the detection of tumor recurrence with the successive addition of CS-SEMAC and DCE imaging to WARP (area-under-the-curve: WARP=0.84, +CS-SEMAC=0.92, +DCE=1.0).

CONCLUSION

An MRI protocol including conventional metal reduction (WARP), and fast CS-SEMAC and DCE-MRI offers good diagnostic performance for the detection of recurrence in patients with a history of limb salvage surgery and tumor prostheses.

CLINICAL RELEVANCE/APPLICATION

Following resection and reconstruction with a tumor prosthesis, cross-sectional imaging has traditionally been limited. With the advent of SMART-MRI, surveillance imaging of patients with tumors prostheses is now possible with high diagnostic accuracy.

SSQ13-07 Minimizing CT Radiation Dose in Total Hip Arthroplasty Patients Using Model-Based Iterative Reconstruction and Orthopedic Metal Artifact Reduction

Thursday, Nov. 30 11:30AM - 11:40AM Room: E451A

Participants

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PURPOSE

To minimize CT radiation dose in patients with large metal-on-metal total hip prostheses using model-based iterative reconstruction (iMR) combined with orthopedic metal artifact reduction (O-MAR).

METHOD AND MATERIALS

Patients with a unilateral or bilateral metal-on-metal total hip prosthesis were included. Patients were scanned on a Philips iCT 256-slice CT scanner. Each patient received a conventional CT pelvis and a low-dose CT pelvis with respectively -20%, -43%, -60% or -80% lower CT radiation dose for patients in group 1, 2, 3 or 4 respectively. The conventional CT pelvis was reconstructed with iterative reconstruction, iDose4 level 4. The low-dose CT pelvis was reconstructed with iDose4 level 4 and model-based iterative reconstruction (iMR, levels 1, 2 and 3). All images were reconstructed with and without the use of O-MAR. CT numbers, noise or standard deviations (SDs) and contrast-to-noise-ratios (CNRs) were determined in muscle, fat, the bladder and background.

RESULTS

In this ongoing study, 23/80 patients were included for first analysis. In total 5, 6, 7 and 5 patients were included in group 1, 2, 3 and 4 respectively. Dose-length-products (DLPs) were reduced from 767.4 to 659.3 (-16%), 637.6 to 380.8 (-41%), 670.3 to 306.6 (-56%) and 840.1 to 199.6 (-77%) for group 1, 2, 3 and 4 respectively. While reducing radiation dose with 20%, 43%, 60% or 80%, CT numbers accuracy was maintained, SDs decreased ($p<0.01$) and CNRs ($p<0.001$) increased in iMR and O-MAR images compared to iDose4 and O-MAR images. In iMR level 1 and O-MAR images, CNRs between muscle and fat were on average 94%, 74%, 54% and 47% higher compared to iDose4 and O-MAR images while reducing radiation dose with 20%, 43%, 60% or 80%.

CONCLUSION

The use of iMR and O-MAR reduces standard deviations, increases CNRs and maintains CT number accuracy while reducing radiation dose in total hip arthroplasty patients up to 80% compared to iDose4 and O-MAR.

CLINICAL RELEVANCE/APPLICATION

Despite quantitative measurements show that the use of iMR enables a radiation dose reduction up to 80% compared to iDose4 in total hip arthroplasty patients, qualitative analysis is essential.

SSQ13-08 Evaluation of CT Metal Artifact Reduction Techniques in Patients with Total Shoulder Arthroplasties

Thursday, Nov. 30 11:40AM - 11:50AM Room: E451A

Awards

Student Travel Stipend Award

Participants

Scott M. Boeke, DO, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To determine the CT metal reduction technique that optimizes visualization of bone and soft tissue adjacent to a total shoulder arthroplasty.

METHOD AND MATERIALS

19 patients with TSA underwent dual energy CT (DECT). Post processing was performed for each study, creating 4 different image sets, each in soft tissue and bone kernels: (1) routine reconstruction (2) iterative metal reduction technique (iMAR) (3) DECT with virtual mono-energetic images at 130 keV and (4) combined iMAR and DECT virtual mono-energetic images at 130 keV. 2 experienced MSK Radiologists and 1 MSK Fellow blinded to processing data independently graded extent of artifact and image quality of one reconstruction for each patient, randomly ordered across 4 weekly reading sessions. A fifth reading session compared the 4 techniques side-by-side for each patient and a rank order preference was submitted. Attenuation measurements within bone and soft tissue at areas of greatest artifact near the hardware were collected for each reconstruction and compared to standard attenuation measurements collected from areas unaffected by artifact.

RESULTS

Of the four techniques utilized, iMAR combined with DECT with virtual mono-energetic images at 130 keV ranked best in overall image quality and in rank order preference by each of the 3 readers. The difference between attenuation measurements of bone and soft tissue in areas of greatest artifact and standard attenuation measurements was greatest in standard technique and lowest in iMAR combined with DECT Mono+.

CONCLUSION

In the setting of TSA, iMAR combined with DECT with virtual mono-energetic images at 130 keV objectively and subjectively decreases metal artifact when compared to standard reconstruction, iMAR alone and DECT with mono-energetic images at 130 keV alone.

CLINICAL RELEVANCE/APPLICATION

Orthopedic surgeons often utilize CT imaging to assess the necessity and nature of intervention. Metallic implants contribute to substantial artifact on CT imaging limiting visualization of adjacent structures. This is particularly relevant when trying to evaluate shoulder arthroplasties for evidence of loosening or fracture and to assess adjacent bone stock for revision surgery. This study demonstrates that utilization of iMAR with DECT with virtual mono-energetic technique in the setting of TSA provides optimal imaging quality of the adjacent osseous and soft tissue structures thus improving diagnostic evaluation.

SSQ13-09 Metal Artifact Reduction Using Spectral Dual-Energy CT with Virtual Monoenergetic Images for Patients with Metallic Orthopedic Implants of the Distal Radius

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

Participants

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PURPOSE

To evaluate the image qualities of virtual monoenergetic images obtained from spectral dual-energy CT (DECT) for patients with metallic orthopedic implants of the distal radius

METHOD AND MATERIALS

Forty-three consecutive patients with internal metallic implants for distal radius fracture underwent spectral DECT (33 women and 11 men, with a mean age of 50.7 ± 15.4 years (24-77 years)). Sixteen virtual monoenergetic image sets ranging from 50 keV to 200 keV were generated at one single slice with the most pronounced hypodense streak artifacts of implants in axial plane. The image quality of sixteen monoenergetic images were assessed quantitatively and qualitatively by two independent musculoskeletal radiologists. Quantitative analysis included the density of most hypodense artifact and reference tissue, background image noise and artifact index (AI). Qualitative assessment included degree of artifacts, diagnostic image quality of peri-implant bones, and delineation of fracture lines if present. Friedman rank-sum test with post hoc tests and kappa analysis were used for the statistical analysis.

RESULTS

There was a statistically significant difference in CT number of most pronounced hypodense streak in peri-prosthetic region depending on monoenergy level ($p < 0.001$). There was a statistically significant difference in AI of most pronounced hypodense streak in periprosthetic region depending on monoenergy level ($p < 0.001$). AI of different monoenergy level was the lowest at 120-200 keV to provide the most significant metal artifact removal. The degree of artifacts, diagnostic image quality, and delineation of

fracture lines were significantly different among the keV settings (both $p < 0.001$). The hypodense streak in peri-prosthetic region was least pronounced at 110 keV and diagnostic image quality of peri-implant bones was best at 130 keV. Fracture lines were found in 22 patients, which was well delineated in all cases at 80~110 keV settings ($p < 0.001$).

CONCLUSION

Virtual monoenergetic images at high-energy levels have a well-concordant effect of reducing metal artifacts, and 110-130 keV monoenergetic images provided a least peri-implant artifact and best diagnostic image quality in patients with implants of the distal radius.

CLINICAL RELEVANCE/APPLICATION

Virtual monoenergetic images acquired from spectral DECT was useful to reduce metal artifacts caused by metallic implants in patients with distal radius fracture

SSQ14

Nuclear Medicine (Endocrine and Musculoskeletal Imaging)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S504CD

CT MR MK NM

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

Participants

Frederik L. Giesel, MD, MBA, Heidelberg, Germany (*Moderator*) Patent application for F18-PSMA-1007
Matthew S. Robertson, MD, Cleveland, OH (*Moderator*) Nothing to Disclose

Sub-Events

SSQ14-01 Measurement Repeatability of Cold-Activated Brown Adipose Tissue Volume on [18F]FDG-PET Using both PET/CT and PET/MRI

Thursday, Nov. 30 10:30AM - 10:40AM Room: S504CD

Participants

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PURPOSE

Brown adipose tissue (BAT) is a promising target for anti-obesity interventions, which may entail induction of BAT volume expansion. Valid assessments of changes in BAT volumes require knowledge of intrinsic volumetric variability. Our aim was to determine the repeatability of cold-activated BAT volumes using [18F]FDG, the gold standard for detecting BAT activity, with both PET/CT and PET/MRI.

METHOD AND MATERIALS

To date, our study has enrolled 25 healthy volunteers (21 female, 4 male). As young, normal weight individuals are more likely to have detectable BAT, we included only subjects 18-35 y/o with BMI $\leq$ 25 kg/m². A 5 mCi dose of [18F]FDG was injected midway through a 120 min cooling period, using a target temperature just above the shivering point. Subjects then underwent PET/CT immediately followed by PET/MRI. Imaging extended from the skull base to the upper abdomen, covering all common BAT areas. Repeat imaging occurred 2-7 days later per an identical protocol. BAT volumes were defined per BARCIST 1.0 criteria (Figure), incorporating a validated Dixon-based fat segmentation method for PET/MRI. Repeatability coefficients (RCs), based on percent differences between measurements (0% = perfect repeatability), were calculated.

RESULTS

Three subjects failed to complete the imaging protocol, and 6 had no detectable BAT. For the 16 evaluable subjects, RCs for BAT volumes (range, 24-315 ml) were 138.8% (PET/CT) and 98.8% (PET/MRI). Considering only the 8 subjects with the largest BAT volumes (range, 150-315 ml), RCs improved to 32.2% (PET/CT) and 36.4% (PET/MRI). The degree of BAT volume correlation between PET/CT and PET/MRI was significantly ($p = 0.04$) greater at baseline (R^2 , 0.96) than at repeat imaging (R^2 , 0.80). There was no difference ($p = 0.88$) in the degree of BAT volume correlation on serial PET/CT (R^2 , 0.85) compared with serial PET/MRI (R^2 , 0.87).

CONCLUSION

Volumetric repeatability was better for patients with more BAT. The higher degree of BAT volume correlation between PET/CT and PET/MRI on baseline imaging than between imaging sessions for either PET/CT or PET/MRI suggests that BAT activation factors (e.g., cooling protocol) may be a greater source of variability than imaging-related factors.

CLINICAL RELEVANCE/APPLICATION

Although repeatability of cold-activated BAT volumes on [18F]FDG-PET was acceptable for subjects with large amounts of BAT, further work is needed to improve the repeatability of small BAT volumes.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality

educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Richard L. Wahl, MD - 2013 Honored Educator

SSQ14-02 Localization of the Elusive Parathyroid Adenoma by 18F-choline PET/CT: Preliminary Results

Thursday, Nov. 30 10:40AM - 10:50AM Room: S504CD

Participants

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PURPOSE

Preliminary studies have shown choline-PET/CT to be of value in the preoperative localisation of parathyroid adenoma in primary hyperparathyroidism. Choline-PET/CT is used in our centre for patients with persistent hyperparathyroidism and in whom sestamibi scintigraphy, ultrasound, and either contrast enhanced CT or MRI, and venous sampling localisation investigations, and prior neck exploration have failed to identify the adenoma. This retrospective study aims to evaluate choline-PET/CT as a tool for localisation of parathyroid adenoma in a cohort of patients with repeatedly inconclusive conventional imaging.

METHOD AND MATERIALS

10 patients with biochemical hyperparathyroidism underwent choline-PET/CT. The findings were analysed and correlated with the prior localisation investigations. The reference standard was based on results of surgical exploration and histopathological correlation.

RESULTS

The patient cohort had undergone investigation for a mean of 5 years 3 months, had a mean of 9 previous localisation investigations (range 2-18) and a mean of 2 previous failed neck explorations (range 1-4), with 9/10 being symptomatic from their hyperparathyroidism. Choline-PET/CT identified likely causative lesions with relative certainty in 9/10 of cases. 7 cases had histologically-proven parathyroid adenoma following surgical exploration of the site identified by choline-PET/CT. A post-operative drop in serum parathyroid and/or calcium levels has been observed in all patients with positive histology.

CONCLUSION

In this challenging cohort of patients with persistent symptomatic hyperparathyroidism, with failed localization despite extensive non-invasive and invasive investigations, choline-PET/CT was able to accurately identify the location of the parathyroid adenoma in 70% cases, showing excellent promise as a second-line imaging tool.

CLINICAL RELEVANCE/APPLICATION

Choline-PET/CT shows initial promise at localising parathyroid adenoma in symptomatic patients with persistent primary hyperparathyroidism in whom conventional imaging has proved inconclusive.

SSQ14-03 Does the Risk of Development of Graves' Eye Disease after I-131 Therapy Depend On the I-131 Dosage?

Thursday, Nov. 30 10:50AM - 11:00AM Room: S504CD

Participants

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PURPOSE

Graves' ophthalmopathy, or Graves' eye disease (GED) is sometimes a manifestation of Graves' disease. It is controversial in the medical literature as to whether or not GED can be precipitated or worsened by Radioiodine therapy with I-131 (RAI). The aim of this study was to determine if there is a relationship between the dosage of I-131 administered and the onset of GED.

METHOD AND MATERIALS

We reviewed the cases of all patients receiving RAI for Graves' disease for the last 5 years. Those patients who already had GED prior to RAI were excluded from this study. Follow-up was achieved by review of medical records as well as follow-up notes of the patients' ophthalmologists. The I-131 dosage of each patient and whether or not GED later developed was then recorded. The I-131 dosage calculation was based on a desired dose of 160-200 microcuries of I-131 per gram of thyroid tissue, ranging from 10 mCi to 25 mCi of I-131.

RESULTS

Abstract SSQ14-03: Does the Risk of Development of Graves' Eye Disease after I-131 Therapy Depend On the I-131 Dosage? Charles M. Intenzo, MD, Philadelphia, PA; Simindokht Dadparvar, MD, Gladwyne, PA; Aaron Gish, BS, Philadelphia, PA; Stephen L. Kent, Phila, PA; Jacqueline Carrasco, MD, Phila, PA; Robert Penne, MD, Phila, PA; Sung M. Kim, MD, Philadelphia, PA

A total of 82 patients received RAI for Graves' disease. Eight patients had known GED prior to RAI, and 20 patients were lost to follow-up; therefore these 2 groups were excluded. Of the remaining 54 patients, 17 (31.5%) developed GED. The remaining 37 patients thus far have not. There was no correlation between the incidence of GED and the dosage of I-131 dispensed. Statistical analysis indicates only a 1% chance to observe a correlation greater than 0.30, based on the observed incidence.

CONCLUSION

There is no relationship between the likelihood of the onset of Graves' eye disease and the dosage of I-131 in the range of 10-25 mCi dispensed.

CLINICAL RELEVANCE/APPLICATION

In RAI therapy for Graves' disease, the I-131 dosage contemplated should not be influenced by the concern for the development of Graves' ophthalmopathy.

SSQ14-04 Two Weeks' Withdrawal of Inorganic Iodine Therapy is Appropriate for Radioiodine Therapy for Graves' Hyperthyroidism

Thursday, Nov. 30 11:00AM - 11:10AM Room: S504CD

Participants

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PURPOSE

Inorganic iodine therapy has been getting wide popularity as an adjunctive to anti-thyroid drugs (ATDs) in treating hyperthyroidism in countries where dietary iodine intake is sufficient. The aim of this study was to investigate whether 2 weeks' withdrawal of inorganic iodine therapy was appropriate for radioactive iodine I-131 therapy (RAI) for Graves' hyperthyroidism (GH).

METHOD AND MATERIALS

We used potassium iodide (KI) pill which contains 38mg of iodine per pill. 37 patients with GH (M 5/F 32. Age 42.6 $\pm$ 13.9yrs), who had been pretreated by combination of ATD and KI and were to undergo RAI, were enrolled. Thyroid weight ranged from 26 to 97g. Dose of KI (mg/day) ranged from 50 to 300mg/day (average:141). KI was withdrawn 14 days prior to RAI while ATDs were withdrawn 3 to 4 days prior to RAI. Patient were instructed to follow low iodine diet from 7days before to 3 days after administration of I-131. As a parameter for total body iodine, urinary iodine concentration normalized by urinary creatinine (UIC: μ g/gCRE) was measured before withdrawal of KI (UIC1) and on the day of RIA UIC2). Thyroid function and TRAb(IU/ml) were determined on the day of RIA. 24hr uptake of radioiodine (RU; %) was determined using gamma camera and I-123. All patients were followed up for more than 2years after RAI. Results of UIC, RU, and efficacy of RAI in patients (KI group) were compared with those in 39 patients with GH, who underwent RAI with pretreatment by ATD alone (ATD group).

RESULTS

The average value of UIC2 in KI group was less than 0.1% of UIC1(147330 vs. 131.9. $p=0.0008$), but was higher than that in ATD group (131.9 vs.89.0, $p=0.032$). However, difference in RU was not significant between KI group and ATD group (64.9 vs. 71.0, ns). There was a inverse correlation between UIC2 in KI group and RI ($r=-0.523$, $p=0.045$). Additionally, successful rate of RAI in KI group was comparable to that in ATD group (78 vs.82%, ns). TRAb value in KI group was higher compared to ATD group (22.9 vs. 15.1, $p=0.013$).

CONCLUSION

Pretreatment by KI does not impair therapeutic efficacy of RAI for GH if the drug is discontinued 2 weeks before administration of I-131 and is combined with a low iodine diet.

CLINICAL RELEVANCE/APPLICATION

Combination therapy of KI and ATD seems feasible as a pretreatment for radioiodine therapy for Graves' hyperthyroidism.

SSQ14-05 The Relationship among FDG Uptake: Thyroglobulin Doubling Time and Behavior of Tumor in Radioiodine Negative Metastasis from Thyroid Cancer

Thursday, Nov. 30 11:10AM - 11:20AM Room: S504CD

Participants

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PURPOSE

Recent studies have suggested that doubling time of serum Tg (Tg-DT) under TSH suppression may better predict prognosis of

postoperative thyroid carcinomas. Aim of the present study was to investigate relationship between FDG uptake and Tg-DT in radioiodine- negative metastasis from differentiated thyroid cancer (DTC).

METHOD AND MATERIALS

66 patients with metastatic thyroid cancer (PCA/FCA 64/5) who had received total thyroidectomy followed by radioiodine ablation and had negative I-131 scan results underwent FDG PET/CT. TgAb was negative in all patients. Location of metastatic tumor was lymph nodes in the neck and/or the mediastinum in 29, lung in 21, and both lymph nodes and lung in 16. Intensity of FDG uptake in the tumor was visually compared with that of the mediastinum to be determined as positive or negative. Additionally, tumors with positive FDG uptake were classified into 2 subgroups based on SUVmax (high uptake: SUV max $\geq$ 5.0, low uptake: SUV Max $<$ 5.0). When a patient had more than 2 tumors, the largest tumor was used for evaluation of FDG uptake. Tg-DT was determined as previously described (Thyroid 2011; 21:707-716). All patients were followed up for 36-85 months. Imaging modalities including US, CT, MRI and/or PET/CT were performed at a regular interval to investigate relationship among FDG uptake, Tg-DT, and behavior of tumor.

RESULTS

FDG uptake was negative (N) in 16 pts., was low (L) in 28 pts., and was high (H) in the remaining 22 pts. The average of Tg-DT (yrs) in N group, L group, and H group were 9.1, 4.7, and 1.7, respectively. There were significant differences in Tg-DT between H group and other 2 groups ($p<0.001$ for L group and $p<0.01$ for H group). Additionally, more than 20% increase in the short diameter of the largest tumor and/or appearance of new lesions during the follow up period were seen in 0/16 (0%) in N group, 6/21 (26%) in L group, and 17/22 (77%) in H group. 2 patients in H group showed rapid growth of metastatic tumors despite of longer Tg-DT (>3 yrs.).

CONCLUSION

Negative FDG uptake in metastatic tumors may indicate longer Tg-DT and stable disease for long period while tumors with high FDG uptake tend to have shorter Tg-DT and aggressive clinical behavior. FDG PET/CT correlates well with Tg-DT and is a valuable predictor for prognosis of metastasis from DTC.

CLINICAL RELEVANCE/APPLICATION

FDG PET/CT has a positive role as an alternative to Tg-DT in management of metastasis from thyroid cancer.

SSQ14-06 I-131 Thyroid Dosimetry in Patients with Abnormal Renal Function

Thursday, Nov. 30 11:20AM - 11:30AM Room: S504CD

Participants

Kenneth Nichols, PhD, New Hyde Park, NY (*Presenter*) Royalties, Syntermed, Inc;
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PURPOSE

Maximum permissible activity (MPA) of administered I-131 to treat thyroid cancer conventionally is estimated by combining whole body gamma camera & blood sample well counter measurements following oral administration of I-131. In attempting to simplify methodology by computing MPA from blood sample measurements, it is important to determine potential influence of various factors on methods used for estimating MPA. We retrospectively investigated the effects of previous treatment (PT) &/or abnormal renal function (AF) on MPA estimates derived from whole body counting and blood samples.

METHOD AND MATERIALS

Data were reviewed for 71 pts (age = 60 ± 14 yrs; 38 female; 33 male) who previously had undergone total thyroidectomy for thyroid cancer and who were referred for pretreatment dosimetry to determine MPA. 30 pts (42%) had PT (PT+) & 41 pts (58%) did not (PT-), while 23 pts (32%) had AF (AF+) & 48 (68%) did not (AF-). Anterior & posterior whole body counts were measured by un-collimated gamma camera & blood samples were drawn & assayed in vitro by a well counter 1, 4, 24, 48, 72-96, & 96-144 hrs after 37-148 MBq I-131 administration to compute whole body γ & in-vivo β dose contributions to compute conventional (Method1) total dose D, with MPA = 200 cGy/D . Linear regression comparing in-vitro blood sample measurements alone to conventional D yielded Method 2 predictions of D & MPA based on well counter blood measurements alone. Method 2 D & MPA were compared to conventional Method1 values by the paired t-test or Wilcoxon test & by linear regression.

RESULTS

MPA was similar for Method1 & Method2 for all 71 pts (21 ± 14 versus $21\pm14 \text{ cGy/GBq}$, $p=0.97$), & for each pt subgroup: PT+ & AF- (N=24) MPA = 22 ± 9 versus $22\pm9 \text{ GBq}$ ($p=0.20$); PT- & AF- (N=24) MPA = 14 ± 8 versus $14\pm8 \text{ GBq}$ ($p=0.78$); PT- & AF+ (N=17) MPA = 8 ± 2 versus $8\pm3 \text{ GBq}$ ($p=0.92$); PT+ & AF+ (N=6) MPA = 7 ± 3 versus $7\pm3 \text{ GBq}$ ($p=0.29$). Correlation of Method2 to Method1 MPA was similar for PT-, PT+, AF- & AF+ subgroups ($r = 0.98, 0.99, 0.99 \text{ \& } 0.94$, respectively).

CONCLUSION

In pts with metastatic thyroid carcinoma or compromised renal function, MPA can be accurately estimated by measuring I-131 blood clearance, without the need to perform wholebody counting.

CLINICAL RELEVANCE/APPLICATION

Blood sampling alone suffices to estimate I-131 dose, regardless of renal function..

SSQ14-07 Utility of Fused Images by 99mTc-MDP SPECT and Low Dose CT in Detecting for Chronic-Infected Nonunion of the Lower Limb

Participants

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PURPOSE

To evaluate the benefits of using SPECT/CT fused images than using simple SPECT or CT in diagnosis and positioning of chronic-osteomyelitis nonunion of the lower limb.

METHOD AND MATERIALS

1. Patients are intravenous-injected typically 740-1110 MBq 99mTc-MDP. Images were acquired on a SPECT/CT (Discovery™NM/CT670, GE). 2. The hybrid SPECT/CT system has a 16 slice multidetector CT. The SPECT was followed by CT examination with settings of 80-100 kV, 240 mAs, pitch-1. The CT images were reconstructed with 0.625mm slice thickness in multiplanar reformatting (MPR). 3. The author presents 36 cases of lower limb fracture nonunion, associated with or be suspicious of chronic osteomyelitis. For data analysis findings of three bone imaging models for every patients were categorized as yes (osteomyelitis), no (no osteomyelitis), or equivocal for the presence of osteomyelitis. Secondly, SPECT/CT fused imaging were compared to SPECT and CT with respect to localization, extent of lesions, the body surface location consistency and the influence of internal and external fixed on each method.

RESULTS

The degree of interobserver agreement was evaluated by computing the kappa coefficient ($\kappa=0.759$ for SPECT/CT, $\kappa=0.184$ for CT, $\kappa=0.192$ for SPECT). Sensitivity of whole body bone scan for osteomyelitis was 52.2%, specificity 15.4%. Sensitivity of CT was 65.2%, specificity 23.1%. SPECT/CT fused images was sensitivity 91.3%, specificity 84.6%. It is the best choice in our study. Definition of anatomical localization of inflammatory foci was much easier by SPECT/CT fused images due to better description of anatomical details and concentration areas of eye-catching.

CONCLUSION

SPECT/CT fused images increased specificity than SPECT or CT. In distinguishing between soft tissue infection with osteomyelitis, it is more accurate than only using SPECT. Hybrid SPECT/CT (With 16 row diagnostic CT) at the same time provide both anatomical and functions information. 99mTc-MDP SPECT/CT is more suitable for detecting osteomyelitis in China. Because it is more efficient, convenient (no special training), cheap than radiolabelled autologous white cells and 99mTc labelled monoclonal antibodies. Because of combination of SPECT and CT, radiation dose of patients has been increased. In order to reduce the radiation dose, the author adopts the method of low dose for lower limb CT scans (about 40% off).

CLINICAL RELEVANCE/APPLICATION

osteomyelitis

SSQ14-08 Correlation of Bone SPECT/CT and Plain Radiography with Clinical Findings in Painful Hip Prostheses

Thursday, Nov. 30 11:40AM - 11:50AM Room: S504CD

Participants

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PURPOSE

The concomitant use of plain radiography (PR) and bone SPECT/CT scans (BSCS) have greater potential to accurately detect complications after hip arthroplasty compared to each modality alone. We aimed to correlate patient-reported sites of pain with findings on BSCS and PR in patients with painful hip prostheses.

METHOD AND MATERIALS

A retrospective review of 12 consecutive patients with painful hip prosthesis who received BSCS was performed. The pain location and duration and prosthesis type, treatment, and surgical pathology were noted from nuclear medicine and orthopedic clinic reports. Each BSCS was interpreted side-by-side with the most recent hip PR obtained prior to each BSCS. The Gruen zones and De Lee and Charnley zones were noted for sites with increased uptake on BSCS. For each zone, an uptake ratio (UR) was measured as uptake intensity in counts/1.8 cm³ divided by a background uptake value of half the average uptake at the iliac crests, and a pixel value ratio (PVR) was obtained from dividing the average pixel value by a background pixel value of the adjacent normal bone-prosthesis or cement-prosthesis (BPCP) interface. Qualitative and quantitative grades were applied to sites of increased uptake on BSCS and areas of increased bone formation on PR.

RESULTS

In each case, UR on BSCS and PVR on PR were increased at each patient-reported site of pain upon evaluation with both qualitative and quantitative grading. The pain location had concordance rates of 83.3% with the zone of greatest PVR (10/12 cases) and 83.3% with the zone of highest UR (10/12 cases). The concordance rate between the zone of greatest PVR and the zone of greatest UR was 83.3%. Focal areas of increased bone formation/density on PR in the BPCP interface were noted

contralateral to the side of the prosthesis with loosening with BSCS demonstrating increased uptake in a pattern of prosthesis loosening.

CONCLUSION

Each patient-reported site of pain demonstrated increased uptake on BSCS and increased pixel value on PR. Focal areas of increased bone density contralateral to periprosthetic loosening sites may suggest loosening in the absence of the characteristic greater-than-2-mm radiolucent zone at the BPBC interface and be an earlier radiographic indication of loosening.

CLINICAL RELEVANCE/APPLICATION

Correlations between findings on BSCS and PR may help overcome interpretive challenges on either modality alone, important when only one modality is available.

SSQ14-09 F-18 FDG PET Trumps MRI on PET MRI evaluation of Diabetic Pedal Osteomyelitis

Thursday, Nov. 30 11:50AM - 12:00PM Room: S504CD

Participants

Kavitha Yaddanapudi, MD, Stony Brook, NY (*Presenter*) Nothing to Disclose

Dinko Franceschi, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

Robert Matthews, MD, Stony Brook, NY (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

The purpose of this study is to evaluate the relative sensitivity of PET and MRI in diabetic osteomyelitis of foot as detected on PET MRI and confirmed by histopathological correlation.

METHOD AND MATERIALS

Retrospective evaluation of PET MRI imaging and correlation with histopathology was performed on 12 consecutive cases of suspected diabetic pedal osteomyelitis. On MRI imaging signal abnormalities were classified as grade 0 (normal), grade I (edema) and grade II (confluent T1 hypointense signal). Grade II signal was diagnosed as osteomyelitis. Focal abnormal FDG uptake in the bones on PET was diagnosed as osteomyelitis. Of the 12 patients 10 (83.3%) had histopathological confirmation from surgery.

RESULTS

Ten of the twelve patients (83.3%) had osteomyelitis diagnosed on PET MRI which was confirmed at pathology (100% specificity). The two patients without evidence of osteomyelitis on PET MRI who were followed up were concluded not to have osteomyelitis according to clinical end points. Of the ten patients all ten had abnormal FDG uptake (100% sensitivity FDG) localizing to bone. Only 7 of the 10 had MRI signal abnormalities Grade II representing osteomyelitis (70% sensitivity MRI). Sites of pedal osteomyelitis included distal phalanges (N=6), tarsals (N=2), metatarsal (N=3) and calcaneus (N=1). Three of the ten patients had focal abscesses in the soft tissues.

CONCLUSION

FDG PET abnormalities on PET MRI are more sensitive than MRI component for detection of diabetic osteomyelitis of the foot. Localisation to the bone however is only possible because of the simultaneous MRI acquisition which makes it an invaluable component of this modality.

CLINICAL RELEVANCE/APPLICATION

Diabetic osteomyelitis of the foot is a common problem that has significant clinical ramifications. Diagnosing osteomyelitis in diabetic foot especially on MRI and CT is complicated by preexisting chronic bony changes from neuropathy and non-healing ulcers. Magnetic Resonance Imaging (MRI) is a useful modality for diagnosis of osteomyelitis and is more sensitive than CT. FDG PET is a very sensitive modality for diagnosing osteomyelitis however in PET alone or PET CT anatomical localisation to the bone is not optimal, a problem that is remedied by excellent anatomical detail on MRI. PET MRI serves as a one-stop investigation for evaluation of osteomyelitis in diabetic foot.

SSQ15

Neuroradiology (Extracranial Vascular Imaging)

Thursday, Nov. 30 10:30AM - 12:00PM Room: N228

CT **NR** **VA**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Diana M. Gomez-Hassan, MD, PhD, Ann Arbor, MI (*Moderator*) Nothing to Disclose
Alexander M. McKinney IV, MD, Minneapolis, MN (*Moderator*) Nothing to Disclose

Sub-Events

SSQ15-01 Modified Blooming-Independent Dual-Energy CT Carotid Angiography for Calcified Plaque Removal: Comparison with Digital Subtraction Angiography

Thursday, Nov. 30 10:30AM - 10:40AM Room: N228

Participants

Manoj Mannil, Zurich, Switzerland (*Presenter*) Nothing to Disclose
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PURPOSE

To investigate a new dual-energy computed tomography (DECT) technique with a modified 3-material decomposition algorithm for calcium removal in extracranial carotid artery stenosis.

METHOD AND MATERIALS

In this retrospective, IRB-approved study 30 calcified carotid plaques in 22 patients (15 males, mean age 73±10 years) with suspicion of stroke were included. DECT image data were obtained using second-generation dual-source CT with tube voltages at 80/140Sn kVp. Conventional CTA and virtual non-calcium (VNCa) images using the modified DECT algorithm were reconstructed. By assessing spectral characteristics, blooming-independent calcium removal was achieved. Two independent, blinded readers evaluated subjective image quality, blooming artifacts, amount of (residual) calcification, and performed stenosis measurements according to the NASCET-criteria. Differences were tested using a pairwise sign test. Paired sample t-tests with Bonferroni correction ($p < 0.017$) and Bland-Altman analyses were used for assessing differences in stenosis measurements between VNCa and conventional CTA with digital subtraction angiography (DSA) as reference.

RESULTS

Subjective image quality was similar among conventional CTA and VNCa image datasets ($p = 0.82$), while blooming artifacts were significantly reduced in VNCa images compared to conventional CTA ($p < 0.001$). Residual calcifications in VNCa images were absent in 11 (37%), minor in 12 (40%), medium-sized in 2 (7%), and large in 5 (17%) arteries. Stenosis measurements differed significantly between VNCa (mean stenosis: 27±20%) and conventional CTA images (mean stenosis: 39±16%; $p < 0.001$) and between conventional CTA and DSA (23±16%; $p < 0.001$). No significant differences in stenosis measurements were observed between VNCa and DSA ($p = 0.189$), with narrow limits of agreement (mean difference ±1.96 SD, -4.7%; -35.13%; 25.71%).

CONCLUSION

The modified three-material decomposition DECT algorithm for blooming-independent calcium removal allows for an accurate removal of calcified carotid plaques in extracranial carotid artery disease.

CLINICAL RELEVANCE/APPLICATION

A novel, blooming-independent modified 3-material decomposition algorithm for calcium removal improves stenosis assessments by preventing overestimation of calcified stenosis in DECTA.

SSQ15-02 CT Texture of Carotid Arteries identifies Vulnerable Plaque in Stroke and Transient Ischaemic Attack: A Preliminary Outcome Study

Thursday, Nov. 30 10:40AM - 10:50AM Room: N228

Awards

Student Travel Stipend Award

Participants

Fulvio Zaccagna, MD, Cambridge, United Kingdom (*Presenter*) Nothing to Disclose

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PURPOSE

To assess the potential role of texture analysis in carotid arteries imaging.

METHOD AND MATERIALS

A retrospective case-control study. From a study population of 341 patients with CV risk factors that underwent whole-body CTA (detector configuration: 64x0.6mm; Iomeprol-400, 400mgI/ml; 70+50ml@4ml/s), 12 patients (age 63±10.29 yrs) with carotid atherosclerosis and a subsequent history of Transient Ischemic Attack (TIA) or Stroke were identified. These were age and sex matched with 12 control cases (age 62.9±10.16 yrs) with asymptomatic carotid atherosclerosis (follow-up 103.58±9.2 months). Stenosis and plaque composition were determined. Texture analysis was performed using a commercially available software (TexRAD, Somerset, UK) by a single operator blinded to clinical data. TexRAD uses a filtration-histogram based texture analysis technique to extract pixel size based (fine, medium, coarse) features and quantified histogram parameters including skewness (S) and normalized standard-deviation (SDn). A single axial slice was selected to best represent the carotid bifurcation for each side and a region of interest (ROI) was manually delineated in order to fully enclose the artery. Statistical analysis was performed using X2, t-test and Mann-Whitney test. ROC curves were constructed using TIA/Stroke as outcome.

RESULTS

Stenosis degree was greater at the right carotid bifurcation in the patient group (41.08 vs 12.08; p=.014), however no statistically significant differences were found at the left carotid bifurcation (p=.56); there were no differences in plaque composition for both sides (right p=.39, left p=.72). There was a statistically significant difference in Skewness at the fine and medium texture level (p=0.009 for spatial scaling factor (SSF) =2mm; p<0.001 for SSF=3mm and p=0.003 for SSF=4mm). SDn was statistically significant different between patients and control group for SSF=2mm (p=0.033). AUC values at SSF2 were .684 for SD and .723 for S (p values of .033 and .009 respectively); AUC values for S were .808 (p=.0001) at SSF3 and .075 (p=0.003) at SSF4.

CONCLUSION

CT texture identified vulnerable plaque in Stroke and TIA and may, therefore, have the potential to act as a new means of risk stratification in patients with carotid atherosclerosis.

CLINICAL RELEVANCE/APPLICATION

CT texture of carotid arteries may improve the identification of patients at risk for ischemic strokes.

SSQ15-03 Evaluation of Spectral Imaging in Craniocervical CT Angiography: Comparison with Conventional 120kVp CT Imaging

Thursday, Nov. 30 10:50AM - 11:00AM Room: N228

Participants

Shu Wang, Yancheng, China (*Presenter*) Nothing to Disclose
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PURPOSE

To evaluate the application of gemstone spectral imaging (GSI) protocol in craniocervical CTA by comparing the image quality and radiation dose with a conventional 120-kVp protocol.

METHOD AND MATERIALS

40 patients were scanned on Discovery CT750-HD (GE Healthcare) with parameters of 40mm helical 0.984:1, 360 mA, 0.6s rotation time. 20 patients underwent conventional 120 kVp scan and the other 20 were scanned using GSI mode, with monochromatic images of 60keV and 70keV being reconstructed. Both groups received 60 ml contrast agent of 350 mgI/ml with an injection speed of 4.5 ml/s. Objective image quality of the two groups was compared in terms of arterial enhancement and contrast-to-noise-ratio (CNR), which were measured at seven ROIs placed respectively in bilateral carotid artery bifurcation, basal artery, bilateral internal carotid artery C2 segment, and bilateral middle cerebral artery proximal end. Subjective image quality was evaluated using a 5 grade scale (5-excellent; 1-fail). The effective radiation dose (ED) was also recorded and compared. Data were analyzed by using independent-sample t-test.

RESULTS

As compared to 120kVp group, 60keV monochromatic images had significantly higher arterial enhancement (120kVp: 355±64.2 HU vs. 60keV: 483±81.1 HU, p<.001), comparable CNR (120kVp: 29±7.7 vs. 60keV: 29±7.5, p=.933), and significantly higher subjective image quality (120 kVp: 3.7±0.80 vs. 60keV: 4.5±0.51, p<.001). In contrast, 70keV monochromatic images did not differ from the 120kVp group in image quality of arterial enhancement (352±57.0 HU, p=.549), CNR (25±6.1, p=.085), or subjective image quality (3.7±0.80, p=.547). Radiation dose in GSI group (2.61mSv) reduced 27.5% compared with 120 kVp group (3.60mSv).

CONCLUSION

Compared with conventional 120 kVp scan protocol, 60keV GSI could reduce radiation dose, maintain CNR and improve subject

Compared with conventional 120 kVp scan protocol, 60kVp GSI could reduce radiation dose, maintain CNR and improve subject image quality.

CLINICAL RELEVANCE/APPLICATION

The application of GSI mode in craniocervical CTA with appropriate single energy level could significantly reduce radiation dose while maintaining image quality.

SSQ15-04 Feasibility of 70kV and Adaptive Statistical Iterative Reconstruction V Technique in Low Dose Craniocervical CT Angiography

Thursday, Nov. 30 11:00AM - 11:10AM Room: N228

Participants

Fang Wang, Yinchuan, China (*Presenter*) Nothing to Disclose
Lili Yang, Yinchuan, China (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

To investigate the feasibility of 70kV and adaptive statistical iterative reconstruction V (ASiR-V) to reduce radiation dose in wide-coverage craniocervical CT angiography, compared with 100kV

METHOD AND MATERIALS

This study was approved by the institutional review board. Written informed consent was waived. Twenty cases planned to craniocervical CT angiography was enrolled and randomly divided into two groups: A with 70kV and 40% ASiR-V (n=10), B with 100kV and 0%ASiR-V (n=10). Regions of interest (ROI) were placed on the thoracic inlet of carotid artery and cranial segment of carotid artery to measure the CT attenuation value and standard deviation (SD), the signal-noise-ratio (SNR) and contrast-noise-ratio (CNR) were calculated. Two experienced radiologists, who were blinded to the scan and reconstruction information, independently graded the CT images in terms of visibility and artifacts with a 4-grade rating scale. Dose length product (DLP) and effective radiation dose (ED) were recorded and calculated. Measurement data was compared with independent student T test, the concordance of image quality scores by the two radiologists was evaluated with kappa analysis, the image quality score was compared with Mann-Whitney U test.

RESULTS

The kappa value for the image quality scores from two radiologists was 0.618. The image quality score had no significant difference between two groups (3.80 ± 0.42 vs 3.90 ± 0.21 , $P=0.842$). The effective radiation dose in group A was 59.5% lower than that in group B (0.30 ± 0.27 mSv vs 0.74 ± 0.15 mSv, $t=8.957$, $P<0.001$). The CT value of carotid artery in group A was higher than that in group B (501.20 ± 113.22 HU vs 328.39 ± 53.34 HU, $F=16.937$, $P=0.001$). The SD value of carotid artery in group A was higher than that in group B (25.53 ± 3.01 vs 22.52 ± 3.89 , $F=1.463$, $P=0.242$). The SNR and CNR of carotid artery in group A was higher than that in group B (SNR, 19.84 ± 4.87 vs 16.51 ± 5.50 , $F=13.862$, $P=0.002$; CNR, 32.22 ± 10.01 vs 24.12 ± 10.62 , $F=5.435$, $P=0.032$).

CONCLUSION

Application of 70kV and adaptive statistical iterative reconstruction V (ASiR-V) can achieve approximate 60% radiation dose reduction and provide similar image quality compared with 100kV.

CLINICAL RELEVANCE/APPLICATION

Application of 70kV and adaptive statistical iterative reconstruction V (ASiR-V) can achieve approximate 60% radiation dose reduction and provide similar image quality compared with 100kV.

SSQ15-05 Who Is the Source of Redundant Imaging: Clinicians versus Radiologists?

Thursday, Nov. 30 11:10AM - 11:20AM Room: N228

Participants

Sahra Emamzadehfard, MD, MPH, San Antonio, TX (*Presenter*) Nothing to Disclose
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David M. Yousem, MD, Baltimore, MD (*Abstract Co-Author*) Royalties, Reed Elsevier; Royalties, Oakstone Publishing, LLC; Employee, Medicolegal Consultation; ; ;
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PURPOSE

Redundant neurovascular imaging studies such as Carotid US, CTA, MRA, and DSA may add cost to healthcare in the evaluation of patients with new neurologic deficits. However there has been an assumption that this is due to clinicians' mismanagement. We sought to determine to what extent such redundant studies are generated by radiologists' recommendations.

METHOD AND MATERIALS

The study was considered a quality improvement analysis and therefore did not require an IRB submission and was HIPAA compliant. The Radiology Information System was queried for the presence of carotid ultrasound, CT angiography, Digital Subtraction Angiography (DSA) and MR angiography occurring within 48 hours, 72 hours, and 7 days of each other in the setting of new neurologic symptoms during calendar year 2016. The reports were reviewed to determine how often 1) there were redundant studies and 2) radiologists recommended the additional studies.

RESULTS

3,300 exams from 2,939 patients conducted at both inpatient and outpatient clinics at three affiliated institutions from January 1, 2016 to December 31, 2016 were included in this study. Redundant studies occurred in 86/2939 (6.7%) of these 2939 patients. Of these 86 redundant studies, the radiology report contained a recommendation for another vascular study in 35 out of the 86 (40.7%). This included 15 cases of recommending MRA after CTA, 15 cases of DSA after CTA, 3 cases of DSA after MRA and 2 cases of US after CTA. The remaining 51 of the 86 redundant studies were driven by the clinical services, not radiologists. Of the 35 instances in which the radiologist recommended a second study, that second study confirmed the first study in 24/35 (68.6%) cases and disagreed with the first study in 11/35 (31.4%). Of the 51 cases of redundant studies generated by clinicians, 36/51 (70.6%) of the subsequent studies agreed with the first study and 15/51 (29.4%) were discrepant.

CONCLUSION

Of cases of redundant neurovascular imaging, the majority (59.3% = 51/86) are generated by clinicians, but radiologists recommended additional imaging in 40.7% of cases. When radiologists at our institution recommend additional radiological studies, 32/35 (91.4%) occurred following a CTA. Most second studies (68.6%) confirmed the first study's findings.

CLINICAL RELEVANCE/APPLICATION

Clinicians generate most redundant neurovascular studies but radiologists are responsible as well.

SSQ15-06 Optimizing Image Quality in Head and Neck CT Angiography with Spectral CT Optimal Monochromatic Image Technique

Thursday, Nov. 30 11:20AM - 11:30AM Room: N228

Participants

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PURPOSE

To study the use of the optimal monochromatic image technique in dual-energy Spectral imaging to optimize the image quality in head and neck CT angiography (CTA)

METHOD AND MATERIALS

28 patients were selected to undergo head and neck CTA using Spectral scan mode with patient body mass index (BMI)-dependent scan protocols (GSI-51 for BMI<23kg/m² and GSI-1 for BMI>23kg/m²). After scanning, 5 sets of monochromatic images at 60, 65, 70, 75 and 80keV were reconstructed. Images were transferred to AW4.6 workstation for MPR, VR and CPR reconstruction. Two experienced radiologists evaluated the subjective image quality with a 4-point scoring system with the consistency of the scores evaluated by Kappa test. The CT values and their standard deviations of the aortic arch, common carotid artery, internal carotid artery, middle cerebral artery, cleidomastoid, and brain parenchyma were measured. The signal-to-noise ratio (SNR) and contrast to noise ratio (CNR) of the cervical vessels were calculated. Measurements in the 5 groups were compared by using the single factor variance analysis

RESULTS

The differences of SNR, CNR and subjective image scores among the 5 groups were statistically significant ($P < 0.05$). The average subjective image quality scores were the highest at 60keV (3.64 ± 0.49) and 65keV (3.61 ± 0.50) and the two observers had excellent agreement ($Kappa > 0.8$). The highest SNR and CNR values were also obtained at these two energy levels. The SNR at 60keV and 65keV levels were (66.42 ± 18.84 and 68.04 ± 13.67) for the common carotid artery, (42.42 ± 13.08 and 12.98 ± 43.10) for the internal carotid artery and (45.51 ± 12.47 and 45.52 ± 11.47) for the middle cerebral artery. The respective CNR values were (77.22 ± 24.10 , 75.92 ± 24.04), (77.31 ± 25.47 , 25.04 ± 76.03), and (39.97 ± 11.99 , 39.45 ± 11.05). The CT values at these two levels were all greater than 300HU for adequate vessel display.

CONCLUSION

The optimal energy levels in Spectral CT for head and neck CTA were at 60-65keV to provide adequate enhancement and to improve image quality.

CLINICAL RELEVANCE/APPLICATION

The optimal energy level technique in Spectral CT imaging may be used in head and neck CT to provide adequate enhancement and to improve image quality.

SSQ15-08 The Ability of Whole-Body CT to Detect Blunt Cerebrovascular Injury in a Large Trauma Patient Cohort: A Prospective Evaluation

Thursday, Nov. 30 11:40AM - 11:50AM Room: N228

Awards

Student Travel Stipend Award

Participants

Justin E. Vranic, MD, Seattle, WA (*Presenter*) Nothing to Disclose
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PURPOSE

The purpose of this study is to assess the ability of whole-body CT (WBCT) to detect blunt cerebrovascular injury (BCVI) in a trauma patient population.

METHOD AND MATERIALS

All trauma patients presenting to our institution between 8/1/2013 and 10/31/2016 were retrospectively identified from a radiology report database. Patients were 18-years of age or older; had sustained blunt trauma causing BCVI; and underwent WBCT imaging with neck CTA reconstructions at presentation. A 64-detector WBCT consisting of a chest CTA extending through the circle of Willis with 2 mm thick axial slices was performed, and neck CTA reconstructions with 1 mm thick axial slices and coronal, sagittal, and oblique MIP reconstructions were generated from WBCT source data. A neuroradiologist blinded to clinical history prospectively evaluated each WBCT, noting injury presence, location, and grade using the Biffi scale for BCVI grading. Following a 7 day washout period, neck CTA reconstructions were evaluated by the same rater in identical fashion. Twenty-one normal WBCT and neck CTA were randomly inserted into each respective group, and the reviewer was told that an unknown number of normal studies were present prior to evaluation. Sensitivity, specificity, and positive and negative predictive values were calculated with neck CTA findings serving as the reference standard.

RESULTS

During this study period, 3,392 trauma patients presented for WBCT with 118 trauma patients diagnosed with BCVI. Six patients were subsequently excluded due to poor image quality, resulting in a final cohort of 112 (3.3%) BCVI patients who met all inclusion criteria and possessed 133 individual vascular injuries. WBCT correctly detected 115 BCVI. Eighteen BCVI were missed by WBCT whereas 5 vessels were incorrectly identified as having BCVI. The sensitivity of WBCT for detecting BCVI was 86.5%, and its specificity was 76.2%. The positive predictive value was 95.8% and the negative predictive value was 47.1%. Of the 18 missed BCVI, 8 (44.4%) were grade I injuries, 9 (50.0%) were grade II injuries, and 1 (0.6%) was grade III. No grade IV injuries were missed.

CONCLUSION

WBCT is sufficiently sensitive and specific for detecting BCVI, with grade I and II injuries accounting for the majority of missed lesions.

CLINICAL RELEVANCE/APPLICATION

WBCT is sensitive enough to detect the majority of BCVI and should be used as a first-line screening tool in trauma patients.

SSQ15-09 Improving the Accuracy of Quantifying Carotid Atherosclerotic Plaques with High Definition Acquisition and Reconstruction

Thursday, Nov. 30 11:50AM - 12:00PM Room: N228

Participants

Xiaoling Yao, Chengdu, China (*Presenter*) Nothing to Disclose
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PURPOSE

To investigate the accuracy of quantifying carotid atherosclerotic plaques with high-definition (HD) acquisition and reconstruction model on a high-definition computed tomography (HDCT) system.

METHOD AND MATERIALS

20 Patients with carotid stenosis and plaques (9 males, 11 females, mean age $66 \pm 0.46y$) underwent HDCT carotid arteries angiography with a high-definition acquisition mode. Images were reconstructed with the high-definition algorithm with the new adaptive statistical iterative reconstruction (ASIR-V) at 50% strength (50% ASIR-V) and standard algorithm with 40% ASIR-V. The axial images of the two reconstructions were further processed to generate the maximum intensity projection (MIP) and multi-planar reconstruction (MPR) three-dimensional images. CT values, standard deviation (SD) in arteries and muscle and the areas of plaques, calcifications and the degree of stenosis in vessels were measured. Contrast-to-noise ratio (CNR) for the carotid arteries was calculated $CNR = (CT \text{ carotid arteries} - CT \text{ muscle}) / SD \text{ muscle}$. All measured data were compared using paired sample t test for statistical analysis using SPSS software, $\alpha = 0.05$ indicating significant difference.

RESULTS

73 plaques, including 28 calcified plaques, 23 mixed plaques and 22 soft plaques were identified in both standard and HD reconstructions. CNR values of two reconstruction methods were statistically the same ($P > 0.05$). However, the area measurement for the calcified plaques with the HD reconstruction ($3.60 \pm 3.00mm^2$) was statistically smaller than that with the standard reconstruction ($4.27 \pm 3.45mm^2$) ($p = 0.02$). There was no difference between the two reconstructions in the vascular stenosis degree ($P = 0.129$) and plaque area measurement ($P = 0.598$).

CONCLUSION

High-definition acquisition and reconstruction on a HDCT system improves the accuracy of quantifying calcified carotid atherosclerotic plaques.

CLINICAL RELEVANCE/APPLICATION

High-definition acquisition and reconstruction on a HDCT system improves the accuracy of quantifying calcified carotid atherosclerotic plaques.

SSQ16

Neuroradiology (Cognitive and Psychiatric Disorders)

Thursday, Nov. 30 10:30AM - 12:00PM Room: N229

NR

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

FDA

Discussions may include off-label uses.

Participants

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Rupa Radhakrishnan, MD, Cincinnati, OH (*Moderator*) Nothing to Disclose

Sub-Events

SSQ16-01 Neurotransmitters in Young People with Internet and Smartphone Addiction: A Comparison with Normal Controls and Changes after Cognitive Behavioral Therapy

Thursday, Nov. 30 10:30AM - 10:40AM Room: N229

Participants

Hyung Suk Seo, Ansan-si, Korea, Republic Of (*Presenter*) Nothing to Disclose
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Sungwon Choi, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Yunna Kwon, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Hae-Jeong Park, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose
Inseong Kim, Seoul, Korea, Republic Of (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To reveal changes in neurotransmitters in internet and smartphone addicted youth compared with normal controls and after cognitive behavioral therapy, and to identify the correlations between neurotransmitters and affective factors related to addiction.

METHOD AND MATERIALS

Institutional review board approved this prospective study and informed consents were obtained. Nineteen young persons with internet and smartphone addictions consisted of 9 males and 10 females and their mean age was 15.47±3.06 years. Nineteen gender and age-matched healthy controls were also included. Nine weeks cognitive behavioral therapy was administered to 12 addicts ages 11 to 17 years. MEGA-press MRS was used to measure GABA and glutamate-glutamine (Glx) levels in the anterior cingulate cortex. GABA and Glx levels in the addicted group were compared to controls and after 9 weeks of cognitive behavioral therapy. GABA and Glx levels were correlated to clinical scales of internet and smartphone addictions, impulsiveness, depression, anxiety, insomnia and sleep quality.

RESULTS

Brain-parenchymal and gray-matter volume adjusted GABA to creatine ratios ($p=0.028$ and 0.016) and GABA to Glx ratios ($p=0.031$ and 0.021) were significantly increased in internet and smartphone addictions. After 9 weeks of cognitive behavioral therapy, brain-parenchymal and gray-matter volume adjusted GABA to creatine ratios ($p=0.034$ and 0.026) and brain-parenchymal volume adjusted GABA to Glx ratio ($p=0.05$) were significantly decreased. Glx was not statistically significant. Most brain-parenchymal and gray-matter volume adjusted GABA to creatine ratios and GABA to Glx ratios were significantly correlated with clinical scales of internet and smartphone addictions, depression and anxiety.

CONCLUSION

The increased GABA level and disrupted balance between GABA and glutamate in the anterior cingulate cortex may contribute to understanding the pathophysiology of and treatment for internet and smartphone addictions. Correlations between neurotransmitters and psychology tests in internet and smartphone addictions may reveal the relation and solution to their psychological comorbidities.

CLINICAL RELEVANCE/APPLICATION

The increased GABA in internet and smartphone addicted youth and its decrease after cognitive behavioral therapy will be useful to reveal the neurobiology of comorbidities and treatment.

SSQ16-02 Spontaneous Low-Frequency Fluctuations in Neural System for Emotional Perception in Major Psychiatric Diagnostic Categories: Amplitude Similarities and Differences across Frequency Bands

Thursday, Nov. 30 10:40AM - 10:50AM Room: N229

Participants

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PURPOSE

Growing evidence indicates shared and distinct emotional perception in schizophrenia (SZ), bipolar disorder (BD), and major depressive disorder (MDD). The alterations of spontaneous low-frequency fluctuations have been increasingly reported in emotional perception neural system in these disorders. However, it is unknown what similarities and differences of their amplitudes (ALFF) are across SZ, BD, and MDD.

METHOD AND MATERIALS

ALFF and its signal balance between two frequency bands (slow-5 and slow-4) within emotional perception neural system were compared across 119 SZ, 100 BD, 123 MDD, and 183 healthy control (HC) participants. Exploratory analyses were performed to determine the relationship between an ALFF balance and clinical variables.

RESULTS

Commonalities in ALFF change pattern were observed across three disorders in emotional perception neural substrates, such as increased ALFF in the anterior cerebrum, including subcortical, limbic, paralimbic, and heteromodal cortical regions, and decreased ALFF in the posterior visual cortices. SZ, BD, and MDD showed significant decreased ALFF signal balance within emotional perception neural system in both slow-5 and slow-4, with greatest alterations in SZ, followed by BD, and then MDD. A negative correlation was shown between the ALFF balance and negative/disorganized symptoms in slow-4 across SZ, BD, and MDD.

CONCLUSION

Our findings suggest that the extent of observed commonalities herein further support the presence of core neurobiological disruptions shared among SZ, BD, and MDD. ALFF signal balance might be considered as an important neuroimaging marker for the future diagnosis and treatment in these major psychiatric disorders.

CLINICAL RELEVANCE/APPLICATION

Our major findings suggest that the extent of observed commonalities herein further support the presence of core neurobiological disruptions shared among SZ, BD, and MDD. The balance of ALFF signals within emotional perception neural system might be considered as an important neuroimaging marker for the future diagnosis and treatment in these major psychiatric disorders.

SSQ16-03 The Impact of Apolipoprotein E Gene Polymorphism on the Cerebral Blood Flow in Patients with Mild Cognitive Impairment

Thursday, Nov. 30 10:50AM - 11:00AM Room: N229

Participants

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PURPOSE

We sought to investigate whether the apolipoprotein E (APOE) genotype specifically modulates cerebral blood flow in patients with amnesic mild cognitive impairment (aMCI) by using the pulsed arterial spin labeling (ASL) data.

METHOD AND MATERIALS

83 aMCI and 130 healthy controls (HC) underwent neuropsychological battery assessments, genetic screening and MRI scanning. ASL data preprocessing was carried out using the ASLtbx toolbox. A voxel-wise two-way ANOVA was performed to examine the main effects of diagnosis (aMCI vs. HC) and APOE genotype ($\epsilon 2$ vs. $\epsilon 3\epsilon 3$ vs. $\epsilon 4$), and the diagnosis-by-genotype interactions on CBF maps. Then, we performed multiple linear regression analyses to examine the relationships between the neuropsychological test scores and CBF values in brain areas showing significant diagnosis-by-genotype interactions.

RESULTS

(1) Significant diagnosis-by-genotype interactions on CBF were observed in the left superior frontal gyrus, right anterior cingulate/medial prefrontal cortex and bilateral superior temporal gyrus. Post-hoc pairwise analysis revealed that compared with the $\epsilon 2$ carriers and $\epsilon 3\epsilon 3$ carriers, the $\epsilon 4$ carriers had significant higher CBF values in the above areas in the aMCI group, but there were no significant genotype differences in the HC group. (2) APOE $\epsilon 4$ carriers showed significant higher CBF values in the right anterior and posterior cingulate cortex than the $\epsilon 2$ carriers and $\epsilon 3\epsilon 3$ carriers respectively; (3) Compared with HC group, the aMCI group exhibited higher CBF values primarily in the left superior and middle frontal gyrus. (4) We found that the CBF values in the right anterior cingulate/medial prefrontal gyrus and superior temporal gyrus were negatively correlated with the similarity test scores ($r = -0.453$, $P = 0.014$; $r = -0.497$, $P = 0.006$).

CONCLUSION

The APOE genotype has disease-specific effects on cerebral perfusion; the increased CBF within the lateral prefrontal and temporal cortex in the aMCI $\epsilon 4$ carriers may be interpreted as reflecting greater cognitive "effect" by aMCI $\epsilon 4$ carriers to achieve the same

level of performance as aMCI ϵ 4 non-carriers (e.g., ϵ 2 carriers and ϵ 3 ϵ 3 carriers).

CLINICAL RELEVANCE/APPLICATION

(dealing with functional MR and cortical activation) ' fMRI may lay a foundation for the perfusion index of AD early diagnosis , disease severity, the following-up of AD and drug efficacy determination.'

SSQ16-04 Interaction of Systemic Oxidative Stress and Mesial Temporal Network Degeneration in Parkinson's Disease with and without Cognitive Impairment

Thursday, Nov. 30 11:00AM - 11:10AM Room: N229

Participants

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PURPOSE

Systemic oxidative stress is the well-investigated factor and contributes to neuroinflammation of Parkinson's disease (PD). Cognitive impairments in PD are strong-associated with mesial temporal lobe (MTL) dysfunction. In the present study, we sought to evaluate the relationship between systemic oxidative stress and MTL function by measuring the morphology and functional network alteration in PD patients with and without cognitive impairment.

METHOD AND MATERIALS

Forty-one patients with PD (subgrouping into 3 groups [PD-normal, PD-mild cognitive impairment, PD-dementia]) and 29 normal control volunteers underwent peripheral blood sampling to quantify systemic oxidative stress markers, and T1W volumetric and resting state functional MRI (rs-fMRI) scans. Rs-fMRI was used to derive the healthy intrinsic connectivity patterns seeded by the epicenter vulnerable to any of significant oxidative stress markers. The functional connectivity correlation coefficient (fc-CC) and gray matter volume (GMV) of the network seeded by the epicenter among groups were compared. The correlation analysis among fc-CC, GMV and cognitive impairment were performed.

RESULTS

The oxidative stress markers including leukocyte apoptosis and LFA-1 values were significantly higher in the PD group. Using whole brain VBM based correlation analysis, bilateral MTL were identified as the most vulnerable epicenters of lymphocyte apoptosis ($p < 0.005$). The following resting state functional connectivity analysis further revealed the MTL network seeded by the epicenter. The MTL network of normal connectivity profile was resembled the PD-associated atrophy pattern. The GMV of the MTL network also demonstrated the significant difference between groups. Reduced fc-CC and GMV were associated with the progressed cognitive impairment.

CONCLUSION

The epicenters vulnerable to lymphocyte apoptosis can be linked to an altered MTL network that modifies both architecture and functional connectivity, with relationship to cognitive impairment. The possible relations among them may represent consequent cognitive impairment processes of systemic oxidative stress and MTL network injuries in PD patients.

CLINICAL RELEVANCE/APPLICATION

The volumetric and re-fMR can demonstrate damages of MTL network vulnerable to oxidative stress.

SSQ16-05 Effects of Mentally Stimulating Activities Training On Resting-State Network Functional Connectivity in Amnesic Mild Cognitive Impairment: A Pilot Controlled Trial

Thursday, Nov. 30 11:10AM - 11:20AM Room: N229

Awards

Student Travel Stipend Award

Participants

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PURPOSE

To explore the resting-state network functional connectivity alterations in patients with amnesic mild cognitive impairment(aMCI) before and after mentally stimulating activities training.

METHOD AND MATERIALS

Cognitive diagnosis was made by an expert consensus panel based on previous published criteria. Thirty-eight elderly subjects with aMCI comprising of training group (18) and control group (18), with age-, sex- and MoCA score-matched participated in this study. Rest-state fMRI (rs-fMRI) and neuropsychological assessment were conducted at baseline and after 6-month following training/control program. The global functional connectivity of rs-fMRI was analysed based on the graph theoretical modeling and seed-based analysis. The changes of functional connectivity and neuropsychological scores were compared between the two groups.

RESULTS

After 6-month training/control program, the MoCA score was significantly increased in training group (25.53 ± 2.51) compared with the control group (21.81 ± 2.02). Based on the graph theoretical modeling, the bilateral angular gyrus presented positive connectivity with the global brain in training group. Seed-based analysis, functional connectivity between the hippocampus and a set of regions was decreased in training group, these regions are: the right angular, cingulate gyrus and praecuneus; While, the left supplement motor area showed increased connectivity to the hippocampus.

CONCLUSION

These findings would be helpful to aid our understanding of the neurofunctional mechanisms associated with effects of mentally stimulating activities training on the cognitive function in aMCI.

CLINICAL RELEVANCE/APPLICATION

The network functional connectivity analysis of resting-state fMRI maybe a potentially useful tool for exploring the mechanism of mentally stimulating activities in aMCI.

SSQ16-06 Multi-voxel Pattern Analysis with Large-scale Granger Causality to Investigate Brain Connectivity Changes in Resting-State Functional MRI of Patients with HIV-Associated Neurocognitive Disorder

Thursday, Nov. 30 11:20AM - 11:30AM Room: N229

Participants

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PURPOSE

To develop and evaluate a novel machine learning framework using large-scale Granger causality (IsGC) for identification of subjects with HIV-Associated Neurocognitive Disorder (HAND) by capturing differences in resting-state functional MRI (rsfMRI) connectivity.

METHOD AND MATERIALS

Resting-state fMRI scans (3T, EPI sequence, TR=1.65s, 250 acquisitions) were acquired in a cohort of 45 age-matched subjects (20 healthy, 25 HIV+ of which 16 had HAND symptoms (HAND+)). After pre-processing, data was parcellated into regions defined by the Automated Anatomical Labeling (AAL) atlas. Regions were represented by their average time-series. A novel multivariate directional extension of Granger causality, IsGC, quantified the interdependence between time-series. Generalized matrix learning vector quantization, a method that combines supervised machine learning with embedded feature selection was used to classify HAND+ and healthy subjects from the resulting connectivity matrix in a Multi-Voxel Pattern Analysis (MVPA) framework. Strict data separation (90% train/10% test) was carried out in a 100-iteration cross-validation scheme. As a standard reference method, we used conventional multivariate Granger Causality (mGC) for comparative evaluation. Area Under the Curve (AUC) for Receiver Operator Characteristics (ROC) analysis and prediction accuracy were used to quantitatively evaluate the diagnostic quality of HAND+ subject classification.

RESULTS

Our novel IsGC rsfMRI connectivity analysis approach outperformed mGC in identifying HAND+ subjects, with AUC = 0.86 ± 0.29 and accuracy = $0.88 \pm 0.17\%$ for IsGC compared to AUC = 0.70 ± 0.35 and accuracy = $0.64 \pm 0.25\%$ for the conventional mGC method, respectively. Diagnostic quality differences between both methods were statistically significant ($p < 0.01$, Wilcoxon signed-rank test) for both AUC and prediction accuracy.

CONCLUSION

Our results suggest that the novel IsGC analysis method significantly improves the diagnostic quality for identification of patients with HAND. We conclude that, when compared to conventional mGC analysis, our MVPA framework is better suited to capture disease-related brain network connectivity changes based on rsfMRI neuroimaging.

CLINICAL RELEVANCE/APPLICATION

Our framework identifies HAND+ subjects by revealing disease-related changes in brain connectivity patterns, which can serve as a useful diagnostic biomarker in HIV-related neurologic disease.

SSQ16-07 The Altered Resting-State Functional Connectivity and Regional Homogeneity in Type 2 Diabetes with Mild Cognitive Impairment

Thursday, Nov. 30 11:30AM - 11:40AM Room: N229

Participants

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PURPOSE

Patients with Type 2 Diabetes Mellitus (T2DM) have considerably higher risk of developing cognitive impairment and dementia. This

Patients with type-2 diabetes mellitus (T2DM) have considerably higher risk of developing cognitive impairment and dementia. This study aims to investigate the possible alterations in spontaneous neural activity of brain through resting state-functional MRI (rs-fMRI) in T2DM patients with and without mild cognitive impairment.

METHOD AND MATERIALS

Eighteen T2DM patients with mild cognitive impairment (DM-MCI) and 18 matched T2DM patients with normal cognition (DM-NC) were enrolled. On a 3 Tesla scanner, rs-fMRI data were obtained axially using a gradient-echo planar imaging sequence. Using the Brainnetome toolkit (BRAT) (www.brainnetome.org/en/brat) and SPM8 software, the regional homogeneity (ReHo) was calculated to represent spontaneous brain activity in different brain areas. ReHo changes were correlated with neuropsychological scores and disease duration. Based on the anatomically labeled (AAL) template, the whole-brain partition analysis on functional connectivity was also applied to search for significant links.

RESULTS

Compared to DM-NC group, DM-MCI group exhibited decreased ReHo value in the right inferior, middle, and superior temporal gyrus; but increased ReHo value in the bilateral superior and medial frontal gyrus, the right orbital gyrus and the inferior frontal gyrus (fig.1). In the DM-MCI group, ReHo value was negatively correlated with Montreal Cognitive Assessment scores in the left medial frontal gyrus ($R = -0.662$, $p = 0.01$), and positively correlated with diabetes duration in the right inferior and middle frontal gyrus ($R = 0.594$, $p = 0.026$) (fig.2). Correlation between ReHo and glycosylated hemoglobin A1c was not significant. The DM-MCI group showed 11 pairs of weaker functional connectivity between different brain areas ($p < 0.01$, FDR corrected) (fig.3).

CONCLUSION

The abnormal brain activity reflected by ReHo measurements and the weaker functional connectivity of multiple brain regions could help uncover the susceptible regions of T2DM patients who progress into cognitive dysfunction, and may provide insights into the pathogenesis of T2DM related cognitive impairment.

CLINICAL RELEVANCE/APPLICATION

Resting state-fMRI may be able to track early progression of brain functional alterations, and can be an appropriate approach for studying the spontaneous brain activity in diabetes related cognitive impairment.

SSQ16-08 Early Volume Reduction of Hippocampus after Whole-Brain Radiation Therapy: Automated Brain Structure Segmentation Study

Thursday, Nov. 30 11:40AM - 11:50AM Room: N229

Participants

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PURPOSE

It is well known that cognitive decline often occurs after whole-brain radiation therapy (WBRT), especially in the long survivors. Our hypothesis was that the hippocampus is vulnerable to radiation and may become atrophic even at early stage after WBRT. Therefore, using automated segmentation of brain structures, we assessed volume changes of the various brain structures including the hippocampus within 10 months after WBRT.

METHOD AND MATERIALS

Twenty patients with lung cancer who underwent both WBRT and chemotherapy were recruited as a WBRT group. As a control group, 18 patients with lung cancer who underwent only chemotherapy were also recruited. Pre-treatment MRI was performed within one month before radiation or chemotherapy, and post-treatment MRI were performed 6 to 10 months after the radiation or chemotherapy. Contrast enhanced high-resolution 3D T1-weighted images of pre- and post-treatment were analyzed using longitudinal processing of FreeSurfer. We calculated volume reduction ratios [$\{(\text{volume of pre-radiation} - \text{volume of after radiation}) / \text{volume of pre-radiation} \} \times 100$] for the whole-brain cortex and white matter, hippocampus, and amygdala defined by Aseg atlas in FreeSurfer.

RESULTS

In the WBRT group, the hippocampus showed significant volume reduction (5.7%, $p < 0.01$), while the whole-brain cortex and white matter, and amygdala did not show significant volume reduction (4.9%; $p = 0.21$, 1.3%; $p = 0.19$, 1.3%; $p = 0.95$, respectively). The volume reduction ratio of the hippocampus was significantly higher than those of the whole-brain cortex and white matter ($p = 0.01$ and 0.02 , respectively). In the control group, there was no significant volume reduction in any regions (the ratios: 0.3%, 1.0%, 1.0%, and 0.9% for the hippocampus, amygdala, whole-brain cortex and white matter, respectively).

CONCLUSION

Among the whole-brain cortex and white matter, hippocampus, and amygdala, only the hippocampus showed significant volume reduction within 10 months after WBRT suggesting its vulnerability to radiation.

CLINICAL RELEVANCE/APPLICATION

Our study may support the validity of the "hippocampus-sparing" WBRT to prevent the radiation-induced cognitive impairment.

SSQ16-09 Nonlinear Modulation of Interacting Between COMT and Depression on Brain Function

Thursday, Nov. 30 11:50AM - 12:00PM Room: N229

Participants

Cancan He, Nanjing, China (*Presenter*) Nothing to Disclose
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PURPOSE

The catechol-O-methyltransferase (COMT) gene is related to dopamine degradation and has been suggested to be involved in the pathogenesis of major depressive disorder (MDD). However, how this gene affects brain function properties in MDD is still unclear.

METHOD AND MATERIALS

Fifty patients with MDD and 35 cognitively normal participants were underwent a resting-state functional magnetic resonance imaging scan. A voxel-wise data-drive global functional connectivity density (gFCD) analysis was used to investigate the main effects and interactions of disease states and COMT rs4680 on brain function.

RESULTS

We found significant group differences on the gFCD in bilateral fusiform area (FFA), postcentral and precentral cortex, left superior temporal gyrus (STG), rectal and superior temporal gyrus, right ventrolateral prefrontal cortex (vlPFC), and the abnormal gFCDs in left STG was positively correlated with depressive severity in MDD patients. Significant disease × COMT interaction effects were found in the bilateral calcarine gyrus, right vlPFC, hippocampus, and thalamus, and left SFG and FFA. Further post-hoc tests showed a nonlinear modulation effect of COMT on gFCD in the development of MDD. Interesting, an inverted U-shaped modulation was showed in the prefrontal cortex (control system), while U-shaped modulations were found in the hippocampus, thalamus and occipital cortex (processing system).

CONCLUSION

Our study manifested a nonlinear modulation of interacting between COMT and depression on brain function. This findings expand our understudying of the COMT effect underlying pathophysiology in MDD patients.

CLINICAL RELEVANCE/APPLICATION

The brain functional features detecting combined with COMT genotyping may provide a useful biomarker to the occurrence and development of depression.

SSQ17

Science Session with Keynote: Pediatrics (Neuroradiology)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S103CD

MR **NR** **PD**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Susan Palasis, MD, Atlanta, GA (*Moderator*) Nothing to Disclose
Daniela Prayer, MD, Vienna, Austria (*Moderator*) Nothing to Disclose

Sub-Events

SSQ17-01 Pediatrics Keynote Speaker: Pediatric Neuroimaging in the Age of Precision Medicine

Thursday, Nov. 30 10:30AM - 10:40AM Room: S103CD

Participants

Susan Palasis, MD, Atlanta, GA (*Presenter*) Nothing to Disclose

SSQ17-02 Association of Childhood Obesity with the Central Nervous System (CNS): Study of Diffuse Tensor Imaging (DTI)

Thursday, Nov. 30 10:40AM - 10:50AM Room: S103CD

Participants

Pamela Bertolazzi, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose
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PURPOSE

The aim of this work is to investigate the influence of childhood obesity on changes in anatomy and cerebral connectivity, using the DTI by Magnetic Resonance Imaging (MRI). The hypothesis is that the brain is an organ also affected by high adiposity, particularly the hypothalamus, which is a complex region involved in the regulation of appetite and hormonal homeostasis.

METHOD AND MATERIALS

The images were obtained on Achieva 3T Phillips Magnetic Resonance. The sample for statistical analysis consisted of 120 subjects: 59 obese adolescents and 61 healthy adolescents, aged 11 years to 18 years, and matched regarding gender, age, and schooling. The images were processed with the FSL-Tbss (Tract Based Spatial Statistics) program and analyzed statistically by the same program with Randomize.

RESULTS

Statistical analysis showed decrease in the values of Fractional Anisotropy (FA) of obese pediatric patients compared with healthy controls in amygdala, hippocampus, thalamus, cingulate gyrus, fornix, insula, putamen, orbital gyrus and bilateral hypothalamus. There was no region of higher FA in obese patients in relation to the control group.

CONCLUSION

The data reveal a pattern of involvement in important regions in the control of appetite and emotions. Limbic structures, such as amygdala, hippocampus, thalamus, cingulate gyrus, fornix and insula are altered. Important regions related to impulse control, reward and pleasure in eating (putamen and orbital gyrus) and autonomic appetite control (bilateral hypothalamus) were also shown to have decreased FA.

CLINICAL RELEVANCE/APPLICATION

Childhood obesity is a subject of high clinical importance, and presents data of ascent from 10 to 40% of the last 10 years in most countries. Previous studies have pointed to obesity as a risk factor for neurodegenerative disorders through DTI tractography. In this way, we investigated previous or early cerebral changes in obesity.

SSQ17-03 Voxel-Based Morphometry (VBM) and Tract-Based Spatial Statistics-Diffusion Tensor Imaging

(TBSS-DTI) in Rett Syndrome: Alterations in Visuomotor Areas and Limbic System

Thursday, Nov. 30 10:50AM - 11:00AM Room: S103CD

Participants

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PURPOSE

Rett syndrome (RTT) is a neurodevelopmental disorder presenting with loss of motor and speech abilities, stereotypic movements, gait disturbance, autistic behavior and seizures. We aimed to investigate underlying morphometric and white matter (WM) changes in patients with RTT using MRI.

METHOD AND MATERIALS

IRB approved this study and all the participants/ parents gave signed consent form. T1-weighted 3D images (MPRAGE) (TR/TE/TI: 1910/3,5/1100ms) and diffusion tensor imaging (DTI) of the brain along 60 non-collinear directions (TR/TE: 5814 /98 ms, bmax:1000s/mm²) were obtained from 15 female patients with classical Rett syndrome and MECP2 mutation, and 14 healthy age and sex-matched subjects (median ages, 3.99 and 5.08 respectively; $p>0.95$). We used SPM12 for voxel-based morphometry (VBM) and TBSS, a part of FSL 4.0 software package for voxel-wise statistical DTI analysis. From VBM analysis, segmented GM, WM and CSF volume, total intracranial volume (TIV), and normalized volumes by dividing to TIV were measured. Statistically significant clusters in VBM and TBSS-FA map (all, FWE correction, $p<0.05$) were determined using MNI atlas.

RESULTS

Although GM, WM, CSF volumes were significantly smaller in patients ($p<0.02$), the significance didn't remain in comparison of normalized volumes ($p>0.1$). Patients showed significantly reduced WM density in frontal and parieto-occipital areas related with visuomotor coordination, sensorimotor areas and cognition; also significantly less GM density in superior and middle temporal gyri and left prefrontal cortex ($p<0.05$). Patients showed reduced FA in the cerebellar hemispheres, corpus callosum, inferior frontooccipital fascicles, anterior thalamic radiations, thalami, external capsules, fornices, cinguli, superior longitudinal fascicles ($p<0.05$).

CONCLUSION

When normalized to TIV, no significant volume loss was observed in patients with RTT. VBM and TBSS-DTI revealed mostly WM density and FA reductions in bilateral visuomotor areas and limbic system components such as cingulum and fornices related with cognition, behavior and seizures.

CLINICAL RELEVANCE/APPLICATION

Multimodal neuroimaging link structural and connectivity alterations related with diverse clinical features in patients with RTT.

SSQ17-04 Preterm Neonates Show a 'Catch-Up' Pattern toward Term in Motor Development during the Neonatal Period: A Diffusion Tensor Imaging Study

Thursday, Nov. 30 11:00AM - 11:10AM Room: S103CD

Participants

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PURPOSE

To detail the postnatal trajectory of neonatal sensorimotor functions by comparing the postnatal age-related changes of brain white matter (WM) microstructure and neurobehavioral abilities between preterm and term neonates during the neonatal stage.

METHOD AND MATERIALS

118 neonates (within 28 days after birth) with no abnormality who underwent conventional MRI and DTI were included (Table1). The DTI-derived fractional anisotropy (FA) and neonatal neurobehavioral assessment were separately used to characterize the brain WM microstructure and neurobehavioral development levels. The scatterplot with linear fitting was used to investigate the relations of FA and neurobehavioral scores (active tone and behavior) with postnatal age (day), setting gestational age (GA) as a covariate. Here, OR (optical radiation), AR (auditory radiation), CST (corticospinal tract), PTR (posterior thalamic radiation) and thal-PSC (thalamus-primary somatosensory cortex) were selected as regions of interest; active tone and behavior were used to separately evaluate the abilities of motor and integrated visual, auditory and sensory. All statistical analysis were performed by using Matlab; $p<0.05$ was considered as statistically significant difference.

RESULTS

Significant correlations of adjusted FA with postnatal age were found in preterm CST ($p=0.042$), term OR ($p=0.018$) and PTR

Significant correlations of adjusted FA with postnatal age were found in preterm CST ($p=0.042$), term OR ($p=0.010$) and FTR ($p=0.002$). Compared to term neonates, preterm showed an obviously higher correlation in CST (0.29 vs 0.08), while less correlations in visual, auditory and somatosensory-associated WMs (Figure 1). Being relatively consistent, neurobehavioral results indicated that preterm neonates presented relatively higher and lower correlations than term in active tone (0.48 vs 0.35) and behavior scores (0.36 vs 0.52), respectively (Figure 2).

CONCLUSION

Although being delayed, preterm neonates show a 'catch-up' pattern toward the term in motor development during the neonatal period.

CLINICAL RELEVANCE/APPLICATION

Postnatal trajectory of neonatal sensorimotor function e.g. preterm 'catch-up' motor development provide valuable references in guiding the early intervention and thus gaining more effective outcomes.

SSQ17-05 Visually Accessible Rembrandt Imaging (VASARI) Features Predict Survival and Identify Distinct Groups of Pediatric High Grade Glioma

Thursday, Nov. 30 11:10AM - 11:20AM Room: S103CD

Participants

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PURPOSE

To understand the relationship of Visually Accessible Rembrandt Imaging (VASARI) features to prognosis and disease subgroups in pediatric high grade glioma (pHGG).

METHOD AND MATERIALS

Seventy one consecutive cases of newly diagnosed pHGG were systematically reviewed and scored for VASARI features by two expert radiologists. Agreement between reviewers was scored for each VASARI feature. The inter-correlation between VASARI features and impact on hierarchical clustering of patients were evaluated. The distance between variables is as follows; Pearson correlation was used among the continuous variables, Kendall's correlation was used among binary/ordinal variables, and Spearman correlation was used between continuous variables and binary/ordinal variables. Pearson correlation was used to measure the distance between subjects. The number of clusters was determined using the hybrid method proposed by Langfelder and Zhang (2008). Patient clusters were evaluated for their subgroup specific survival. Analyses were completed in either SAS v9.3 or R 3.3.3.

RESULTS

The median concordance between reviewers for VASARI features was 60% (range, 29-79%). The most concordant features include tumor location, diffusion characteristics, and pial invasion, while the most discordant features were ependymal invasion, proportion of non-contrast enhancing tumor (nCET), and proportion of edema. Univariate cox proportional hazards analysis identified hemorrhage (HR 5.6, 95% CI 1.1-28.2, $p=0.035$), nCET crossing midline (HR 2.5 95% CI 1.2-5.2, $p=0.048$), and size (HR 1.15 95% CI 1.01-1.33, $p=0.05$) as features which increased the hazard for progression. Hierarchical clustering identified 5 patient subgroups with distinctive correlated imaging features and varied survival.

CONCLUSION

VASARI features require refinement in their definition before broad acceptance for pHGG. Some features may be prognostic at diagnosis, and may aid further risk classification beyond classic clinical and pathologic factors.

CLINICAL RELEVANCE/APPLICATION

VASARI features may be prognostic and identify distinct populations in pHGG.

SSQ17-06 Post Treatment DSC-MRI is Predictive of Early Treatment Failure in Children with Supratentorial High-Grade Glioma Treated with Erlotinib

Thursday, Nov. 30 11:20AM - 11:30AM Room: S103CD

Participants

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PURPOSE

The role of perfusion imaging in the management of pediatric high grade glioma is unclear. We evaluated the ability of DSC-MRI to determine grade, evaluate post-treatment response and predict treatment failure.

METHOD AND MATERIALS

Twenty-two patients with high-grade glioma underwent biopsy and were treated with concurrent and sequential radiotherapy and erlotinib as part of a phase I/II clinical trial (NCTXXXX). Pre-, immediate post-radiotherapy, 6-month, and treatment failure DSC MR images were reviewed, registered, and processed for the ratio of CBF and CBV. Processed, derived perfusion, and T1WI, T2WI, and FLAIR MRI sequences were used for segmentation and extraction of tumor perfusion parameters at all time-points. Patient, tumor, treatment, and outcome data were summarized and related to perfusion data.

RESULTS

Regional CBF in tumors increased from diagnosis to post radiotherapy, while they decreased to levels below those at diagnosis from post radiotherapy to 6-month follow up. At 6 months, the median regional CBF was higher in tumors that progressed (median, 1.16) than in those that did not (median, 0.95; $P < .05$). Patients with CBF ratios above 1.4 at diagnosis had shorter survival times relative to CBF ratios below 1.4 ($P = .77$). Tumors with a regional CBV above 1.15 at the post-radiotherapy (1- to 3-month) follow-up scan were associated with an earlier time to death than that of tumors with a CBV below 1.15 ($P < .05$).

CONCLUSION

Post-treatment perfusion characteristics are prognostic and may predict survival. Perfusion MRI is useful for managing pediatric high-grade glioma and should be incorporated into future trials.

CLINICAL RELEVANCE/APPLICATION

DSC-MRI is recommended in the evaluation of treatment response in pediatric patients with high grade glioma

SSQ17-07 Differentiation of Medulloblastoma and Astrocytoma in Children Using Histogram Analysis of Enhancement MRI

Thursday, Nov. 30 11:30AM - 11:40AM Room: S103CD

Participants

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PURPOSE

To investigate the diagnostic value of the histogram analysis derived from enhancement MR imaging in differentiating medulloblastomas from astrocytomas.

METHOD AND MATERIALS

Retrospective analysis of 47 patients which were pathologically confirmed posterior fossa tumors, including 29 cases of medulloblastoma, 18 cases of astrocytoma. Drawing the region of interest (ROI) on the maximum level of enhanced MR sagittal image and going on histogram analysis, these two steps are all performed on the software named Mazda. Performed a statistical analysis on the histogram parameters to find out the characteristics of the significant differences between the two groups.

RESULTS

In the 9 parameters which are extracted from histogram, C99 has the statistical significance. The maximum area under the ROC curve was 0.85. The optimum C99 to distinguish medulloblastomas from astrocytomas was 176.5 (76% specificity and 61% sensitivity).

CONCLUSION

Histogram analysis of enhancement MR imaging can provide reliably objective basis for differentiating medulloblastomas from astrocytomas.

CLINICAL RELEVANCE/APPLICATION

Histogram analysis of enhancement MR imaging is a new method, can provide reliably objective basis for differentiating medulloblastomas from astrocytomas.

SSQ17-08 Diagnostic Accuracy of MRI Perfusion (DSC) to Determine Grades and Types of Pediatric Primary Brain Tumors: A Multiparametric Approach

Thursday, Nov. 30 11:40AM - 11:50AM Room: S103CD

Participants

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PURPOSE

The goal of this prospective study was to assess the diagnostic accuracy of multiple parameters from dynamic susceptibility contrast (DSC) perfusion, in the distinction of pediatric brain tumor grades and types.

METHOD AND MATERIALS

A retrospective blinded review of 53 histologically proven pediatric brain tumors with DSC perfusion was performed independently by two neuroradiologists. Tumors were categorized by grade and by histological. Maximum rCBV (rCBVmax), Percentage Signal Recovery (PSR) and Contrast Leakage Patterns (CLP) were measured from manual ROI placement for each reviewer and averaged. Results from all three analyses were compared to WHO grade and tumors type. Multivariate statistical analysis was performed to evaluate the diagnostic accuracy of single and combined perfusion parameters, and of single parameters to distinguish the different groups.

RESULTS

rCBVmax demonstrated a positive correlation with tumor grade, but limited specificity for tumors type. PSR and CLP demonstrated a positive correlation with tumor type when tumors were grouped by astrocytic and non-astrocytic. The highest diagnostic accuracy for tumor grading and typing was obtained using all three perfusion parameters. Pilocytic astrocytomas demonstrated a peculiar perfusional pattern: rCBV<1.6, high PSR and T1-dominant leak.

CONCLUSION

Multiparametric MR imaging can be accurate in determining tumor grades and types (mainly pilocytic astrocytomas and embryonal tumors) in children.

CLINICAL RELEVANCE/APPLICATION

Perfusion MRI is of utility to increase diagnostic accuracy for adult brain tumor. In pediatric population the heterogeneity of tumors need more than one perfusion parameter to gain an higher sensitivity and specificity for grading and distinguishing brain neoplasms

SSQ17-09 MRI Surrogates of Molecular Subgroups in Pediatric Atypical Teratoid / Rhabdoid Tumor

Thursday, Nov. 30 11:50AM - 12:00PM Room: S103CD

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PURPOSE

Recent research identified new molecular subgroups in atypical teratoid / rhabdoid tumor (AT/RT). MRI characteristics of AT/RT have not yet been analyzed according to molecular parameters. We aimed to identify morphological features that may help predict molecular subgroups by means of MRI.

METHOD AND MATERIALS

A total of 43 consecutive patients with known molecular subtyping (AT/RT-TYR n=16, -SHH n=17, -MYC n=10) were obtained from the EU-RHAB register. We analyzed epidemiologic and standardized imaging parameters as well as meningeal dissemination status. Statistical analysis between molecular subgroups was performed by Mann-Whitney U test and chi-squared test.

RESULTS

In contrast to distinct origin (supra-/infratentorial, $p=.002$) of molecular AT/RT subgroups, a midline/off-midline localization was not significantly different. Typical cysts in the tumor periphery were found most frequently in AT/RT-TYR ($p=.012$). There was a tendency ($p=.052$) to strong contrast enhancement in AT/RT-TYR and AT/RT-MYC, whereas enhancement was absent in almost one third of -SHH tumors. Patient age and gender as well as tumor volume and visible meningeal dissemination were not significantly different between molecular subgroups.

CONCLUSION

This is the first study that describes and compares MR imaging features according to molecular subgroups in pediatric AT/RT. In contrast to previous studies, we show that an off-midline location is not specific for infratentorial AT/RT. Peripheral cysts and/or a band-like 'wavy' enhancement, if present, are important characteristics to differentiate AT/RT from other tumor entities in children < 3 years of age. These findings could be observed throughout all molecular subgroups, but with different frequencies. Correlation of initial MR imaging features with clinical outcome might be of great interest for individual risk assessment and patient stratification.

CLINICAL RELEVANCE/APPLICATION

Beyond typical anatomical distribution of molecular subgroups, we identified morphological parameters that may help to differentiate pediatric AT/RT with MR imaging.

SSQ18

Physics (Quantitative Image Analysis)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S403B

BQ CT PH

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FDA Discussions may include off-label uses.

Participants

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Sub-Events

SSQ18-01 Feasibility of Multi-Reference-Tissue Normalization of T2-Weighted Prostate MRI

Thursday, Nov. 30 10:30AM - 10:40AM Room: S403B

Participants

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PURPOSE

To explore a novel multi-reference-tissue normalization method applied to t2-weighted prostate MRI.

METHOD AND MATERIALS

Assuming the availability of a set of distinct reference tissue segmentations, the hypothesis is that it allows computing a patient specific sequence model that can normalize MRI. The normalization should produce similar scalar values in the same reference regions for different patients/scanners/sequences and interpolate in between reference values for other tissue areas. Regions of interest (ROI) were drawn in four distinct tissue types in a cohort of sixty-five t2-weighted images from regular multiparametric prostate MRI (mpMRI). The four reference tissue types were: skeletal muscle, body fat, femur head, bladder lumen. Four average ROI signals were computed per patient. Each reference tissue was assigned a fixed reference value (t2 relaxation found in literature). Per patient, a smooth sequence model was fitted to the (average, reference) pairs. The estimated sequence model was then inverted to map patients' raw t2-weighted image scalar values to normalized values. To test the method, the effect of normalization on observed variance and tissue discriminability was analyzed. A leave-one-out experiment was performed in which for each ROI its normalized value was computed using the sequence model estimate using the three remaining reference ROIs. The difference between original t2-weighted and normalized scalar MRI was analyzed by means of variability and ROC analysis.

RESULTS

Multi-reference-tissue normalization significantly ($p < 0.05$) decreased variability and increased the area under the ROC curve for discriminating each reference tissue combination. The ROC curves in the figure show the effect of the normalization (T2-n) on the discrimination between body fat and femur head tissue.

CONCLUSION

Semi-automatic multi-reference-tissue normalization shows reduced inter-patient variability and may allow better quantitative discrimination between tissue types.

CLINICAL RELEVANCE/APPLICATION

Multi-reference-tissue t2-weighted MRI normalization seems feasible. In combination with automatic segmentation, this could be providing clinical quantitative imaging support to mpMRI diagnosis of prostate cancer. This result motivates us to continue to explore the ability of this novel method to help detect and discriminate prostate cancer in mpMRI.

SSQ18-02 Automatic Algorithm for Joint Morphology Measurements in Volumetric Musculoskeletal Imaging

Thursday, Nov. 30 10:40AM - 10:50AM Room: S403B

Participants

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PURPOSE

An automated algorithm was developed for measurements of bone morphology and joint alignment in volumetric musculoskeletal imaging. The algorithm was applied to evaluation of the weight-bearing tibiofemoral and patellofemoral joints using a dedicated extremity cone-beam CT (CBCT) system.

METHOD AND MATERIALS

Weight-bearing CBCT scans were acquired from 24 healthy subjects at ~12 mGy dose; reconstructed field of view was 20x20x30 cm³ with 0.56 mm isotropic voxels. Anatomical landmarks on tibia, femur, and patella were set by an expert radiologist for the following metrics: Medial Tibial Depth (MTD), Tibial Tuberosity-Trochlear Groove (TTTG) distance, and Insall-Salvati-Ratio (ISR). The automated algorithm uses three sets of atlas volumes, one for each of the bones. The atlases are annotated with pertinent anatomical landmarks according to expert reader consensus. The atlas volumes are first registered (individually for each bone) to the analyzed volume using Mattes mutual information and similarity transforms. The best fitting atlas images are then selected, and their bone surfaces are deformably registered to the corresponding bones in the analyzed volume. No segmentation of the analyzed volume is necessary. The transforms found in the registration are then applied to the atlas landmarks to compute the anatomical metrics.

RESULTS

The deviation of the anatomical landmarks found by the algorithm from the locations selected by the expert reader are within the range of intra-reader variability (~1 mm). The automated algorithm achieved high level of agreement with expert radiologist readings in leave-one-out evaluation of the anatomical metrics, with ICC of 1.0, 0.93, and 0.97 for TTTG, ISR, and MTD, respectively. The RMSE of the metrics sharply decreases with increasing number of atlas images, achieving RMSE of less than 0.5 mm for TTTG and MTD less than 0.2 [a.u.] for ISR when 15 atlas images are used for each bone.

CONCLUSION

The algorithm achieved high correlation with expert radiologist readings, providing quantitative assessment of the complex, multi-body anatomy of the joints in support of orthopedic diagnosis and surgical planning.

CLINICAL RELEVANCE/APPLICATION

An automatic algorithm for image-based anatomical measurements in musculoskeletal radiology supports quantitative assessment of joint morphology in diagnostic and surgical applications.

SSQ18-03 A Contrast-to-Noise Ratio for Clinical Mammographic Images

Thursday, Nov. 30 10:50AM - 11:00AM Room: S403B

Participants

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PURPOSE

Image quality estimation directly from clinical mammograms rather than from phantom images would allow for patient-specific and 'real-time' monitoring of complete system performance. This study evaluates a novel method to estimate a contrast-to-noise ratio (CNR) directly from mammograms.

METHOD AND MATERIALS

The novel CNR uses a noise estimation from the compressed breast region that minimizes the influence tissue characteristics, while a signal difference between pixels with known tissue compositions serves as an alternative to the difference between a phantom contrast feature and uniform background. For initial validation, a phantom with 0.2 mm Al and 2-8 cm PMMA was imaged with technique factors to match automatic exposure control (AEC)-acquisition on the GE Senographe Essential, and in combo-mode (FFDM & DBT) on the Hologic Selenia Dimensions. CNR measured from phantom images per EUREF guidelines was compared to CNR determined using noise estimated by the proposed method. The novel CNR was calculated for AEC-acquired clinical images and plotted against compressed thickness following typical analysis of AEC performance. The dataset included 274 Hologic Selenia Dimensions combo-mode images and 80 GE Senographe Essential FFDM images. Phantom and clinical images were acquired on different machines. Version 1.5.3.0 of the VolparaDensity algorithm was applied to measure tissue composition.

RESULTS

The correlation was excellent between the EUREF-derived and novel CNR for phantom images, with Pearson coefficients over 0.99. The trends between mammographic image CNR and thickness correspond well to the phantom-verified relationships, with differences in phantom and mammographic CNR magnitudes largely resulting from the different contrast materials and methodologies, along with some variability from machine-specific performance.

CONCLUSION

A novel CNR measure was assessed using phantom and clinical mammographic images. The validation results show promise for the ability to avoid signal variations due to tissue structure, while extracting system-dependent data to make objective CNR estimates. Future work will assess clinical image CNR sensitivity to variations in acquisition parameters.

CLINICAL RELEVANCE/APPLICATION

To our knowledge this is the first description of an objective CNR measure that can be made directly from mammographic images, thereby enabling real-time and patient-specific image quality evaluation.

SSQ18-04 Framework for Automatic 3D Coronary Artery Vessel Wall Segmentation from Coronary CT Angiography

Thursday, Nov. 30 11:00AM - 11:10AM Room: S403B

Participants

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PURPOSE

To develop a framework for automated 3D segmentation of the coronary vessel wall and atherosclerotic plaque in the three major coronary artery vessels using level sets and centerline as a guide. To overcome premature termination of coronary segmentation caused by poor contrast, motion artifacts, and severe stenosis.

METHOD AND MATERIALS

The proposed framework computes the vesselness and, with the original 3D coronary image, obtains an initial lumen contour via region growing. Next, a level set energy function is minimized to segment the lumen boundaries. Subsequently, the segmented lumen is utilized as the initial vessel outer boundaries. A second level set energy function segments the final outer wall using a specific sigmoid feature image. The lumen and vessel boundaries are joined to create the coronary wall. Once the wall is segmented, curved multiplanar reformation is used to straighten the segmented lumen and wall using the lumen centerline. Coronary CTA data were acquired from 41 asymptomatic CAD subjects. Images were read by a radiologist to identify the segments of adequate diagnostic image quality and the extent of atherosclerosis plaque burden therein including plaque presence, type, volume, and luminal stenosis severity. Wall and plaque volumes were segmented using the framework and compared to an expert radiologist's manual delineation. The evaluation dataset contained 122 plaques of different characteristics.

RESULTS

Agreement between automatic and radiologist segmentation improved as a function of plaque. For small, mild, medium, and large plaques, mean $\pm$ SD similarity DICE coefficient between segmented and radiologist's delineation was 86 $\pm$ 13%, 90 $\pm$ 10%, 95 $\pm$ 5%, and 95 $\pm$ 6%, respectively. Relative volume difference was 7.3 $\pm$ 7.3%, 5.2 $\pm$ 5.2%, 4.9 $\pm$ 3.9%, and 4.1 $\pm$ 5.4%, respectively. The p-values from a paired t-test comparing the radiologist to framework segmentation volumes were p=0.72 for small, p=0.76 for mild, p=0.89 for medium, and p<<0.93 for large plaques.

CONCLUSION

Automatic CTA coronary wall segmentation that is highly similar to radiologist's manual delineation is feasible, which thus is promising for accelerated, reliable, and reproducible atherosclerotic plaque characterization.

CLINICAL RELEVANCE/APPLICATION

Automatic segmentation of CTA coronary wall improves objective quantification of coronary atherosclerotic plaque beyond subjective assessment of stenosis and potentially applicable for monitoring response to therapy.

SSQ18-05 CT Coronary Calcium Scoring with Tin Filtration Using Iterative Beam-Hardening Calcium Correction Reconstruction

Thursday, Nov. 30 11:10AM - 11:20AM Room: S403B

Participants

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PURPOSE

To investigate the diagnostic accuracy of CT coronary artery calcium scoring (CACS) with tin pre-filtration (Sn100kVp) using

to investigate the diagnostic accuracy of CT coronary artery calcium scoring (CACS) with tin pre-filtration (Sn100kVp) using iterative beam-hardening correction (IBHC) calcium material reconstruction compared to the standard 120kVp acquisition.

METHOD AND MATERIALS

In an IRB-approved, HIPAA compliant prospective study, 62 patients (56% male, age 63.9±9.2years) underwent a clinically-indicated CACS acquisition using the standard 120kVp protocol and an additional Sn100kVp CACS research scan. Datasets of the Sn100kVp scans were reconstructed using a dedicated spectral IBHC CACS reconstruction to restore the spectral response of 120kVp spectra. Agatston scores were derived from 120kVp and IBHC reconstructed Sn100kVp studies. Pearson's correlation coefficient was assessed and Agatston score categories and percentile-based risk categorization were compared.

CONCLUSION

Low voltage CACS with tin filtration using a dedicated IBHC CACS material reconstruction algorithm shows excellent correlation and agreement with the standard 120kVp acquisition regarding Agatston score and cardiac risk categorization, while radiation dose is significantly reduced by 75% to the level of a chest x-ray.

CLINICAL RELEVANCE/APPLICATION

Low x-ray tube voltage third generation dual-source CT CACS paired with tin pre-filtration and iterative beam-hardening correction calcium material reconstruction allows for coronary artery calcium quantification in excellent correlation with standard protocols, albeit at a fraction of the radiation dose. This approach thus seems well suited for a screening test in a priori healthy individuals.

SSQ18-06 Robustness Evaluation of RA-950 Scoring in a Cohort of CT Lung Screening Patients Across a Large Range of CT Acquisition and Reconstruction Conditions

Thursday, Nov. 30 11:20AM - 11:30AM Room: S403B

Participants

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PURPOSE

Interest in quantitative evaluation of images is high, however variation in imaging protocols raises questions about the reliability of utilized metrics. In this study we investigate the multivariate effects of CT acquisition and reconstruction parameters on emphysema scoring in CT lung screening.

METHOD AND MATERIALS

30 clinical lung screening scans were selected from an in-house archive that contains raw projection data. Reduced dose acquisitions were simulated at 50%, 10%, and 5% of clinical dose (~2mGy CTDIvol) by adding noise to the raw data. Full-dose and reduced-dose acquisitions were then reconstructed using the open-source software "FreeCT_wFBP" at slice thicknesses of 0.6, 1, 2, and 5mm using smooth, medium and sharp kernels for a total of 48 reconstructions per patient. To score emphysema, a density mask was applied with -950HU as the threshold (RA-950 score), and for each parameter configuration, change in RA-950 relative to a reference (100% dose, 1.0mm slice thickness, medium kernel; chosen for similarity to clinical protocols) was calculated and averaged across the population.

RESULTS

Only 21 of 48 (44%) configurations produced scores within ±5% of the reference suggesting limitations to the range of acceptable parameters for quantitative emphysema evaluation. Configurations using the sharp kernel, the 0.6 mm slice thickness, or doses below 50% of the clinical reference consistently produced scores very different than reference. Protocols producing higher image noise resulted in higher RA-950 scores. With slice thicknesses ≥1.0mm and the smooth or medium kernel, the 50% dose configuration results in RA-950 comparable to reference. Patient-specific surface plots revealed that change in RA-950 as a function of reconstruction parameter strongly depends on the amount of emphysema measured at reference.

CONCLUSION

As quantitative evaluation of COPD increases and efforts to reduce CT dose continue, changes in protocol are likely. This study shows that reliable quantitative emphysema evaluation is possible with further dose reduction (to ~1mGy) when combined with appropriate reconstruction parameters, however care must be taken to prevent parameter-dependent changes in the measured score.

CLINICAL RELEVANCE/APPLICATION

Establishing protocols for reliable quantitative metrics is critical for the use of clinical quantitative imaging. This study assesses and provides guidance on RA-950 scoring for the evaluation of emphysema.

SSQ18-07 Fully Automatic Measurement of the Splenic Volume in CT with U-Net Convolutional Neural Networks

Thursday, Nov. 30 11:30AM - 11:40AM Room: S403B

Participants

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PURPOSE

To develop a fully automatic deep learning method for 3D segmentation of the spleen on computed tomography (CT) scans and to compare the automatically measured spleen volume with the standard splenic index approximation formula that requires three 2D manual measurements.

METHOD AND MATERIALS

145 CT thorax-abdomen scans were collected from our institute. All scans were contrast enhanced and acquired with a slice thickness of 1 or 2 mm. The spleens were manually segmented in 3D by trained human observers in all scans. We used 100 scans for training and 45 scans as an independent test set. In the test set, the standard approximation formula was applied by a human observer to get an estimation of the splenic volume. The system fully analyzes the entire thorax-abdomen CT scan to segment the exact location of the spleen, without any need for pre-processing. Multiple U-net convolutional neural networks were trained for different orthogonal directions using the training data set. A validation set consisting of 30% of the training data was used to optimize the hyperparameters of the neural network. A dedicated hard mining selection strategy was employed to improve the learning process. The predictions of the U-nets were averaged and subsequently thresholded to obtain a 3D spleen segmentation. The mean absolute error of the splenic volume was used to measure the accuracy of the deep learning approach and the standard approximation formula in comparison to the manual reference standard. The performance of the deep learning approach was also evaluated by computing the Dice similarity coefficient on the test set.

RESULTS

The deep learning approach resulted in a mean absolute error of 8.5% (SD 11.6) in the splenic volume while the approximation formula gave a significantly higher ($p < 0.01$) mean absolute error of 17.7% (SD 14.7). The average Dice score between the deep learning segmentations and the reference segmentations was 0.91 (SD 0.08).

CONCLUSION

Splenic volume can be fully automatically assessed using a U-net deep learning approach, with an accuracy that is substantially better than the clinically widely used approximation formula.

CLINICAL RELEVANCE/APPLICATION

An accurate splenic volume measurement can be used for assessing splenomegaly and for detecting changes in splenic volume over time.

SSQ18-08 Newly Developed 3D Computer-Aided Volumetry (CADv) with Pulmonary Nodule Component Evaluation: Capability for Quantitative Prediction of Malignancy and Postoperative Recurrence on Thin-Section CT

Thursday, Nov. 30 11:40AM - 11:50AM Room: S403B

Participants

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PURPOSE

To evaluate the quantitative capability of newly developed 3D computer-aided volumetry (CADv) with pulmonary nodule component assessment for predicting malignancy and postoperative recurrence on thin-section CT.

METHOD AND MATERIALS

59 consecutive patients with 101 pulmonary nodules underwent repeated thin-section CT, pathological examination, surgical resection and/ or follow-up examination. Then, all nodules were divided into malignant ($n=64$) and benign ($n=37$) nodule groups. In addition, all patients with operated as malignancy were also divided into postoperative recurrence ($n=12$) and non-recurrence ($n=53$) groups. In this study, CADv automatically assessed solid, ground-glass opacity, cavity and total nodule volumes from two serial CT data. Then, total volume change per day (TV/day), solid to total volume change ratio per day (S/T ratio/day) and doubling time (DT) were determined. Student's t-test was performed to compare all indexes between malignant and benign groups, and between recurrence and non-recurrence groups. Then, ROC analyses were performed to compare differentiation capabilities of indexes as having significant differences between malignant and benign groups, and between recurrence and non-recurrence groups. Finally, each diagnostic performances was compared by McNemar's test.

RESULTS

TV/day and DT had significant differences between malignant and benign nodule groups ($p<0.05$), although TV/day and S/T ratio/day had significant difference between recurrence and non-recurrence groups ($p<0.05$). On distinguishing malignant from benign groups, area under the curves (Azs) of TV/day ($Az=0.94$) was significantly larger than that of DT ($Az=0.62$, $p<0.001$). In addition, specificity (SP) and accuracy (AC) of TV/day were significantly higher than those of DT ($p<0.001$). For distinguishing recurrence from non-recurrence groups, Az of S/T ratio/day ($Az=0.92$) was significantly larger than that of TV/day ($Az=0.68$, $p=0.006$). Moreover, SP and AC of S/T ratio/day were significantly higher than those of TV/day ($p<0.001$).

CONCLUSION

Newly developed 3D CADv system has quantitative capability for prediction of malignancy and postoperative recurrence on thin-section CT.

CLINICAL RELEVANCE/APPLICATION

Newly developed 3D CADv system has quantitative capability for prediction of malignancy and postoperative recurrence on thin-section CT.

SSQ18-09 Quantitative Evaluation of Partial Obstruction of the Upper Urinary Tract by Analyzing Sequential Fluoroscopic Images from Antegrade Nephrostograms

Thursday, Nov. 30 11:50AM - 12:00PM Room: S403B

Participants

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PURPOSE

Visual monitoring of fluoroscopy images, following PCNL does not allow for objective assessment of partial obstruction in the upper urinary tract. This study describes an algorithm for a quantitative evaluation of the urine flow rate, by analyzing sequential images from a routine nephrostogram.

METHOD AND MATERIALS

Following PCNL, contrast agent is introduced into the renal collecting system and serial fluoroscopic images of the renal pelvis are visually evaluated to ensure that contrast material is drained through the upper urinary tract. This study examined fluoroscopic images obtained retrospectively from nephrostograms of 40 subjects, 3 days following PCNL. In 16 cases, visual estimation of the images indicated partial obstruction. An algorithm was developed to calculate the amount of contrast agent in the renal pelvis, in each sequential image, by analyzing the integrated gray level values. As the contrast material is drained, its radio-opacity is decreased. The amount of contrast material in each image was calculated as a function of time, to yield a clearance curve of the contrast material from the renal pelvis. From this curve, the urine flow rate in the renal collecting system was calculated.

RESULTS

For each of the 40 cases, the obtained clearance curve highly fitted an exponential regression function with a mean correlation coefficient of 0.96. The time constant - τ of the exponential decay was automatically calculated for each case. From the known value of τ , the time $t_{1/2}$ at which half of the contrast agent has drained from the renal pelvis was calculated. The mean value of $t_{1/2}$ for the 16 cases with suspected partial obstruction was 9.1 minutes, while for the 24 cases without suspected obstruction it was 2.4 minutes. The difference between the $t_{1/2}$ value of the two groups was statistically significant ($p<0.05$).

CONCLUSION

The described algorithm provides a quantitative assessment for the urine flow rate in the renal collecting system. The calculated time at which half of the contrast agent has drained from the renal pelvis following PCNL, was significantly longer in cases with partial obstruction.

CLINICAL RELEVANCE/APPLICATION

Measuring urine flow rate by processing fluoroscopic images from a routine nephrostogram examination may be used for diagnosing and quantitatively assessing partial obstruction in the upper urinary tract. This early diagnosis will improve patient care and management.

SSQ19

Physics (CT, Tomosynthesis, Fluoroscopy)

Thursday, Nov. 30 10:30AM - 12:00PM Room: S404AB

CT PH

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

FDA Discussions may include off-label uses.

Participants

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Sub-Events

SSQ19-01 First-Reader Computerized System for Distinction between Malignant and Benign Nodules on Thoracic CT Images By Means of End-To-End Deep Learning: Convolutional Neural Network (CNN) and Neural Network Convolution (NNC) Approaches

Thursday, Nov. 30 10:30AM - 10:40AM Room: S404AB

Participants

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PURPOSE

Existing computer-aided detection (CAdE) systems have not reached high enough sensitivity to be used as a first reader. In the computer vision field, deep learning achieved overwhelming success with substantially higher performance than existing methods. Our purpose was to develop a first-reader CAdE system for distinguishing benign from malignant lung nodules in CT by using deep-learning models, namely, a CNN and our original NNC.

METHOD AND MATERIALS

We developed a CNN with 5 layers: 2 convolution layers and a pooling layer followed by a fully-connected soft-max layer, and NNC consisting of neural network regression (NNR) with 3 layers followed by a scoring layer. In NNC, convolution of the NNR was performed to process the entire 3D volume, but unlike CNN it was done outside the network. The NNC was trained with input volumes containing nodules and "teaching" maps for probability of malignancy. Namely, the desired output volumes for malignant and benign nodules contained a 3D Gaussian distribution and completely dark, respectively. Thus, the NNC was trained to enhance malignant nodules. To obtain a likelihood of malignancy, Gaussian weighting was performed on the output volume in the scoring layer. To test those 2 deep-learning models, we collected 94 lung nodules (34 malignant; 60 benign) from the LIDC-IDRI database. The malignancy and benignancy of the nodules were determined by 3 radiologists. The CT had slice thickness ranging from 0.5-3.0 mm. Tube voltage and current range from 120-140 kVp and 40-570 mA, respectively. We performed a two-fold cross-validation test. Receiver-operating-characteristic (ROC) analysis was used for evaluating the performance.

RESULTS

Our NNC achieved an area-under-the ROC curve (AUC) of 0.997, whereas the CNN achieved 0.986 ($p=.083$). Our NNC distinguished all malignant nodules correctly from 54 out of 60 benign nodules (10% false positive (FP) rate).

CONCLUSION

Our NNC classified 100% of malignant lung nodules correctly with 10% of FPs in CT. Our system could be used as a first reader where radiologists only check the cases suggested by our "screening" system.

CLINICAL RELEVANCE/APPLICATION

Our high-performance deep-learning-based system would reduce radiologists' workload thus improve the efficiency and potentially improve their diagnostic performance.

SSQ19-02 Development of a New Phantom to Measure Image Quality for Iterative Reconstruction in CT for Abdominal Scanning

Thursday, Nov. 30 10:40AM - 10:50AM Room: S404AB

Participants

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PURPOSE

To develop a novel phantom for abdominal CT image quality measurements feasible for iterative reconstructions.

METHOD AND MATERIALS

An anthropomorphic abdominal phantom, designed for ROC studies and quantitative image quality analyses was tested. The phantom consisted of 4 ROC inserts, one MTF insert, and two iodine test inserts. The iodine inserts contained 6 lesions of different sizes and density (1g and 5 g of iodine). The MTF insert contained two tungsten carbide beads. The ROC inserts contained 12 lesions (16 HU contrast to background difference). The phantom was scanned on Siemens Drive. The four ROC inserts were rotated and interchanged between scans. Scan parameters: 120 kVp, CTDIvol 10, 15 and 20 mGy, 3 mm slices, FBP B30f, Admire 2 and Admire 3 reconstructions. Three readers evaluated all images in a blinded, randomized order upon a 5 point scale, and area under curve (auc) was calculated. MTF, SNR and CNR were measured for all reconstructions and all dose levels, using ImageOwl. Spearman's rank correlation coefficient was used for evaluation of correlation between different image quality measurements.

RESULTS

For all dose levels, the iterative reconstruction techniques, Admire, had higher MTF and improved lesion detectability (significant for 10 and 15 mGy, derived from ROC studies) compared to FBP. Admire 3 had the highest score and FBP the lowest score for CNR and SNR for all dose levels. The Spearman's rank correlation coefficients for the correlation between auc and MTF, SNR and CNR were 0.26 (p=0.497), 0.81 (p=0.011) and 0.92 (p=0.001) respectively. The results indicate a strong correlation between ROC lesion detectability and SNR and CNR. The correlation between lesion detectability and MTF was not significant.

CONCLUSION

The new phantom enabled a combination of quantitative and qualitative image quality measurements important for optimization of image quality for CT examinations. The correlation between the lesion detectability and SNR and CNR was good, indicating that both quantitative and qualitative measurements give meaningful results for both FBP and the iterative reconstruction, Admire, for abdominal CT.

CLINICAL RELEVANCE/APPLICATION

Optimization of iterative reconstruction demand phantoms designed for qualitative and quantitative image quality analysis. A new abdominal phantom designed for ROC studies showed promising results.

SSQ19-03 Motion Compensated CT Imaging of the Aortic Valve

Thursday, Nov. 30 10:50AM - 11:00AM Room: S404AB

Participants

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PURPOSE

Cardiac CT imaging is used for the planning of transcatheter aortic valve implantation (TAVI). ECG correlated data acquisition and gated reconstruction enables imaging of the valve in the systolic and diastolic phase. Especially in the systolic phase, motion artifacts may occur and interfere with diagnosis and treatment planning. The purpose of the study was to analyze the efficiency of a second pass motion correction method to compensate cardiac motion.

METHOD AND MATERIALS

A time series of cardiac contrast enhanced CT volume images were first reconstructed at different phase points with a temporal distance of 5% cardiac cycle. Edge features of the valve, the valve leaflets and the neighboring vascular anatomy were enhanced in the reconstructed images by a gradient based filter which uses non-maximum-suppression and hysteresis thresholding. Afterwards, a subsequent elastic image registration was applied to estimate dense motion vector fields for the different cardiac phases. The resulting motion vector fields are included in the motion compensated filtered back projection and interpolated in the time domain to cover the temporal projection range required for reconstruction. The method was applied to retrospective ECG-gated clinical datasets acquired with a 256-slice CT scanner (Brilliance iCT, Philips Healthcare) and tested for systolic (30% R-R-interval) and diastolic (70%) imaging of the valve on ten data sets.

RESULTS

The method achieved motion artifact reduction in both heart phases. Especially in late systole a strong improvement in image quality and visibility of the valve leaflets and aortic boundaries could be observed, as well as reduced blurring compared to the gated reconstructions.

CONCLUSION

Motion compensated reconstruction of the aortic valve is feasible using edge filtering and image based registration for motion estimation. Improved CT image quality and reduced motion artifact levels can be achieved thereby facilitating improved visualization

of the aorta as well as improved planning and device selection for TAVI procedures.

CLINICAL RELEVANCE/APPLICATION

Improved CT visualization of the aorta by new image processing tools is crucial for optimized planning and device selection for TAVI procedures.

SSQ19-04 Body Position's Effect on the Subclavian Vein Artifact in Carotid Artery CT Angiography: Lateral Position vs Supine Position

Thursday, Nov. 30 11:00AM - 11:10AM Room: S404AB

Participants

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PURPOSE

Aim of this study was to assess the body position's effect on the subclavian vein artifact in carotid artery CT angiography by comparing lateral position with supine position.

METHOD AND MATERIALS

80 patients who underwent carotid artery CT angiography imaging were randomly separated into two groups: group A with patient lying with lateral position and B with patient lying with supine position (n=40 for both groups). The other scanning parameters were the same for both groups, including tube voltage of 120kV, tube current of 260mA, pitch of 1.375:1, slice thickness of 5.0mm, large FOV. 70ml contrast agent (omnipaque, 350mg/ml), 4.0ml/s of flow rate and smart contrast agent monitoring with a threshold of 200Hu were used for both groups. Image noise and CT value of subclavian artery (at the level of subclavian artery origin, vertebral artery origin and subscapular artery origin) and adjacent muscle (trapezius) were measured. Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) for subclavian artery were calculated, according the formulas: $SNR = CT_{artery} / SD$ and $CNR = (CT_{artery} - CT_{muscle}) / SD$. Subjective image quality was evaluated by two radiologists with a 5-point scale. Measurement data was compared with independent student T test, the image quality score was compared with Mann-Whitney U test.

RESULTS

The SD of group A were lower than that of group B (35.03 ± 14.09 vs 208.21 ± 35.78 , $p < 0.05$). The SNR and CNR of group A were both higher than those of group B (SNR, 14.19 ± 4.30 vs 6.40 ± 2.3 ; CNR, 10.76 ± 3.62 vs 4.86 ± 1.88 , both $p < 0.05$). The subjective image quality was also higher in group A than group B (4.30 ± 0.47 vs 3.17 ± 0.70 , $p < 0.05$).

CONCLUSION

Changed velocity vector of flowing blood via changed body position, could removed the subclavian vein artifacts during carotid artery CT angiography imaging. This technique is useful and very feasible.

CLINICAL RELEVANCE/APPLICATION

Through changed body position to changed velocity vector of flowing blood is a useful and very feasible way to removed the subclavian vein artifacts during carotid artery CT angiography imaging.

SSQ19-05 The Visibility of Peripheral Pulmonary Arteries in Pulmonary Embolism Patients by Free-breathing Combined with High-threshold Bolus Triggering Technique in CT Pulmonary Angiography

Thursday, Nov. 30 11:10AM - 11:20AM Room: S404AB

Participants

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PURPOSE

To investigate the visibility of peripheral pulmonary by computed tomography pulmonary angiography (CTPA) under free breathing mode and to explore the feasibility of this technique in pulmonary embolism patients who can't hold breathing.

METHOD AND MATERIALS

200 patients who were suspected PE underwent CTPA on GE Revolution CT. They were randomly assigned into two groups: free-breathing group (n=100) and breath-holding group (n=100). CTPA were performed with pitch 0.992:1, rotation time 0.28s and 16cm-detector. Automatic bolus-tracking was used with a monitor ROI placed on main pulmonary artery (MPA). For the free-breathing group, scan started immediately as the CT value reached a 250 HU threshold; for the breath-holding group, scan started 5 seconds after reaching an 80 HU threshold. The reconstruction slice thickness and interval were 0.625 mm with standard lung

algorithm and all images were transferred to the ADW 4.6 workstation for diagnosis and evaluation. Mean scanning time was recorded and analyzed by independent-sample t-test; the displayed distal branches of pulmonary artery was recorded and chi-square test was used for statistical analysis.

RESULTS

All CTPA were performed successfully and all the farthest branches reached of 6 or farther. There was no significant difference between the two groups in mean scanning time (0.67 ± 0.09 s vs 0.67 ± 0.10 s, $p=0.367$). The order of distal pulmonary arteries of 6, 7 and 8 in the free and holding groups were 25, 57, 18 vs 17, 61, 22 respectively. There was no significant difference between the two groups ($\chi^2=2.059$, $p=0.357$), and there was no significant statistical significance ($p > 0.5$).

CONCLUSION

Compared with breath-holding mode, the free breathing mode CTPA by 16cm-wide detector scanner has the same ability to display the peripheral pulmonary arteries.

CLINICAL RELEVANCE/APPLICATION

Free breathing CTPA can be successfully applied in PE patients, especially valuable for the patients who can't hold their breath.

SSQ19-06 Patient Dose Reduction in Tomosynthesis Imaging: Application of a New Computerized Reconstruction Technique

Thursday, Nov. 30 11:20AM - 11:30AM Room: S404AB

Participants

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PURPOSE

A high radiation dose is one of the problem in tomosynthesis examination. Generally, an increase in the number of projected images results in high image quality of reconstructed tomosynthesis images, but also increases the patient dose. In this study, we developed a new interpolation technique for improving the image quality of reconstructed tomosynthesis images with a reduced number of projection images.

METHOD AND MATERIALS

A full projected images (73 projections) were acquired with Safire17 (Shimadzu Co.) as the original data set (Orig-set). Partially projected image data sets (Sub-set) with 37, 19, and 11 projections were selected from the Orig-set with intervals of 1, 3, and 7 projections. In this study, the Path Framework (PF) method, which was originally developed for a video interpolation technique, was applied to interpolate interval projection images of Sub-set images. The pixel value of the interpolated image was estimated from one of the two input images before and after the target phase; this pixel value was determined using the shifted value between the target phase and the two input images. Using this technique, the frequency content of the original image could be preserved without blurring. Three image data sets with 73 projection images were consisted with real projection images and their interpolated projection images obtained by the PF method (PF-set). Tomosynthesis images were reconstructed by these data sets using filtered back-projection. In order to evaluate the image quality, we adopted the wire method and the two-dimensional fast Fourier transformation method for spatial resolution and noise property, respectively.

RESULTS

Spatial resolution and noise property of tomosynthesis images reconstructed from the PF-set were equivalent to those obtained from the Orig-set., whereas the spatial resolution of tomosynthesis images was clearly degraded by using a conventional interpolation technique.

CONCLUSION

The number of projected images can be reduced more than 50% by using the PF method without degradation of image quality. We believe this proposed method would be utilized for the reduction of patient dose in tomosynthesis.

CLINICAL RELEVANCE/APPLICATION

This proposed method would be applied for various tomosynthesis systems without any modification of system hardware and can realize patient dose reduction effectively.

SSQ19-07 Ex-Vivo Neuro-Imaging of Human and Animal Spinal Cords via X-Ray Phase Contrast CT: Detection of Full Organ Anatomy, Micro-Vessels and Single Motor Neurons

Thursday, Nov. 30 11:30AM - 11:40AM Room: S404AB

Participants

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PURPOSE

Achieving non-invasively both full-organ visualization and cellular-resolution in the imaging of anatomical and pathological CNS tissue structure is beyond both current clinical and preclinical cutting-edge neuroimaging techniques. In fact, the study of vascular and neurodegenerative disorders still relies heavily on sample-invasive imaging protocols, which involve dissections, staining or labeling of nervous tissue, and which in most cases fail to capture complete volumetric information on cell populations and microvasculature within a full-organ sample. In this ex-vivo study, we used a staining- and dissection-free imaging technique, X-ray phase contrast tomography (PCI-CT), to visualize full-organ vascularization and concurrent detection of single neuronal cells in excised spinal cord samples from both human donors and animals.

METHOD AND MATERIALS

Lumbar spinal cord samples, extracted from both healthy rats and human donors, were imaged using a synchrotron PCI-CT setup. We used 20-40 keV monochromatic coherent X-rays, a sCMOS-sensor PCO camera and an optics system with isometric voxels of sizes from 46^3 micron³ down to 0.3^3 micron³.

RESULTS

PCI allowed recognition and differentiation of full-organ spinal cord anatomy, including anterior/posterior gray horns, the dorsal/ventral roots and ganglions, the central canal and the meninges. Superficial as well as deep vessel architecture could be extracted without the need of any contrast-agent. Moreover, at the highest resolutions used, single neuronal cells perfused by surrounding vasculature could be recognized: distinct bundles of nerve fibers, single motor neurons and neuro-glial cells, cell bodies and axons, as well as intra-cellular structure (cell nuclei and nucleoli) were successfully detected.

CONCLUSION

CNS PCI micro-CT, with the unique detection of single cells and of single micro-vessels within full-organ samples, enables a volumetric histology-like analysis of neuronal cell populations and micro-vascular networks in extracted spinal cord samples of both human donors and animals.

CLINICAL RELEVANCE/APPLICATION

Non-invasive visualizations of full-organ CNS micro-vascularization and of neuronal cell populations are fundamental in the preclinical study of vascular and neurodegenerative diseases.

SSQ19-08 Evaluation of a New Nonrigid-Registration Method Using Non-Local Spatio-Temporal Priors on Liver Perfusion CT in Patients with Hepatic Cellular Carcinoma

Thursday, Nov. 30 11:40AM - 11:50AM Room: S404AB

Participants

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PURPOSE

To evaluate the feasibility of the Nonrigid-registration method on free-breathing liver CT perfusion in comparison with standard Rigid-registration method.

METHOD AND MATERIALS

Six studies of three patients with hepatic cellular carcinoma underwent free-breathing liver CT perfusion scanning by using a 128-row CT scanner (Revolution CT, GE Healthcare, Milwaukee, WI). The original axial CT images of all studies were registered by Nonrigid-registration method using Non-local Spatio-temporal Priors (GE Healthcare, Milwaukee, WI) and standard Rigid-registration method (ANALYZE software supplied by Mayo Clinic, Rochester, MN) respectively. The CT perfusion maps (BF, BV, MTT, PS, HAF, HAP and PVP) and motion in tumor regions on images registered by Nonrigid-registration and Rigid-registration were compared.

RESULTS

The Nonrigid-registration method significantly reduced respiratory motion on whole liver region, whereas only focused tumor region can be registered well by using standard Rigid-registration in our study. All the perfusion parameters had no statistically difference between Nonrigid-registration and Rigid-registration (all P values > .05)

CONCLUSION

The new Nonrigid-registration method using Non-local Spatio-temporal Priors gained better alignment on whole liver region than Rigid-registration. The Nonrigid-registration method promotes the application of free-breathing liver CT perfusion in clinical practice.

CLINICAL RELEVANCE/APPLICATION

Nonrigid-registration with non-local spatio-temporal can achieve a stable perfusion CT data and is a powerful method as a first step for image post-processing after CT perfusion scanning.

SSQ19-09 Improved Visibility of Guidewires and Devices for Interventional X-Ray Procedures Using a New Approach to Automatic Exposure Control

Thursday, Nov. 30 11:50AM - 12:00PM Room: S404AB

Participants

Michiel Dehairs, Leuven, Belgium (*Presenter*) Research Grant, Siemens AG

Nicholas Marshall, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose

Hilde Bosmans, PhD, Leuven, Belgium (*Abstract Co-Author*) Co-founder, Qaelum NV Research Grant, Siemens AG

Geert Maleux, MD, PhD, Leuven, Belgium (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

Current automatic exposure controls (AEC) of fluoroscopy systems adjust acquisition parameters to achieve a constant signal level in the image receptor. This study investigates a new AEC approach that sets parameters which optimize the visibility of specific materials quantified using a figure of merit (FOM). The clinical motivation is to increase efficiency and clinical outcomes in the angio suite while reducing dose.

METHOD AND MATERIALS

A Siemens Artis Q interventional system was used to image a phantom composed of 4, 8 and 12 composite plates, each of 20mm PMMA and 2mm Al, approximating the attenuation of 10, 20 and 30cm human tissue. Seven materials were studied, including iron, iodine contrast and platinum, covering a range of clinically relevant devices and contrast media. Samples were placed at the phantom center and imaged using a new AEC approach based on an FOM composed of a spatial frequency dependent signal difference to noise ratio (SDNR(u)). Standard SDNR was corrected for the influence of focal spot size and object motion blurring by multiplying with MTF based correction factors, which were calculated with access to unprocessed data. The FOM was defined as $SDNR^2(u)/\text{entrance air kerma rate}$. The FOM was measured for all samples using a total of 10 new AEC regulation curves, each optimized for a specific material, and the current standard curve. The FOM of the curve matching the correct insert was then compared to the FOM data of the other curves: taking the ratio gave an estimate of the efficiency change.

RESULTS

The new AEC improved the imaging efficiency of metals such as iron, tantalum and platinum: for the 20cm phantom the FOM increased by 16%, 165% and 164% respectively compared to the conventional AEC. There was little or no gain for the 30cm phantom, with increases of 0%, 7% and 4%, respectively, due to restricted parameter selection at large patient thicknesses. The FOM for iodine contrast increased between 15% and 20%, for the 20cm phantom.

CONCLUSION

The new AEC approach shows great potential for increasing the imaging efficiency of a wide range of materials. For a typical patient thickness of 20cm, increases between 15% and 165% were seen compared to the conventional AEC.

CLINICAL RELEVANCE/APPLICATION

Selecting AEC factors by optimizing an FOM instead of keeping X-ray detector signal constant can increase visibility of devices, guidewires and contrast media used during interventional procedures.

SSQ20

Vascular Interventional (Ablation)

Thursday, Nov. 30 10:30AM - 12:00PM Room: N227B

IR **VA**

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Nael E. Saad, MBBCh, Saint Louis, MO (*Moderator*) Research Consultant, Veran Medical Technologies, Inc; Proctor, Sirtex Medical Ltd
James T. Bui, MD, Chicago, IL (*Moderator*) Nothing to Disclose

Sub-Events

SSQ20-01 Cone Beam CT Guided Irreversible Electroporation (IRE) Probe Placement in a Liver Phantom Using a Preclinical Robotic Navigation System

Thursday, Nov. 30 10:30AM - 10:40AM Room: N227B

Participants

Arman Smakic, MD, Mannheim, Germany (*Presenter*) Nothing to Disclose
Andreas Rothfuss, DIPLENG, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
Torben Patz, Bremen, Germany (*Abstract Co-Author*) Nothing to Disclose
Michael Kostrzewa, MD, Mannheim, Germany (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Nils Rathmann, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose
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Steffen J. Diehl, MD, Mannheim, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

To evaluate a robotic assistance device for cone beam CT guided IRE probe placement in a liver phantom with regard to ability of parallel probe placement, precision and intervention time.

METHOD AND MATERIALS

16 IRE probes, covering eight lesions, were placed in a liver phantom (CIRS liver phantom 71a) using a preclinical robotic assistance device and a multi axis c-arm system. Cone beam CT was performed for intervention planning and probe position verification.

RESULTS

Parallel probe placement was achieved in all eight cases. Mean angular deviation of the needle pair was only 1.52°(±0.65°). The mean distance delta (planned distance- actual distance) of the needle pairs was only 1.05mm (±1.65mm). Mean intervention time including planning scan, needle path planning, needle placement and verification scan was 10 min 41s (± 1min 27s).

CONCLUSION

Our preclinical data shows that IRE probes can be placed precisely within an acceptable time when cone beam CT and robotic assistance is used.

CLINICAL RELEVANCE/APPLICATION

Precise and time efficient IRE probe placement is possible when combining cone beam CT and robotic assistance. This approach has great potential to expand the spectrum of possible hybrid interventions and therapeutic strategies.

SSQ20-02 Utility of the 2015 American Thyroid Association (ATA) Guidelines for the Prediction of Clinically Significant Thyroid Cancer: A Review of 1,947 Consecutive Thyroid Biopsies

Thursday, Nov. 30 10:40AM - 10:50AM Room: N227B

Participants

Amit Pandya, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Elaine M. Caoili, MD, MS, Ann Arbor, MI (*Abstract Co-Author*) Nothing to Disclose
Matthew S. Davenport, MD, Cincinnati, OH (*Abstract Co-Author*) Royalties, Wolters Kluwer nv ;

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PURPOSE

To determine if the 2015 American Thyroid Association (ATA) Guidelines effectively stratify the risk of clinically significant thyroid cancer

METHOD AND MATERIALS

We retrospectively reviewed 1947 thyroid nodules which underwent us guided Fine needle aspiration from Oct 2009 to Feb 2016 Each nodule was assigned an ATA category based on sonographic features Each pt underwent a dedicated thyroid US and US guided fine needle aspiration performed by our cross-sectional interventional team

RESULTS

We aspirated 14 category 1 lesions which have a < 1% risk of malignancy. These are thyroid cysts. None of these were found to be malignant. We aspirated 249 category 2 lesions which have a < 3% risk of malignancy. These are described as spongiform or partially cystic lesions. One malignancy was associated with each of these appearances We had 733 ATA category 3 lesions which have a 5-10% risk of malignancy. These can be described as hyperechoic nodules, isoechoic solid nodules with regular margin partially cystic with eccentric solid nodule or partially cystic with peripheral nodules. Zero to up to 2% of cancers were found with each imaging appearance We had 850 ATA category 4 lesions which have a 10-20% risk of malignancy. These can be described as solid hypoechoic nodules. 7% were found to be malignant We had 101 ATA category 5 lesions which have a greater than 70-90% risk of malignancy. These can have microcalcifications. They be hypoechoic with irregular margins or hypoechoic and be taller than wide. 31% of the hypoechoic nodules with calcifications were malignant where as 19% were found to be malignant if the nodule was hypoechoic with irregular margins.

CONCLUSION

2015 ATA guidelines; Overestimate the risk for malignancy , ephasize papillary over non-papillary cancers and may contribute to the ongoing over-diagnosis of thyroid nodules Improved risk stratification will help identify patients who will benefit from active surveillance rather than immediate fine-needle aspira

CLINICAL RELEVANCE/APPLICATION

The rapid increase of thyroid cancer is related to over-diagnosis ,87% are well differentiated (papillary) sub-clinical small cancers < 2 cm, majority progress slowly or not at all In 2015, the American Thyroid Association (ATA) presented guidelines for the management of this increasingly common clinical problem with an indolent prognosis

SSQ20-03 Propensity Score-Matched Comparison of Oncologic and Functional Mid-Term Outcomes Following Robotic Partial Nephrectomy and Percutaneous Radiofrequency Ablation for T1a Renal Cell Carcinoma

Thursday, Nov. 30 10:50AM - 11:00AM Room: N227B

Participants

Byung Kwan Park, MD, Seoul, Korea, Republic Of (*Presenter*) Nothing to Disclose

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PURPOSE

To compare oncologic and functional mid-term outcomes following RPN and RFA using propensity score-matching.

METHOD AND MATERIALS

This retrospective HIPPA-compliant study was approved by institutional review board. Between December 2008 and April 2016, 287 and 80 patients underwent RPN or RFA for T1a RCC, respectively. Each treatment was performed by a single urologist or radiologist. Sixty-three patients from each treatment group were propensity score-matched for age, sex, American Society of Anesthesiologists score, tumor size, tumor laterality, tumor histology, R.E.N.A.L. nephrometry score, and preoperative estimated glomerular filtration rate (eGFR). RCC in RPN and RFA groups was histologically confirmed via surgery and biopsy, respectively. Posttreatment follow-up periods for RPN and RFA ranged from 1-90 months (median, 24.6 months) and 1-65 months (21 months), respectively. Tumor location, percentage of eGFR preservation, local recurrence rate, and 2-year recurrence-free survival rate were compared between groups.

RESULTS

Exophytic and endophytic RCC occurred in 73.0% (46/63) and 27.0% (17/63) of the RPN group, and in 52.4% (33/63) and 47.6% (30/63) of the RFA group, respectively ($p=0.017$). There was 91.7% preservation of eGFR in the RPN group and 86.8% in the RFA group ($p=0.088$). Local recurrence rates in the RPN and RFA groups were 0% (0/63) and 4.8% (3/63), respectively ($p=0.244$). However, two-year recurrence-free survival rate was 100% in the RPN group and 95.2% in the RFA group ($p=0.029$).

CONCLUSION

RPN may provide a higher recurrence-free survival rate than RFA. However, RFA can be a treatment option for an endophytic RCC that is difficult to treat with RPN.

CLINICAL RELEVANCE/APPLICATION

Increased likelihood of recurrent tumor should be informed to patients when RFA instead of RPN is chosen for treating T1a RCC.

SSQ20-04 Irreversible Electroporation in the Proximity of Surgical Clips is Safe

Thursday, Nov. 30 11:00AM - 11:10AM Room: N227B

Participants

Martin Liebl, MD, Aachen, Germany (*Presenter*) Nothing to Disclose

Maximilian F. Schulze-Hagen, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

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Peter Isfort, MD, Aachen, Germany (*Abstract Co-Author*) Nothing to Disclose

PURPOSE

Irreversible electroporation (IRE) is a minimal-invasive treatment option for hepatic malignancies close to vessels or bile ducts, due to its non-thermal ablation effect. Materials with good electric conductivity within the ablation zone could generate unwanted heating effects due to the induced electric current. Our aim was to evaluate the heating effects during IRE and the possible influences of surgical clips within the ablation zone.

METHOD AND MATERIALS

19 IRE procedures were performed in ex-vivo bovine liver tissue using the NanoKnife device (Angiodynamics) with 2 applicators. In each experiment three consecutive treatment cycles (each 90 pulses; pulse length 90 μ s, 3000 Volt/cm) were performed immediately after each other. The electrode distance was fixed at 1.7 cm. At the midpoint between the electrodes, 4 points of interest (POI) for temperature measurements were established on a line perpendicular to the line connecting the electrodes (interelectrode line): 6 and 12 mm on both sides of the interelectrode line. On one side, a titanium surgical clip was placed at the 6 mm-POI. Temperature was measured every second at all 4 points during the electric pulse application. The mean temperature curve for all 19 ablations was calculated for each POI. After the IRE, the liver was dissected to evaluate possible tissue alterations.

RESULTS

IRE could be successfully performed in all 19 liver specimens. In the experiments an amperage of 15-20 A was reached. The titanium clip had no significant influence on the ablation temperature. The mean temperature increases at the 2 inner POI were 11.7 ± 4.5 °C (SD) and 10.3 ± 5.7 °C (SD), with a maximum of up to 20.4 °C. The mean temperatures at 6 mm to the interelectrode line were significantly higher compared to the temperatures on the same sides at 12 mm at all times during ablation with a maximum difference of 7.6 °C at the end of the energy deposition. ($p < 0.00002$). Macroscopic evaluation of treatment zones showed no signs of heat-induced tissue alterations.

CONCLUSION

Titanium surgical clips have no influence on the ablation temperature during IRE. However, during pulse application a significant temperature increase was measured.

CLINICAL RELEVANCE/APPLICATION

IRE is a safe treatment option, even near surgical resection sites containing surgical clips. Substantial heating effects can occur in the center of IRE ablations, challenging the theory of a non-thermal ablation modality.

SSQ20-05 Heat Stress and Thermal Ablation Induced Expression of Nerve Growth Factor Inducible (VGF) in Hepatocytes and HCC Cells: Pre-Clinical and Clinical Studies

Thursday, Nov. 30 11:10AM - 11:20AM Room: N227B

Awards

Trainee Research Prize - Resident

Participants

Scott M. Thompson, MD, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

Danielle Jondal, Rochester, MN (*Abstract Co-Author*) Nothing to Disclose

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Matthew R. Callstrom, MD, PhD, Rochester, MN (*Abstract Co-Author*) Research Grant, EDDA Technology, Inc; Research Grant, Galil Medical Ltd; Consultant, Medtronic plc; Consultant, Endocare, Inc; Consultant, Johnson and Johnson; Consultant, Thermedical, Inc; David A. Woodrum, MD, PhD, Rochester, MN (*Abstract Co-Author*) Consultant, Galil Medical Ltd; Consultant, Clinical Laserthermia Systems AB

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PURPOSE

Prior studies have shown that 1) sublethal heat stress of hepatocytes and HCC cells stimulates accelerated proliferation of HCC cells *in vitro* and 2) that thermal ablation of liver induces accelerated HCC tumor growth *in vivo*. The aim of the present study was to identify candidate growth factors induced by heat stress and thermal ablation *in vitro* and *in vivo* and in HCC patients undergoing thermal ablation.

METHOD AND MATERIALS

Hepatocyte and HCC cells underwent sublethal heat stress and were assessed for growth factor expression using expression microarray, qRT-PCR, western immunoblotting and ELISA. In an IACUC approved study, laser thermal ablation or sham ablation was performed in normal rat liver following HCC cell implantation. Rat liver and serum were harvested at 0-7 days post-ablation and analyzed for VGF expression using western-immunoblotting, immunohistochemistry and ELISA. Following IRB approval and informed consent, serum was collected from 16 patients undergoing thermal ablation for HCC at baseline, 3-6 hours and 18-24 hours post-ablation and analyzed for VGF using ELISA.

RESULTS

Sublethal heat stress induced a time-dependent significant increase in VGF mRNA (3-15 fold; $p < 0.05$) and protein expression in both hepatocytes and HCC cells. Additionally there was a significant 3-fold increase in VGF concentration in the supernatant 48-72 hours following sublethal heat stress of HCC cells ($p < 0.05$). Thermal ablation induced increased protein expression of VGF at the liver ablation margin 1-3 days post ablation and in HCC tumor 7 days post-ablation. There was no significant increase in serum VGF concentration following liver thermal ablation in rats or HCC thermal ablation in patients ($p > 0.05$).

CONCLUSION

Sublethal heat stress and thermal ablation induce increased VGF expression in hepatocyte and HCC cells *in vitro* and in liver and HCC tumor *in vivo* but not in serum, thereby suggesting that heat stress induced VGF expression may be localized within the liver near the ablation zone. VGF warrants further investigation as a novel candidate growth factor mediating thermal ablation induced

accelerated intrahepatic HCC tumor growth.

CLINICAL RELEVANCE/APPLICATION

Nerve growth factor inducible (VGF) is induced by thermal ablation in the liver and may represent a novel growth mechanism mediating thermal ablation induced accelerated HCC tumor growth.

SSQ20-06 Irreversible Electroporation (IRE) for the Treatment of Recurrent Prostate Cancer (PCa) after Prostatectomy, Radiation Therapy and HiFU

Thursday, Nov. 30 11:20AM - 11:30AM Room: N227B

Participants

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Boris Rubinsky, PhD, Berkeley, CA (*Abstract Co-Author*) Shareholder, InterScience GmbH

Ross E. Schwartzberg, MD, San Diego, CA (*Presenter*) Nothing to Disclose

PURPOSE

Over the last 7 years we have successfully treated over 500 patients with primary prostate cancer with Irreversible Electroporation (IRE). Here we present our experience with IRE for the treatment of recurrent prostate cancer in 36 men with a minimum follow-up of 1 year. We discuss indication, technique, efficacy, toxicity, limitations and potential pitfalls.

METHOD AND MATERIALS

36 men with recurrent prostate cancer (PCa) were treated with IRE. Initial treatments consisted of: radical prostatectomy (RPE; N=9), external beam radiation (RT; N=14), RPE and RT (N=4), high energy focal ultrasound (HiFU; N=7) and brachytherapy (N=2). Initial PCa stages were T1 (N=4), T2 (N=12), T3 (N=8), T4 (N=6) and NA (N=6), respectively. Mean follow-up time after IRE was 25.7 months (min. 13, max. 72 months). Follow-up was performed with PSA and multi-parametric (mp)MRI in all and PSMA-PET/CT and re-biopsy in selected cases. Erectile function and urinary continence were assessed by IIEF5 and ICIQ questionnaires; all other adverse events were recorded and classified by CTCAE criteria.

RESULTS

In all cases mpMRI (DCE-sequences) showed complete ablation. Grade 0 to 1 adverse events were observed in 29 cases. Grade 2 (moderate) adverse events were observed in 4 cases (urinary tract infections). A Grade 3 (severe) adverse event was observed in 3 cases (urinary retention). No Grade 4 or 5 events were noted. There was no statistically significant change in the recorded ICIQ (urinary continence) nor IIEF5 scores before and 6 months after IRE.

CONCLUSION

IRE is a suitable technique for the treatment of recurrent PCa after RPE, RT, brachytherapy and HiFU. It can be employed with lower toxicity than other second line treatments such as salvage RPE and/or RT. This could establish IRE as a 'problem solver' technology for recurrent PCa.

CLINICAL RELEVANCE/APPLICATION

Irreversible Electroporation (IRE) is a suitable treatment for recurrent PCa. Its low toxicity affords local tumor control without damage of crucial anatomical structures, particularly after RT.

SSQ20-07 Contrast-enhanced Ultrasound as an Assessment Method During Microwave Ablation for Benign Thyroid Nodules: A Prospective Study

Thursday, Nov. 30 11:30AM - 11:40AM Room: N227B

Participants

Yi Dong, MD, PhD, Shanghai, China (*Presenter*) Nothing to Disclose

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Jiaying Cao, Shanghai, China (*Abstract Co-Author*) Nothing to Disclose

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PURPOSE

The major goal of ultrasound - guided microwave ablation (MWA) procedure is to reduce the volume and eliminate the activity of benign thyroid nodules. The purpose of our present study is to observe the value of contrast-enhanced ultrasound (CEUS) during both pre- and post-treatment evaluation of MWA for benign thyroid nodules.

METHOD AND MATERIALS

Between June 2016 and February 2017, 86 patients with a total of 86 benign thyroid nodules who were admitted to our hospital for MWA treatment were included. A microwave system including a microwave generator, a flexible low-loss coaxial cable and an internally cooled shaft antenna was used. The generator is designed with a frequency of 2450 MHz and a maximum output power of 100W. The MWA antenna is 16-gauge (10cm in total length, 1.6mm in diameter, 3 mm in length of the active tip). The ablation procedures were monitored by real-time ultrasound. Before MWA, dynamic CEUS examinations were performed to make pre-treatment assessment, including blood perfusion of nodules and their relationship with surrounding large vessels. One day and six months after ablation, the post-treatment CEUS were conducted to evaluate whether the original nodule was completely ablated.

RESULTS

During pre-ablation CEUS evaluation, peripheral hyperenhanced rings were detected during arterial phase of all nodules, with mean thickness 1.4 ± 0.6 mm. Fifteen nodules were located very close to superior or inferior thyroid artery. MWA were conducted successfully in all 86 thyroid nodules. Post-ablation CEUS showed that 82 (95.3%) nodules with complete ablation had no enhancement. The peripheral hyperenhanced ring disappeared in all nodules. The volume reduction of 91 ± 7.3 % was achieved with benign thyroid nodules after six months by ultrasound guided MWA. No major complications occurred.

CONCLUSION

Microwave ablation with real time ultrasound guidance is an effective and safe method in treatment of benign thyroid nodules. CEUS is a sensitive and effective method to make both pre-treatment evaluation and post-treatment efficacy of MWA.

CLINICAL RELEVANCE/APPLICATION

With application of CEUS both pre-and post-treatment of WMA, we can guarantee the effective and safety of treatment.

SSQ20-08 Percutaneous Cryoablation of Lymph Node Metastases

Thursday, Nov. 30 11:40AM - 11:50AM Room: N227B

Participants

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PURPOSE

To assess the safety and efficacy of percutaneous computed tomography (CT)-guided cryoablation for local control of lymph node metastases in patients with oligometastatic malignancy.

METHOD AND MATERIALS

In this single-institution study, a retrospective search of the institutional cryoablation database identified 39 unique patients (mean age 64 ± 14 years; 33 men, 6 women) treated with 45 cryoablation procedures targeting a total of 48 lymph nodes between October 2006 and March 2017. Patient demographics, disease characteristics, and procedural details were recorded. Primary endpoints were technical success and complications. The secondary endpoint was time to local progression. Technical success was defined as complete coverage of the target node by the ablation zone. Complications were graded according to the Society of Interventional Radiology consensus guidelines. Time to progression was calculated using the Kaplan-Meier method.

RESULTS

Technical success was achieved in 100% of cases. Targeted nodes measured 1.8 ± 1.6 cm (mean short axis diameter). Adjunctive maneuvers performed to protect adjacent structures included hydrodissection ($n=28$) and preprocedural ureteral stenting ($n=2$). There were no major complications. One patient developed a subcutaneous hematoma following ablation of an axillary lymph node and required thrombin injection to control bleeding. Another patient developed a tiny apical pneumothorax following ablation of a supradiaphragmatic node, prompting temporary chest tube placement and overnight observation. Mean imaging follow-up duration was 17.3 months. Local recurrence occurred in 9/48 cases (19%) with a mean time to progression of 18.8 ± 3.1 months.

CONCLUSION

Percutaneous cryoablation is a safe and effective therapy for achieving local control of lymph node metastases in the setting of oligometastatic malignancy. Further investigation is warranted to determine long-term efficacy.

CLINICAL RELEVANCE/APPLICATION

Percutaneous image-guided cryoablation is safe and effective for treatment of limited nodal metastases and may be a useful adjunct to other oncologic therapies for achieving local control of oligometastatic disease.

SSQ20-09 Tumor Response Assessment in Unresectable Hepatocellular Carcinoma (HCC) Patients: Functional MRI as a Substitute for Traditional Anatomic Sized Based Tumor Response Assessment

Thursday, Nov. 30 11:50AM - 12:00PM Room: N227B

Participants

Mounes Aliyari Ghasabeh, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Pegah Khoshpouri, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
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Nanna Shao, MBBS, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Li Pan, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
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Angela Jacob, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
Yan Luo, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose
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PURPOSE

The aim of this study was to evaluate superiority of functional MRI biomarkers to traditional sized based criteria in assessing tumor response in unresectable HCC patients who had trans-arterial chemoembolization (TACE).

METHOD AND MATERIALS

One hundred and seventy HCC patients with unresectable lesions were enrolled in this retrospective HIPAA-compliant study. Informed consent was waived. All patients had baseline MRI, 3-4 weeks and 6 months' follow-up MRI after TACE therapy. Change in functional MRI biomarkers (Apparent diffusion coefficient (ADC), arterial enhancement (AE) and tumor volume) were measured on 3-4 weeks MRI using a semiautomatic volumetric software package (Onco Treat, 3.1.1, Siemens). Anatomic response variables including Response Evaluation Criteria in Solid Tumors (RECIST), modified RECIST (mRECIST), and European Association for the Study of the Liver (EASL) were measured on 6 months' follow-up MRI. Patients were stratified into responder and non-responder groups based on median survival (20 months). Change in functional variables (ADC, AE, tumor volume) at 1 month and change in anatomic variables (RECIST, mRECIST, EASL) at 6 months were measured for each group. Hazard ratio (HR) was calculated for all variables with Cox proportional hazards model.

RESULTS

Mean volumetric change in ADC, AE, tumor volume, RECIST, mRECIST and EASL were summarized in Table 1. ADC and AE change were significantly different between responder and non-responder group ($p = 0.0007$ and 0.001 ; respectively) whereas tumor volume, RECIST, mRECIST and EASL were not ($p = 0.6, 0.23, 0.34, 0.4$; respectively). Patients with greater than 15% increase in ADC demonstrated better overall survival (OS) compared with those with $<15\%$ increase in ADC; hazard ratio for predicting increased OS was 0.59 (95% CI: $0.3-0.8$; $p = 0.01$) (Fig 1-A, B). Also, patients with greater than 23% decrease in AE demonstrated better OS than those who did not; HR: 0.60 (95% CI: $0.4-0.5$; $p = 0.01$) (Fig 1-C, D).

CONCLUSION

ADC and AE changes precede and are superior to anatomic criteria in assessing treatment response to TACE.

CLINICAL RELEVANCE/APPLICATION

Functional MRI biomarkers provide early and more accurate prediction of tumor response in HCC patients undergoing TACE. These metrics can potentially be used in future clinical trials.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Ihab R. Kamel, MD, PhD - 2015 Honored Educator

MSRT54

ASRT@RSNA 2017: Gender Diversity - It's The Parts That Matter

Thursday, Nov. 30 11:45AM - 12:45PM Room: N230B

PR

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

Participants

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Virginia Sanders, Calgary, AB (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Gain an understanding of how gender variances effect reproductive organ placement. 2) Bring awareness to the marginalization that people in the gender spectrum face during their experiences in health care. 3) Apply the gender continuum to formulate new communication methods for the purpose of radiation protection.

ABSTRACT

Traditionally MRTs have used a binary sex model known as male /female to determine appropriate radiation protection practices. This binary model is now obsolete. Now, a gender continuum has been identified that contains many different categories of gender variance. Gender variances that are presented within this continuum may include sex to gender congruency and sex to gender non congruencies. Therefore, it is imperative for us as MRTs to be aware of the diversity within the gender continuum as we are the ones delivering ionizing radiation to the public. To adhere to best practice guidelines for radiation protection, we must determine the location of the patients' reproductive organs and degree of mammary gland development. Questionnaires and communication must be adapted to ensure that MRTs are protecting the public appropriately, while remaining professional and respectful of people's diversity.

RCA53

Leveraging Machine Learning Techniques and Predictive Analytics for Knowledge Discovery in Radiology (Hands-on)

Thursday, Nov. 30 12:30PM - 2:00PM Room: S401AB

IN

AMA PRA Category 1 Credits [™]: 1.50

ARRT Category A+ Credit: 1.75

Participants

Kevin Mader, DPhil,MSc, Zuerich, Switzerland (*Moderator*) Employee, 4Quant Ltd; Shareholder, 4Quant Ltd

Kevin Mader, DPhil,MSc, Zuerich, Switzerland (*Presenter*) Employee, 4Quant Ltd; Shareholder, 4Quant Ltd

Joshy Cyriac, Basel, Switzerland (*Presenter*) Nothing to Disclose

Bram Stieltjes, MD,PhD, Basel, Switzerland (*Presenter*) Nothing to Disclose

Barbaros S. Erdal, PhD, Columbus, OH (*Presenter*) Nothing to Disclose

Luciano M. Prevedello, MD, MPH, Columbus, OH (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Review the basic principles of predictive analytics. 2) Be exposed to some of the existing validation methodologies to test predictive models. 3) Understand how to incorporate radiology data sources (PACS, RIS, etc) into predictive modeling. 4) Learn how to interpret results and make visualizations.

ABSTRACT

During this course, an introduction to machine learning and predictive analytics will be provided through hands on examples on imaging metadata (scan settings, configuration, timestamps, etc). Participants will use open source as well as freely available commercial platforms in order to achieve tasks such as image metadata and feature extraction, statistical analysis, building models, and validating them. Imaging samples will include datasets from a variety of modalities (CT, PET, MR) and scanners. The course will begin with a brief overview of important concepts and links to more detailed references. The concepts will then be directly applied in visual, easily understood workflows where the participants will see how the data are processed, features are selected, and models are built.

RCC53

Informatics Strategic Planning and Execution: How-To's and Lessons Learned

Thursday, Nov. 30 12:30PM - 2:00PM Room: S501ABC



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Christopher J. Roth, MD, Durham, NC (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Learn how to create an effective imaging IT and informatics strategic plan that will align practice and health system operations, infrastructure, capabilities, human resources, and provider governance around future direction. 2) Understand how your strategic plan can incorporate cross cutting themes like revenue, care quality, branding, and innovation in areas such as EHR image enablement, image exchange, clinical decision support, procurement, and IT security.

ABSTRACT

Since almost all of radiology based in IT and informatics today, having a broad and multifaceted imaging informatics strategic plan is necessary. An imaging IT and informatics strategic plan requires alignment between the goals of your practice - private or academic - and your health system, and your department and health system IT teams. Strategic plan creation is however complex and time consuming work. This session will provide time saving how-tos and lessons learned from private practice and academic radiology departments who have successfully deployed an imaging informatics strategy.

Sub-Events

RCC53A Private Practice Informatics Strategy Development

Participants

Syed Furqan Zaidi, MD, El Segundo, CA (*Presenter*) Nothing to Disclose

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LEARNING OBJECTIVES

1) Discuss data analytic tools to measure clinical quality and outcomes. 2) Identify data mining strategies to build the radiology department's quality platform. 3) Describe the use of data mining to engage in population health management.

ABSTRACT

The purpose of this session is to educate radiologists about data analytics tools available for use, along with data mining strategies. The application of data mining to demonstrate the value and impact of radiology on downstream quality and utilization in healthcare will be discussed. Private practice strategies to use analytics as a strategic differentiator as well as defining the role of radiology in population health management, will be discussed.

RCC53B Radiology Department Informatics Strategy Development

Participants

Cree M. Gaskin, MD, Keswick, VA (*Presenter*) Author with royalties, Oxford University Press; Author with royalties, Thieme Medical Publishers, Inc; Research Grant, Carestream Health, Inc; ;

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Identify major radiology informatics issues that may warrant a strategic plan. 2) Apply radiology departmental informatics strategies which have been successful at other institutions.

RCC53C Enterprise Imaging Informatics Strategy Development

Participants

Christopher J. Roth, MD, Durham, NC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand methods for gathering and aligning individual and department imaging informatics needs with enterprise wide Goals, Strategies, Key Initiatives, Outcomes, Future States, Dependencies and Risks. 2) Review some strategic planning frameworks applicable to health systems wishing to pursue image capture, storage, indexing, EHR distribution, viewing, exchange, analytics, and governance for the spectrum of enterprise imaging content they own.

MSCA51

Case-based Review of the Abdomen (An Interactive Session)

Thursday, Nov. 30 1:30PM - 3:00PM Room: S100AB

GI

AMA PRA Category 1 Credits [™]: 1.50
ARRT Category A+ Credit: 1.75

Participants

Julie H. Song, MD, Providence, RI (*Director*) Nothing to Disclose

Sub-Events

MSCA51A Imaging of Liver

Participants

Jay P. Heiken, MD, Saint Louis, MO (*Presenter*) Patent agreement, Guerbet SA; Patent agreement, Bayer AG

For information about this presentation, contact:

heikenj@wustl.edu

LEARNING OBJECTIVES

1) Identify the imaging features of select benign and malignant liver masses. 2) Discuss the indications for MRI hepatobiliary contrast agents. 3) Apply basic principles of LI-RADS categorization of observations in patients with cirrhosis.

MSCA51B Imaging of Pancreas

Participants

Frank H. Miller, MD, Chicago, IL (*Presenter*) Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Diagnose the typical imaging appearances of common and uncommon pancreatic lesions. 2) Recognize the less common but increasingly important types of pancreatitis. 3) Recognize and analyze mimickers of common benign and malignant pancreatic lesions.

ABSTRACT

MR imaging of the pancreas can be useful as a problem-solving tool, based on initial imaging on sonography or MDCT, but MRI can be the initial imaging exam of choice. With newer imaging sequences such as diffusion-weighted imaging, MR offers improved ability to detect and characterize lesions, as well as identify and stage tumors and inflammation. MR can also be used to help delineate and better define both cystic and solid pancreatic neoplasms. MR is particularly useful in the evaluation and staging of both acute and chronic pancreatitis as well as their complications. MR can help evaluate the uncommon forms of pancreatitis. This presentation reviews the use of MR to evaluate the pancreas, including recent advances and discusses inflammatory diseases, congenital abnormalities, and neoplasms of the pancreas.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Frank H. Miller, MD - 2012 Honored Educator Frank H. Miller, MD - 2014 Honored Educator Frank H. Miller, MD - 2017 Honored Educator

MSCA51C Imaging of Kidneys

Participants

Stuart G. Silverman, MD, Brookline, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

sgsilverman@bwh.harvard.edu

LEARNING OBJECTIVES

1) Diagnose renal infections that may mimic a renal neoplasm. 2) Diagnose and recommend management for incidental small renal masses including those which are incompletely characterized. 3) Use CT urography to diagnose urothelial carcinoma of the kidney.

MSCA51D Women's Imaging

Participants

Marcia C. Javitt, MD, Haifa, Israel (*Presenter*) Consultant, Bayer AG;

LEARNING OBJECTIVES

1) Recognize imaging patterns of benign and malignant disease, to analyze key findings that enable an informed interpretation. 2) Be mindful of the need for accurate, safe, and efficient patient management.

ABSTRACT

This case based review of female pelvic imaging will emphasize the process of triage, appropriate selection of diagnostic imaging tools, lesion detection, characterization, and differential diagnosis. The complimentary role of Ultrasound, CT, and MRI will be emphasized with a discussion of the utility of each modality, the clinical impact on medical decision making, and the need for cost minimization.

MSCB51

Case-based Review of Breast (An Interactive Session)

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

BR MR US

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Jiyon Lee, MD, New York, NY (*Director*) Nothing to Disclose

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Jiyon.Lee@nyumc.org

LEARNING OBJECTIVES

1) Identify appropriate application of multimodality breast imaging for routine screening, supplemental screening, and diagnostic indications. 2) Select appropriate methods for image-guided percutaneous biopsy and perform post-biopsy radiologic-pathologic correlation for next management recommendation. 3) Review appropriateness criteria and performance benchmarks, and guidelines for ongoing breast imaging audits.

ABSTRACT

Our case-based review course will use the interactive audience response system (ARS) to walk and skip through the fundamentals of breast imaging. We will present how we use mammography, ultrasound, and MRI in daily screening and diagnostic scenarios, along with reminders of overarching principles of ACR appropriateness criteria and performance metrics. Our international faculty (sessions 1 and 2) will also add depth, and the fun added dimensions of how breast imaging works around the world. Varying breast cancer statistics, possible innate ethnic variations, differing cultural expectations and socioeconomic context can and do impact how we carry out our discretionary work. Such interesting details will inform the narrative of the speakers' case scenarios, while the core diagnostic radiology skills aim to be constant, and teachable. The focus is using lots of cases to demonstrate breast imaging now and evolving. Please join us for smart fun!

Sub-Events

MSCB51A Mammography and Ultrasound: Appropriateness Criteria and Performance Measures in the United States

Participants

Priscilla J. Slanetz, MD, MPH, Boston, MA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

pslanetz@bidmc.harvard.edu

LEARNING OBJECTIVES

1) Discuss the appropriate indications for screening and diagnostic mammography for symptomatic and asymptomatic patients. 2) Describe the target metrics of performance for interpretation of mammography and breast ultrasound in the United States. 3) Understand the components of the MQSA audit and their implications for clinical practice. 4) Preview emerging imaging tools for which performance metrics have yet to be established and discuss their potential clinical utility.

MSCB51B Screening and the Rest: Use the Tools You've Got

Participants

Jean M. Seely, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jeseely@toh.ca

LEARNING OBJECTIVES

1) Recognize the fundamental tools available to evaluate screening mammography performance. 2) Understand the target metrics of performance in the Canadian screening mammography program. 3) Identify some practical educational methods to help improve screening mammography performance. 4) Perform a basic audit of a screening mammography program.

ABSTRACT

This course will provide basic information about performance metrics used in the Canadian population based screening program and show how these metrics can be applied to help improve performance with an educational approach. Using a case-based approach the course will provide practical ways for evaluating and improving performance in screening mammography.

MSCB51C Breast MRI Cases: Appropriateness Criteria and Performance Measures in the United States

Participants

Peter R. Eby, MD, Seattle, WA (*Presenter*) Consultant, Leica Biosystems Nussloch GmbH

For information about this presentation, contact:

peter.eby@virginiamason.org

LEARNING OBJECTIVES

1) Recognize and discuss the appropriate and inappropriate indications for breast MRI in the United States. 2) Understand the target metrics of performance for individuals and groups reading breast MRI in the United States. 3) Perform a basic audit of a breast MRI program and interpret the results. 4) Discuss the risks and benefits of breast MRI in terms of general test performance with patients.

Active Handout: Peter R. Eby

[http://abstract.rsna.org/uploads/2017/17000531/Active MSCB51C.pdf](http://abstract.rsna.org/uploads/2017/17000531/Active_MSCB51C.pdf)

MSCB51D Breast MRI in Netherlands and Europe

Participants

Ritse M. Mann, MD, PhD, Nijmegen, Netherlands (*Presenter*) Research agreement, Siemens AG; Research agreement, Seno Medical Instruments, Inc; Research agreement, Identification Solutions Inc; Research agreement, Micrima Limited; Scientific Advisor, ScreenPoint Medical BV

LEARNING OBJECTIVES

1) Have a feeling for the breast radiology within the Netherlands and Europe and the varying use of guidelines. 2) Discuss the patient information to women prior to breast MRI. 3) Understand the use and indications for breast MRI in Europe. 4) Describe common European protocols for breast MRI.

ABSTRACT

This session will provide insight in the European use of breast imaging with a specific focus on breast MRI

SPRG51

RadioGraphics' Publication Information for Potential Authors

Thursday, Nov. 30 1:30PM - 2:45PM Room: E353A

OT

AMA PRA Category 1 Credits [™]: 1.25
ARRT Category A+ Credits: 1.50

Participants

Jeffrey S. Klein, MD, Burlington, VT (*Presenter*) Nothing to Disclose
James Clinton, Oak Brook, IL (*Presenter*) Nothing to Disclose
Stephanie Khio, Oak Brook, IL (*Presenter*) Nothing to Disclose
Melissa L. Reen, Burlington, VT (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jklein@rsna.org

LEARNING OBJECTIVES

1) Explain the process that RadioGraphics uses to invite manuscripts for consideration of publication. 2) Detail the differences in submitting standard manuscripts and interactive online presentations for the Training and Fundamentals section of the journal. 3) Understand the process of submitting manuscripts for consideration. 4) List criteria used by the journal to render decisions on peer-reviewed papers and online journal presentations.

ABSTRACT

This course, directed towards those education exhibit exhibitors who have been notified that their exhibit is to be invited for submission to RadioGraphics for 2018, will review the process the journal uses to identify content for potential submission and detail the submission and decision processes for standard manuscripts and interactive online presentations. Staff of the Publications group at RSNA and the editor will provide information to aid in the development and submission of materials for the journal's consideration. There will be ample time for questions.

LEARNING OBJECTIVES

1) Prepare a format- and content-compliant manuscript or Powerpoint[™] presentation for possible publication. 2) Use ScholarOne Manuscripts to submit a manuscript for possible publication. 3) Become familiar with the RadioGraphics publication process.

VSIO51

Interventional Oncology Series: IO Practice and Clinical Trials

Thursday, Nov. 30 1:30PM - 6:00PM Room: S405AB



ARRT Category A+ Credits: 5.00
AMA PRA Category 1 Credits™: 4.25



Discussions may include off-label uses.

Participants

Riad Salem, MD, MBA, Chicago, IL (*Moderator*) Research Consultant, BTG International Ltd Research Grant, BTG International Ltd

Sub-Events

VSIO51-01 Nuts and Bolts of Clinical Trials in Oncology: Why and How?

Thursday, Nov. 30 1:30PM - 1:50PM Room: S405AB

Participants

Stacey M. Stein, MD, New Haven, CT (*Presenter*) Nothing to Disclose

VSIO51-02 Strengths and Weaknesses of Retrospective Data

Thursday, Nov. 30 1:50PM - 2:10PM Room: S405AB

Participants

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

For information about this presentation, contact:

r-lewandowski@northwestern.edu

LEARNING OBJECTIVES

1) Learn rationale behind performing retrospective research. 2) Gain basic understanding of strengths of retrospective data. 3) Gain basic understanding of weaknesses of retrospective data.

VSIO51-03 Comparative Radioembolization Outcomes between Various Hepatic Malignancies: A Single Institution Experience

Thursday, Nov. 30 2:10PM - 2:20PM Room: S405AB

Awards

Student Travel Stipend Award

Participants

Abieyuwa Eweka, MD, Mineola, NY (*Presenter*) Nothing to Disclose
Joshua Harris, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Neha DeSouza, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Derek T. Kim, Port Jefferson, NY (*Abstract Co-Author*) Nothing to Disclose
Prashanti Atluri, Mineola, NY (*Abstract Co-Author*) Nothing to Disclose
Jason C. Hoffmann, MD, Mineola, NY (*Abstract Co-Author*) Consultant, Merit Medical Systems, Inc; Speakers Bureau, Merit Medical Systems, Inc

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PURPOSE

Transcatheter arterial radioembolization (TARE) with Y90 has been increasingly utilized in multiple tumor types over the past 5-10 years, for patients with primary hepatic malignancy or metastatic disease that is either liver-dominant or liver-only in distribution. As there is a relative paucity of data in the current literature comparing response rates across various tumor types, the goal of this study is to report short and medium-term data about response rates when using TARE to treat a variety of hepatic tumors.

METHOD AND MATERIALS

This single-institution, retrospective study included all patients with hepatic malignancy treated with TARE from May 2012 to June 2016. Patients had a primary diagnosis of colon, breast, HCC, carcinoid, pancreatic or gastric cancer. Response was determined according to RECIST 1.1 criteria, based on each patient's followup cross-sectional imaging. 67 doses were administered to 44 patients. The mean dose administered was 25.27 mCi. The primary endpoint was response to therapy. The secondary endpoint was time to progression in the liver.

RESULTS

There were no major complications noted during the study period. Mild post-embolization syndrome occurred in 37 patients (84%), which was self-limiting with no hospitalizations. Initial post-treatment cross-sectional imaging was obtained at an average of 13.9 ($\pm$ 3.55 weeks, 95% CI) weeks on all patients, with 68% of patients demonstrating partial response, 29% stable disease and 3% of patients with progression. Median imaging follow-up was 6.86 months ($\pm$ 1.5 months, 95% CI). Over that time period, 16% of patients developed recurrence or disease progression in previously treated lesions. In these patients, the median time to liver progression was 66 weeks. Highest disease control rates were seen in HCC and carcinoid during the study period, which are classically hypervascular tumors.

CONCLUSION

TARE is an effective and durable means of attaining control of unresectable hepatic malignancy. Patients with HCC demonstrated the highest response rate overall. This data adds to the building body of evidence supporting the use of TARE, and is unique as it comparatively assesses TARE response rates in various hepatic malignancies.

CLINICAL RELEVANCE/APPLICATION

TARE can be used effectively to provide acceptable rates of liver tumor disease control in a wide variety of hepatic malignancies.

VSIO51-04 Are Randomized Clinical Trials Mandatory in IO?

Thursday, Nov. 30 2:20PM - 2:40PM Room: S405AB

Participants

Stacey M. Stein, MD, New Haven, CT (*Presenter*) Nothing to Disclose

VSIO51-05 Imaging Issues in Interventional Oncology Trials

Thursday, Nov. 30 2:40PM - 3:00PM Room: S405AB

Participants

Richard Kinh Gian Do, MD, PhD, New York, NY (*Presenter*) Consultant, Guerbet SA

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VSIO51-06 CT Perfusion for Characterization of Embolization Effects after DEB-TACE versus Lipiodol Injection in the VX2 Liver Cancer Model

Thursday, Nov. 30 3:00PM - 3:10PM Room: S405AB

Participants

Eleni A. Liapi, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

Sahar Mirpour, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Pramod P. Rao, MBBS, DMRD, Strasbourg, France (*Abstract Co-Author*) Nothing to Disclose

Olivier Pellerin, MD, MSc, Paris, France (*Abstract Co-Author*) Nothing to Disclose

Vania Tacher, MD, Baltimore, MD (*Abstract Co-Author*) Nothing to Disclose

Jean-Francois H. Geschwind, MD, Westport, CT (*Abstract Co-Author*) Consultant, Koninklijke Philips NV; Consultant, Terumo Corporation; Consultant, Bayer AG; Consultant, Boston Scientific Corporation; Consultant, BTG International Ltd; Consultant, Bristol-Myers Squibb Company; Consultant, Johnson & Johnson; Consultant, Guerbet SA; Consultant, Merck & Co, Inc; Research Grant, Boston Scientific Corporation; Research Grant, BTG International Ltd; Research Grant, Guerbet SA; Research Grant, Koninklijke Philips NV; Research Grant, PreScience Labs, LLC; Founder and CEO, PreScience Labs, LLC

PURPOSE

To characterize the vascular embolization effects of DEB-TACE versus lipiodol embolization with wide-array volumetric CT perfusion in the rabbit VX2 liver model.

METHOD AND MATERIALS

Twenty rabbits implanted with VX2 liver tumor were treated with either DEB-TACE (n=10, 100-300 microns) or lipiodol injection (n=10) at 2 weeks following tumor implantation. Wide array CT perfusion of liver was performed at baseline and 7 days post-treatment. CT perfusion parameters analyzed included arterial (AF) and portal flow (PF), as well as perfusion index (PI), for tumor and hepatic lobes.

RESULTS

There was a statistically significant decrease in tumor AF after DEB-TACE (p=0.002), but no change in PF or PI. In contrast, there was a statistically significant decrease in tumor PI (p=0.003) after lipiodol embolization, without change in AF and PF. After DEB-TACE, liver parenchyma in proximity with the tumor showed a statistically significant change in AF (p=0.02) and PF (p=0.04). After lipiodol embolization, liver parenchyma in proximity to the tumor showed no statistically significant change in AF, PF or PI. Contralateral liver parenchyma did not show any statistically significant changes after treatment with either DEB-TACE or lipiodol injection.

CONCLUSION

CT perfusion of liver may identify distinct changes in tumor vascularity after DEB-TACE or lipiodol embolization, representing the different levels of vascular embolization after each procedure, most likely larger order vessels for DEB-TACE and microvasculature for lipiodol embolization.

CLINICAL RELEVANCE/APPLICATION

In clinic, CT perfusion may be used to characterize the success of embolization after DEB-TACE or lipiodol embolization and demonstrate the level of embolization in the tumor vasculature.

VSIO51-07 Introduction to Cost-Effectiveness Trials

Thursday, Nov. 30 3:10PM - 3:30PM Room: S405AB

Participants

Nishita Kothary, MD, Stanford, CA (*Presenter*) Scientific Advisor, Siemens AG;

LEARNING OBJECTIVES

1) Briefly review the elements of cost-effective studies. 2) Understand the urgency to conduct such trials. 3) Identify opportunities where IR can emerge as a leader in providing excellent care while reducing the financial burden on the society.

ABSTRACT

The US healthcare system is one of the most expensive without providing a substantial gain in overall health of its population. The growing cost and limited resources make this practice unsustainable. Hence, identifying areas in which IR can provide lower cost yet equally effective solutions will be key to the growth of the specialty.

VSIO51-08 Introduction to Statistics and the P-Value (Facts and Myths): Does the Magnitude of the P Value Matter?

Thursday, Nov. 30 3:30PM - 3:50PM Room: S405AB

Participants

Jeffrey D. Blume, PhD, Nashville, TN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

(1) To understand the origins of the p-value and its proper usage (2) To understand why confidence intervals are critical when interpreting results, and how p-value based inference can go awry when confidence intervals are not considered.

ABSTRACT

Verifying that a statistically significant result is scientifically meaningful is not only good scientific practice, it is a natural way to control the Type I error rate. Here I will review the origins of p-value based inference by contrasting significance testing with hypothesis testing. I will explain the role of the tail area probability in both inferential paradigms and I will show examples to illustrate why p-value based inference, without reference to a confidence interval, can be highly misleading.

VSIO51-09 Power and Statistical Significance of Data in Clinical Trials - Lessons Learned by Surgeons and Interventional Oncologists

Thursday, Nov. 30 3:50PM - 4:10PM Room: S405AB

Participants

Carl Schmidt, MD, Columbus, OH (*Presenter*) Nothing to Disclose

VSIO51-10 Outcomes in Interventional Oncology Trials: Survival as an Endpoint for Staged and Repeatable Therapies

Thursday, Nov. 30 4:20PM - 4:40PM Room: S405AB

Participants

Michael C. Soulen, MD, Philadelphia, PA (*Presenter*) Royalties, Cambridge University Press; Consultant, Guerbet SA; Research support, Guerbet SA; Research support, BTG International Ltd; Consultant, Merit Medical Systems, Inc; Speaker, Sirtex Medical Ltd; Consultant, Terumo Corporation; Consultant, Bayer AG

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) To understand the many different definitions of survival used in clinical trials and when to employ each. 2) To explore design strategies used in clinical trials for staged therapies such as embolization. 3) To explore design strategies used in clinical trials for repeatable therapies such as embolization and ablation.

VSIO51-11 Using Machine Learning to Automate Response Criteria Calculations Following Loco-Regional Therapies: Applications to Interventional Oncology

Thursday, Nov. 30 4:40PM - 4:50PM Room: S405AB

Participants

Aaron C. Abajian, BS, MA, New York, NY (*Presenter*) Employee, Health Fidelity, Inc
John Treilhard, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Johanna M. van Breugel, MSc, Utrecht, Netherlands (*Abstract Co-Author*) Nothing to Disclose
Irvin Rexha, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Milena A. Miszczuk, New Haven, CT (*Abstract Co-Author*) Nothing to Disclose
Ming De Lin, PhD, Cambridge, MA (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jean-Francois H. Geschwind, MD, Westport, CT (*Abstract Co-Author*) Consultant, Koninklijke Philips NV; Consultant, Terumo Corporation; Consultant, Bayer AG; Consultant, Boston Scientific Corporation; Consultant, BTG International Ltd; Consultant, Bristol-Myers Squibb Company; Consultant, Johnson & Johnson; Consultant, Guerbet SA; Consultant, Merck & Co, Inc; Research Grant, Boston Scientific Corporation; Research Grant, BTG International Ltd; Research Grant, Guerbet SA; Research Grant, Koninklijke Philips NV; Research Grant, PreScience Labs, LLC; Founder and CEO, PreScience Labs, LLC

For information about this presentation, contact:

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PURPOSE

Assessment of tumor response after loco-regional therapies plays an important role in evaluating treatment success. Response calculations are time-consuming, suffer from inter-operator variability, and do not take into consideration clinical features. Our objective was to use supervised machine learning to automate the calculation of response assessment for patients with hepatocellular carcinoma (HCC) who undergo transarterial chemoembolization (TACE). Our model integrates clinical features alongside imaging characteristics.

METHOD AND MATERIALS

A cohort of 34 patients diagnosed with HCC and treated with TACE was selected for analysis. qEASL response criteria were applied to classify each patient as a responder or non-responder. The qEASL classifications were used as target labels to train logistic regression (LR), random forest (RF), and support vector machine (SVM) classifiers. We derived 40 features from imaging, clinical, and demographic data. An 80% variance threshold and a univariate chi-squared cutoff were applied to reduce the feature space. Leave-one-out cross-validation was used to validate the models.

RESULTS

qEASL identified 7/34 (20.6%) patients as responders and 27/34 (79.4%) as non-responders. Five features satisfied the variance and univariate chi-squared cutoffs: i. post-TACE mean liver intensity ($p=0.15$), ii. pre-TACE mean tumor intensity ($p=0.20$), iii. performance status ($p=0.27$), iv. cirrhosis ($p=0.44$), and v. hepatitis C status ($p=0.51$). Our LR, SVM and RF models correctly classified the outcome in 3/7 (42.9%), 2/7 (28.6%), and 0/7 (0.0%) of responders and 25/27 (92.6%), 23/27 (85.2%), and 33/34 (96.3%) of non-responders, respectively.

CONCLUSION

The LR, RF and SVM models accurately identified non-responders to TACE therapy. The LR and RF models also showed promise at identifying responders. Clinical and imaging feature selection play an important role as variables known to be correlated with response are essential in training an accurate model.

CLINICAL RELEVANCE/APPLICATION

Machine learning reduces the time required to compute response criteria, removes inter-operator variability and provides reasonable accuracy in identifying non-responders to TACE treatment. Our work demonstrates that clinical features are important to the interpretation of imaging-based response assessments.

VSIO51-12 Predictors and Surrogate Endpoints of Long-term Outcomes

Thursday, Nov. 30 4:50PM - 5:10PM Room: S405AB

Participants

Etay Ziv, MD, PhD, New York, NY (*Presenter*) Nothing to Disclose

VSIO51-13 Quality of Life and Pain Management: Are These Appropriate Endpoints in IO?

Thursday, Nov. 30 5:10PM - 5:30PM Room: S405AB

Participants

Bernhard Gebauer, MD, Berlin, Germany (*Presenter*) Research Consultant, C. R. Bard, Inc; Research Consultant, Sirtex Medical Ltd; Research Grant, C. R. Bard, Inc; Research Consultant, PAREXEL International Corporation; Travel support, AngioDynamics, Inc;

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) To understand commonly used QoL assessment scores/scales and toxicity analysis techniques. 2) To learn about loco-regional therapies to improve patient's pain in end-stage cancer disease. 3) To gauge the economic benefits of IO therapies.

VSIO51-14 Risk Factors of Severe Abdominal Pain during and After Intra-Arterial Hepatic Treatments: A Prospective Study with Visual Analog Scale Evaluation

Thursday, Nov. 30 5:30PM - 5:40PM Room: S405AB

Participants

Atanas Pachev, Clichy, France (*Presenter*) Nothing to Disclose
Maxime Ronot, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Matthieu Lagadec, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Carmen Garcia Alba, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose
Vincent Roche, Creteil, France (*Abstract Co-Author*) Nothing to Disclose
Marco Dioguardi Burgio, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Annie Sibert, MD, Paris, France (*Abstract Co-Author*) Nothing to Disclose
Valerie Vilgrain, MD, Clichy, France (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

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PURPOSE

To identify the patients at risk of severe pain during and after an intra-arterial hepatic treatment with prospective evaluation of

to identify the patients at risk of severe pain during and after an intra-arterial hepatic treatment with prospective evaluation of pain using the visual analog scale (VAS).

METHOD AND MATERIALS

Were included in this study 140 procedures performed on 104 patients (mean 65±12 yo, 78 male) including trans-catheter arterial chemo-embolization (TACE)/ embolization (TAE) and radio-embolization (SIRT) in patients suffering from hepatocellular carcinoma (n=94), neuroendocrine metastasis (n=8) and cholangiocarcinoma (n=2). Our criteria for severe pain during and after the treatment were VAS>=30 after the injection of treatment, and the need for opioid analgesics (grade 2 or 3) uptake during hospitalization, respectively. Patients and tumor characteristics, and technical factors associated with severe pain during/after the treatment were identified by multivariate analysis.

RESULTS

Severe pain occurred during 26.5%, and after 21.6% of the procedures. For severe pain during treatment predictors were: ischemic treatment (TACE/TAE vs. SIRT) OR=8.803 [1.111; 69.742], p=0.039, and an alcoholic liver disease (ALD) OR=0.157 [0.035; 0.716], p=0.017. In ischemic treatments alone and in TACE alone, ALD remained a strong protective factor with respectively: OR=0.178 [0.039; 0.819], p=0.027, and OR=0.183 [0.039; 0.847], p=0.030. For delayed severe pain predictors were: size of largest treated tumor OR=1.048 [1.025; 1.071], p<0.001, and maximum VAS value during the treatment OR=1.044 [1.022; 1.067], p<0,001. They were age OR=0.947 [0.898; 0.998], p=0.042, size of largest treated tumor OR=1.035 [1.013; 1.057], p=0.002, and maximum VAS value during treatment OR=1.031 [1.011; 1.051] for TACE alone. Cut-off values were age 59.5 years (Se=0.808 and Sp=0.583), size of largest treated tumor 26.5mm (Se=0.826, Sp=0.594), and maximum VAS 39 (Se=0.565, Sp=0.826).

CONCLUSION

Occurrence of severe pain due to treatment is common during intra-arterial hepatic treatment, especially when it causes ischemia. If the presence of alcoholic liver disease appears to be a strong protective factor, pain remains difficult to predict. The occurrence of severe pain during treatment appears to be an important factor in the occurrence of delayed pain.

CLINICAL RELEVANCE/APPLICATION

The rates of severe pain during and after intra-arterial liver treatments are underevaluated and point at a better pain control.

VSIO51-15 Limitations of Clinical Trials in Interventional Oncology

Thursday, Nov. 30 5:40PM - 6:00PM Room: S405AB

Participants

Riad Salem, MD, MBA, Chicago, IL (*Presenter*) Research Consultant, BTG International Ltd Research Grant, BTG International Ltd

PS52

Thursday Plenary Session: The Next 20 Years: How Science and Technology Will Revolutionize Business, the Economy, Jobs and Our Way of Life

Thursday, Nov. 30 2:00PM - 3:00PM Room: Arie Crown Theater

IN

ARRT Category A+ Credit: 0

CME credit is not available for this session.

Participants

Richard L. Ehman, MD, Rochester, MN (*Presenter*) CEO, Resoundant, Inc; Stockholder, Resoundant, Inc;
Michio Kaku, PhD, New York, NY (*Presenter*) Nothing to Disclose

Quick overview of the talk: In a profoundly informative and deeply optimistic discussion, Professor Michio Kaku delivers a glimpse of where science will take us in the next hundred years, as warp drives, teleportation, inter-dimensional wormholes, and even time travel converge with our scientific understanding of physical reality. While firing up our imaginations about the future, he also presents a succinct history of physics to the present. He will also talk about the opportunities--and threats--that artificial intelligence brings to every facet of modern life and AI's role in the future of humanity. Short bio: Dr. Michio Kaku is one of the world's most recognized scientists. He has 3 million fans on Facebook, and half a million fans follow him on Twitter. He has written three NY Times Best Sellers: *The Physics of the Impossible*, *The Physics of the Future*, and *The Future of the Mind*, which hit number #1 on the NY Times Best seller list. He has two goals in life: The first is to complete Einstein's dream of a theory of everything, which can unify all physical laws into a single theory. He is the cofounder of string field theory. String theory is the leading candidate for this 'theory of everything.' The second goal is to predict how science will revolutionize the future. He appears regularly as the science correspondent on CBS This Morning with Charlie Rose. He has also appeared on Good Morning America, the Today Show, the Larry King Show, David Letterman show, The Conan O'Brien Show, The Stephen Colbert Report, the Daily Show, 60 Minutes. He has hosted a number of science series for BBC - TV, The Discovery Channel, and Science Channel. He hosts a weekly national radio science show that airs in over 100 cities across the US, which is the largest science radio show on commercial radio in the US. He has written for the Wall Street Journal, Newsweek Magazine, Time Magazine, Scientific American, Astronomy Magazine, and many other national publications. NY Magazine voted him as one of the 100 smartest people in New York.

RCB54

Using Publicly Accessible 'Big Data' from the NIH/NCI's Cancer Imaging Archive (TCIA) to Research Quantitative Radiomics, Proteomics, Genetics and Pathology (Hands-on)

Thursday, Nov. 30 2:30PM - 4:00PM Room: S401CD

BQ **IN**

AMA PRA Category 1 Credits [™]: 1.50
ARRT Category A+ Credit: 1.75

Participants

Justin Kirby, Bethesda, MD (*Presenter*) Stockholder, Myriad Genetics, Inc
Lawrence R. Tarbox, PhD, Little Rock, AR (*Presenter*) Nothing to Disclose
C. Carl Jaffe, MD, Boston, MA (*Presenter*) Nothing to Disclose
Brenda Fevrier-Sullivan, BA, Bethesda, MD (*Presenter*) Nothing to Disclose
Fred W. Prior, PhD, Little Rock, AR (*Presenter*) Nothing to Disclose
John B. Freymann, BS, Bethesda, MD (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

carljaffe@gmail.com

Brenda.Fevrier-Sullivan@fnlcr.nih.gov

LEARNING OBJECTIVES

1) Discover the data sets available in The Cancer Imaging Archive (TCIA). 2) Learn how to share/publish your research data in TCIA. 3) Review the full scope of TCIA functionality for searching and downloading data. 4) Learn how you can build 'Data Analysis Centers' to add new ways to view/analyze TCIA data. 5) Identify support resources that include the TCIA helpdesk, FAQs, and system documentation.

ABSTRACT

Access to large, high quality data is essential for researchers to understand disease and precision medicine pathways, especially in cancer. However HIPAA constraints make sharing diagnostic clinical images outside an individual institution a complex process. The NCI's Cancer Imaging Archive (TCIA) addresses this challenge by providing hosting and de-identification services which take the burden of data sharing off researchers. TCIA now contains over 70 unique data collections of more than 28 million images. Recognizing that images alone are not enough to conduct meaningful research, most collections are linked to rich supporting data including patient outcomes, treatment information, genomic / proteomic analyses, and expert image analyses (segmentations, annotations, and radiomic / radiogenomic features). This hands-on session will teach the skills needed to fully access TCIA's existing data as well as learn how to submit new data for potential inclusion in TCIA.

RCC54

3D Printing

Thursday, Nov. 30 2:30PM - 4:00PM Room: S501ABC

IN

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Andy Christensen, BS, Littleton, CO (*Moderator*) Consultant, 3D Systems, Inc; Consultant, Integrum AB; Board Member, Integrum AB

Sub-Events

RCC54A Regulatory and Quality Considerations for Hospital-based 3D Printing

Participants

Andy Christensen, BS, Littleton, CO (*Presenter*) Consultant, 3D Systems, Inc; Consultant, Integrum AB; Board Member, Integrum AB

LEARNING OBJECTIVES

1) Recognize regulations by the FDA regarding devices, and explore how patient risk drives the FDA's classification of medical devices. 2) Review how point-of-care manufacturing in a hospital environment impacts patient care (applications, risk types). 3) Better understand how different steps for production of 3D printed parts can impact their ultimate quality and faithfulness to the original medical image data.

RCC54B 3D Printing and Phantoms

Participants

Shuai Leng, DPHIL, Rochester, MN (*Presenter*) License agreement, Bayer AG

For information about this presentation, contact:

leng.shuai@mayo.edu

LEARNING OBJECTIVES

1) Understand the need of anthropomorphic and patient-specific phantoms. 2) Identify key elements of using 3D printing to construct phantoms. 3) Assess pros and cons of different types of 3D printer and printing technique. 4) Develop applications of 3D printed phantoms in medical imaging and radiation therapy.

RCC54C Quality Assurance in Medical 3D Printing

Participants

Kieran P. McGee, PhD, Rochester, MN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the concepts of and differences between quality assurance and quality control. 2) Understand why the needs and objectives of a quality control program in 3D printing are unique for medical applications. 3) Identify key elements of a medical 3D printing quality control program. 4) Obtain new knowledge on how to establish a medical 3D printing quality control/assurance program.

SPDL51

Peds, IR, Potpourri (Case-based Competition)

Thursday, Nov. 30 3:00PM - 4:00PM Room: E451B



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

Participants

Paul J. Chang, MD, Chicago, IL (*Presenter*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Advisory Board, Bayer AG; Advisory Board, Aidoc Ltd; Advisory Board, McCoy
Kate A. Feinstein, MD, Chicago, IL (*Presenter*) Nothing to Disclose
Brian S. Funaki, MD, Chicago, IL (*Presenter*) Data Safety Monitoring Board, Novate Medical Ltd

For information about this presentation, contact:

kfeinstein@radiology.bsd.uchicago.edu

pchang@radiology.bsd.uchicago.edu

LEARNING OBJECTIVES

1) Be introduced to a series of radiology case studies via an interactive team game approach designed to encourage 'active' consumption of educational content. 2) 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) Receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance. This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.

ABSTRACT

The extremely popular audience participation educational experience, Diagnosis Live!, is an expert-moderated session featuring a series of interactive case studies that will challenge radiologists' diagnostic skills and knowledge. The session features a lively, fast-paced game format: participants will be automatically assigned to teams who will then use their personal mobile devices to test their knowledge in a fast-paced session that will be both educational and entertaining. After the session, attendees will receive a personalized self-assessment report via email that will review the case material presented during the session, along with individual and team performance.

SPSH51

Hot Topic Session: 3D Imaging in Musculoskeletal: Acquisitions, Printing, and Applications

Thursday, Nov. 30 3:00PM - 4:00PM Room: E450A

MK

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

FDA

Discussions may include off-label uses.

Participants

Corrie M. Yablon, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

cyablon@med.umich.edu

LEARNING OBJECTIVES

1) Explain the basics of what a musculoskeletal radiologist needs to know about 3D printing. 2) Describe how 3D models can be used in musculoskeletal imaging to benefit patient care. 3) Discuss how CT and MRI protocols can be tailored to create 3D prints.

ABSTRACT

3D printing is a recent and exciting development in musculoskeletal (MSK) imaging. This course will review what an MSK radiologist should know about 3D printing and protocol design. Real life applications of 3D printing with respect to musculoskeletal pathology will be discussed.

Sub-Events

SPSH51A 3D Printing Basics: What the MSK Radiologist Needs to Know

Participants

Adnan M. Sheikh, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

asheikh@toh.ca

LEARNING OBJECTIVES

1) To become familiar with 3D printing technologies. 2) To have an introduction of materials used to create 3D-printed anatomical models and how they can be used in medical applications. 3) To be exposed to the process of 3D printing, terminologies and software.

ABSTRACT

3D printing (Additive manufacturing) is a growing field in medicine. There is a growing interest in this technology and its impact on patient's lives. The basic principles of 3D Printing will be discussed along with the different technologies, which encompass the field. The steps of converting radiographic images into three-dimensional printable files and the differences between the multitudes of additive manufacturing techniques will be presented.

SPSH51B 3D Printing in MSK: How to Tailor CT and MR Protocols to Render MSK Anatomy on Screen and Make 3D Prints

Participants

Benjamin M. Howe, MD, Rochester, MN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

howe.benjamin@mayo.edu

LEARNING OBJECTIVES

1) Employ optimal CT acquisition technique for optimal threshold of osseous anatomy. 2) Describe limitations of standard MSK sequences in creation of 3D anatomic models. 3) Summarize potential of advanced MR sequences in the generation of 3D anatomic models.

SPSH51C Use of 3D Models in the Real Life Management of MSK Pathology

Participants

Marcelo Bordalo-Rodrigues, MD, PhD, Sao Paulo, Brazil (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

marcelo.bordalo@hc.fm.usp.br

LEARNING OBJECTIVES

1) To acknowledge clinical applications of 3D models in musculoskeletal pathologies.

ABSTRACT

Although relevant studies and clinical data on 3D printing in musculoskeletal pathologies are scarce, its clinical applications are evolving and have a huge potential in diagnosis and treatment. We will discuss potential applications: complex anatomy comprehension, fracture classification improvement, surgical planning, design of patient-specific instrument guides and design of custom implants.

SPSH52

Hot Topic Session: New and Emerging Theranostic Agents for Prostate Cancer

Thursday, Nov. 30 3:00PM - 4:00PM Room: E451A

GU NM OI

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

FDA Discussions may include off-label uses.

Participants

Frederik L. Giesel, MD, MBA, Heidelberg, Germany (*Moderator*) Patent application for F18-PSMA-1007
Andrei Iagaru, MD, Stanford, CA (*Moderator*) Research Grant, General Electric Company

LEARNING OBJECTIVES

1) To learn about recent developments in theranostics nuclear medicine. 2) To understand new treatment options for prostate cancer using a targeted radionuclide approach.

ABSTRACT

An important aspect of Nuclear Medicine and Molecular Imaging is that the same core compound of the administered radiopharmaceutical can be labeled with both gamma emitters (for diagnostic) and alpha or beta emitters (for therapy), allowing for the targeted treatment of lesions. This is known as theranostics, the combination of therapy and diagnostics that is based on the specific tumor biology of each patient's disease. This session will highlight several examples of such paired diagnostic studies and treatments using Nuclear Medicine methods for prostate cancer.

Sub-Events

SPSH52A 18F-FACBC (Axumin) as a Newly FDA Approved Prostate Cancer Imaging Agent

Participants

David M. Schuster, MD, Decatur, GA (*Presenter*) Institutional Research Grant, Nihon Medi-Physics Co, Ltd; Institutional Research Grant, Blue Earth Diagnostics Ltd; Consultant, WellPoint, Inc; Speaker, Siemens AG; ;

LEARNING OBJECTIVES

1) Describe the mechanism of uptake of the PET radiotracer fluciclovine. 2) Identify normal biodistribution of fluciclovine. 3) Identify the FDA approved clinical indication of fluciclovine. 4) Discuss clinical interpretive criteria of fluciclovine PET.

SPSH52B 68Ga PSMA and GRPR Ligands as New and Emerging Prostate Cancer Imaging Agents and Theranostics

Participants

Andrei Iagaru, MD, Stanford, CA (*Presenter*) Research Grant, General Electric Company

LEARNING OBJECTIVES

1) To learn about the use of PSMA and GRPR as targets for imaging prostate cancer at initial diagnosis and biochemical recurrence. 2) To understand how the PSMA and GRPR targets can be used as treatment options for prostate cancer using a theranostic approach.

ABSTRACT

Tracers binding to the prostate-specific membrane antigen (PSMA) elicit high interest. This cell surface protein is significantly overexpressed in prostate cancer cells when compared to other PSMA-expressing tissues such as kidney, proximal small intestine or salivary glands. It therefore provides a promising target for prostate cancer-specific imaging. Gastrin-releasing peptide receptors (GRPR) proteins are highly overexpressed in several human tumors, including prostate cancer. The GRPR was detected in 63-100 % of human prostate cancer tissue. Moreover, because of their low expression in benign prostate hypertrophy and inflammatory prostatic tissues, imaging of GRPR has potential advantages over current choline- and acetate-based radiotracers.

SPSH52C 18F-PyL PSMA-targeting Diagnostic Agent

Participants

Martin G. Pomper, MD, PhD, Baltimore, MD (*Presenter*) Researcher, Progenics Pharmaceuticals, Inc; License agreement, Progenics Pharmaceuticals, Inc; Researcher, Advanced Accelerator Applications SA; License agreement, Advanced Accelerator Applications SA; Co-founder, Cancer Targeting Systems, Inc; Board Member, Cancer Targeting Systems, Inc; Researcher, Juno Therapeutics, Inc; Licensing agreement, Juno Therapeutics, Inc; Co-founder, Neurly; Board Member, Neurly; Co-founder, Theraly Pharmaceuticals, Inc; Board Member, Theraly Pharmaceuticals, Inc; ;

SPSH52D PSMA-ligands for Diagnostic Stratification and Alpha/Beta PSMA-targeted Therapy in Prostate Cancer

Participants

Frederik L. Giesel, MD, MBA, Heidelberg, Germany (*Presenter*) Patent application for F18-PSMA-1007

For information about this presentation, contact:

f.giesel@dkfz.de

LEARNING OBJECTIVES

1) To understand challenges of different PSMA-ligands. 2) To understand the impact of PSMA-ligands in primary diagnostics. 3) To understand the impact of PSMA-ligands in recurrent disease. 4) To understand the patient treatment stratification of beta- and alpha targeted therapy.

ABSTRACT

The high specificity, especially in the undifferentiated stage, makes it an excellent target for diagnosis and therapy. Integrating PSMA-PET/CT into the planning phase of radiotherapy, the treatment concept is changed in 30%-50% of the patients. The combination of the Glu-urea-motif with DOTA, which can be labeled with several diagnostic and therapeutic radionuclides, opened new avenues for therapeutic usage of the small-molecule PSMA ligands. In the beginning of 2016, there are four confirmative reports (n = 19, n = 24, n = 30, and n = 56) from four different centers reporting a PSA response in approximately 70% of patients treated with (177)Lu-labeled PSMA ligands. In conclusion, the data available up to now and this review will cover the theranostic perspective of PSMA ligands in regard to imaging and further therapeutic options like beta- and alpha-emitters.

SPSH53

Hot Topic: Dual Energy CT in the Emergency Department

Thursday, Nov. 30 3:00PM - 4:00PM Room: E450B



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

Participants

Aaron D. Sodickson, MD, PhD, Boston, MA (*Moderator*) Institutional Research Agreement, Siemens AG; Consultant, Bayer AG

For information about this presentation, contact:

asodickson@bwh.harvard.edu

Sub-Events

SPSH53A Dual Energy CT of Abdominal and Pelvic Trauma

Participants

Jeremy R. Wortman, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the basic physics and technical principles of dual energy CT (DECT). 2) Have a knowledge of how DECT post-processing techniques may add value in patients with abdominal and pelvic trauma, including the uses iodine selective imaging, virtual monoenergetic imaging, and virtual non-calcium imaging in trauma patients. 3) Learn the technical limitations, diagnostic pitfalls, and challenges of interpretation with DECT.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Jeremy R. Wortman, MD - 2017 Honored Educator

SPSH53B Dual Energy CT of Neuro Trauma

Participants

Thorsten R. Fleiter, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

tfleiter@umm.edu

LEARNING OBJECTIVES

1) Understand how to use multi-energy scanning to differentiate acute from chronic lesions. 2) Learn how to improve the workflow using high KeV virtual monochromatic images for quick assessment of hemorrhages, edema and fractures. 3) Understand the use of iodine specific imaging of the brain using virtual non-enhanced and monochromatic images to differentiate between expanding acute hemorrhages and iodine accumulation after contrast enhanced imaging studies. 4) Learn how to use DECT in acute brain injuries to suppress foreign body artifacts.

SPSH53C Dual Energy CT for Pulmonary Embolism

Participants

Savvas Nicolaou, MD, Vancouver, BC (*Presenter*) Institutional research agreement, Siemens AG

LEARNING OBJECTIVES

1) Brief introduction of Dual Energy CT/Spectral Imaging. 2) Introduction to Iodine Overlay Maps. 3) Benefits of DECT/Spectral imaging for Pulmonary Embolism including contrast volume reduction and improved diagnostic capability. 4) Select cases demonstrating problem solving capability of DECT/Spectral Imaging.

SPSH53D Q&A and Panel Discussion

SPSH54

Hot Topic Session: The Role of Proton and Heavy Ion Therapy in Solid Tumors

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

RO

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

Participants

Zhongxing Liao, MD, Houston, TX (*Moderator*) Nothing to Disclose

Sub-Events

SPSH54A Why Proton and Heavy Ion for Thoracic Cancers

Participants

Charles B. Simone II, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

charlessimone@umm.edu

LEARNING OBJECTIVES

1) Understand the rationale for and potential benefits of proton therapy to reduce irradiation doses to normal tissues, be more safely combined with surgery and/or chemotherapy, and allow for radiation dose escalation. 2) Review the clinical outcomes and toxicities of patients treated with proton therapy for thoracic malignancies. 3) Understand the role of proton reirradiation in the management of patients with local or regional disease recurrence.

ABSTRACT

Providers are increasingly delivering proton therapy for lung cancer and other thoracic malignancies. Proton therapy for thoracic malignancies may reduce the irradiation dose to normal tissues that could reduce toxicities, allow for definitive therapy of otherwise difficult-to-treat tumors, enable dose escalation, more safely allow for multimodality therapy, and allow for reirradiation of recurrence thoracic tumors. Use of advanced modalities like pencil beam scanning and image-guided proton therapy have recently emerged for thoracic tumors. Existing data on the clinical outcomes and toxicities for lung cancer and other thoracic malignancies will be described and the potentials and future directions of thoracic proton therapy will be discussed.

URL

http://www.findadoctor.umm.edu/details/35142/charles-simone-ii-cancer-radiation_oncology-baltimore

SPSH54B Proton Therapy in the Management of Lymphoma and Pediatric Malignancies

Participants

Bradford Hoppe, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) List long term side effects from radiation among pediatric and lymphoma survivors. 2) Describe the ability of proton therapy to improve the therapeutic ratio in different malignancies. 3) Identify patients who benefit the most from proton therapy.

SPSH54C Importance of Imaging Guidance Using MRI for Particle Therapy

Participants

Jihong Wang, PhD, Houston, TX (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Jihong.Wang@mdanderson.org

LEARNING OBJECTIVES

1) Understanding of the importance of MRI guidance in Radiation Therapy (RT). 2) Appreciation of the differences in RT imaging guidance vs diagnostic imaging. 3) Current status of MRI guidance in RT.

SPSH55

Hot Topic Session: Controversies in Radiology

Thursday, Nov. 30 3:00PM - 4:00PM Room: E352

BQ **BR**

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

Participants

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

Sub-Events

SPSH55A Comparison of Digital Mammography (DM) and DM Plus Digital Breast Tomosynthesis (DBT): True and False Positive Interpretations According to Automatic Density Categories in A Population Based Screening Program

Participants

Constance D. Lehman, MD, PhD, Boston, MA (*Presenter*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company
Bjorn Helge Osteras, MSc, Oslo, Norway (*Presenter*) Nothing to Disclose
Per Skaane, MD, PhD, Oslo, Norway (*Presenter*) Equipment support, Hologic, Inc Consultant, Hologic, Inc Support, Hologic, Inc
Randi Gullien, RT, Oslo, Norway (*Abstract Co-Author*) Support, Hologic, Inc; Travel support, Hologic, Inc

PURPOSE

Compare true and false positive interpretations of digital mammography (DM) vs. DM plus digital breast tomosynthesis (DBT) stratified by automatically calculated breast density categories.

METHOD AND MATERIALS

The trial was approved by the ethical committee and all women gave written consent. 24,310 women age 50-69 years underwent DM and DBT. Prospective independent reading was performed in 4 arms. Arm 1: DM, 2: DM+CAD, 3: DBT+DM and 4: DBT+DMs (synthetic DM). Arm 1 and 2 is hereafter referred to as 2D (double reading) and arm 3 and 4 as 2D+3D (double reading). All findings were confirmed either by histology or 2 years' follow-up. The software Quantra classified the exams into one of four BI-RADS density like categories: quantized density (QD), where QD 1 and 2 is considered fatty, 3 and 4 dense. True and false positive interpretations were compared using McNemar test.

RESULTS

There were 296 breasts with malignancies including 244 screen detected and 52 interval cancers. 17 in women with QD 1, 129 with QD 2, 116 with QD 3, 32 with QD 4 and 2 with missing QD. There were 48324 breasts without malignancies, 5709 in women with QD 1, 25723 with QD 2, 13184 with QD 3, 3610 with QD 4 and 98 with missing QD. The breast based true positive rates were significantly higher for 2D+3D than for 2D for the intermediate density categories (QD 2 and 3) but not significantly higher in the others. QD 1: 100 vs 88.2 % ($p = 0.5$), QD 2: 83.7 vs 65.9 % ($p < 0.001$), QD 3: 79.3 vs 62.1 % ($p < 0.001$) and QD 4: 79.3 vs 62.5 % ($p = 0.063$). The breast based false positive rates were significantly lower for 2D+3D than for 2D for all densities, except for extremely dense breasts (QD 4) where the rate was comparable: QD 1: 2.66 vs 3.45 % ($p = 0.004$), QD 2: 3.78 vs 4.75 % ($p < 0.001$), QD 3: 5.45 vs 6.17 % ($p = 0.003$) and QD 4: 6.43 vs 6.29 % ($p = 0.78$).

CONCLUSION

Addition of DBT increases the true positive rates for all breast densities. Though results were not significant for quantized density 1 and 4, likely because of few cancers in these categories. Addition of DBT reduces the false positive rates for all density categories except for extremely dense breasts, where the false positive rates are comparable.

CLINICAL RELEVANCE/APPLICATION

Addition of DBT increases true positive and reduces false positive rates for all breast densities except for extremely dense breasts, where the false positive rates are comparable.

SPSH55B Using Quantitative Analysis to Understand How Performance of Digital Breast Tomosynthesis Varies with Breast Density

Participants

Constance D. Lehman, MD, PhD, Boston, MA (*Presenter*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company
Elizabeth S. Burnside, MD, MPH, Madison, WI (*Presenter*) Nothing to Disclose
Jean-Pierre Laake, PhD, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose
Fiona J. Gilbert, MD, Cambridge, United Kingdom (*Abstract Co-Author*) Research Grant, Hologic, Inc; Research Grant, General Electric Company; Research Grant, GlaxoSmithKline plc
Stephen W. Duffy, London, United Kingdom (*Abstract Co-Author*) Nothing to Disclose

For information about this presentation, contact:

eburnside@uwhealth.org

PURPOSE

Understanding the differential performance of DBT based on breast density would help target and better anticipate performance pitfalls of this technology. We analyze a large reader study with quantitative breast density measurements to determine how breast density influences the performance of DBT.

METHOD AND MATERIALS

The TOMMY trial, a multicenter, multireader, retrospective study recruited 7060 women in 6 screening centers in England (July, 2011-March, 2013) to undergo 2D + DBT. Relevant to this study, these readers provided an overall recall or no recall decision and estimating the % fibroglandular tissue using a visual analog scale (VAS) from 0 to 100. Software (Volpara version 1.4.2) assessed volumetric breast density (VBD) on 2D. Complete data captured on 6707 cases was used to analyze the sensitivity and specificity of 2D vs. 2D + DBT in the following two categorizations for VAS: 1) <25%, 25-75% [inclusive], and >75%; 2) <50% and $\geq$ 50%; and a categorization for VBD 3) <4.5; 4.5-15.5 [inclusive]; and >15.5. We used McNemar's test for statistical comparisons.

RESULTS

Overall sensitivity and specificity for 2D vs. 2D + DBT was comparable to the larger TOMMY trial dataset. Specificity was statistically significantly superior in all density categories assessed with either VAS or VBD (Table). Sensitivity of 2D + DBT was statistically significantly superior to 2D, as in the larger dataset, in women with dense tissue, VAS $\geq$ 50% ($p < 0.05$). Interestingly, when we categorized quantitative breast density to approximate the BI-RADS A, B-C, and D, the sensitivity of 2D + DBT improved to a statistically significant degree only in the middle density ranges for VAS ($p < 0.01$) and VBD ($p < 0.01$), however numbers in the upper density categories are small, prohibiting definitive conclusions, an important area of further investigation.

CONCLUSION

The addition of DBT significantly increased the specificity of 2D for all breast density subgroups but only significantly increased sensitivity in patients with quantitative breast density in the middle ranges. Our results raise the possibility that DBT may not improve cancer detection in women with very low or very high breast density.

CLINICAL RELEVANCE/APPLICATION

When considering differential performance based on breast density, adding DBT appears to consistently improve specificity but may only improve sensitivity in women in the middle ranges of density.

FIGURE

https://abstract.rsna.org/uploads/2017/17013222/17013222_loaz.jpg

MSCA52

Case-based Review of the Abdomen (An Interactive Session)

Thursday, Nov. 30 3:30PM - 5:00PM Room: S100AB

GI

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Julie H. Song, MD, Providence, RI (*Director*) Nothing to Disclose

Sub-Events

MSCA52A Congenital Abdominal Pathology that Can Be Seen in Adults

Participants

Andrew T. Trout, MD, Cincinnati, OH (*Presenter*) Author, Reed Elsevier; Research Grant, Siemens AG; Research Grant, Toshiba Medical Systems Corporation; Board Member, Joint Review Committee on Educational Programs in Nuclear Medicine Technology; Advisory Board, Perspectum Diagnostics Ltd

For information about this presentation, contact:

andrew.trout@cchmc.org

LEARNING OBJECTIVES

1) Improve knowledge of the imaging appearance of congenital and inherited anomalies in the abdomen and pelvis that can be seen in adults. 2) Improve knowledge of the developmental processes that contribute to congenital and inherited anomalies of the abdomen and pelvis that can be seen in adults.

MSCA52B Imaging of the Acute Abdomen

Participants

Jay K. Pahade, MD, New Haven, CT (*Presenter*) Consultant, Precision Imaging Metrics, LLC

LEARNING OBJECTIVES

1) To review a selection of cases highlighting salient points in recognizing, diagnosing and avoiding pitfalls in common and more rare cases of non-traumatic acute abdomen.

MSCA52C Pitfalls in Abdominal Trauma

Participants

Martin L. Gunn, MBChB, Seattle, WA (*Presenter*) Research Grant, Koninklijke Philips NV; Royalties, Cambridge University Press; Spouse, Consultant, Reed Elsevier; Spouse, Consultant, athenahealth, Inc

For information about this presentation, contact:

marting@uw.edu

LEARNING OBJECTIVES

1) Recognize common radiologic mimics of abdominal trauma. 2) Identify subtle or uncommon radiologic findings or severe or important traumatic findings. 3) Reduce unnecessary testing or delays in patient management resulting from image interpretation.

MSCA52D Imaging of Adrenal Glands

Participants

Julie H. Song, MD, Providence, RI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jsong2@lifespan.org

LEARNING OBJECTIVES

1) Recognize the imaging features of common and uncommon adrenal masses. 2) Understand the principles of imaging characterization of adrenal masses and apply imaging tools appropriately for optimal management. 3) Learn to avoid pitfalls and misdiagnoses of adrenal lesions

MSCB52

Case-based Review of Breast (An Interactive Session)

Thursday, Nov. 30 3:30PM - 5:00PM Room: S406A

BR

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Jiyon Lee, MD, New York, NY (*Director*) Nothing to Disclose

For information about this presentation, contact:

Jiyon.Lee@nyumc.org

LEARNING OBJECTIVES

1) Identify appropriate application of multimodality breast imaging for routine screening, supplemental screening, and diagnostic indications. 2) Select appropriate methods for image-guided percutaneous biopsy and perform post-biopsy radiologic-pathologic correlation for next management recommendation. 3) Review appropriateness criteria and performance benchmarks, and guidelines for ongoing breast imaging audits.

ABSTRACT

Our case-based review course will use the interactive audience response system (ARS) to walk and skip through the fundamentals of breast imaging. We will present how we use mammography, ultrasound, and MRI in daily screening and diagnostic scenarios, along with reminders of overarching principles of ACR appropriateness criteria and performance metrics. Our international faculty (sessions 1 and 2) will also add depth, and the fun added dimensions of how breast imaging works around the world. Varying breast cancer statistics, possible innate ethnic variations, differing cultural expectations and socioeconomic context can and do impact how we carry out our discretionary work. Such interesting details will inform the narrative of the speakers' case scenarios, while the core diagnostic radiology skills aim to be constant, and teachable. The focus is using lots of cases to demonstrate breast imaging now and evolving. Please join us for smart fun!

Sub-Events

MSCB52A Evolution and Adaptations in the UK Breast Screening and 'Symptomatic' Pathways

Participants

Tamara Suaris, MBBS, London, United Kingdom (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Tamara.suaris@bartshealth.nhs.uk

LEARNING OBJECTIVES

1) Describe the evolution of the UK breast screening program. 2) Appreciate the differences between the screening and symptomatic pathways in the UK. 3) Explain the targets and metrics that are monitored through both breast pathways. 4) Understand the typical and challenging pathways through the screening and symptomatic services through case based reviews. 5) Outline the challenges to the UK symptomatic and screening program.

ABSTRACT

This lecture will describe the evolution and adaptations in the UK breast screening and symptomatic program since its inception in 1988. Case-based format will illustrate how we use mammography, US, tomosynthesis, and MRI to screen and assess 'symptomatic' women. Cases will show common, adapted, and challenging pathways through the national screening program. Importance of quality assurance and key monitoring parameters will be highlighted.

MSCB52B Supplemental Screening for Dense Breasts: When DBT vs US?

Participants

Jung Min Chang, MD, Seoul, Korea, Republic Of (*Presenter*) Research Grant, General Electric Company

For information about this presentation, contact:

imchangjm@gmail.com

LEARNING OBJECTIVES

1) Review important relevant literatures and data of supplemental tomosynthesis and ultrasound in dense breast. 2) Learn about the advantages and disadvantages of using tomosynthesis and breast ultrasound, and when to perform. 3) Discuss the limitation of tomosynthesis/ultrasound interpretation in dense breast women.

ABSTRACT

Along with wide implementation of the breast density notification legislation, which requires women with dense breasts to be

informed that additional supplemental screening might be necessary, there is a growing need for adjunctive imaging, including ultrasonography and tomosynthesis. Given the frequent use of tomosynthesis and ultrasonography as adjuvant imaging modalities to mammography, their potential values in both screening and diagnostic settings need to be comparatively evaluated, and there have some researches related on these topic. This presentation will discuss 1) current relevant literatures of supplemental tomosynthesis and ultrasound in dense breast, 2) the advantages and disadvantages of using tomosynthesis and breast ultrasound, and when to perform and 3) the limitation of tomosynthesis/ultrasound interpretation in dense breast women.

MSCB52C Ethnic Diversity: Socioeconomic Disparity? Breast Rad in a Pay as You Go World

Participants

Alexandra A. Economacos, MBBCh, FFRad(D)SA, Dubai, United Arab Emirates (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

dralex.economacos@gmail.com

LEARNING OBJECTIVES

1) Understanding the need for technically good mammography. 2) Identify after the presentation the most cost effective method of managing a mammography problem in a pay as go world. 3) Correctly interpreting the need for good comparison mammography to assess subtle changes important for cancer diagnosis. 4) Understanding the concept of subtle hyperechoic changes on sonography and their correct management.

ABSTRACT

A chance to share up to date information on UAE, specifically Dubai private practice breast imaging demographics, BC stats, and screening guidelines as they do/don't exist now, and to illustrate some points about the kind of disease we see. I have a potpourri of cases presented in quiz format reflecting real life screening and diagnostic scenarios while showing the radiology that the audience is there to learn. The social/political/economic/cultural/religious/medical, etc context of my practice environment will be woven into the descriptive narrative that I use to show my cases.

MSCB52D Interventions and Managing Expectations

Participants

Jiyon Lee, MD, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Jiyon.Lee@nyumc.org

LEARNING OBJECTIVES

1) Review the types of imaging findings that are indicated for percutaneous breast biopsy and which modality guidance. 2) Identify relative and potential pearls and pitfalls in how we do various image-guided biopsies. 3) Apply our radiologic-pathologic correlation knowledge to determine appropriate next management recommendations.

ABSTRACT

In this talk, cases will illustrate the various image-guided breast biopsy techniques available. Range of challenge will demonstrate basic concepts and the more nuanced situations that make breast imaging unique. Thank you for your interest.

RC701

Practical Issues in Thoracic Imaging

Thursday, Nov. 30 4:30PM - 6:00PM Room: E353C

CH CT SQ

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Sub-Events

RC701A Practical Guide to Radiation Dose Reduction

Participants

John R. Mayo, MD, Vancouver, BC (*Presenter*) Speaker, Siemens AG

For information about this presentation, contact:

john.mayo@vch.ca

LEARNING OBJECTIVES

1) To review patient factors determining radiation sensitivity. 2) Outline thoracic CT dose reduction strategies. 3) Illustrate information systems that improve radiation dose awareness.

RC701B 'No Touch' Thoracic Interventional Lesions

Participants

Joseph G. Mammarrapallil, MD, PhD, Durham, NC (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

joseph.mammarrapallil@duke.edu

LEARNING OBJECTIVES

1) Identify lesions in thorax that should not undergo percutaneous biopsy by utilizing imaging findings and patient history.

RC701C Managing the Indeterminate Lung Nodule

Participants

Claudio Silva, MD, Santiago, Chile (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

csilvafa@alemana.cl

LEARNING OBJECTIVES

1) Present a systematic approach to the incidental indeterminate lung nodule. 2) Provide insight on the incremental value of the classic features that suggest malignancy/benignity. 3) Provide evidence-based information on the strengths and weakness of the available diagnostic procedures following detection. 4) Review current follow-up recommendations for solid and subsolid incidental nodules.

RC701D Incidental Findings at Thoracic Imaging

Participants

Carol C. Wu, MD, Houston, TX (*Presenter*) Author, Reed Elsevier

For information about this presentation, contact:

carolcwu@gmail.com

LEARNING OBJECTIVES

1) Understand the definition and prevalence of incidental findings on chest CT. 2) Learn and apply available evidence and recommendations for appropriate evaluation and management of incidentalomas encountered on chest CT.

RC702

Educator Survival Techniques

Thursday, Nov. 30 4:30PM - 6:00PM Room: S404CD

ED

AMA PRA Category 1 Credits [™]: 1.50
ARRT Category A+ Credit: 1.75

Participants

Priscilla J. Slanetz, MD, MPH, Boston, MA (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

pslanetz@bidmc.harvard.edu

LEARNING OBJECTIVES

1) Understand the nuances surrounding successful mentorship of trainees and junior faculty. 2) Be able to provide more effective and timely feedback to trainees in order to help close performance gaps. 3) Gain insight into the self-study process for accredited training programs.

ABSTRACT

This session is designed to provide strategies to become more effective as radiologic educators by focusing on developing skills in mentorship and feedback and by providing insight into the newly implemented self-study process for accredited training programs. The session will consist of a combination of didactic presentations and panel discussions with ample time allotted for audience interaction and questions.

Sub-Events

RC702A Mentorship

Participants

Mark E. Mullins, MD, PhD, Atlanta, GA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

memulli@emory.edu

LEARNING OBJECTIVES

1) List examples of effective mentorship. 2) Apply available resources to improve their own ability to be a mentor. 3) Identify characteristics in mentees that are more likely to result in effective mentorship.

RC702B Feedback and Difficult Conversations

Participants

Lori A. Deitte, MD, Nashville, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify key elements of effective feedback. 2) Differentiate between destructive and constructive feedback. 3) Apply available resources to improve their own ability to provide feedback.

RC702C ACGME Self Study

Participants

Ingrid Philibert, PhD, MBA, Chicago, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) List the new elements of the self-study, including program aims, the environmental assessment, and consideration of program improvement ("what will take this program to the next level?"), and provide the rationale for their inclusion in the self-study approach. 2) Describe the common and unique elements of diagnostic radiology programs' aims and associated improvement priorities. 3) Discuss design and validation of a developmental assessment approach for gauging the effectiveness and maturity of programs' self-improvement processes, with feedback. 4) Describe elements of the 10-year accreditation site visit, and practical approaches for preparing for this new type of site visit.

ABSTRACT

Most programs on continued accreditation have very few citations. The ACGME instituted the self-study to facilitate ongoing program improvement, with a focus on improvements in areas where the program is already in compliance with the accreditation requirements. This session will provide highlight key changes in the approach, and provide practical guidance for effectively responding to the enhanced ACGME focus on ongoing evaluation and improvement.

RC702D ACGME Self Study Panel

Participants

Jessica B. Robbins, MD, Madison, WI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jrobbins@uwhealth.org

LEARNING OBJECTIVES

1) Articulate residency program strategies for a successful self-study. 2) Recognize the perspectives of both large and small residency programs as they prepare for a self-study. 3) Describe how the self-study and annual program evaluation processes are related.

RC703

Imaging of Atherosclerosis

Thursday, Nov. 30 4:30PM - 6:00PM Room: E353B

CA VA CT MI MR

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

John J. Carr, MD, MS, Nashville, TN (*Moderator*) Nothing to Disclose

Sub-Events

RC703A The Biology and Molecular Imaging of Atherosclerosis

Participants

Pamela K. Woodard, MD, Saint Louis, MO (*Presenter*) Research agreement, Siemens AG; Research, Eli Lilly and Company; Research, F. Hoffmann-La Roche Ltd; ; ; ;

For information about this presentation, contact:

woodardp@mir.wustl.edu

LEARNING OBJECTIVES

1) Discuss the initiation of the atherosclerotic disease process, including chemical, mechanical and immunological factors. 2) Discuss the molecular biology of atherosclerosis and cellular mechanisms involved in plaque remodeling, progression, instability and repair. 3) Discuss potential molecular targets in atherosclerosis imaging.

RC703B MR Imaging of Atherosclerosis

Participants

Chun Yuan, PhD, Seattle, WA (*Presenter*) Research Grant, Koninklijke Philips NV; Consultant, BGI; ;

For information about this presentation, contact:

cyuan@u.washington.edu

LEARNING OBJECTIVES

1) Identify the clinical goals of MRI of atherosclerosis, describe the critical information needed for imaging atherosclerosis at different vascular beds; 2) Explain the technical need and challenges in imaging atherosclerosis; 3) Assess current approaches and applications and future directions.

RC703C CT Imaging of Atherosclerosis

Participants

Pal Maurovich-Horvat, MD, PhD, Pecs, Hungary (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

p.maurovich-horvat@cirg.hu

LEARNING OBJECTIVES

1) Discuss the morphologic characteristics of vulnerable plaques on coronary CT angiography images, including positive remodelling, low-attenuation and napkin-ring sign. 2) Discuss comprehensive plaque assessment strategies. 3) Discuss the potential link between plaque features and lesion specific ischemia. 4) Discuss novel radiomic techniques for atherosclerotic plaque assessment.

ABSTRACT

The quest to identify vulnerable patients and predict acute coronary events on an individual atherosclerotic coronary plaque level remain to be the greatest challenges of modern cardiovascular imaging. Current guidelines focus on the detection of significant coronary artery stenosis that causes symptoms and myocardial ischemia, but not on the detection, characterisation and quantification of atherosclerotic lesions. This strategy ignores the fact that >50% of those who die suddenly due to acute coronary events lack prior clinical symptoms related to coronary artery disease. It has been demonstrated by post-mortem investigations that majority of acute coronary syndromes are caused by plaque rupture and subsequent sudden luminal thrombosis. Rupture prone atherosclerotic lesions have been termed as vulnerable plaques, which have a distinct characteristics from stable lesions. The differences in morphology, functional and metabolic characteristics provide unique opportunity for non-invasive coronary imaging to identify these lesions before they cause acute events. Moreover, it has been demonstrated that on a patient level the total quantity of plaques (i.e. plaque burden) has a strong predictive value for myocardial infarction. Therefore, it seems that the assessment of coronary plaque morphology and plaque burden are potentially more important in prediction of these devastating events than the detection of luminal stenosis. Coronary computed tomography angiography is a unique imaging technique that allows for the non-invasive depiction of the global coronary plaque burden, not just the individual plaques and luminal stenoses.

RC704

Sports MRI - Arthroscopy Correlation

Thursday, Nov. 30 4:30PM - 6:00PM Room: E450A

MR **MK**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

William E. Palmer, MD, Boston, MA (*Director*) Nothing to Disclose

LEARNING OBJECTIVES

1) Compare MRI and arthroscopic findings. 2) Illustrate sports-related MRI abnormalities. 3) Discuss arthroscopic diagnoses and treatments.

Sub-Events

RC704A Hip: Labral Tears and Femoroacetabular Impingement

Participants

Soterios Gyftopoulos, MD, MSc, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Soterios.Gyftopoulos@nyumc.org

LEARNING OBJECTIVES

1) Review the MR imaging appearance of common hip pathologies, such as labral tears and femoroacetabular impingement. 2) Identify the clinically relevant MR imaging findings that are important in terms of hip arthroscopy planning. 3) Correlate arthroscopic and MRI evaluations of common hip pathologies.

RC704B Knee: Ligaments and Menisci

Participants

Lawrence M. White, MD, FRCPC, Toronto, ON (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review the etiologic mechanisms and MR imaging appearance of meniscal and cruciate ligament injuries in the knee. 2) Identify MR imaging findings of importance in triage and pre-surgical planning for knee arthroscopy. 3) Correlate MRI and arthroscopic evaluation of the menisci and cruciate ligaments of the knee.

RC704C Shoulder: Labrum and Instability

Participants

William E. Palmer, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Illustrate labral tears in the shoulder. 2) Describe signs of glenohumeral instability. 3) Correlate MRI and arthroscopic findings.

RC704D Shoulder: Rotator Cuff and Impingement

Participants

Michael J. Tuite, MD, Madison, WI (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Assess the rotator cuff on MR and distinguish normal findings from tendinosis and tears. 2) Practice viewing the appearance of rotator cuff tears on arthroscopic videos and correlate with MR findings. 3) Apply the MR/Arthroscopy correlation knowledge to improve accuracy for interpreting the rotator cuff on MR.

RC704E Wrist and Elbow

Participants

Maha Torabi, MD, Winston Salem, NC (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mtorabi@wakehealth.edu

LEARNING OBJECTIVES

1) Discuss elbow and wrist arthroscopy setup. 2) Correlate osseous and ligamentous anatomy on MR and arthroscopy images. 3) Correlate common pathology on MR and arthroscopy images. 4) Discuss common arthroscopic interventions.

ABSTRACT

Elbow arthroscopy has been performed since the 1980s. It has made diagnosis, treatment, and recovery from surgery easier and faster than was once thought possible. Major indications for elbow arthroscopy include lateral epicondylitis, osteochondral lesions, ligament repair, inflammatory arthropathies and osteoarthritis. Common arthroscopic interventions including extensor carpi radialis brevis release, loose body removal, synovectomy, lateral collateral ligament repair and chondroplasty. Since its introduction in 1979, wrist arthroscopy has continuously evolved as a diagnostic and therapeutic tool. With advances in arthroscopy, new classification schemes are being introduced for various osseous and soft tissue wrist disorders. Common osseous pathology indications include fracture management and Kienbock's disease. Common soft tissue pathology indications include assessment of triangular fibrocartilage complex (TFCC) lesions, evaluation of carpal instability with dynamic maneuvering to assess scapholunate (SL) and lunotriquetral (LT) ligament injuries, evaluation and treatment of chondral lesions, resection of synovitis and scar tissue in cases of radiocarpal arthritis, ganglion excisions, and release of contractures. The goal of this presentation is to provide a primer for any radiologist interested in correlating Magnetic Resonance (MR) and arthroscopy images of the elbow and wrist joints.

RC705

Spine Imaging: Diagnosis & Intervention

Thursday, Nov. 30 4:30PM - 6:00PM Room: E450B

NR

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

FDA

Discussions may include off-label uses.

Participants

Vinil Shah, MD, San Francisco, CA (*Moderator*) Nothing to Disclose

LEARNING OBJECTIVES

1) Examine ways to effectively image the postop spine. 2) Differentiate normal postoperative imaging findings from those complications. 3) Identify imaging features of postoperative infection. 4) Understand the diagnostic criteria for SIH and the lesions that cause spinal CSF leaks. 5) Apply knowledge of these leak types in selecting the best imaging test to localize CSF leaks. 6) Suggest appropriate treatment for CSF leaks based on knowledge of the interventional and surgical treatments available. 7) Appraise the current literature concerning efficacy, safety, and cost-effectiveness of epidural steroid injections. 8) Describe the mechanism of action, safety profile, and effectiveness of traditional and investigative injectates. 9) Assess additional relevant issues, such as: a. Which type of back pain (radicular, stenosis, discogenic) should be treated with epidural steroid injection? b. Which route of injection is the safest and most efficacious? c. Does the type of image guidance make a difference?

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC705A Postoperative Spine: What Am I Looking For?

Participants

Lubdhra M. Shah, MD, Salt Lake City, UT (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Examine ways to effectively image the postop spine. 2) Differentiate normal postoperative imaging findings from those complications. 3) Identify imaging features of postoperative infection.

RC705B Spontaneous Intracranial Hypotension: How to Find and Stop the Leak

Participants

Peter G. Kranz, MD, Durham, NC (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

peter.kranz@duke.edu

LEARNING OBJECTIVES

1) Understand the diagnostic criteria for SIH and the lesions that cause spinal CSF leaks. 2) Apply knowledge of these leak types in selecting the best imaging test to localize CSF leaks. 3) Suggest appropriate treatment for CSF leaks based on knowledge of the interventional and surgical treatments available.

RC705C Epidural Injections: What is the Evidence?

Participants

Wende N. Gibbs, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Wende.Gibbs@med.usc.edu

LEARNING OBJECTIVES

1) Appraise the current literature concerning efficacy, safety, and cost-effectiveness of epidural steroid injections. 2) Describe the mechanism of action, safety profile, and effectiveness of traditional and investigative injectates. 3) Assess additional relevant issues, such as: a. Which type of back pain (radicular, stenosis, discogenic) should be treated with epidural steroid injection? b. Which route of injection is the safest and most efficacious? c. Does the type of image guidance make a difference?

RC706

Pearls and Pitfalls of Pediatric Head & Neck Imaging: An Interactive Review

Thursday, Nov. 30 4:30PM - 6:00PM Room: E451A

HN **NR**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Sub-Events

RC706A Imaging the Child with a Neck Mass

Participants

Jennifer A. Vaughn, MD, Boston, MA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the strengths of the various imaging modalities utilized for pediatric neck imaging in order to guide appropriate recommendations in clinical practice. 2) Review the most commonly encountered neck masses in children. 3) Classify pediatric neck masses using a categorical approach to develop a differential diagnosis. 4) Recognize key imaging features to distinguish among the most commonly encountered neck masses in children. 5) Apply the assessment tools by practicing with several cases.

Active Handout:Jennifer Ann Vaughn

<http://abstract.rsna.org/uploads/2017/17000277/Imaging the Child with a Neck Mass RSNA Handout.pdf>

RC706B Imaging the Child with Hearing Loss

Participants

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

LEARNING OBJECTIVES

1) Become familiar with temporal bone cross sectional imaging protocols. 2) Improve knowledge in interpreting temporal bone exams in children with hearing loss. 3) Become familiar with an anatomic classification of inner ear malformations. 4) Recognize various syndromes that have a pathognomonic temporal bone imaging appearance.

Active Handout:Caroline Diana Robson

<http://abstract.rsna.org/uploads/2017/17000278/Active RC706B.pdf>

RC706C Imaging the Child with Proptosis

Participants

Mai-Lan Ho, MD, Rochester, MN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

mai-lan.ho@mayo.edu

LEARNING OBJECTIVES

1) Review the pathophysiology and major etiologies of pediatric proptosis. 2) Utilize clinical history and appropriate imaging modalities for evaluation. 3) Demonstrate pearls and pitfalls of diagnosis.

RC707

Predicting Outcomes for Genitourinary Malignancies: Role of Radiomics in Clinical Practice

Thursday, Nov. 30 4:30PM - 6:00PM Room: E353A

GU

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Ivan Pedrosa, MD, Dallas, TX (*Coordinator*) Nothing to Disclose

Ivan Pedrosa, MD, Dallas, TX (*Moderator*) Nothing to Disclose

Ivan Pedrosa, MD, Dallas, TX (*Presenter*) Nothing to Disclose

Atul B. Shinagare, MD, Boston, MA (*Presenter*) Advisory Board, Arog Pharmaceuticals, Inc.; Research grant, GTx, Inc.

Masoom A. Haider, MD, Toronto, ON (*Presenter*) Consultant, Bayer AG; Advisory Board, Siemens AG; ;

For information about this presentation, contact:

ashinagare@partners.org

ivan.pedrosa@utsouthwestern.edu

LEARNING OBJECTIVES

1) Recognize the differences in the biologic behavior and prognosis between cystic and solid renal cancers and learn how the imaging phenotype can be helpful in guiding management decisions when incorporated into the radiology report. 2) Assess tumor aggressiveness of urothelial carcinomas of the upper tract and bladder with imaging and understand the added value of this information in disease management. 3) Use imaging characteristics of aggressive prostate cancer and the 'index lesion' to distinguish clinically significant prostate cancers from indolent ones.

ABSTRACT

The development of imaging phenotypes in genitourinary (GU) malignancies, supported by the application of Radiomics, has improved our understanding of the relationship between imaging phenotypes and clinical outcomes. Radiomics are based on the extraction of more information than what may be obvious to the eye with the use of quantitative and advanced feature analysis techniques. Radiomics provide a platform for whole-tumor analysis in vivo, and offer the opportunity for investigating pathophysiologic phenomena (e.g. blood flow, vascular permeability, tumor proliferation) that are difficult to examine in ex vivo tissue - these image-based features may serve as surrogate biomarkers of tumor aggressiveness. Furthermore, radiomics correlate with genetic profiles that predict tumor aggressiveness and provides a pathway toward the understanding of tumor heterogeneity, classification, and risk stratification. This refresher course will review the correlation between imaging phenotypes and the clinical behavior of renal, prostate, and urothelial malignancies. We will show how radiomics can be incorporated into radiology reports in patients with GU malignancies and emphasize how radiomics features can be used to affect patient care.

Active Handout: Atul Bhanudas Shinagare

<http://abstract.rsna.org/uploads/2017/16000424/Active RC707.pdf>

Active Handout: Ivan Pedrosa

<http://abstract.rsna.org/uploads/2017/16000424/Active RC707.pdf>

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Atul B. Shinagare, MD - 2017 Honored Educator

RC708

Imaging of Thoracic/Cardiovascular Emergencies

Thursday, Nov. 30 4:30PM - 6:00PM Room: N230B

CA CH CT ER VA

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Douglas S. Katz, MD, Mineola, NY (*Moderator*) Nothing to Disclose

Sub-Events

RC708A Emergency CT of Aortic Aneurysms

Participants

Douglas S. Katz, MD, Mineola, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

dkatz@winthrop.org

LEARNING OBJECTIVES

1) To review the current status of MDCT for imaging known or suspected acute presentations/complications of thoracic and/or abdominal aortic aneurysms, including rupture, dissection, fistula formation to the thorax/bowel, superinfection/primary infection, and the 'draped aorta sign'. 2) To review technical issues, and to demonstrate examples of these entities/complications on MDCT, with an emphasis on potential pitfalls, such as the crescent sign. 3) To review the current literature on the use of MDCT for imaging acute presentations/complications of thoracic and/or abdominal aortic aneurysms.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Douglas S. Katz, MD - 2013 Honored Educator Douglas S. Katz, MD - 2015 Honored Educator

RC708B Understanding the Role of CT in the Imaging of Pulmonary Infections

Participants

Constantine A. Raptis, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand important indications for CT in the setting of pneumonia. 2) Recognize important imaging findings which can affect differential diagnosis. 3) Appreciate imaging findings that have the potential to change management in patients with pulmonary infections.

RC708C CT Pulmonary Angiography for Pulmonary Embolism

Participants

Sanjeev Bhalla, MD, Saint Louis, MO (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the role of CT for Pulmonary Embolism in the modern era. 2) To highlight tips for radiation dose reduction and artifact minimization. 3) To emphasize tips on correctly diagnosing embolic disease.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Sanjeev Bhalla, MD - 2014 Honored Educator Sanjeev Bhalla, MD - 2016 Honored Educator Sanjeev Bhalla, MD - 2017 Honored Educator

RC708D Emergency Coronary CT Angiography

Participants

Jeffrey M. Levsky, MD, PhD, Bronx, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

jlevsky@montefiore.org

LEARNING OBJECTIVES

1) Assess the evidence base for coronary CTA in the Emergency Department, including this modality's impact on outcomes, downstream interventions and length of stay. 2) Understand the appropriate use criteria for patient selection for coronary CTA in the emergent setting. 3) Identify important unanswered questions regarding the use of emergency coronary CTA.

RC709

Liver Imaging

Thursday, Nov. 30 4:30PM - 6:00PM Room: S406B

GI

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Sub-Events

RC709A Hypervascular Liver Lesions in Non-Cirrhotic Patients

Participants

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

For information about this presentation, contact:

dsahani@mgh.harvard.edu

LEARNING OBJECTIVES

1) To review common focal liver lesions (FLL) encountered in the patients without cirrhosis. 2) Discuss MRI features of common hypervascular FLL. 3) Provide imaging approach to hypervascular FLL. 4) Understand the role of DWI-MR and hepatobiliary specific MR contrast media in diagnosing hypervascular FLL.

Active Handout: Dushyant V. Sahani

[http://abstract.rsna.org/uploads/2017/16000493/Active RC709A.pdf](http://abstract.rsna.org/uploads/2017/16000493/Active_RC709A.pdf)

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RC709B Liver Imaging Reporting and Data Systems (LI-RADS) Version 2017: Updates and Pearls

Participants

Ania Z. Kielar, MD, Ottawa, ON (*Presenter*) Research Grant, General Electric Company

For information about this presentation, contact:

aniakielar@gmail.com

LEARNING OBJECTIVES

1) Apply Liver Imaging Reporting and Data System (LI-RADS), version 2017, to daily practice when interpreting cross-sectional images of livers in patients at risk for hepatocellular carcinoma. 2) Discuss and differentiate ancillary features which can be applied to LI-RADS categories. 3) Apply the new version 2017 LI-RADS algorithm for use in screening liver ultrasound. 4) Demonstrate proficiency for assessing response of liver lesions post locoregional treatment with the newly developed LI-RADS algorithm.

ABSTRACT

Liver Imaging Reporting and Data System (LI-RADS) was initially introduced in 2011 in an effort to standardize radiology reports when assessing liver observations in patients at risk for hepatocellular carcinoma (HCC). It was designed by radiologists for use by all radiologists. The goal of LI-RADS is to improve communication between radiologists at different workplace, as well as to improve quality of reports created for clinicians and surgeons. In 2017, the most recent update to LI-RADS has undergone refinements of the standard algorithm based on new evidence published in the literature. LI-RADS version 2017 has also introduced a new algorithm for ultrasound screening in patients at risk for HCC. Contrast enhanced ultrasound evaluation for liver lesions detected on screening ultrasound has also been incorporated into the 2017 version of LI-RADS. A new algorithm for Tumor Response has also been developed for reporting liver lesions which have been treated with various types of locoregional therapy. The goal of this presentation is to review the 2017 version of LI-RADS algorithms for radiologists so that they will be able to incorporate this standardized reporting system into their daily practice.

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RC709C The Difficult Hepatocellular Carcinoma

Participants

Cher Heng Tan, MBBS, FRCR, Singapore, Singapore (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

Cher_Heng_Tan@ttsh.com.sg

LEARNING OBJECTIVES

1) Relate the classic imaging features of hepatocellular carcinoma (HCC) to its histological characteristics. 2) Discuss the criteria set forth by current clinical guidelines for the imaging diagnosis of HCC. 3) Assess the potential of diffusion weighted MRI and hepatobiliary contrast MRI agents for improving detection of HCC.

ABSTRACT

Hepatocellular carcinoma (HCC) is widely known for its association with chronic hepatitis and liver cirrhosis. The classic imaging features of HCC can be explained by its unique histological characteristics. This enables patients to proceed to definitive treatment without lesion biopsy, provided that specific criteria for imaging diagnosis are met. However, due to the heterogeneous nature of HCC, non-classical imaging findings are frequently encountered. Distinct variants of HCC and mimics of HCC further complicate imaging evaluation. Diffusion weighted MRI and hepatobiliary contrast MRI agents may assist radiologists in making the correct diagnoses in some instances.

RC709D MR Elastography and Liver Fibrosis

Participants

Frank H. Miller, MD, Chicago, IL (*Presenter*) Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Understand the role of MR elastography in the diagnosis of hepatic fibrosis and cirrhosis. 2) Understand the advantages and limitations of MR elastography. 3) Recognize uncommon causes of elevated stiffness.

ABSTRACT

MR imaging plays an important role in the diagnosis of cirrhosis and hepatic. Invasive biopsy is currently the standard approach to diagnosis and stage liver fibrosis and inflammation. Biopsies however are invasive, prone to sampling error and poor patient acceptance. Magnetic resonance elastography can measure fibrosis-associated changes in liver stiffness. MR elastography is rapid and allows differentiation between the different stages of fibrosis and can be easily added to conventional liver MR examinations. Studies in the literature using MR elastography to assess hepatic fibrosis will be discussed. Comparisons with conventional imaging features of cirrhosis will be described. The role of MR elastography will also be discussed in diagnosing conditions such as nonalcoholic steatohepatitis in patients with nonalcoholic fatty liver disease. Uncommon causes of elevated hepatic stiffness values on MR elastography will be discussed. In addition, challenges faced with MR elastography including iron overload will be discussed.

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RC710

Thyroid and Neck Ultrasound

Thursday, Nov. 30 4:30PM - 6:00PM Room: S402AB

HN NR US

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Sub-Events

RC710A Thyroid Nodules: When and What to Biopsy

Participants

Jill E. Langer, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Identify and describe the sonographic features that are associated with thyroid cancer and those that are associated with benign thyroid nodules. 2) Discuss the rationale for the current biopsy and sonographic follow-up imaging recommendations.

RC710B Thyroid Elastography

Participants

Richard G. Barr, MD, PhD, Campbell, OH (*Presenter*) Consultant, Siemens AG; Consultant, Koninklijke Philips NV; Research Grant, Siemens AG; Research Grant, SuperSonic Imagine; Speakers Bureau, Koninklijke Philips NV; Research Grant, Bracco Group; Speakers Bureau, Siemens AG; Consultant, Toshiba Medical Systems Corporation; Research Grant, Esaote SpA; Research Grant, BK Ultrasound; Research Grant, Hitachi, Ltd

LEARNING OBJECTIVES

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

Honored Educators

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RC710C Parathyroid and Other Neck Masses

Participants

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

For information about this presentation, contact:

mfrates@bwh.harvard.edu

LEARNING OBJECTIVES

1) Identify abnormal parathyroid glands based on sonographic characteristics. 2) Develop an accurate differential for cystic lesions in the neck based on sonographic characteristics, lesion location, and clinical circumstances. 3) List the most common etiologies of solid lesions located between the thyroid and the superior mediastinum.

RC711

Update on Radionuclide Therapies

Thursday, Nov. 30 4:30PM - 6:00PM Room: S504CD

IR **NM** **OI**

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Sub-Events

RC711A New Guidelines for I-131 Therapy of Thyroid Cancer

Participants

Don C. Yoo, MD, E Greenwich, RI (*Presenter*) Consultant, Endocyte, Inc

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.

RC711B Lu177-DOTATATE Therapy for Neuroendocrine Tumors

Participants

Lale Kostakoglu, MD, MPH, New York, NY (*Presenter*) Research Consultant, F. Hoffmann-La Roche Ltd

LEARNING OBJECTIVES

1) Learn the objectives and indications of the Lu-177 DOTATATE treatment. 2) Learn the short term and long term side effects of the Lu-177 treatment. 3) Learn how to set up this treatment modality at one's center.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Lale Kostakoglu, MD, MPH - 2012 Honored Educator

RC711C Hepatic Artery Infusion Therapy with Y90 Microspheres

Participants

Charles Y. Kim, MD, Durham, NC (*Presenter*) Consultant, Merit Medical Systems, Inc; Consultant, Cook Group Incorporated

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 tumoral 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.

RC712

Acute Abdominal Vascular Diseases (An Interactive Session)

Thursday, Nov. 30 4:30PM - 6:00PM Room: S103AB

GI VA ER

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Dominik Fleischmann, MD, Palo Alto, CA (*Moderator*) Research Grant, Siemens AG;
Alan H. Stolpen, MD, PhD, Iowa City, IA (*Moderator*) Stockholder, General Electric Company

Active Handout: Dominik Fleischmann

<http://abstract.rsna.org/uploads/2017/13012007/Active RC712.pdf>

Sub-Events

RC712A Aortic Branch Dissections

Participants

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

LEARNING OBJECTIVES

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

ABSTRACT

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

RC712B Symptomatic Aneurysms

Participants

Phillip M. Young, MD, Rochester, MN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

young.phillip@mayo.edu

LEARNING OBJECTIVES

1) To review the importance, findings, clinical and surgical implications of symptomatic aortic aneurysms.

ABSTRACT

Symptomatic aneurysms cover the spectrum of arterial aneurysms presenting with a) localized symptoms secondary to aneurysm expansion and possible rupture b) regional symptoms secondary to dissection and embolism and c) systemic cardiovascular dysfunction related to hypotension and organ dysfunction. Common clinical scenarios include aneurysm rupture - most commonly abdominal aortic, popliteal and abdominal visceral aneurysms as well as thoracoabdominal aortic dissection. Symptomatic aneurysms may also occur in patients with known arterial pathology including connective tissue disorders such as Marfan's and Ehlers-Danlos syndrome and Takayasu aortitis/arteritis. Patients with suspected rupture of abdominal aortic or iliofemoropopliteal artery aneurysms may initially be evaluated by sonography. However, in all circumstances, CT angiography due to its robust implementation and high-resolution imaging of the vasculature and regional anatomy that allows for planning of endovascular and surgical intervention is the preferred technique. CT Angiographic protocols appropriate to the suspected anatomic location of the aneurysm that provide an adequate roadmap for endovascular or surgical intervention are employed. Extended coverage is particularly important in patients with suspected thoracoabdominal aortic dissection or aneurysms associated with peripheral

embolism. Cardiac gating should be utilized in any patient with a suspected type A aortic dissection or rupture of an ascending aortic aneurysm. Aortic, cardiac and coronary artery imaging are integral to the evaluation and management of these patients. A particular subset of the "symptomatic aneurysm" is post-trauma aortic disruption, usually thoracic in which diagnosis of traumatic aneurysm is critical and the aneurysm is associated with additional sites of soft tissue and skeletal trauma. Guidelines for endovascular or surgical intervention or non invasive management with serial CT Angiographic imaging will be discussed.

RC712C Mesenteric Ischemia

Participants

Iain D. Kirkpatrick, MD, Winnipeg, MB (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

kirkpatrick_iain@hotmail.com

LEARNING OBJECTIVES

1) Discuss the various categories of mesenteric ischemia (arterial occlusive, embolic, venous thrombotic, and nonocclusive), and the pathophysiologic basis behind the imaging findings in each case. 2) Understand the basis behind modern CT protocols for mesenteric ischemia, particularly the biphasic examination with CT mesenteric angiography. 3) Demonstrate techniques to rapidly analyze a mesenteric CT angiographic dataset. 4) Review the CT signs of mesenteric ischemia and their sensitivity and specificity. 5) Evaluate the current literature on mesenteric ischemia and discuss optimal diagnostic criteria.

ABSTRACT

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

RC712D Gastrointestinal Bleeding

Participants

Jorge A. Soto, MD, Boston, MA (*Presenter*) Royalties, Reed Elsevier

For information about this presentation, contact:

jorge.soto@bmc.org

LEARNING OBJECTIVES

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

ABSTRACT

Acute gastrointestinal bleeding is a serious condition that may threaten a patient's life depending on the severity and duration of the event. Precise identification of the location, source and cause of bleeding are the primary objectives of the diagnostic evaluation. Implementation of colonoscopy in the emergency setting poses multiple challenges, especially the inability to adequately cleanse the colon and poor visualization owing to the presence of intraluminal blood clots. Scintigraphy with technetium 99m-labeled red blood cells is highly sensitive but also has some limitations, such as the inability to precisely localize the source of bleeding and determine its cause. Properly performed and interpreted CT angiography examinations offer logistical and diagnostic advantages in the detection of active hemorrhage. A three-phase examination (non-contrast, arterial and portal venous) is typically performed. Potential technical and interpretation pitfalls should be considered and will be explained. The information derived from CT angiography helps direct therapy and select the most appropriate hemostatic intervention (when necessary): endoscopic, angiographic, or surgical. Precise anatomic localization of the bleeding point also allows a targeted endovascular embolization. The high diagnostic performance of CT angiography makes this test a good alternative for the initial emergent evaluation of patients with acute lower intestinal bleeding.

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RC713

Pediatric Anorectal and GU Anomalies

Thursday, Nov. 30 4:30PM - 6:00PM Room: N227B

GU **PD**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

LEARNING OBJECTIVES

1) To discuss the most frequently detected fetal anorectal malformations. 2) To identify presentation patterns and imaging clues that can be helpful in reaching a prenatal diagnosis. 3) List the different basic types of anorectal malformations that occur in males and females. 4) List the associated malformations that occur with anorectal malformations. 5) List the logical imaging tests that are required to evaluate for these associated malformations. 6) List imaging tests that are NOT necessarily required in the neonatal period. 7) Describe the importance of sonographic imaging of the abdomen and pelvis in females born with cloaca type anorectal malformation 8) Know the radiologist's role in the evaluation of disorders of sexual development (DSD) . 9) Understand the some of the developmental and genetic changes that result in DSDs. 10) Learn an ultrasound algorithm for the evaluation for infants with DSD. 11) See common examples of DSDs for easy recognition in the future.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC713A Prenatal Imaging of Anorectal Malformations

Participants

Maria A. Calvo-Garcia, MD, Cincinnati, OH (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

maria.calvo@cchmc.org

LEARNING OBJECTIVES

1) To discuss the most frequently detected fetal anorectal malformations. 2) To identify presentation patterns and imaging clues that can be helpful in reaching a prenatal diagnosis.

RC713B Postnatal Imaging of Anorectal Malformations

Participants

Steven J. Kraus, MD, Cincinnati, OH (*Presenter*) Author, Reed Elsevier

For information about this presentation, contact:

steven.kraus@cchmc.org

LEARNING OBJECTIVES

1) List the different basic types of anorectal malformations that occur in males and females. 2) List the associated malformations that occur with anorectal malformations. 3) List the logical imaging tests that are required to evaluate for these associated malformations. 4) List imaging tests that are NOT necessarily required in the neonatal period. 5) Describe the importance of sonographic imaging of the abdomen and pelvis in females born with cloaca type anorectal malformation.

ABSTRACT

An anorectal Malformation (ARM) is diagnosed in about 1 in 5000 live births. The diagnosis is made clinically in newborn males and females by the absence of the opening of the rectum on the perineum, an abnormally located opening of the rectum on the perineum, or a single opening on the perineum of a newborn female. However, radiologic imaging in the newborn period is essential for management, surgical planning, and the eventual outcome in patients with ARM. There is a wide spectrum of possible malformations of the anorectal region, some of which also involve the urinary and genital tracts. Approximately 50% of newborns with ARM will have associated abnormalities, most commonly genitourinary, followed by cardiovascular, spinal cord, gastrointestinal, and abnormalities of the VATER or VACTERL associations. The early management (first 48 hours) of a newborn born with an ARM is two-fold; (1) to assess if there are any life-threatening associated abnormalities that are severe enough to preclude an operation for the ARM or associated abnormalities that need to be addressed immediately to avoid significant morbidity, and (2) to decide if the newborn is eligible for a primary operation to repair the malformation in the neonatal period with no protective colostomy or, is a protective decompressing colostomy required, with delayed definitive repair at 3-6 months of age. Clinical and imaging information are utilized to address these issues. Newborns, (male and female) born with the rectal opening in a location visible on the otherwise normal appearing perineum or just posterior to the vaginal opening (vestibular location) in girls will potentially be eligible for a primary repair by posterior sagittal anorectoplasty (PSARP) in the neonatal period. All other newborns with other types of ARM will require a diverting colostomy, with imaging to characterize the exact type of ARM performed just prior to definitive repair which is usually performed at 3-6 months of age. The decision which path to follow is made after the first 24-48 hours of life. During this

period gas develops in the newborn gastrointestinal tract causing enough distention to establish if the rectum connects to the skin (meconium on the perineum) or if the rectum connects to the urinary tract (meconium in urine in boys).

Active Handout: Steven Jay Kraus

[http://abstract.rsna.org/uploads/2017/17000792/Active RC713B.pdf](http://abstract.rsna.org/uploads/2017/17000792/Active_RC713B.pdf)

RC713C Imaging of Ambiguous Genitalia

Participants

Jeanne S. Chow, MD, Boston, MA (*Presenter*) CEO, Numberone LLC

LEARNING OBJECTIVES

1) Know the radiologist's role in the evaluation of disorders of sexual development (DSD) . 2) Understand the some of the developmental and genetic changes that result in DSDs. 3) Learn an ultrasound algorithm for the evaluation for infants with DSD. 4) See common examples of DSDs for easy recognition in the future.

Active Handout: Jeanne S. Chow

[http://abstract.rsna.org/uploads/2017/17000793/Active RC713C.pdf](http://abstract.rsna.org/uploads/2017/17000793/Active_RC713C.pdf)

RC714

Interventional Course (An Interactive Session)

Thursday, Nov. 30 4:30PM - 6:00PM Room: S502AB

IR

AMA PRA Category 1 Credits™: 1.50

ARRT Category A+ Credit: 1.75

FDA

Discussions may include off-label uses.

Participants

Steven M. Zangan, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Rakesh C. Navuluri, MD, Chicago, IL (*Presenter*) Nothing to Disclose

Kush R. Desai, MD, Chicago, IL (*Presenter*) Speakers Bureau, Cook Group Incorporated; Consultant, Cook Group Incorporated; Consultant, The Spectranetics Corporation; Consultant, AngioDynamics, Inc; Consultant, Boston Scientific Corporation

For information about this presentation, contact:

RNavuluri@radiology.bsd.uchicago.edu

kdesai007@northwestern.edu

LEARNING OBJECTIVES

1) Recognize vascular and non-vascular conditions and their image-guided treatment in the chest, abdomen and pelvis. *This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.*

ABSTRACT

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

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

RC715

BIRADS-Difficult Cases (Interactive Session)

Thursday, Nov. 30 4:30PM - 6:00PM Room: E451B

BR **MR** **US**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Cherie M. Kuzmiak, DO, Chapel Hill, NC (*Moderator*) Nothing to Disclose

Sub-Events

RC715A Mammography

Participants

Carol H. Lee, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Recognize situations in which choosing the appropriate BI-RADS assessment may difficult. 2) Learn how to assign the appropriate BI-RADS assessment for cases in which the assessment and management may not be concordant. 3) Apply principles of BI-RADS assessment to difficult cases.

RC715B Ultrasound

Participants

Rachel F. Brem, MD, Washington, DC (*Presenter*) Board of Directors, iCAD, Inc; Board of Directors, Dilon Technologies, Inc; Stock options, iCAD, Inc; Stockholder, Dilon Technologies, Inc; Consultant, Dilon Technologies, Inc; Consultant, ClearCut Medical Ltd; Consultant, Delphinus Medical Technologies, Inc

For information about this presentation, contact:

rbrem@mfa.gwu.edu

LEARNING OBJECTIVES

1) Appropriately use BIRADS descriptors for breast lesions using ultrasound. 2) Assess lesion characteristics to appropriately assign BIRADS for breast lesions. 3) Identify appropriate and inappropriate use of ultrasound for challenging cases. 4) Access resources to assist with challenging cases for the appropriate use of BIRADS for ultrasound.

ABSTRACT

This presentation will discuss challenging ultrasound cases and how to appropriately assess the BIRAD categories. Examples of appropriate and inappropriate cases will be presented using an interactive, audience participation format.

RC715C MRI

Participants

Bonnie N. Joe, MD, PhD, San Francisco, CA (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

bonnie.joe@ucsf.edu

LEARNING OBJECTIVES

1) Be able to apply a systematic approach to using MRI BI-RADS. 2) Recognize the similarities between BI-RADS for MRI and mammography. 3) Recognize situations where a BI-RADS assessment is not used for MRI.

ABSTRACT

Breast MRI BI-RADS follows a systematic approach analogous to mammography BI-RADS. BI-RADS includes three important components: (a) a lexicon of descriptors, (b) a reporting structure to include final assessment categories and management recommendations, and (c) a framework for data collection and auditing. This session will use an interactive format (audience response system) to review appropriate use of BI-RADS for breast MRI interpretation including scenarios where BI-RADS assessments are not appropriate.

RC716

Communicating Effectively with Patients in the Digital Age (Sponsored by the RSNA Public Information Committee)

Thursday, Nov. 30 4:30PM - 6:00PM Room: S404AB

PR

AMA PRA Category 1 Credits [™]: 1.50

ARRT Category A+ Credit: 1.75

Participants

Max Wintermark, MD, Lausanne, Switzerland (*Moderator*) Advisory Board, General Electric Company;

Christoph I. Lee, MD, Seattle, WA (*Presenter*) Nothing to Disclose

Arvind Vijayasarathi, MD, Phoenix, AZ (*Presenter*) Nothing to Disclose

Ankur Doshi, MD, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ankur.doshi@nyumc.org

LEARNING OBJECTIVES

1) Create patient-friendly radiology reports. 2) Use available technology to improve communication with patients. 3) Use digital tools and the Internet to inform patients of the value of imaging services and expertise.

ABSTRACT

Patients are becoming increasingly involved in their healthcare with direct access to their radiology reports and online information about radiologists and imaging procedures. Patients want radiology reports they can understand and informative, readily available information online about providers and services, so that they may make better informed decisions about their healthcare. This course will provide specific examples and a strategy for communicating honestly and directly with patients via a wealth of digital tools.

RC717

Emerging Technology: Dual Energy CT-Opportunities and Challenges (An Interactive Session)

Thursday, Nov. 30 4:30PM - 6:00PM Room: S505AB

CT

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

FDA

Discussions may include off-label uses.

Participants

Savvas Nicolaou, MD, Vancouver, BC (*Moderator*) Institutional research agreement, Siemens AG

Sub-Events

RC717A DECT Neuroradiology Applications

Participants

Aaron D. Sodickson, MD, PhD, Boston, MA (*Presenter*) Institutional Research Agreement, Siemens AG; Consultant, Bayer AG

For information about this presentation, contact:

asodickson@bwh.harvard.edu

LEARNING OBJECTIVES

1) Describe fundamentals of Dual Energy CT acquisition and post-processing relevant to Neuro imaging applications. 2) Demonstrate applications that add clinical value in Neuro imaging, including iodine and calcium characterization, virtual monoenergetic imaging, and bone subtraction.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Aaron D. Sodickson, MD, PhD - 2014 Honored Educator Aaron D. Sodickson, MD, PhD - 2017 Honored Educator

RC717B Musculoskeletal Applications of DECT: Latest Advances and New Perspectives

Participants

Fabio Becce, MD, Lausanne, Switzerland (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

fabio.becce@chuv.ch

LEARNING OBJECTIVES

1) Comprehend the basic principles and technical aspects of dual-energy and multi-energy spectral CT when imaging the musculoskeletal system. 2) Apply dual-energy and multi-energy spectral CT techniques when assessing various musculoskeletal disorders, from crystal-related arthropathies to iron-related musculoskeletal disorders. 3) Identify the latest advances and emerging applications of dual-energy and multi-energy spectral CT techniques in musculoskeletal imaging.

RC717C DECT Abdomen Where it Makes a Difference Clinically

Participants

Patrick D. McLaughlin, FFR(RCSI), Vancouver, BC (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To better understand the rationale, physical basis and clinical evidence which supports the use DECT to dispense with troublesome abdominal incidentalomas. 2) To review selected cases of occlusive and non occlusive intestinal ischemia, with surgical correlation, so that participants may develop a better understanding of how DECT can be used to increase sensitivity and specificity when searching for bowel ischemia. 3) To learn the rationale, physical basis and clinical evidence which supports the use of DECT to better identify isodense gallstones and better characterize urate containing renal calculi in the final section on 'non iodine related applications.'

RC717D Practical Approach to DECT and How To Implement in a Community Practice

Participants

Kenneth Wong, MD, New Westminster, BC (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

kenneth.wong@fraserhealth.ca

LEARNING OBJECTIVES

1) To identify the main difficulties in implementing a CT Dual Energy Program in your CT department. 2) As a result of attending this presentation you will be able to formulate a plan to implement a CT Dual Energy Program in your CT department. 3) As a result of attending this presentation you will be able to determine whether your CT Dual Energy Program is a success.

RC717E A Rheumatologists Perspective Where DECT Matters the Most

Participants

Hyon-Khoo Choi, MD, Boston, MA (*Presenter*) Research Consultant, Takeda Pharmaceutical Company Limited; Research Consultant, Ironwood Pharmaceuticals, Inc; Research Consultant, Selecta Biosciences, Inc; Research Grant, AstraZeneca PLC

RC718

Challenging Cases in Body Oncologic Imaging (An Interactive Session)

Thursday, Nov. 30 4:30PM - 6:00PM Room: E351

CT MR NM OI US

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

Participants

Gary A. Ulaner, MD, PhD, New York, NY (*Moderator*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd

For information about this presentation, contact:

ulanerg@mskcc.org

LEARNING OBJECTIVES

1) Learn how to correlate CT and FDG PET findings to optimize diagnosis. 2) Identify iatrogenic effects which mimic malignancy on FDG PET/CT. 3) Learn histologies of breast cancer which may not be appreciably FDG-avid. *This interactive session will use RSNA Diagnosis Live™. Please bring your charged mobile wireless device (phone, tablet or laptop) to participate.*

ABSTRACT

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

Sub-Events

RC718A Magnetic Resonance Imaging

Participants

Alexander R. Guimaraes, MD, PhD, Portland, OR (*Presenter*) Consultant, Agfa-Gevaert Group

LEARNING OBJECTIVES

1) Updated understanding of soft tissue contrast mechanisms inherent in MRI including T1rho, diffusion weighted imaging, DCE-MRI. 2) Updated protocols for each organ site. 3) Potential benefits of PET/MRI in diagnosing disease.

ABSTRACT

This course is designed to update the attendee on novel MRI techniques and the benefits of MRI in diagnosing challenging cases within the abdomen and pelvis. Multiparametric MRI offers the unique ability to monitor the tumor microenvironment. Increasingly, multiparametric MRI is used for diagnosis and grading of malignancy in various organ systems (e.g. prostate cancer).

RC718B Ultrasound

Participants

Deborah J. Rubens, MD, Rochester, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the technical parameters to optimize to improve ultrasound diagnosis. 2) Identify discrete ultrasound features to discriminate between various pathologic entities. 3) Characterize disease processes in solid organs, vessels and soft tissues using the unique features of ultrasound and appreciate how ultrasound is complementary to CT, MRI and PET in the oncology patient.

ABSTRACT

This session will highlight a variety of disease processes in the oncology patient using grayscale, color and spectral Doppler ultrasound. Technique and potential pitfalls will be highlighted as they contribute to diagnostic acumen of the sonologist. Cases will include neoplastic, infectious and vascular processes in multiple organs. Differential diagnosis will be stressed with companion case examples, as well as when to use comparative imaging such as CT, MRI or PET/CT

RC718C PET/CT

Participants

Gary A. Ulaner, MD, PhD, New York, NY (*Presenter*) Research support, General Electric Company; Research support, F. Hoffmann-La Roche Ltd

For information about this presentation, contact:

ulanerg@mskcc.org

LEARNING OBJECTIVES

1) Learn where CT findings can improve FDG PET interpretation and where FDG PET findings can improve CT interpretation.

ABSTRACT

FDG PET/CT has become an indispensable modality in the treatment of cancer. While proven to be of great clinical benefit in the management of a wide array of malignancies, there are many potential pitfalls which may be detrimental if not properly identified and explained. In particular, FDG-avidity may be incorrectly ascribed to malignancy when corresponding CT findings demonstrate the FDG-avidity to be benign. In other cases, the presence of FDG avidity correctly determines the presence of malignancy despite to lack of correlate findings on CT. In this presentation, challenging FDG PET/CT cases will be used to demonstrate how correlation of FDG PET and CT findings leads to optimal FDG PET/CT interpretation.

RC721

Advances in CT: Technologies, Applications, Operations-Quantitative CT (QIBA)

Thursday, Nov. 30 4:30PM - 6:00PM Room: S102CD

BQ CT PH

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Ehsan Samei, PhD, Durham, NC (*Coordinator*) Research Grant, General Electric Company; ; Research Grant, Siemens AG; ; Advisory Board, medInt Holdings, LLC
Norbert J. Pelc, DSc, Stanford, CA (*Coordinator*) Research support, Koninklijke Philips NV; Research support, General Electric Company; Research support, Siemens AG; Consultant, Varian Medical Systems, Inc; Consultant, NanoX; Scientific Advisory Board, RefleXion Medical Inc; Scientific Advisory Board, Prismatic Sensors AB; Scientific Advisory Board, Theranos, Inc; Medical Advisory Board, OurCrowd, LP

For information about this presentation, contact:

samei@duke.edu

Sub-Events

RC721A Volumetry

Participants

Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Presenter*) Institutional research agreement, Siemens AG; ; ; ;

LEARNING OBJECTIVES

1) Understand the role of lesion volumetry in CT, especially in the setting of oncologic imaging; (2) Understand the basic methods in lesion volumetry and (3) Understand the factors that influence the measurement of lesion volume in CT.

RC721B Material Identification

Participants

Daniele Marin, MD, Durham, NC (*Presenter*) Research support, Siemens AG

For information about this presentation, contact:

daniele.marin@duke.edu

LEARNING OBJECTIVES

1) Review different dual-energy CT imaging techniques for material identification. 2) Provide an overview of clinically available applications of material identification using dual-energy CT. 3) Identify factors that can affect the reproducibility of quantitative measurements of material composition using dual-energy CT.

RC721C Texture Characterization

Participants

Samuel G. Armato III, PhD, Chicago, IL (*Presenter*) Consultant, Aduro Biotech, Inc
Maryellen L. Giger, PhD, Chicago, IL (*Presenter*) Stockholder, Hologic, Inc; Stockholder, Quantitative Insights, Inc; Shareholder, QView Medical, Inc; Co-founder, Quantitative Insights, Inc; Royalties, Hologic, Inc; Royalties, General Electric Company; Royalties, MEDIAN Technologies; Royalties, Riverain Technologies, LLC; Royalties, Mitsubishi Corporation; Royalties, Toshiba Medical Systems Corporation

For information about this presentation, contact:

m-giger@uchicago.edu

LEARNING OBJECTIVES

1) Understand the concept of texture-based image characterization. 2) Identify radiologic tasks in CT that could benefit from image texture analysis. 3) Describe the limitations of these techniques.

RC722

Imaging for Proton Treatment Guidance and Verification

Thursday, Nov. 30 4:30PM - 6:00PM Room: E261

RO **PH**

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Jon J. Kruse, PhD, Rochester, MN (*Moderator*) Research Grant, Varian Medical Systems, Inc

ABSTRACT

Proton therapy dose distributions are highly conformal and are often used to deliver therapeutic doses to tumors close to critical, radiosensitive normal anatomy. Precise daily reproduction and alignment of the patient anatomy is crucial, then, for successful outcome of proton radiotherapy. This course will describe modern approaches to pre- and intra-treatment imaging to align the patient for proton therapy as well as post-treatment modalities which can verify patient alignment and proton beam range. Pre-treatment image guidance for protons has evolved differently than many common approaches for standard external beam radiotherapy. One reason for this is the dissimilar impact of setup variations on the delivered proton dose distributions, while another is related to the expense of building a proton center and the need to maximize efficiency by moving as many complex processes out of the treatment room as possible. Additionally, the sensitivity of proton dose distributions to intra-fractional changes has led to the development of novel techniques to monitor patient anatomy throughout a treatment. Modest errors in patient positioning or in calculation of proton range could lead to tumor or healthy tissues receiving vastly different doses than were planned. This has led to the development of a number of approaches for post treatment verification of proton beam placement and range. Proton dose verification via positron emission tomography, prompt gamma imaging, and magnetic resonance imaging will be presented.

Sub-Events

RC722A Pre- and Intra-treatment Imaging Strategies for Patient Alignment

Participants

Jon J. Kruse, PhD, Rochester, MN (*Presenter*) Research Grant, Varian Medical Systems, Inc

LEARNING OBJECTIVES

1) Explain the impact of inter- and intra- fractional variations in patient anatomy on proton dose distributions. 2) Describe proton specific approaches to pre-treatment and intra-treatment imaging for patient alignment. 3) Compare various imaging modalities for post-treatment verification of a delivered proton dose distribution.

RC722B Advanced Imaging Techniques for Range Verification

Participants

Brian A. Winey, PHD, Boston, MA (*Presenter*) Research Grant, Elekta AB; ;

For information about this presentation, contact:

bwiney@mgh.harvard.edu

LEARNING OBJECTIVES

1) Explain the impact of inter- and intra- fractional variations in patient anatomy on proton dose distributions. 2) Describe proton specific approaches to pre-treatment and intra-treatment imaging for patient alignment. 3) Compare various imaging modalities for post-treatment verification of a delivered proton dose distribution.

RC723

Molecular Imaging Mini-Course: Clinical Applications of Molecular Imaging—Oncology

Thursday, Nov. 30 4:30PM - 6:00PM Room: S403B

MI OI PH

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Sub-Events

RC723A Diagnosis

Participants

Terence Z. Wong, MD, PhD, Chapel Hill, NC (*Presenter*) Consultant, Lucerno Dynamics, LLC;

LEARNING OBJECTIVES

1) Discuss the value of combined FDG-PET and CT for diagnosing malignant disease. 2) Discuss selection of PET radiotracers the potential role of non-FDG PET tracers in managing patients with cancer.

RC723B Staging

Participants

Dominique Delbeke, MD, PhD, Nashville, TN (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) The potential clinical indications of PET and PET/CT in the evaluation of patients with malignancies. 2) The impact on patient care. 3) Recommendations for PET/CT in the NCCN guidelines.

Active Handout: Dominique Delbeke

[http://abstract.rsna.org/uploads/2017/15002834/Active RC723B.pdf](http://abstract.rsna.org/uploads/2017/15002834/Active_RC723B.pdf)

RC723C Evaluation of Treatment

Participants

David A. Mankoff, MD, PhD, Philadelphia, PA (*Presenter*) Speaker, Koninklijke Philips NV; Consultant, General Electric Company; Advisory Board, RefleXion Medical Inc; Consultant, Blue Earth Diagnostics

For information about this presentation, contact:

david.mankoff@uphs.upenn.edu

LEARNING OBJECTIVES

1) List applications of quantitative imaging for clinical trials. 2) Describe the approach to the design of cancer imaging trials. 3) Discuss biomarkers applications of cancer imaging.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> David A. Mankoff, MD, PhD - 2013 Honored Educator

RC724

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

Thursday, Nov. 30 4:30PM - 6:00PM Room: N226

OT

AMA PRA Category 1 Credits [™]: 1.50
ARRT Category A+ Credit: 1.75

Participants

Angela D. Levy, MD, Washington, DC (*Moderator*) Nothing to Disclose
Howard T. Harcke, MD, Dover AFB, DE (*Presenter*) Nothing to Disclose
Barry D. Daly, MD, Baltimore, MD (*Presenter*) Nothing to Disclose
Edward L. Mazuchowski, MD, PhD, Dover AFB, DE (*Presenter*) Nothing to Disclose
David Fowler, MD, Baltimore, MD (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

angela.d.levy@gunet.georgetown.edu

bdaly@umm.edu

howard.harcke@gmail.com

LEARNING OBJECTIVES

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

ABSTRACT

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

RC725

Quantitative Imaging Mini-Course: Modality Independent Issues

Thursday, Nov. 30 4:30PM - 6:00PM Room: S403A

BQ PH

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

FDA Discussions may include off-label uses.

Participants

Michael F. McNitt-Gray, PhD, Los Angeles, CA (*Coordinator*) Institutional research agreement, Siemens AG; ; ; ;

Sub-Events

RC725A The Role of Physical Phantoms in Quantitative Imaging

Participants

William D. Erwin, MS, Houston, TX (*Presenter*) Research Grant, FUJIFILM Holdings Corporation; Research Grant, Leadiant Biosciences SpA;

LEARNING OBJECTIVES

1) To understand the definitions and requirements of quantitative medical imaging. 2) To learn the role of phantoms and tradeoffs in comparison with simulations and patient studies. 3) To review the classes of phantoms available: Commercial, experimental, and virtual (digital reference objects.)

Active Handout: William Daniel Erwin

http://abstract.rsna.org/uploads/2017/17000434/Active_RC725A.pdf

RC725B Digital Reference Objects

Participants

Daniel P. Barboriak, MD, Durham, NC (*Presenter*) Advisory Board, General Electric Company

For information about this presentation, contact:

daniel.barboriak@duke.edu

LEARNING OBJECTIVES

1) Explain why digital reference objects are useful for evaluation of software packages used to derive quantitative imaging biomarkers. 2) Understand the difference between aggregated and disaggregated metrics of software performance.

ABSTRACT

This lecture will familiarize the audience with digital reference objects (DROs) and their place in the development of quantitative imaging biomarkers (QIBs). To determine whether a quantitative imaging study is measuring a pathological or physiological process in an unbiased way, the quantitative imaging result would need to be compared to an independently ascertained unbiased measurement in the imaged subject or animal. Unfortunately, obtaining a precise and unbiased measurement (also known as ground truth) is generally impractical or impossible. Frequently there are several software packages that can be used to create maps reflecting the spatial distribution of the QIB. Because different software packages often give different quantitative results, the choice of software contributes to the variability of the result. Without ground truth data, it can be difficult to determine which softwares calculate the underlying biomarker with sufficient precision and lack of bias to be applicable for a particular use case. DROs are synthetic images whose pixel values are partially or completely determined by mathematical equations. Although these images may be designed to mimic real imaging data, their content is ultimately determined by mathematical models. Even though DROs do not perfectly simulate real data, they are useful because they are created assuming particular underlying parameter values, which can be regarded as ground truth for these objects. DROs can be particularly valuable for evaluation of software packages. Because they are created using known ground truth, they can be used to determine whether a particular image analysis strategy introduces biases when used to extract a QIB. (This is not possible with real data if the ground truth is not known). Assuming that realistic image noise and/or artifact can be included in the DRO, they can also be used to estimate how precisely a software package is deriving quantitative metrics in real images. This lecture will describe how DROs are used in the RSNA Quantitative Imaging Biomarker Alliance (QIBA) process. Topics that will be discussed include: 1) the variety of metrics that can be used to evaluate software performance with DROs; 2) the differences between aggregated and disaggregated measures of performance, and the relevance of this for determining whether software complies with a standard; and 3) best practices for creation of DROs.

Honored Educators

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RC725C CT Image Analysis and Sources of Variation

Participants

Binsheng Zhao, DSc, New York, NY (*Presenter*) License Agreement, Varian Medical Systems, Inc; Royalties, Varian Medical Systems, Inc; License Agreement, Keosys SAS; License Agreement, Hinacom Software and Technology, Ltd; License Agreement, ImBio, LLC; License Agreement, AG Mednet, Inc; Research Grant, ImBio, LLC;

For information about this presentation, contact:

bz2166@cumc.columbia.edu

LEARNING OBJECTIVES

1) To familiarize the audience with quantitative image analysis methods such as tumor segmentation and feature extraction, using response assessment in oncology as an example. 2) To discuss sources of variation in tumor characterizations, using both in-vivo tumor and phantom study data. 3) To raise awareness of the need for standardization of imaging acquisition parameters and tumor quantification techniques.

RC727

Comparative Effectiveness Research: Translating Science into Health Policy and Practice

Thursday, Nov. 30 4:30PM - 6:00PM Room: S504AB



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Jason N. Itri, MD, PhD, Charlottesville, VA (*Moderator*) Nothing to Disclose

For information about this presentation, contact:

jason.iritri@virginia.edu

LEARNING OBJECTIVES

1) Detail the process for identifying high-priority areas for CER. 2) Discuss the scientific methods used in CER. 3) Describe how CER influences health policy in the era of value-based health care.

ABSTRACT

Despite various diagnostic and treatment options available to patients, practical information to help patients and providers choose the most effective options for a particular population is often not available or accessible, which contributes to regional variations in clinical practice and negatively impacts patient outcomes. Comparative effectiveness research (CER) is one of the key approaches to address this gap, designed to generate and synthesize evidence that compares the benefits and harms of alternative methods to prevent, diagnose, treat, and monitor a clinical condition, or to improve delivery of care. CER is playing an increasingly critical role in guiding health care policy and practice in order to achieve the aims of improving the health of populations, reducing the cost of healthcare, and improving the patient experience. This course will introduce participants to the key principles of CER using examples such as screening chest CT for lung cancer, lumbar spine MRI for low back pain, and imaging for breast cancer screening.

Sub-Events

RC727A NLST and Chest CT for Lung Cancer

Participants

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

For information about this presentation, contact:

Mitchell.schnall@uphs.upenn.edu

LEARNING OBJECTIVES

1) Understand the conduct and results of the National Lung Cancer Screening trials. 2) Learn how a comparative effectiveness clinical trial results can impact healthcare policy. 3) Learn the limitation of a clinical trial to predict clinical impact.

Honored Educators

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RC727B Imaging for Breast Cancer Screening

Participants

Constance D. Lehman, MD, PhD, Boston, MA (*Presenter*) Research Grant, General Electric Company; Medical Advisory Board, General Electric Company

LEARNING OBJECTIVES

1. Understand the conduct and results of three key large screening trials of digital mammography, CAD and MRI. 2. Understand barriers to translating science into health policy and clinical practice.

RC727C MRI for Low Back Pain

Participants

Jeffrey G. Jarvik, MD, MPH, Seattle, WA (*Presenter*) Co-founder, PhysioSonics, Inc; Stockholder, PhysioSonics, Inc; Consultant, HealthHelp, LLC; Consultant, UpToDate, Inc; Royalties, Springer Nature

For information about this presentation, contact:

jarvikj@uw.edu

LEARNING OBJECTIVES

1) Review the definitions and key aspects of observational studies vs. clinical trials. 2) Compare advantages/disadvantages of observational studies vs. clinical trials for CER. 3) Describe the rationale and design of the Back pain Outcomes using Longitudinal Data (BOLD) study and the Lumbar Imaging with Reporting of Epidemiology (LIRE) study.

ABSTRACT

Both observational studies as well as Pragmatic Clinical Trials (PCTs) are important parts of the comparative effectiveness research toolkit. Effectiveness research in general and PCTs in particular differ from traditional, efficacy/explanatory trials in a number of important aspects. Two examples of CER for lumbar spine imaging are the Back pain Outcomes using Longitudinal Data (BOLD)¹ study and the Lumbar Imaging with Reporting of Epidemiology (LIRE)² trial. BOLD is a large, multicenter observational study while LIRE is a multicenter, pragmatic, cluster randomized trial. I will review the advantages and disadvantages of observational vs. PCTs for CER in the context of these two studies. 1. Jarvik JG, Gold LS, Comstock BA, et al. Association of early imaging for back pain with clinical outcomes in older adults. JAMA 2015;313:1143-53. 2. Jarvik JG, Comstock BA, James KT, et al. Lumbar Imaging With Reporting Of Epidemiology (LIRE)-Protocol for a pragmatic cluster randomized trial. Contemp Clin Trials 2015;45:157-63.

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RC729

Pancreaticobiliary MR Imaging (An Interactive Session)

Thursday, Nov. 30 4:30PM - 6:00PM Room: N228



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Hero K. Hussain, MD, Ann Arbor, MI (*Moderator*) Nothing to Disclose

Sub-Events

RC729A The Incidentally Detected Cystic Pancreatic Lesion: What to Do Next

Participants

Ihab R. Kamel, MD, PhD, Baltimore, MD (*Presenter*) Research Grant, Siemens AG

For information about this presentation, contact:

ikamel@jhmi.edu

LEARNING OBJECTIVES

1) Illustrate the imaging features of various pancreatic cysts. 2) Discuss the differential diagnosis of incidental pancreatic cysts. 3) Compare various follow up algorithms.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Ihab R. Kamel, MD, PhD - 2015 Honored Educator

RC729B The Value of Secretin-Enhanced MR Imaging

Participants

Kumaresan Sandrasegaran, MD, Indianapolis, IN (*Presenter*) Consultant, Guerbet SA

For information about this presentation, contact:

ksandras@iupui.edu

LEARNING OBJECTIVES

1) To learn the rationale and technique for using secretin-enhanced MRCP (S-MRCP). 2) To understand the uses and limitations of S-MRCP in diagnosing pancreatic diseases. 3) To comprehend functional information about exocrine reserve of pancreas that may be obtained from S-MRCP.

ABSTRACT

Secretin causes temporary dilation of pancreatic ducts principally by increasing pancreatic exocrine secretions. This allows better visualization of pancreatic ducts on MRCP. In this presentation, we discuss the use of secretin-enhanced MRCP in congenital, inflammatory and neoplastic conditions of the pancreas as well as potential use in assessing pancreatic function in chronic pancreatitis and sphincter of Oddi disturbance.

Honored Educators

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RC729C MRI for Staging and Treatment Planning of Hilar Cholangiocarcinoma

Participants

Peter S. Liu, MD, Cleveland, OH (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Review important concepts for staging hilar cholangiocarcinoma, including biliary and vascular considerations. 2) Describe modern magnetic resonance imaging (MRI) techniques which can be used for preoperative evaluation of hilar cholangiocarcinoma. 3) Discuss the diagnostic accuracy and potential pitfalls of MRI for staging hilar cholangiocarcinoma with case examples.

RC731

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

Thursday, Nov. 30 4:30PM - 6:00PM Room: E263

MK **NR** **IR**

AMA PRA Category 1 Credits™: 1.50
ARRT Category A+ Credit: 1.75

Participants

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

LEARNING OBJECTIVES

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

ABSTRACT

Sub-Events

RC731A Pre- and Post Biopsy Assessment

Participants

Richard Silbergleit, MD, Royal Oak, MI (*Presenter*) Consultant, Relievant Medsystems, Inc

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 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.

RC731B Equipment Used for Image-guided Biopsies of the Spine

Participants

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

LEARNING OBJECTIVES

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

RC731C Thoracic and Lumbar Biopsies

Participants

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

LEARNING OBJECTIVES

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

ABSTRACT

RC731D Cervical Spine Biopsies

Participants

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

For information about this presentation, contact:

oortiz@winthrop.org

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.

RC731E Disc Biopsy and Aspiration

Participants

Amish H. Doshi, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) To review the indications for spinal biopsies in the setting of discitis and osteomyelitis of the spine. 2) The various techniques and imaging modalities for these biopsies will be reviewed. 3) Sample collection and analysis as well as typical diagnostic yield will also be reviewed.

RC732

Compensation

Thursday, Nov. 30 4:30PM - 6:00PM Room: N229

HP **LM**

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

LEARNING OBJECTIVES

1) To learn about the implementation of fair market value compensation plans. 2) To understand the importance of utilizing appropriate benchmarks for clinical productivity metrics. 3) Provide a history of important legislation and policies that have had a significant impact on health care reform. 4) Review recent transformative health care legislation and policies that will impact radiology reimbursement. 5) Present concepts that can help radiology departments adapt to the changing reimbursement environment. 6) Define the need for, and importance and role of, the expert witness in the initiation and execution of a medical malpractice lawsuit. 7) Identify the factors that increase, and diminish, the value and effectiveness of the expert witness before a courtroom jury. 8) Appreciate the potential rewards, and the potential penalties, that can arise from testifying as an expert witness on behalf of the plaintiff, or the defendant.

SAM

New in 2017: PLEASE NOTE - All courses designated for SAM credit at RSNA 2017 will require attendees bring a personal device e.g. phone, iPad, laptop to complete the required test questions during the live session.

Sub-Events

RC732A Radiology Compensation Issues

Participants

Vincent P. Mathews, MD, Hartland, WI (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

vmathews@mcw.edu

LEARNING OBJECTIVES

1) To learn about the implementation of fair market value compensation plans. 2) To understand the importance of utilizing appropriate benchmarks for clinical productivity metrics.

RC732B The Impact of Health Care Reform on Radiology Reimbursement and Revenue

Participants

Robert J. Witte, MD, Rochester, MN (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

witte.robert@mayo.edu

LEARNING OBJECTIVES

1) Provide a history of important legislation and policies that have had a significant impact on health care reform. 2) Review recent transformative health care legislation and policies that will impact radiology reimbursement. 3) Present concepts that can help radiology departments adapt to the changing reimbursement environment.

RC732C Testifying as an Expert Witness: Rules, Compensation and Other Rewards, Prevarications and Penalties

Participants

Leonard Berlin, MD, Wilmette, IL (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

1) Define the need for, and importance and role of, the expert witness in the initiation and execution of a medical malpractice lawsuit. 2) Identify the factors that increase, and diminish, the value and effectiveness of the expert witness before a courtroom jury. 3) Appreciate the potential rewards, and the potential penalties, that can arise from testifying as an expert witness on behalf of the plaintiff, or the defendant.

RC750

MR Imaging-guided Breast Biopsy (Hands-on)

Thursday, Nov. 30 4:30PM - 6:00PM Room: E260



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Beatriz E. Adrada, MD, Houston, TX (*Presenter*) Nothing to Disclose
Chloe M. Chhor, MD, Brooklyn, NY (*Presenter*) Nothing to Disclose
Mark J. Dryden, MD, Houston, TX (*Presenter*) Nothing to Disclose
Sarah M. Friedewald, MD, Chicago, IL (*Presenter*) Consultant, Hologic, Inc; Research Grant, Hologic, Inc;
Sujata V. Ghate, MD, Durham, NC (*Presenter*) Research Grant, Bracco Group; Reader, QT Ultrasound; Travel support, QT Ultrasound; ;
Richard S. Ha, MD, New York, NY (*Presenter*) Nothing to Disclose
Brian Johnston, MD, Gilbert, AZ (*Presenter*) Nothing to Disclose
Jennifer R. Kohr, MD, Seattle, WA (*Presenter*) Nothing to Disclose
Santo Maimone IV, MD, Jacksonville, FL (*Presenter*) Nothing to Disclose
Erin I. Neuschler, MD, Chicago, IL (*Presenter*) Research Grant, Seno Medical Instruments, Inc; Speaker, Northwest Imaging Forums, Inc; Faculty, ABC Medical Education, LLC; Speakers Bureau, General Electric Company; Speakers Bureau, Anderson Publishing, Ltd;
Bethany L. Niell, MD, Tampa, FL (*Presenter*) Nothing to Disclose
Elissa R. Price, MD, San Francisco, CA (*Presenter*) Nothing to Disclose
John R. Scheel, MD, PhD, Seattle, WA (*Presenter*) Research support, General Electric Company
Jean M. Seely, MD, Ottawa, ON (*Presenter*) Nothing to Disclose
Stephen J. Seiler, MD, Dallas, TX (*Presenter*) Nothing to Disclose
Toma Omofoye, MD, Houston, TX (*Presenter*) Nothing to Disclose
Roberta M. Strigel, MD, MS, Madison, WI (*Presenter*) Research support, General Electric Company
Jocelyn A. Rapelyea, MD, Washington, DC (*Presenter*) Speakers Bureau, General Electric Company;
Ryan W. Woods, MD, MPH, Madison, WI (*Presenter*) Nothing to Disclose
Lizza Lebron, MD, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

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LEARNING OBJECTIVES

1) Explain why MR-guided breast biopsy is needed for patient care. 2) Identify relative and absolute contraindications to MR-guided breast biopsy. 3) Describe criteria for MR-guided breast biopsy patient selection. 4) Debate risks and benefits of pre-biopsy targeted ultrasound for suspicious MRI findings. 5) Understand the basic MR-guided biopsy procedure, protocol and requirements for appropriate coil, needle and approach selection. 6) Manage patients before, during and after MR-guided breast biopsy. 7) Define the benefits and limitations of MR-guided vacuum assisted breast biopsy. 8) Apply positioning and other techniques to challenging combinations of lesion location and patient anatomy for successful MR-guided biopsy.

ABSTRACT

This course is intended to provide basic didactic instruction and hands-on experience for MR-guided breast biopsy. Because of the established role of breast MRI in the evaluation of breast cancer through screening and staging, there is a proven need for MR-guided biopsy of the abnormalities that can only be identified at MRI. This course will be devoted to the understanding and identification of: 1) appropriate patient selection 2) optimal positioning for biopsy 3) target selection and confirmation 4) various biopsy technologies and techniques 5) potential problems and pitfalls and 6) practice audits. Participants will spend 30 minutes in didactic instruction followed by 60 minutes practicing MR-guided biopsy using provided phantoms. Various combinations of full size state-of-the-art breast MRI coils, biopsy localization equipment and needles from multiple different vendors will be available for hands-on practice. Some stations will have monitors loaded with targeting software. Expert breast imagers from around the world will be at each of 10 stations to provide live coaching, tips, techniques and advice.

Active Handout: Roberta Marie Strigel

[http://abstract.rsna.org/uploads/2017/4426451/Active RC750.pdf](http://abstract.rsna.org/uploads/2017/4426451/Active_RC750.pdf)

RC752

Dynamic Musculoskeletal US: Clicks and Clunks of the Lower Extremity (Hands-on)

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

MK US

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Viviane Khoury, MD, Philadelphia, PA (*Presenter*) Nothing to Disclose
Etienne Cardinal, MD, Montreal, QC (*Presenter*) Nothing to Disclose
Jon A. Jacobson, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
David P. Fessell, MD, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Ghiyath Habra, MD, Troy, MI (*Presenter*) Nothing to Disclose
Joseph H. Introcaso, MD, Neenah, WI (*Presenter*) Nothing to Disclose
Kenneth S. Lee, MD, Madison, WI (*Presenter*) Grant, General Electric Company; Research support, SuperSonic Imagine; Research support, Johnson & Johnson; Consultant, Echometrix, LLC; Royalties, Reed Elsevier
Humberto G. Rosas, MD, Madison, WI (*Presenter*) Nothing to Disclose
Marnix T. van Holsbeeck, MD, Detroit, MI (*Presenter*) Consultant, General Electric Company; Stockholder, Koninklijke Philips NV; Stockholder, General Electric Company; Stockholder MedEd3D; Grant, Siemens AG; Grant, General Electric Company;
Kambiz Motamedi, MD, Los Angeles, CA (*Presenter*) Nothing to Disclose
Mark Cresswell, MBCh, Vancouver, BC (*Presenter*) Research Consultant, RepliCel Life Sciences Inc; Investigator, RepliCel Life Sciences Inc; ; ;
Girish Gandikota, MBBS, Ann Arbor, MI (*Presenter*) Nothing to Disclose
Benjamin D. Levine, MD, Santa Monica, CA (*Presenter*) Research Consultant, Merck & Co, Inc
J. Antonio Bouffard, MD, Novi, MI (*Presenter*) Nothing to Disclose
Joseph G. Craig, MD, Detroit, MI (*Presenter*) Nothing to Disclose
Thomas Moser, MD, Montreal, QC (*Presenter*) Nothing to Disclose
Carlo Martinoli, MD, Genova, Italy (*Presenter*) Nothing to Disclose
Robert R. Lopez, MD, Charlotte, NC (*Presenter*) Nothing to Disclose
Marcos L. Sampaio, MD, Ottawa, ON (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

viviane.khoury@uphs.upenn.edu

msampaio@toh.ca

LEARNING OBJECTIVES

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

ABSTRACT

This course will demonstrate standardized techniques of performing the dynamic examination of hip and ankle lesions that are only or best demonstrated dynamically. These include the snapping hip, peroneal tendon subluxation/dislocation, flexor hallucis longus impingement, and ankle ligament instability. In the first portion of the course, probe positioning will be demonstrated on a model patient with overhead projection during live scanning. In the second portion of the course, an international group of expert radiologists will assist participants in learning positioning and scanning of hip and ankle joint lesions described. An emphasis on dynamic maneuvers and ergonomic documentation of tissue dynamics will be taught. Participants will be encouraged to directly scan model patients.

Honored Educators

Presenters or authors on this event have been recognized as RSNA Honored Educators for participating in multiple qualifying educational activities. Honored Educators are invested in furthering the profession of radiology by delivering high-quality educational content in their field of study. Learn how you can become an honored educator by visiting the website at: <https://www.rsna.org/Honored-Educator-Award/> Jon A. Jacobson, MD - 2012 Honored Educator Jon A. Jacobson, MD - 2017 Honored Educator

RC753

Preparing your Radiology Practice and IT Department for Big Data

Thursday, Nov. 30 4:30PM - 6:00PM Room: E350



AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Paul J. Chang, MD, Chicago, IL (*Moderator*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Advisory Board, Bayer AG; Advisory Board, Aidoc Ltd; Advisory Board, McCoy

LEARNING OBJECTIVES

1) The potential of applying "Big Data" approaches to radiology will be discussed. 2) The participant will be introduced to the importance of developing a comprehensive IT architecture and capability beyond the EMR in order to effectively use "Big Data" tools. 3) Strategies for preparing IT for "Big Data" will be discussed.

ABSTRACT

Current and near future requirements and constraints will require radiology practices to continuously improve and demonstrate the value they add to the enterprise. Merely "managing the practice" will not be sufficient; groups will be required to compete in an environment where the goal will be measurable improvements in efficiency, productivity, quality, and safety. This will require optimally leveraging IT enabled business intelligence, analytics, and data driven workflow. In many ways, this challenge can be described as a "Big Data" problem, requiring the application of newer "Big Data" approaches and tools. Unfortunately, many have discovered that an "EMR centric" IT perspective may severely limit the ability for the enterprise to maximally leverage these newer tools to create differentiable value. This session will provide an introduction to the importance of developing a comprehensive architectural strategy to augment the existing EMR to more effectively consume "Big Data" tools.

Sub-Events

RC753A Getting Your IT Infrastructure Ready for Big Data

Participants

Paul J. Chang, MD, Chicago, IL (*Presenter*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Advisory Board, Bayer AG; Advisory Board, Aidoc Ltd; Advisory Board, McCoy

LEARNING OBJECTIVES

1) The potential of applying "Big Data" and noSQL approaches to radiology will be discussed. 2) The participant will be introduced to the importance of developing a comprehensive IT architecture and capability beyond the EMR in order to effectively use "Big Data" tools. 3) Strategies for preparing IT for business intelligence and analytics will be discussed.

ABSTRACT

Current and near future requirements and constraints will require radiology practices to continuously improve and demonstrate the value they add to the enterprise. Merely "managing the practice" will not be sufficient; groups will be required to compete in an environment where the goal will be measurable improvements in efficiency, productivity, quality, and safety. This will require optimally leveraging IT enabled business intelligence, analytics, and data driven workflow. In many ways, this challenge can be described as a "Big Data" problem, requiring the application of newer "Big Data" approaches and tools. Unfortunately, many have discovered that an "EMR centric" IT perspective may severely limit the ability for the enterprise to maximally leverage these newer tools to create differentiable value. This session will provide an introduction to the importance of developing a comprehensive architectural strategy to augment the existing EMR to more effectively consume "Big Data" approaches and fully leverage business intelligence and analytics.

RC753B NoSQL Approaches: Beyond the Traditional Relational Database

Participants

Paul J. Chang, MD, Chicago, IL (*Presenter*) Co-founder, Stentor/Koninklijke Philips NV; Researcher, Koninklijke Philips NV; Advisory Board, Bayer AG; Advisory Board, Aidoc Ltd; Advisory Board, McCoy

LEARNING OBJECTIVES

1) The distinction between the traditional relational (SQL) database and "NoSQL" approaches will be discussed. 2) The attendees will be given a basic introduction to how "NoSQL" tools, such as Hadoop, MapReduce, MongoDB can be complementary to existing approaches. 3) NoSQL applications and their relevance to radiology will be discussed.

ABSTRACT

Current and near future requirements and constraints will require radiology practices to continuously improve and demonstrate the value they add to the enterprise. Merely "managing the practice" will not be sufficient; groups will be required to compete in an environment where the goal will be measurable improvements in efficiency, productivity, quality, and safety. This will require optimally leveraging IT enabled business intelligence, analytics, and data driven workflow. These approaches will require the ability to consume and utilize all available enterprise data, including unstructured reports, multimedia objects, etc. Other industries have realized that traditional IT approaches, such as the relational (SQL) database, cannot optimally address these "difficult" data

objects. Many outside of the medical domain have successfully augmented traditional approaches by newer “Big Data” and “NoSQL” methodologies, such as Hadoop, MapReduce, MongoDB, etc. In this session, an introduction to these newer tools will be presented.

RC753C Deep Learning: An Example of Big Data Applications

Participants

William W. Boonn, MD, Penn Valley, PA (*Presenter*) Officer, Nuance Communications, Inc; Shareholder, Nuance Communications, Inc

For information about this presentation, contact:

wboonn@gmail.com

LEARNING OBJECTIVES

1) A technical overview of machine learning and deep learning will be presented. 2) Applications of machine learning and deep learning in radiology will be illustrated. 3) Challenges in deploying machine learning and deep learning in radiologist workflow and productivity demands will be discussed.

ABSTRACT

Computers in radiology have often promised to deliver faster clinical decisions, more accurate diagnoses, and transformative visualizations. Computer aided diagnostics (CAD) has been deployed to guide radiologists in their detection of abnormalities and identification of disease. Historically, CAD has been based on domain-driven heuristics, and more recently used simple machine learning on structured data. Both of these require extensive manual engineering making them very slow to build, limited in their flexibility, and less accurate than we would like. Deep learning is a new paradigm that offers a transformative solution. Instead of demanding countless human hours of painstaking feature generation and selection, deep learning automatically discovers clinically-relevant features by first architecting a hierarchy of patterns (loosely modelled on the brain’s own neural neural networks) and then updating those patterns upon observing examples. As radiology requires complex associative pattern recognition, deep learning is the ideal companion tool. Enlitic is developing a deep neural network of the entire human body that will offer a new way forward in which the radiologist has immediate access to the most relevant clinical information. In this talk, we will present a technical overview of machine learning and deep learning, illustrate its applications in radiology, and detail some of the challenges improving radiological workflow using deep learning poses.

Honored Educators

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RC754

Clinical Decision Support: Impact and Lessons from Large Scale Implementations

Thursday, Nov. 30 4:30PM - 6:00PM Room: E352

IN

AMA PRA Category 1 Credits TM: 1.50
ARRT Category A+ Credit: 1.75

Participants

Emanuele Neri, MD, Pisa, Italy (*Moderator*) Nothing to Disclose

Sub-Events

RC754A Results and Lessons from the Medicare Imaging Demonstration

Participants

Keith D. Hentel, MD, MS, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

keh9003@med.cornell.edu

LEARNING OBJECTIVES

- 1) Apply lessons learned from the Medicare Demonstration project to implement effective Clinical Decision Support (CDS) programs.
- 2) Formulate strategies for compliance with current regulations requiring CDS.

RC754B The European Experience and Perspective

Participants

Luis Donoso-Bach, MD, Barcelona, Spain (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

- 1) To learn about the use of imaging referral guidelines in Europe.
- 2) To understand the challenges of implementing a CDS for heterogeneous European countries.
- 3) To describe the varying experiences of implementing CDS and imaging referral guidelines in different countries.

RC754C Results and Lessons from Virginia Mason

Participants

C. Craig Blackmore, MD, MPH, Seattle, WA (*Presenter*) Author with royalties, Springer Science+Business Media Deutschland GmbH

For information about this presentation, contact:

craig.blackmore@vmmc.org

LEARNING OBJECTIVES

- 1) To understand the Virginia Mason approach to clinical decision support.
- 2) To understand the practical application and limitations of clinical decision support.

RC754D Results and Lessons from Brigham and Women's Hospital

Participants

Ramin Khorasani, MD, Boston, MA (*Presenter*) Consultant, Medicalis Corp; ; ;

LEARNING OBJECTIVES

- 1) Briefly review existing federal regulations pertinent to imaging clinical decision support.
- 2) Discuss design, implementation and results of large scale imaging CDS intervention at Brigham and Women's Hospital.
- 3) Contrast results and discuss implications from CDS interventions that have and have not impacted ordering physician behavior.
- 4) Recommend strategies to optimize imaging CDS implementation to improve quality and enable and promote evidence-based practice.

RCA55

Introduction to Computational Fluid Dynamics from Medical Images: A Step by Step Demonstration (Hands-on)

Thursday, Nov. 30 4:30PM - 6:00PM Room: S401AB

IN **PH**

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

Participants

Dimitris Mitsouras, PhD, Boston, MA (*Presenter*) Research Grant, Toshiba Medical Systems Corporation;

For information about this presentation, contact:

dmitsouras@alum.mit.edu

LEARNING OBJECTIVES

1) Describe each of the steps involved in performing a computational fluid dynamic (CDF) simulation of blood: a) Segment the blood lumen in a 3D volumetric angiography image dataset (e.g., CT or MRI) starting from DICOM images. b) Produce a finite volume mesh on which to perform the CFD computation starting from the segmented lumen. c) Determine appropriate CFD boundary conditions to set up the problem physics on this mesh. d) Perform the blood flow simulation e) Finally, interrogate the resulting solution for quantities of interest such as pressure, fractional flow reserve (FFR) or endothelial shear stress. 2) Identify the different software components required to perform each of the steps. 3) Use these software components to perform their own computational fluid dynamic analyses in their own field of interest.

ABSTRACT

In this exercise, we will be working with the contrast-enhanced coronary CT angiogram (CTA) of a 48-year-old male patient with hypertension and dyslipidemia who presented with atypical chest pain and that had no personal or family history of CAD. Coronary CTA demonstrated a 59% stenosis of the proximal RCA (AHA segment 1). The patient then underwent elective catheter angiography, which demonstrated a 61% stenosis of the corresponding segment and an FFR measurement of 0.85, indicating no hemodynamic significance of this obstructive ($\geq 50\%$) lesion. We will first use a semi-automated coronary segmentation tool in Mimics (Materialise NV) to segment the right coronary artery and its two terminal branches, the posterior descending artery (PDA) and posterior left ventricular branch (PLV) from the CTA and create a 3D model. We will then export the 3D model in the Standard Tessellation Language, or STereo Lithography (STL) file format. The STL file will then be imported into the CFD software (Fluent, ANSYS Inc) and we will generate a finite volume mesh to fill the lumen defined by this STL. We will finally solve the Navier-Stokes equations in this mesh simulating blood flow at hyperemic conditions in the steady state, and we will interrogate the solution for pressure and CT-FFR after setting the coronary pressure at the ostium to that measured in the patient using a sphygmomanometer at the time of CTA. The training guide for this course can be downloaded from here: [Click to Download PDF automatically](http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/documents/RSNASyllabus-final-online.pdf) or if link doesn't work, copy paste this URL to your web browser: http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/documents/RSNASyllabus-final-online.pdf

RCB55

Creating and Delivering Online and Mobile Education Content: From Online Courses to Interactive Books (Hands-on)

Thursday, Nov. 30 4:30PM - 6:00PM Room: S401CD



AMA PRA Category 1 Credits [™]: 1.50
ARRT Category A+ Credit: 1.75

Participants

George L. Shih, MD, MS, New York, NY (*Moderator*) Consultant, Image Safely, Inc; Stockholder, Image Safely, Inc; Consultant, MD.ai, Inc; Stockholder, MD.ai, Inc;

For information about this presentation, contact:

george@cornellradiology.org

LEARNING OBJECTIVES

1) Assess the potential of online and mobile e-learning innovations to augment your residents', medical students', and staff's educational curricula. 2) Acquire the domain knowledge to use already available content (eg, PowerPoint presentations) to both create video content and deploy e-learning courses on modern web-based and mobile platforms. 3) Acquire the domain knowledge to create an interactive Apple iBook (electronic books) with text, images, video, and interactive questions.

Sub-Events

RCB55A Screencasting Basics on the Desktop and on the iPad

Participants

Ian R. Drexler, MD, MBA, New York, NY (*Presenter*) Nothing to Disclose

For information about this presentation, contact:

ird7002@med.cornell.edu

LEARNING OBJECTIVES

View Learning Objectives under main course title

RCB55B Massive Open Online Course (MOOC) Creation and Hosting

Participants

Kurt T. Teichman, BSc, MEng, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View Learning Objectives under main course title

RCB55C Interactive iBooks to Supplement Your Online Courses

Participants

Alan C. Legasto, MD, New York, NY (*Presenter*) Nothing to Disclose

LEARNING OBJECTIVES

View Learning Objectives under main course title

RCC55

Imaging Informatics: Year in Review (RSNA/AMIA/SIIM Joint Sponsorship)

Thursday, Nov. 30 4:30PM - 6:00PM Room: S501ABC

IN

AMA PRA Category 1 Credits [™]: 1.50
ARRT Category A+ Credit: 1.75

Participants

Charles E. Kahn JR, MD, MS, Philadelphia, PA (*Moderator*) Nothing to Disclose

Charles E. Kahn JR, MD, MS, Philadelphia, PA (*Presenter*) Nothing to Disclose

William Hsu, PhD, Los Angeles, CA (*Presenter*) Research Consultant, Prosocial Applications, Inc; Research Grant, F. Hoffmann-La Roche Ltd; Research Grant, Siemens AG

For information about this presentation, contact:

ckahn@upenn.edu

LEARNING OBJECTIVES

1) Review the year's most significant advances in imaging informatics. 2) Understand current directions in biomedical informatics research of importance to radiology, including ontologies, data mining, natural language processing, reporting systems, and decision support. 3) Describe recent advances in image processing and analysis, and their applications in radiology, including image reconstruction, filtering and post-processing, pattern recognition, computer-aided detection and diagnosis, and visualization.

ABSTRACT

The field of imaging informatics is rapidly advancing in its ability to address challenges related to clinical big data and harnessing this information for precision medicine. In the past year, the field has experienced growth in a variety of areas including radiomics (the generation of high dimensional features from images), development of new ontologies and standards for capturing information from images and reports, and unsupervised learning from images to predict the course of a disease and treatment response. In addition, we have seen a remarkable growth in novel approaches that go beyond pixel data by integrating imaging with other biomedical data, standardizing imaging workflows, and improving the quality and utility of image-derived information in clinical practice. This session, developed in partnership with the American Medical Informatics Association (AMIA) and the Society of Imaging Informatics in Medicine (SIIM), highlights the year's most important advances in imaging informatics. This course provides a comprehensive "Year in Review" of informatics in medical imaging.

URL

<http://www.rsna.org/Informatics/2017>

Honored Educators

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